Hamilton

CITY OF HAMILTON

PUBLIC HEALTH SERVICES
Health Protection Division

TO: Mayor and Members Board of Health	**WARD(S) AFFECTED:** CITY WIDE
COMMITTEE DATE: July 11, 2013	
SUBJECT/REPORT NO: *Clean Air Hamilton* 2012 Progress Report (BOH13023) (City Wide)	
SUBMITTED BY: Elizabeth Richardson, MD, MHSc, FRCPC Medical Officer of Health Public Health Services Department	**PREPARED BY:** Brian Montgomery (905) 546-2424 Ext. 1275
SIGNATURE:	

RECOMMENDATION

a) That Appendix A "*Clean Air Hamilton* Air Quality Progress Report 2012" attached to Report BOH13023 respecting air quality in Hamilton be received;

b) That the City of Hamilton enter into an agreement with Hamilton-Wentworth Green Venture Incorporated to provide funding in the amount of $40,000 for the delivery of air quality and climate change programs on behalf of Clean Air Hamilton in 2013, as approved in the 2013 budget;

c) That City staff from Public Health Services work with staff from Planning and Economic Development to review planning process options for the adoption of the D-Series Guidelines from the Ontario Ministry of Environment to address land use planning;

d) That City staff from Public Health Services, Planning and Economic Development, and Public Works review options that can be taken at a municipal level to control and reduce air particulates; and

e) That City staff from Public Works continue to support the implementation of low-emission transportation alternatives and identify opportunities for increasing the use of green corridors for active transportation.

EXECUTIVE SUMMARY

Clean Air Hamilton is a community initiative to improve air quality in the City of Hamilton. It has a diverse membership with representation from environmental organizations, industry, businesses, academic institutions and different levels of government. Initiated in 1998, *Clean Air Hamilton* works to improve air quality throughout the City of Hamilton and meet all ambient air quality criteria.

Despite significant reductions in pollutant levels since the mid 90s, further improvements in air quality are warranted. *Clean Air Hamilton* is concerned that over the past three to four years the downward trends in some air pollutant levels have either levelled off or have shown modest increases. The only pollutant that continues to decline steadily is nitrogen dioxide (NO_2). The annual values for inhalable particulate matter (PM_{10}), respirable particulate matter ($PM_{2.5}$), sulphur dioxide (SO_2), benzene and benzo[a]pyrene all have shown increases over the past three to four years. The increases in PM_{10}, $PM_{2.5}$ and SO_2 in Hamilton are in contrast to recent trends in other major Ontario cities.

The "*Clean Air Hamilton* Air Quality Progress Report 2012" (Appendix A) makes recommendations in the areas of health protection, transportation planning, land-use planning, energy conservation, air monitoring and emissions reductions. These recommendations are listed within this staff report under Section 5.0 on Page 23-24. Highlights include:

- The adoption of the D-Series Guidelines from the Ministry of Environment (MOE) to address land-use planning;
- Working with local industry and MOE to control sources of air pollution;
- Encouraging the use of transportation alternative with less emission output and increasing the use of green corridors for active transportation; and
- Educating the public on individual measures to conserve energy and decrease air emissions.

The City benefits by maintaining support for actions that will improve local air quality. *Clean Air Hamilton* provides the opportunity to share scientific and technical information to increase the level of dialogue within the community on the health impacts of poor air quality; and the best industrial, business and personal actions that will lead to air quality and health improvements for all citizens.

Clean Air Hamilton will continue to address air quality issues and their relationships to public health outcomes. It will work in partnership with City staff to ensure that air quality goals are integrated into the decision-making processes across all departments within the City. *Clean Air Hamilton* also actively cultivates partnerships with organizations that have air quality improvement goals that are aligned with those of *Clean Air Hamilton* and the City of Hamilton.

Alternatives for Consideration – See Page 24

FINANCIAL / STAFFING / LEGAL IMPLICATIONS (for Recommendation(s) only)

Financial: No new funds are requested as a result of this recommendation. A base budget amount of approximately $56,000 has been established for air quality and climate change related projects. Air Quality and Climate Change Projects for 2013 include: $5,500 Totally Transit (bus education for children and elderly citizens); $20,000 Climate Change Champions and the Hamilton Climate Change Charter (engaging and supporting local organizations in reducing greenhouse gas emissions), $500 Clean Air Events and Speakers (making Hamiltonians aware of air quality and the work of *Clean Air Hamilton*); $1,000 Climate Change brochures; $2,000 Smart Driver (anti-idling education); and $12,000 supporting the Air Quality Health Index (AQHI) in Hamilton and a mobile air monitoring study of schools. These programs will be supported by the volunteer and advisory team from *Clean Air Hamilton* members which was $69,000 in 2012 and expected to increase in 2013.

Hamilton-Wentworth Green Venture (Green Venture) will be the delivery agent for some of these programs for *Clean Air Hamilton* at a total cost of $40,000. These 2013 programs are: Totally Transit, Climate Change Champions and the Hamilton Climate Change Charter, Smart Driver, Clean Air Events and Speakers and a mobile air monitoring study of schools.

