To: Chair and Members  
Social & Public Health Services Committee

From: Dr Elizabeth Richardson  
Medical Officer of Health  
Public Health & Community Services  
Prepared by: Deborah Carr, Marie McKeary (MIEH), Natasha Mihas, Steve Walsh

Date: November 4, 2005

Re: Air Quality Initiatives and Issues Summary   SPH05060 (City Wide)

Council Direction:

(a) A Councillor raised concern regarding current air quality levels in the City and made reference to one day last fall where the Air Quality Index in Hamilton was recorded at the 100 point level. He asked staff to report back to Committee with an update on the issue. (SPHS Committee minutes June 14, 2005).

(b) On a motion, the Social and Public Health Services Committee directed the Medical Officer of Health to bring a report back to Committee in Q4 summarizing air quality initiatives and issues in conjunction with other City Departments and outside agencies. (SPHS Committee minutes June 28, 2005, item 10.2).

Background:

On October 26, 2004, the Air Quality Index (AQI) in Hamilton reached a reading of 103. The AQI is an indicator of air quality, based on hourly measurements of key pollutants, and includes SO₂, NO₂, O₃, CO, and PM₂.₅. The concentration of each reading is converted into a number starting from zero upwards. The pollutant with the highest
number at a given time becomes the AQI reading. Fine Particulate Matter (PM$_{2.5}$) was the pollutant which triggered the AQI incident on October 26.

Using the Air Quality Index as the trigger for the Smog Advisory process, there may be a false impression that this is a comprehensive way to understand and summarize air pollution. In fact, air quality changes from hour to hour, and from area to area, in significant ways. The properties, concentrations and origins of individual pollutants, along with the weather, season, local terrain, and traffic conditions, all affect the air quality. The result is that a poor air quality day does not necessarily mean that all areas at all times are equally affected. Likewise, ‘good’ air day in Hamilton does not mean that other communities will not experience a Smog Advisory.

On October 26, there was a thermal inversion which effectively held pollutants in the ‘bowl’ of the escarpment, and a high reading of 103 was observed at the downtown monitor. It is not surprising that other readings taken elsewhere in Hamilton (at the same time) were 55 and 60, nearly half that of the high. Dr. Brian McCarrey, chair of Clean Air Hamilton, characterized the events of October 26 as similar to releasing gas in a tent. It is not that more pollutants were being generated, but that they were contained. The 103 reading may well serve to stratify public opinion about air pollution, but it does little to help understand the current state of affairs.

To effectively understand the issues associated with air quality, it is necessary to look at four broad areas. They are Research, Policies, Initiatives, and Partnerships. This report is a precursor to future reports on Public Health activities related to Air Quality.

**Research**

In the past, researchers have been concerned with the impact of protracted, severe levels of air pollution and the subsequent health effects for the population. The focus now includes an examination of the impact of long term exposure to ‘acceptable’ or ‘low’ levels of pollution.

**Methods**

It is difficult to estimate the exact level of mortality and morbidity which can be attributed to air pollution. A number of studies have focused on premature death and hospitalizations, and in some cases, used that information to predict the total burden of illness.

Some research has focused on specific populations such as children and the elderly. Children are believed to be more vulnerable because their lungs are more sensitive, their rate of respiration to their body weight is greater, particles have the potential to become embedded deeply into their lungs, and early exposure can predispose them to respiratory illnesses later in life. Children are also of interest as they are less likely to
be involved in ‘risky’ lifestyle or economic behaviours. Similarly, the elderly are seen to be more at risk from poor air quality as they may have serious underlying health problems which already impair their cardiovascular system.

Other research has focused on the unequal burden of illness across different populations, e.g., elderly, children, women vs. men, and alternatively, examines the unequal impact of improvements in air quality.

Measures and Tools
Research has debated the validity and reliability of measurement tools, as well as what pollutants to focus on. A number of studies have focused on floating particulate matter (Total Suspended Particulate or TSP) and Sulphur Dioxide (SO$_2$). However, TSP levels estimate the potential exposure, not actual exposure. More recent studies have concentrated on gaseous emissions from traffic as a more accurate model of exposure.

In the past, free standing monitors operated by the Ministry of Environment have been utilized for measurements. These monitoring stations are fixed and relatively few in numbers, therefore, dispersion models have been necessary to estimate the air quality levels over the entire surface of the city. More recently, the use of sophisticated mobile monitoring equipment, larger numbers of low cost monitoring devices, combined with Geographical Information Systems (GIS) mapping, have allowed for other spatial analysis methods to better understand air pollution over space.

External Factors
Confounding variables are also an issue in the research. Especially important variables include the Social Economic Status (SES), dwelling values, employment and unemployment, indoor air quality, overcrowding, smoking, gas cooking, and poverty. It is difficult to control for these variables when attempting to examine the relationship between air pollution and the burden of illness.

Summary of Research
Research was the first of the four areas to be examined, as it should ultimately provide the foundation for evidence based policies. However, given the fact that there is still much room to for further research, it is best for policymakers to refer to the research findings as a guide, and not a definitive answer. Research papers which examine air quality in Hamilton listed below, and summarized in Appendix A.

- 1977, D. Levy, M. Gent & T. Newhouse. Relationship between Acute Respiratory Illness and Air Pollution Levels in an Industrial City

• 1986, L.D. Pengelly, et al. The Hamilton Study: Effect of Particle Size on Respiratory Health in Children

• 1987, L.D. Pengelly et al. The Hamilton Study: Estimating Exposure to Ambient Suspended Particles


• 2001, Ontario Medical Association. Ontario’s Air: Years of Stagnation

• 2001, M. Jerrett et al. A GIS-environmental justice analysis of particulate air pollution in Hamilton, Canada


• 2003, T. Sahsuvaroglu & M. Jerrett. A Public Health Assessment of Mortality and Hospital Admissions Attributable to Air Pollution in Hamilton

• 2003, M. Buzzelli, M. Jerrett, R. Burnett, & N. Finkelstein. Spatiotemporal Perspectives on Air Pollution and Environmental Justice in Hamilton, Canada, 1985-1996


• 2004, T. Sahsuvaroglu & M. Jerrett. Sources of Uncertainty in calculating Mortality and Morbidity attributable to Air Pollution

• 2004, M. Jerrett, R.T. Burnett, et al. Do socioeconomic characteristics modify the short term association between air pollution and mortality? Evidence from a zonal time series in Hamilton, Canada

• 2004, F.W. Lipfert. Air Pollution and poverty: Does the sword cut both ways?