Staffing: No new staffing is requested as a result of this recommendation. Public Health Services (PHS) has an Air Quality and Climate Change Co-ordinator in the Health Protection Division who supports the work of *Clean Air Hamilton* in the City and to the community.

Legal: No legal implications.

HISTORICAL BACKGROUND (Chronology of events)

In 2010, *Clean Air Hamilton* identified nine strategic issues related to air quality improvements and climate change that the committee wished to focus on from 2010 to 2013. These issues have been identified for research, communication and program activities by *Clean Air Hamilton* in collaboration with our partners:

- ***Public Health Protection:*** Bring an AQHI to Hamilton and produce communications to citizens about the health effects of poor air quality; particularly on smog days and inversion days. This objective was achieved in 2011.
- ***Active & Sustainable Transportation:*** Encourage the use of active and sustainable means of energy-efficient transportation and encourage emissions reductions by moving away from single occupancy personal transportation.
- ***Smart Drivers:*** Reduce unnecessary idling of vehicles, reduce impacts of vehicle emissions and reduce emissions from driving.
- ***Air Quality Communication:*** Continue to communicate on the impacts and sources of poor air quality, encourage behavioural changes and increase support for *Clean Air Hamilton*.
- ***Climate Change:*** Provide a forum to discuss the linkages between climate change and air quality and encourage action to reduce climate change impacts in Hamilton.
- ***Emission Reductions Strategies:*** Develop a plan to reduce emissions from small, medium and large scale sources on "bad air" days (e.g., smog days).
- ***Energy Conservation:*** Encourage energy conservation by promoting best practices in energy efficiency and renewable energy, and by encouraging reductions in wasteful uses of electricity. This promotion will assist the public and decision-makers to make the connection between climate change mitigation and air quality improvements.
- ***Land-Use Planning:*** Encourage actions by the City through land use policies to promote reductions of emissions and improvements in air quality through better planning tools.
- ***Tree Programs:*** Develop a tree networking and tree inventory organization for all the tree planting activities across the City.

The City has historically maintained support for actions that will improve local air quality, reduce greenhouse gas emissions and increase energy conservation. It has also increased the level of dialogue within community groups on the health impacts of poor

air quality; and the best actions and lifestyle changes that will lead to air quality improvements for all citizens.

In 2012, the Board of Health requested that an Air Quality Task Force (AQTF) be established under *Clean Air Hamilton* to provide recommendations on actions that can be undertaken at the municipal level to address local air quality issues such as fugitive dust and particulate matter. The AQTF was established under *Clean Air Hamilton* and will be reporting back to the Board of Health in Fall 2013.

This report reflects the activities of *Clean Air Hamilton* in 2012 and the recommendations highlighted are those of *Clean Air Hamilton*; and not the AQTF.

POLICY IMPLICATIONS/LEGISLATED REQUIREMENTS

The City has adopted 2012 and 2020 emissions targets for air pollutants and greenhouse gas under the 2008 Corporate Air Quality and Climate Change Strategic Plan from the Planning Committee report PED06336(a).

2012	2020
10% reduction of 2005 emission levels	20% reduction of 2005 emissions levels

In 2011, the City achieved a 16% reduction in emissions compared to 2005 emission levels (as per report BOH12029). City policies that support the initiatives of improving air quality and addressing climate change include:

- Urban Official Plan
- Rural Official Plan
- GRIDS
- Transportation Master Plan
- Cycling Master Plan
- Pedestrian Master Plan
- Hamilton Public Health Strategic Plan
- Corporate Smog Plan
- Public Works Strategic Plan

- Planning and Economic Development Strategic Plan
- Corporate Energy Policy
- Corporate Green Fleets

City staff must consider air quality and climate change impacts and sources in the development and review of local municipal health, land-use, transportation and quality of life planning policies and programs, to meet the desired improvements in local air and combating climate change outlined in City policies.

RELEVANT CONSULTATION

This Report has been prepared in collaboration with the *Clean Air Hamilton* Coordination Committee. City staff on the *Clean Air Hamilton* Coordination Committee includes representation from Planning & Economic Development - Community Planning; Public Health Services - Health Protection; and Public Works - Transportation, Energy and Facilities.

Members of the *Clean Air Hamilton* Coordination Committee include the MOE, Health Canada, McMaster University, McMaster Institute of Environment and Health, Mohawk College, Green Venture, Environment Hamilton, Rotek Environmental Inc., Horizon Utilities, the Hamilton Industrial Environmental Association, ArcelorMittal Dofasco, U.S. Steel Canada and citizens.

ANALYSIS / RATIONALE FOR RECOMMENDATION

(include Performance Measurement/Benchmarking Data, if applicable)

The following is a summary of the "*Clean Air Hamilton* Air Quality Progress Report 2012" and highlights some of the key areas of research and programs on air quality and climate change in 2012. More information on the 2012 work of *Clean Air Hamilton* and partners can be found in the "*Clean Air Hamilton* Air Quality Progress Report 2012", attached as Appendix A to Report BOH13023.