• 2005, M. Jerrett, M. Buzzelli, R.T. Burnett & P.F. DeLuca. Particulate air pollution, social confounders, and mortality in small areas of an industrial city

Federal Government

The federal government is responsible for a number of policies and regulations which have an impact on air quality. The Federal Government policies include:

- **The Sulphur in Diesel Fuel Regulations** and the **Sulphur in Gasoline Regulations**. Both regulations serve to reduce SO\(_2\) emissions from internal combustion engines by limiting the amount of sulphur in fuel that is produced, imported and sold. Through various phases of implementation, the amount of SO\(_2\) has been continuously reduced since 1999. The final phase of the gasoline regulation is to reduce the sulphur content of gasoline by more than 90% from current levels.

- **The Alternative Fuels Act**. Designed to encourage the use of alternative fuels for federal government automobiles, light and medium duty trucks, vans and buses. Alternative fuel refers to ethanol, methanol, propane, natural gas, hydrogen or electricity.

- **The Canada – U.S. Air Quality Agreement**. The objective is to control transboundary air pollution between Canada and the U.S. Both countries agree to reduce emissions of sulphur dioxide (SO\(_2\)) and nitrogen oxides (NO\(_X\)), the primary precursors of acid rain. The agreement also serves to foster cooperation with regards to technical and scientific topics relating to acid rain.

- **The Ozone Annex to the Canada – U.S. Air Quality Agreement**. This is specifically designed to reduce the emissions of NO\(_2\) and Volatile Organic Compounds (VOC), which are the precursors to the formation of Ground Level Ozone (GLO). The Ozone Annex commits both countries to reduce their emissions from large industries, like coal burning power plants. In general, this agreement does not apply to local transportation, in spite of the fact that transportation contributes to about 65% of NO\(_2\) emissions in Ontario.

- **The Benzene in Gasoline Regulation**. This regulation restricts the amount of benzene allowed in gasoline, thereby reducing the emissions of benzene from gasoline powered engines.
Provincial Government

Ministry of Transportation

Drive Clean

Ontario’s Drive Clean program is part of Ontario’s air quality strategy to improve air quality through targeting the reduction of smog, greenhouse gases and acid rain. It is mandated under Ontario Reg. 353/01 made under the Highway Traffic Act, amending O. Reg. 628/90 and Ontario Reg. 343/01 made under the Environmental Protection Act, amending O. Reg. 361/98. Drive Clean was implemented in 1999 with the aim to cut smog-causing pollutants from vehicle sources. This program includes emission testing every two years for cars, vans, light trucks, and sport utility vehicles. Heavy-duty vehicles must pass regular emissions tests including diesel-powered vehicles and heavy-duty non-diesel vehicles in various areas of Southern Ontario. Light-duty vehicle and non-diesel heavy-duty vehicle components are implemented in areas which have a history of poor air quality (smog), a population of 50,000 or more, or are within the commuting zone of an urban area of 50,000, or more. Heavy-duty diesel vehicles are tested province-wide because these vehicles travel throughout the province, including the Southern Ontario smog corridor.

Ministry of Environment

The Provincial Ministry of Environment is responsible for a number of policies and regulations which have an impact on air quality. The Provincial policies include:

- **Regulation 194/05.** This is a new regulation and is directed towards specific sectors, including cement, flat glass, iron and steel, chemical manufacturing, and petroleum. The regulation will set the NO$_2$ and SO$_2$ limits even lower in the future, with specific reductions in 2010 and 2015, for the target sectors.

- **Regulation 419/05 (Effective November 30/05).** This regulation will set new and updated air standards for pollutants that could pose a threat to human health. These pollutants are also proposed to be incorporated into the General Air Pollution Regulation 346. The new standards are based on health and environmental impacts rather than technical or economic factors. The standards for pollutants will be used primarily to assess and manage local impacts from industries on surrounding neighbourhoods and communities.

- **Air Pollution Index.** Within regulation 419/05, the Ministry may prepare an index to be known as the “Air Pollution Index” for any area of Ontario (s.39(1)). Along with the Air Pollution Index, there are broad changes in how the Ministry may react to issues. For instance, when increasing pollution may lead to an episode, the Minister of Environment, in consultation with the Minister of Health and Long Term Care, may order curtailment of the operation of sources of pollution. If specific thresholds are exceeded, the Minister of Environment may alone require owners or operators of sources of air pollution to
curtail such operations. However, the Ministry of the Environment has proposed also notifying the local Medical Officer of Health in the case of exceedances. Public Health will be meeting with the MOE to discuss planning and implementation for this.

- **New Air Dispersion Models.** The province’s current 30-plus-year-old air dispersion models are being replaced with new models which provide a more accurate assessment of health and environmental impacts.

## Local

### City Of Hamilton

**Corporate Smog Response Plan**
Whenever the Ontario Ministry of the Environment issues a smog advisory for the City of Hamilton, the city enacts its Corporate Smog Response Plan. In doing so, the City modifies its activities and thereby reduces emissions of smog-forming pollutants, which would otherwise contribute to the problem. Departmental leads train employees on departmental policies that come into effect on smog days.

**Green Fleet Plan – Public Works**
The Green Fleet Implementation Plan has been developed for the Central Fleet, which manages vehicles used by the Public Works Department, the Planning and Development Department, and several other City agencies. The Plan will reduce carbon dioxide output of this inventory by 4,000 to 6,000 tonnes and significantly reduce other forms of pollutants over the three years of the Plan and continue for future years. It will accomplish this by focusing on greater use of biodiesel and hybrid electric vehicles. Participation in anti-idling campaigns has proven to be successful and this plan includes a new anti-idling policy for City vehicles.

**Bus Pass Program**
The bus pass program aims to increase public transit ridership by targeting large organization to offer subsidized transit passes. The program has 15,000 participants from McMaster University, McMaster Graduate Student Union, Columbia International College, and Redeemer College/University. HSR is trying to expand the program to school boards and other private schools.

**Employee Commuter Pass**
Bus passes are available at a reduced rate to City Of Hamilton employees, and the payments for the pass can be made through payroll deduction, as a convenience for the employees.
Anti-Idling Policy

The policy is aimed at vehicles in the City Of Hamilton fleet, and has been implemented since August of 2004. The policy is being expanded to include the installation, on randomly selected vehicles, data loggers that will track idling.

Vision 2020

Employee Trip Reduction Plan

An employee trip reduction strategy is planned to encourage the use of alternative transportation by city staff. The goal of this plan is to eliminate the bias towards single-occupancy vehicle trips. This plan includes: an equitable parking fee structure for all city employees to discourage single occupancy vehicle commuting; parking subsidies to employees who carpool; and a mechanism to encourage other downtown employers to implement similar plans.

Initiatives

Federal

In addition to acting as a regulator, there are a series of initiatives which Environment Canada participate in. These initiatives include:

- The Commission of Environmental Cooperation (CEC). The CEC is comprised of ministers from the three NAFTA (North American Free Trade Agreement) countries. Environment Canada has the overall federal lead for the CEC, and establishes Canadian positions on the issues.

- The UNECE Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants (POP). The objective is to control, reduce or eliminate discharges, emissions, and losses of POP’s to the environment. The United Nations Economic Commission for Europe (UNECE) POP protocol is not yet in force, and performance measures will only be relevant when the protocol comes into effect.

- The Kyoto Protocol. The ultimate goal is to slow the rate of Green House Gas (GHG) emissions. Action Plan 2000 sets the course for action in all sectors of the Canadian Economy, and lays the groundwork for long-term behavioural, technological and economic change.

- The Intergovernmental Panel of Climate Change (IPCC). The role of this international body is to assess the scientific, technical and socio-economic
information related to the risk of human-induced climate change. Environment Canada is a supporter of, and participant in, the IPCC.

- The **World Meteorological Organization** (WMO). The purpose of the WMO is to facilitate cooperation in the establishment of networks to obtain systematic observations of weather, water, climate and chemical constituents of the atmosphere. Environment Canada is a key partner in the global effort to better understand climate change, ozone depletion, transboundary air pollution, and to predict extreme weather events.

- The **Canada-Wide Standards** (CWS). Developed in conjunction with the Canadian Council of Ministers of the Environment, the purpose is to develop qualitative and quantitative guidelines, objectives, and criteria for protecting the environment and reducing the risk to human health. Standards have already been developed for fine particulate matter (PM$_{2.5}$), ground level ozone and benzene.

- A revised **Air Quality Index (AQI)**. Since the first AQI was issued in Canada nearly 25 years ago, there have been significant developments in understanding the health effects of poor air quality. The new AQI hopes to be a Health Risk Based Index that will provide clear, unambiguous information, and enable the public to take actions to reduce the risk to their health and reduce their personal contribution to air pollution.

**Provincial**

**Ministry of Transportation Initiatives**

**High Occupancy Vehicle Lanes**
The Ministry of Transportation will be implementing High Occupancy Vehicle (HOV) lanes in various areas in the Greater Toronto Area, including Highway 403 both directions from 401 to 407 and Highway 404 southbound from 401 to 407. These lanes are designed to help move more people through congested areas by reserving the inside lane for vehicles carrying 2 or more individuals. HOV lanes can move more people than a general traffic lane and therefore can encourage carpooling and transit use. Air quality in the Southern Ontario area will be impacted greatly through reduced vehicle emissions and improved air quality.

**Smart Commute**
The Smart Commute is an association between the cities and regions of the Greater Toronto Area and Hamilton. Smart Commute helps local employers and commuters to explore various commuting options through carpooling, teleworking, transit, cycling, walking or flexible work hours. Local public transits, cycling, walking routes, are
available through the Smart Commute association, as well as carpooling and ride sharing information.

Greater Toronto Area Fare Card
The Greater Toronto Area (GTA) Fare Card allows travel throughout the GTA including Hamilton, on any transit vehicle without purchasing tickets, passes or exact cash fare. The Fare Card is a plastic card embedded with a computer chip and allows for a more convenient commute when traveling throughout the Greater Toronto Area, and therefore may attract more commuters to use public transit and ultimately decrease emissions and improve air quality.

GO Transit Rail Improvement Program
The implementation of the rail improvement program includes an additional third track from Burlington GO Station to the Hamilton GO Station, and is scheduled to be completed by 2007. This will increase rush-hour service to the Hamilton GO Station with fewer conflicts with freight train traffic, as well as extend all-day weekday service from the Burlington GO Station to the Aldershot GO Station. The GO Transit Rail Improvement program includes the improvement of both Burlington and Aldershot GO Stations for accessibility of passengers with mobility devices, and will provide the capability to accommodate 12-car trains, as opposed to the current 10-car system. The 12-car trains will allow an extra 400 passengers per train and will be more environmentally friendly, as the new car trains are newer models. These initiatives will increase peak hour service for commuters, giving more Hamiltonians the opportunity to take GO transit.

Ministry of Environment
The Ontario Ministry of Environment is developing a new approach to set and implement air standards more quickly. The document *Updating Ontario’s Regulatory Framework to Protect Local Air Quality* outlines the proposed regulated decision-making process. This framework could be implemented through an amendment to Regulation 346 on General Air Pollution.

In addition to this current regulatory initiative, the Ontario Ministry of Environment have a history of working with neighbouring jurisdictions across the region, and have several signed Memoranda of Understanding (MOU). They are summarized as follows:

- **Ontario and Quebec.** Signed in 1998, this *Agreement of Environmental Cooperation* is to encourage information sharing, mutual understanding and cooperation on transboundary issues including, but not limited to, air quality and atmospheric pollutants.

- **Ontario and Michigan.** This MOU has led to a greater cooperation between the two jurisdictions on air quality management. Since 2000, meteorological and air
quality discussions between Ontario and Michigan meteorologists have occurred on a weekly basis. Since 2004, discussions have included the topic of harmonizing smog alert protocols, as well as PM$_{2.5}$ forecasting in the Great Lakes transboundary area.

- **Ontario and Minnesota.** This agreement encourages information sharing, including technical expertise and information on emission inventories.

- **Ontario and New York.** Originally drafted in 1983, the agreement was revised in 1999 to ensure the coordination of efforts in Ontario and New York. It provides for data compatibility, ensuring that emission control programs meet goals, and the establishment of a Joint Committee to review progress. Staff of the MOE and the New York Department of Environment Conservation have undertaken collaborative scientific studies under the terms of the agreement. This has culminated in the publication of findings in scientific journals on atmospheric ozone and fine particulate matter (PM$_{2.5}$).

- **Ontario and Ohio.** Both parties to this MOU share a common interest in reduction of air pollution caused by coal-fired plants. While Ontario has committed to shut down the province’s five coal-fired plants, Ohio is committing to reduce emissions with technological and raw materials (ie. Scrubbers, cleaner coal mixtures).

**Local**

**Environment Hamilton - Community Based Initiatives**

**Tonnes for Trees**
Implemented by Environment Hamilton, this program promotes and educates on personal reductions to save greenhouse gases while providing trees to residences. Focusing on three communities within the City of Hamilton including Strathcona, Kirkendall, Westdale; for every tonne of greenhouse gas reduction per household they receive two free trees.

**Transit Neighborhoods for Hamilton (A Moving on Sustainable Transportation (MOST) Project)**
Environment Hamilton and the Ontario Public Interest Research Group at McMaster University have received funding to improve transit in Hamilton. The research is to potentially introduce neighborhood transit passes in Hamilton, and to examine the public perception of transit, reasons that current users ride transit, unmet transit needs, and the type of incentives that could convince non-users to begin riding the buses and therefore reduce pollution.
Stack Watch
Environment Hamilton has designed stack keys to help Hamiltonian’s call in concerns regarding visible air emissions from various stacks in Hamilton’s industrial core. In addition to the stack keys (photographs from various viewpoints), the program identifies the processes of each stack in the Hamilton industrial core, their potential pollutants, and descriptions of colors and shapes of plumes.

Green Venture Initiatives

Commuter Challenge
The Commuter Challenge is a week-long, friendly competition where Canadian cities compete to reduce air pollution by using active and sustainable modes of transportation. Participants make a commitment to walk, jog, cycle, rollerblade, take public transit, carpool or telecommute during a pre-established week, called National Environment Week.

Homeowner Tree Planting Program
The City, in partnership with Clean Air Hamilton and Green Venture, offers homeowners in Hamilton subsidies of $29.99 per tree for up to two native trees to be planted on their properties. Additional tree planting services have expanded to include wood chips, compost, and optional consultations with respect to ideal planting locations.

EnerGuide for Houses was developed by Natural Resources Canada to help homeowners make retrofit choices that improve the comfort and energy efficiency of the home. Certified inspectors visit homes and provide customized home energy plans to improve home energy efficiency and provided homeowners with detailed, easy-to-understand home energy information and rating.

Natural Resources Canada launched a program in the fall of 2003, providing grants for homeowners who complete energy efficiency retrofits based on the EnerGuide for Houses rating of the their home.

Active and Safe Routes to School
The City of Hamilton in conjunction with many stakeholders including Public Health & Community Services Department, Bylaw Enforcement, Police Department, Roads Department, the Hamilton-Wentworth Catholic School Board, the Hamilton Wentworth District School Board, Green Communications Association, and Ontario Trillium Foundation implemented the Active and Safe Routes to School program. This program encourages elementary school children to walk to school thus promoting a healthy, active lifestyle. This in turn reduces traffic congestion and pollution within the vicinity of schools and school yards. A similar program has been implemented to engage, promote
and educate high school students sustainable transportation, and therefore promoting a healthy, active lifestyle.

**PowerWise**

PowerWise is a program implemented by Green Venture in conjunction with Horizon Utilities to encourage electricity conservation. Information is provided to homeowners regarding compact fluorescent light bulbs and efficient nightlights.

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**Clean Air Hamilton Initiatives**

**Upwind/Downwind Conference**

The Upwind/Downwind Conference is hosted by Clean Air Hamilton and the City of Hamilton. It is aimed to cultivate an understanding of the links between air quality, human health, urban sprawl and urban planning. The conference also highlights the ways in which industry, community groups and governments can contribute to improvements in air quality.

**Clean Air Hamilton Studies**

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<th>YEAR</th>
<th>AUTHOR</th>
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<tr>
<td>November 1997</td>
<td>Hamilton-Wentworth Air Quality Improvement Committee (HAQIC) Chair/Co-Author: L. David Pengelly</td>
<td>Odours, Aesthetics &amp; Socio-Economic Aspects of Ham-Went’s Air Quality</td>
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<td>December 1997</td>
<td>(HAQIC) Chair/Co-Author: L. David Pengelly</td>
<td>Human Health Risk Assessment for Priority Air Pollutants</td>
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<td>December 1997</td>
<td>HAQIC Environment Work Group Final Report Chair: Denis Corr, MOE</td>
<td>Ambient Air Quality &amp; Effects on the Environment in Hamilton-Wentworth</td>
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<td>1999</td>
<td>HAQIC</td>
<td>Progress Report (EN971109E)</td>
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<td>June 1999</td>
<td>Region of Hamilton-Wentworth Air Quality Program Ministry of the Environment Technical Support Section Air, Pesticides and Environmental Planning F. Dobroff, West Central Region</td>
<td>Street Cleaning Initiative</td>
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<tr>
<td>2000</td>
<td>HAQIC</td>
<td>Clean Air Hamilton Progress Report</td>
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<tr>
<td>June 2000</td>
<td>Pavlos S. Kanaroglou, R.N. Buliung and B.W. Taylor McMaster University Submitted to Policy &amp; Research Working Group, HAQIC</td>
<td>The relative contribution of trucks to mobile source emissions in Hamilton</td>
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<td>2001</td>
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Public Information
Clean Air Hamilton provide information about the five key pollutants through their webpage.

Heritage Tree Program
The City has partnered with Clean Air Hamilton, the Hamilton Industrial Environmental Association (HIEA), the Royal Botanical Gardens, the Bay Area Restoration Council (BARC), the Hamilton Waterfront Trust, Halton Conservation and the City of Burlington to reintroduce tree species that were once native to this area. The project involves collecting seeds from surviving trees, propagating them in a greenhouse, and then planting the seedlings in and around the Hamilton Harbour.

City of Hamilton

Anti-idling
Staff in Planning and Development have collaborated on the development of anti-idling traffic signs, brochures and posters to be used as education tools in an anti-idling awareness campaign. It is planned that an awareness campaign be conducted in
collaboration with Green Venture, Clean Air Partnership, and Natural Resources Canada. City staff have drafted an idling control by-law which, if adopted, could be rolled-out in conjunction with the education campaign.

**End-of Line Idling Reduction** The End-of-Line Idling Reduction program ensures that Hamilton Street Railway (HSR) bus operators do not idle their vehicles at the end of transit routes. This initiative is formalized by issuing an annual Notice to Operators, with which drivers are required to comply. Public complaints of driver idling are followed-up with a reminder of the policy by the route supervisor on the line where the complaint was registered.

**Hamilton Community Energy Centre.** Hamilton Community Energy’s downtown district heating project is an environmental initiative that will provide thermal energy in the form of hot water to a number of downtown buildings. An efficient gas fired Combined Heat and Power plant (The Energy Centre) will produce electricity using a low NOₓ reciprocating engine with the exhaust heat being recovered and converted to hot water. The energy efficient heat source will result in the decommissioning of the conventional boiler installations in the buildings connected to the system.

This community project will benefit the City of Hamilton in three primary ways:

- The efficient production of heat energy will contribute to improving local air quality as result of reduced emissions and greenhouse gases.
- A standby source of electricity will be provided in the downtown core to supply key municipal buildings in the event of a prolonged power system interruption.
- This major infrastructure project in the downtown core will both create jobs and provide competitive energy supply to assist in attracting new development.

**Natural Gas Public Transit Fleet**
The purpose of this program is to supply and maintain environmentally and ergonomically friendly public transit buses for use in the City of Hamilton. These buses are fuelled by Natural Gas energy. The goal is for the entire fleet to use low-floor design buses, all of which are low-emitting.

**Hybrid Vehicle (HEV) Evaluation**
In 2001, Clean Air Hamilton completed an Evaluation of Hybrid Vehicles use in a Canadian Fleet Environment. Results indicated that HEVs were almost 3 times more fuel efficient than conventional vehicles, HEVs saved $1350.00 per year in fuel costs over conventional vehicles and HEVs emitted up to 10 times fewer air pollutants than conventional vehicles.

**Growth Related Integrated Development Strategy (GRIDS).** The Growth Related Integrated Development Strategy, or GRIDS, is a made-in-Hamilton balanced growth strategy. The purpose of GRIDS is to identify the most ideal places for growth and the
type of growth based on environmental priorities, social issues, economic opportunities and population studies as well as to identify strategies to fund the servicing of these areas. The GRIDS project will recommend a strategy to accommodate population and employment growth over the next 25 years.

Natural Heritage System Project
The purpose of this program is to develop a Natural Heritage System for Hamilton and to implement protection strategies that will improve the health of Hamilton's ecosystem and will protect biodiversity. This project involves developing a GIS-based Natural Heritage System that allows for modeling, to assess the impacts of land use change on natural cover. We will establish targets for the amount of habitat Hamilton needs for a healthy ecosystem. We will use this information to guide Official Plan policy and urban growth management through GRIDS. Completion date Dec. 31, 2004.

Purchase of Ethanol Blended Gasoline
The entire corporate fleet including transit, fire, police, and public works are fuelled by ethanol-blended petroleum provided at city fuelling stations. Through this program, there is a continued review of studies and testing of Ethanol.

Putting People First – Transportation Master Plan
Prepared in conjunction with the new secondary plan for the downtown core of the City, this project developed a Master Transportation Plan that strived to address transportation issues while supporting the land use initiatives identified in the Secondary Plan. Recommendations included: a conversion plan for several of the downtown streets to two-way; a series of roadway improvements to enhance pedestrian movements; in order to improve cycling opportunities, improvements to the cycling network; the need for a new transit terminal was identified; and an auto trip reduction plan for City employees. Recommendations as approved in the report at currently being phased in.

Urban Transportation Showcase Program
In response to the federal government’s request for transportation showcase programs that will result in the reduction of greenhouse gas emissions and address other urban challenges such as air quality, congestion and safety, the City of Hamilton in cooperation with a number of other municipalities in the GTA is proposing to establish a Greater Toronto Demand Management Program. At this time a detailed proposal is being prepared in order for the project to be eligible for one of up to $10 million grants, of which four will be awarded. The project will examine the possibility of establishing a network of transportation management associations throughout Hamilton and the GTA. These associations will focus on reducing auto demand, particularly for peak-periods work trips, through initiatives such as a ride matching service, education/training, establishing a van pool program and car sharing program.
Vision 2020

Environmental Assessments (EAs) Environmental Assessments are a decision-making process used to promote good environmental planning by assessing the potential effects of proposed activities on the environment. They are used to plan infrastructure and are mandated for all public sector undertakings, including roads and highways, transit facilities, waste management facilities, electrical generation and transmission facilities. Public consultation for each EA is a requirement.

Building a Strong Foundation
The City of Hamilton currently has several initiatives underway which will help to achieve the VISION. Planning processes are being coordinated under the title “Building a Strong Foundation” to ensure that sustainable thinking continues to ensure our vision for the future and to integrate vision goals into some of the City’s primary decision-making processes: The Growth-related Integrated Development Strategy (GRIDS), the Master Plans for Transportation, Water and Wastewater, the new Official Plan, the Social Development Strategy, and Vision 2020. Two of the vision goals related to air quality that are supported through this initiative include:

- To ensure the City has the best air quality of any major urban centre
- To reduce greenhouse gas emissions (20 percent) of 1994 levels in municipal operations and six percent of 1994 levels city-wide

Ainslie Wood Westdale Secondary Plan
The City of Hamilton requires the review of existing land use plans in the study, and the preparation of a current land use strategy which addresses existing issues, trends and redevelopment pressures. The secondary plan will provide a framework, within the context of the City Official Plan, for land use planning decisions for the next 20 years. This will include consideration of land use designations and densities, development control approaches, and design strategies. The development of this plan took place from March 2002 to March 2004. Further plans under development that affect this area include a Community Strategy, the Transportation Master Plan, and the Stormwater Management Master Plan.

Brownfield Pilot Project (Less Sprawl = less GHG)
The City of Hamilton has been working to promote the redevelopment of Brownfields in its older industrial areas for several years. In 1997, the City established an Industrial Redevelopment Task Force. This Task Force was formed to develop strategies to bring Brownfield properties back into productive use. With the help of the Industrial Redevelopment Task Force, which includes members of the Hamilton Chamber of Commerce, the City has prepared a Community Improvement Plan that provides financial and other incentives to promote the redevelopment and re-use of Brownfield properties in the City’s 3,400 acre older industrial area. The main feature of this strategy is the implementation of a Tax Increment Financing program to assist with the study and clean-up of Brownfield sites.
Forestry Management Plan for City-Owned Trees. A “Forestry Management Plan” is required to provide coordinated strategic direction for the management of the City’s forest infrastructure to ensure continued and maximized benefits from this significant community resource and appropriate management of inherent risks and liabilities. The creation and eventual implementation of a Forestry Management Plan will ensure that there is an appropriate minimum service level for forestry services affecting municipally owned properties within the “New” City of Hamilton. The components of the urban forest include public owned trees located on residential boulevards, parks, natural areas, institutional/city owned sites, waterfronts and trees from other public use areas. Trees are managed to provide a continuing level of economic, social, and environmental benefits at the present and into the future.

Heavy-Duty Truck Anti-Idling Challenge
Before amalgamation, the city was slated to participate in a competition between organizations to reduce heavy-duty truck idling. A baseline of emissions would be set for one year using on-board instrumentation, and organizations compete to reduce these amounts. Progress in reductions would be monitored using on-board instrumentation. Resources are not available to implement this program. The program was completed in June 2003. Hamilton submitted idling measurements to the Repair Our Air Fleet Challenge along with six other municipalities and was recognized for its effort at the 2003 Smog Summit in Toronto.

Integrated Environmental, Health and Safety Management Program Policy and Planning.
The City of Hamilton is embarking on a leading edge municipal initiative with the launch of the Integrated Management System focusing on the Environment and Health and Safety. The goal is to integrate the economy, the environment and social/health factors in all municipal decision-making, thereby upholding the City’s commitment to create a sustainable community. To date, the City along with Earth Tech Canada Inc. have worked with the Public Works Department and Corporate Management Team to complete an initial Gap Analysis, train staff in Environmental Compliance Auditing and Environmental Aspects/Impacts and Health and Safety Hazards/Risks Inventories. As a result of the training, a number of facilities have been identified for Environmental Compliance Audits over the course of the summer along with developing the inventories. May now be called the Triple Bottom Line Approach.

VISION 2020 Annual Sustainability Indicators Report
The purpose of this report is to provide a tool to inform decision-making for action in the community and the City Corporation, and to generate community debate on Hamilton's progress toward a sustainable community. Data on a set of key indicators is tracked and analyzed annually. Analyses include a synthesis to show how trends are interacting to produce outcomes. Measured parameters related to air quality include: ground level ozone, sulphur dioxide, nitrogen dioxide, inhalable particulate matter, respirable particulate matter, and respiratory illness.
Air Quality Policy Paper
For Phase Two of the Transportation Master Plan for the City of Hamilton, 23 individual policy papers were written to examine specific issues, review related past and present policies, identify and assess different policy options, and recommend policy responses. One such paper concerned the issue of air quality in Hamilton and the links between transportation, air quality, human health and the environment. This paper was submitted to Council in summary form by the Public Works Department on October 28, 2004.

Vision 2020 Clean Air & Climate Change Action Plan
This program is currently being developed within the Planning and Economic Development Department. Key objectives addressed in this plan include: adaptation to smog & climate change; reducing emissions of key pollutants & greenhouse gases; research that informs policies/strategies; and responding to concerns & proposals. This plan incorporates joint programs and initiatives with Green Venture, the Public Works Department, and the Public Health & Community Services Department.

Air Quality Coordinator Position
Long Range Planning is responsible for air quality policy in the City, through the Air Quality Coordinator position, a full-time permanent employee dedicated to air quality policy and programs. Some of these programs include: the air quality program, Idling Control By-law, Community Awareness Campaign, community partnerships, and various research projects.

Hamilton Air Monitoring Network
The Hamilton Air Monitoring Network (HAMN) officially took over operation of all Hamilton air quality monitoring stations, except for three Air Quality Index (AQI) stations. The network is run by a consortium of companies in Hamilton. The West Central Region Office of the Ontario Ministry of the Environment (MOE) has given HAMN responsibility to operate, maintain and upgrade all the industrial air monitoring equipment previously operated by the MOE in Hamilton. HAMN supplies air quality monitoring reports to the MOE on a regular basis. The MOE continues to operate the three AQI sites in Hamilton and will make this data available to the industrial partners in this consortium.

Partnerships

GTA Clean Air Council
Long Range Planning is the City’s representative on the GTA Clean Air Council (GTA-CAC). GTA-CAC is an intergovernmental working group that promotes the reduction of air pollution emissions and increased awareness of regional air quality issues in the
Greater Toronto Area through the collective efforts of all levels of government. Members include all levels of government in the GTA and Hamilton. Participation in with the GTA-CAC will provide a continued opportunity for dialogue and peer review with other municipalities in Southern Ontario.

**Hamilton Air Monitoring Network (HAMN)**
This industry-operated air monitoring network is a co-operative effort, the first of its kind in North America, comprising 22 local companies who are committed to assessing air quality in Hamilton on a regular basis and tracking changes in the air we breathe. The Ministry of Environment (MOE) provides some assistance, but on-going operating costs and expenses related to the upgrading of air monitoring equipment and instruments are borne by industries that generate air emissions. HAMN will be a key element in helping to determine where progress is being made and identifying air quality issues that require additional attention. HAMN will also serve to ensure open communication with local industry.

**Green Venture**
Green Venture’s primary partner is the City Of Hamilton. Since its inception, Green Venture has worked continually to improve the local environment by affecting changes in people of Hamilton. Being a community based, not-for-profit organization, they have built a strong reputation with the general public as an unbiased authority in energy savings, water and waste reduction, and conservation. Green Venture also has the capacity to deliver service initiatives from other levels of government, effectively stretching their funding from local sources. For instance, Green Venture has been a local delivery agent for EnerGuide for Houses since 1998. Programs like this effectively draw funding into the community.

**Clean Air Hamilton (CAH)**
Clean Air Hamilton is a multi-stakeholder group dedicated to improving air quality in Hamilton’s community. Since 1998, Clean Air Hamilton has worked to improve air quality in Hamilton by initiating research, providing advice to government, encouraging emission reductions and behavioural changes from industry and individuals within Hamilton. With representation from other key partners, the MOE, McMaster Institute of Environmental Health (MIEH), and Public Health, Clean Air Hamilton are well suited to act as a single voice for air quality issues in Hamilton.
## Appendix A

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<th></th>
<th>Research Q</th>
<th>Methods</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Yr</strong> 1977</td>
<td>Relationship between acute respiratory illness and air pollution levels in adults and children. There has been less research on associated health effects and exposure to lower &quot;acceptable&quot; levels over long period.</td>
<td>Retrospective study (1970-71) 1,780 patient records for 4 hospitals (4 Q) admissions daily, weekly, &amp; monthly for acute exacerbations among adults with chronic respiratory and children with acute respiratory. Related to standard air pollution index for floating particles &amp; Sulphur Dioxide.</td>
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<tr>
<td></td>
<td><strong>Author</strong> D. Levy, M. Gent &amp; T. Newhouse</td>
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<tr>
<td></td>
<td><strong>Title</strong> Relationship between Acute Respiratory Illness and Air Pollution Levels in an Industrial City</td>
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<td>2</td>
<td><strong>Yr</strong> 1984</td>
<td>Effects of air pollution on respiratory health of over 3,500 school children, 7-10 years. Accounted for confounding variables. Measured air pollution by TSP readings in 27 sites across the city.</td>
<td>Cohort study (diff. cohorts in different areas of city). 1978-81. Epidemiological study. Respiratory health measured by pulmonary function testing &amp; questionnaire administered to parents assessing respiratory symptoms in child. City divided into 5 areas then compare. Random selection.</td>
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<td></td>
<td><strong>Author</strong> L.D. Pengelly, A.T. Kerigan, C.H. Goldsmith &amp; E.M. Inman</td>
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<tr>
<td></td>
<td><strong>Title</strong> The Hamilton Study: Distribution of Factors Confounding the Relationship between Air Quality and Respiratory Health</td>
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<td>3</td>
<td><strong>Yr</strong> 1986</td>
<td>Same study as 1984 Cohort Study</td>
<td>Same methods as 1984 Cohort Study</td>
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<tr>
<td></td>
<td><strong>Author</strong> A.T. Kerigan, C.H. Goldsmith &amp; L.D. Pengelly</td>
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<td></td>
<td><strong>Title</strong> A Three Year Cohort Study of the Role of Environmental Factors in the Respiratory Health of Children in Hamilton, Ontario</td>
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<td>4</td>
<td>Author: L.D. Pengally, C.H. Goldsmith, A.T. Kerigan, W. Furlong &amp; S. Toplack</td>
<td>Same study as 1984 Cohort Study</td>
<td>Similar findings as 1984 Cohort Study</td>
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<td></td>
<td>Title: The Hamilton Study: Effect of Particle Size on Respiratory Health in Children</td>
<td>Same methods as 1984 Cohort Study</td>
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<td>5</td>
<td>Author: L.D. Pengelly, C.H. Goldsmith, A.T. Kerigan, W. Furlong &amp; S. Toplack</td>
<td>Same study as 1984 Cohort Study</td>
<td>Similar findings as 1984 Cohort Study</td>
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<td></td>
<td>Title: The Hamilton Study: Estimating Exposure to Ambient Suspended Particles</td>
<td>Same methods as 1984 Cohort Study</td>
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<td>6</td>
<td>Author: A.A. Diener, R.A. Muller &amp; A.L. Robb</td>
<td>Population not only concerned with health effects of pollution but the aesthetic effects. Choice experiment conducted to test how population values the benefits of improved air quality.</td>
<td>Air Quality was perceived to be poor. Most respondents concerned for all 4 attributes but mostly concerned with health effects. Majority respondents believed air quality in region was worse than rest of Southern Ontario.</td>
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<td></td>
<td>Title: Willingness to Pay for Improved Air Quality in Hamilton-Wentworth: A Choice Experiment</td>
<td>1997 survey conducted by mail 1,908 households with 515 completed (31%). Respondents presented with well defined scenarios involving 4 attributes of air quality: health effects (increased mortality and hospital admissions due to cardio-resp.), bad odour, black fallout, poor visibility) &amp; one payment vehicle property taxes/rent.</td>
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<td>Research Q</td>
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<td>Yr</td>
<td>2001</td>
<td>Outline of OMA’s position on current trends in Ontario air quality. Call for focus on air pollution based on health effects and ambient air concentrations.</td>
<td>For all of Ontario, study estimates approximately 1900 premature deaths in year 2000 from Air Pollution. Annually about 9,800 admitted to hosp. &amp; 13,000 emergency room visits, throughout Ontario. Children &amp; elderly most vulnerable as pop. ages will see increase in # affected. There are no specific mortality or morbidity estimates for Hamilton</td>
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<tr>
<td>Author</td>
<td>Ontario Medical Association</td>
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<tr>
<td>Title</td>
<td>Ontario’s Air: Years of Stagnation</td>
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<th>Research Q</th>
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<td>Yr</td>
<td>2001</td>
<td>Two questions: Are pop with lower SES more likely to be exposed to higher levels of particulate air pollution. How sensitive is the assoc between levels of particulate air pollution &amp; SES to specification of exposure estimates or statistical models.</td>
<td>Compared highest to lowest exposure zones=two fold increase in TSP concentrations and more than 20 fold increase in the probability of exposure to extreme events. Industrial areas exceed MOE objectives more than 25% of the time vs Western part of city less than 5% of the time. Lower the SES the higher the levels of exposure. Dwelling values significant and negative assoc. with pollution exposure -most reliable indicator of potential exposure. Low income &amp; unemployment also significant predictors. Results of variables varied depending on method of analysis</td>
</tr>
<tr>
<td>Author</td>
<td>M. Jerrett, P. Kanaroglou, J. Eyles, N. Finkelstein, C. Giovis, R.T. Burnett, &amp; J.R. Brook</td>
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<td>Title</td>
<td>A GIS-environmental justice analysis of particulate air pollution in Hamilton, Canada</td>
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<td>Social structure of Hamilton over the last thirty years reveals a city with diverse and unique populations in terms of socio economic status, demographic and ethnicity. Analysis suggests the existence of at least 4 neighbourhoods with characteristics associated with health status. #1 = Central Downtown #2 = Northeast industrial #3 = Chedoke-Kirkendall #4 = Southwest mountain</td>
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<td>Results revealed a wide range of estimates in mortality and morbidity attributed to Air Pollution. Range from 96-374 deaths. 139-607 respiratory admission. 257-2000 cardiovascular admissions. Depending on method of measurement. Thus results need to be interpreted and used only as general aids for policy. Since may have under or over estimated the burden of illness.</td>
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<td>High concentration of TSP in Central Hamilton. Dwelling values most closely assoc. with TSP (similar to Jerrett, 2001) strongest co-variant. Dwelling values also assoc. with lower Socio Economic Status (SES). Lower SES may be more vulnerable to health impact. Education may play a role in conditioning exposure.</td>
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<td>Research Q</td>
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<tr>
<td>Yr</td>
<td>2003</td>
<td>Investigate mortality rates specifically Chronic pulmonary Diseases (CPD) including asthma, in relation to neighbourhood levels of income and air pollution</td>
<td>5,228 (40 and over) referred to Firestone Institute for pulmonary function testing. Income calculated by linking postal codes with '96 census. TSP interpolated from network of monitoring stns (19 for SO2 &amp; 29 for TSP)</td>
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<td>Title</td>
<td>Relation between income, air pollution and mortality: a cohort study</td>
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<th>13</th>
<th>Research Q</th>
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<td>Yr</td>
<td>2004</td>
<td>Examines the sensitivity of health effect estimates to a wide range of possible uncertainties. Specifically estimates of morbidity/mortality and ambient air pollution. Update of Pengelly’s work requested by Clean Air Hamilton.</td>
<td>Examined scientific literature from 1997-01 for pooled/average estimates. and applied the estimates to local air pollution, mortality and hosp. Admission data for years 1995-99. Used similar methodology to Pengelly; identified specific pollutants, identified risk co-efficients, acquired air quality/health outcome data; estimated the burden of illness.</td>
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<tr>
<td>Author</td>
<td>T. Sahsuvaroglu &amp; M. Jerrett</td>
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<tr>
<td>Title</td>
<td>Sources of Uncertainty in calculating Mortality and Morbidity attributable to Air Pollution</td>
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<td>Research Q</td>
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<td><strong>Yr</strong></td>
<td>2004</td>
<td><strong>Summary</strong></td>
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<td></td>
<td><strong>Author</strong></td>
<td>M. Jerrett, R.T. Burnett, J. Brook, P. Kanaroglou, C. Giovia, N. Finkelstine &amp; B. Hutchinson</td>
<td>Increased mortality was assoc. with air pollution exposure in zones with lower Socio Economic Status (SES). East end low education and high manufacturing and unemployment had greatest impact. West end had highest SES and no significant effect. Low education and high manufacturing employment were significant and modified the impact of air pollution. May be those in manufacturing receive higher exposures overall.</td>
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<td></td>
<td><strong>Title</strong></td>
<td>Do socioeconomic characteristics modify the short term association between air pollution and mortality? Evidence from a zonal time series in Hamilton, Canada</td>
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<td>Assess short term assoc. between air pollution &amp; mortality in different zones of Hamilton. Hypothesis: that SES char. modify the acute health effects of ambient air pollution exposure.</td>
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<td>Intra-urban study design with city divided into 5 zones based on proximity to fixed site air pollution monitors, in particular for particulate air pollution and SO2. Daily counts of non-trauma mortality and air pollution est. were combined.</td>
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<td><strong>Yr</strong></td>
<td>2004</td>
<td><strong>Summary</strong></td>
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<td></td>
<td><strong>Author</strong></td>
<td>F.W. Lipfert</td>
<td>Concludes we need to examine vulnerabilities/risks created by poverty, esp. lack of air conditioning during heat waves, underlying health status of research subjects, and access to medical care. “Real” issue may be poverty not air pollution levels.</td>
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<td><strong>Title</strong></td>
<td>Air Pollution and poverty: Does the sword cut both ways?</td>
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<td>Review of three different studies examining differential impact of air pollution levels and burden of illness, including Jerrett’s et.al Hamilton study.</td>
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<td>Critical analysis of the findings of all three studies.</td>
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<td>2005</td>
<td>Applied GIS combined with small areas of data. Does chronic exposure to air pollution have significant assoc. with mortality when the effects of other confounders ie. social, demographic, lifestyle are taken into account?</td>
<td>Hamilton census tracts with avg. population 3,419 persons. Social and demographic data from 1991 census. Smoking variables extracted from secondary surveys, and TSP data from 23 MOE monitoring stations. Applied GIS. Strategy of triangulation among multiple methods compensates for limitations in specific methods and corroborates findings of other studies.</td>
<td>Findings show large and statistically significant health effects for women and men. Relative risk of premature mortality due to TSP exposure higher for men than for women, esp. with cardio, respiratory, and cancer mortality. Inclusion of confounding data reduced but did not eliminate the health effects of exposure to particulate air pollution.</td>
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</table>
| M. Jerrett, M. Buzzelli, R.T. Burnett & P.F. DeLuca | **Title**  
Particulate air pollution, social confounders, and mortality in small areas of an industrial city |                                                                                               |                                                                                              |

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<td>2005</td>
<td>Exposure to traffic &amp; air pollution may account for some of the SES differences in mortality rates in city with universal health coverage.</td>
<td>Sample size of 5,228 people aged 40 and over identified from lung function lab. at respirology clinic from 1985-99. Used 1996 census data to estimate household income. Also examined the number of high school graduates and the local unemployment rate. TSP three year average from 1992-94 (19 sites for SO2 &amp; 29 for TSP).</td>
<td>Circulatory diseases (chronic obstructive pulmonary disease, Ischaemic heart disease, diabetes, but not asthma) mortality rates were related to measures of neighbourhood deprivation and ambient air pollution levels. Also with proximity to traffic pollution. Concl: subjects in more deprived neighbourhoods had greater exposure to ambient particulate and gaseous pollutants and to traffic.</td>
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| M.M. Finkelstein, M. Jerrett, M.R. Sears | **Title**  
Environmental inequality and circulatory disease mortality gradients. |                                                                                               |                                                                                              |

Dr. Elizabeth Richardson  
Medical Officer of Health  
Public Health & Community Services