1.0 Air Quality in Hamilton

1.1 Hamilton Air Quality Trends

The annual percentage decreases over time are significant in many pollutant categories as measured at the downtown air monitoring site (MOE Station 29000). These

decreases include an average 2.8% per year decrease in total suspended particulate (TSP) levels, a 1.8% per year decrease in PM_{10}, a 3.1% per year decrease in $PM_{2.5}$, a 2.8% per year decrease in NO_2, a 2.5% per year decrease in SO_2, a 6.0% per year decrease in total reduced sulphur odours, a 6.0% per year decrease in benzene and a 5.3% per year decrease in PAH (as measured as benzo[a]pyrene).

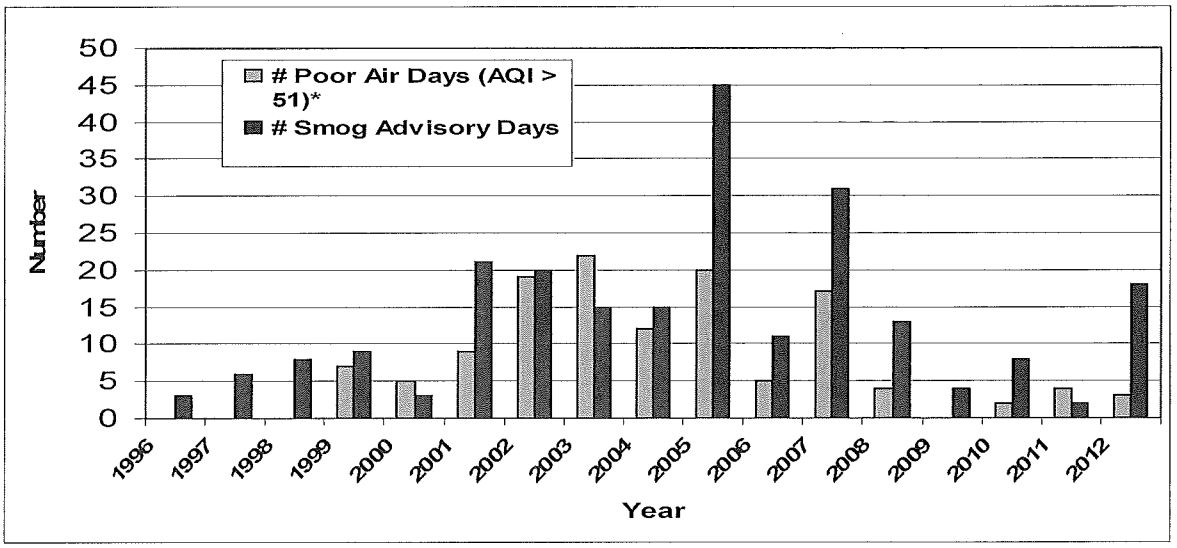
Over the past three to four years, the downward trends in some air pollutant levels have either levelled off or have shown modest increases. The only pollutant that continues to decline steadily is NO_2. The annual values for PM_{10}, $PM_{2.5}$, SO_2, benzene and benzo[a]pyrene all have shown increases over the past three to four years. These increases are notable compared to the levelling off of these contaminants observed in other major Ontario cities.

1.2 Smog Advisories

A smog advisory is issued by the MOE when the Air Quality Index (AQI) reaches or exceeds a value of 50; a smog advisory day is declared when it is predicted that the AQI may reach or exceed 50 on an upcoming day or the AQI has already reached a value over 50 and is expected to remain above 50 for the advisory period. The advisory's purpose is to alert the public that widespread elevated levels of air pollution exist.

There are three air quality monitoring stations in Hamilton which provide the data used to calculate the AQI. Poor Air Quality Days are days where the AQI actually exceeded a value of 51 for one hour. In 2012, there were a total of three days when the air quality was considered to be poor (i.e., an AQI of 50 or greater for at least 1 hour); and 18 smog advisory days that were declared by the MOE for the City of Hamilton (see Figure 1).

Figure 1: Number of Poor Air Quality Days and Smog Advisory Days in Hamilton between 1996 and 2012



1.3 Local Poor Air Quality Notifications

The local MOE office has taken action to improve local air quality through having approximately 30 local industries voluntarily curtail emissions and control dust-generating activities on days when local air quality is poor, due to certain types of particles in the air (fine particulate matter) that are above a certain level. This system was developed by the Ministry in partnership with PHS, McMaster Institute of Environment and Health, *Clean Air Hamilton* and the Hamilton Industrial Environmental Association (HIEA). The system of reporting on and taking action for local poor air quality is exclusive to Hamilton. The protocol is not based on the MOE's AQI in the way that the MOE's current province-wide system of smog alerts is based on the AQI.

The focus of the notification system is on fine particulate matter ($PM_{2.5}$) because there is a significant amount of $PM_{2.5}$ that is locally generated. Participating companies are told when local air quality is poor due to fine particulate matter above a certain level. The companies then implement their plans to reduce local sources of fine particulate matter. These plans may include actions such as wetting or covering material piles (e.g., coal, gravel), postponing material handling activities, increasing property and road cleaning and curtailing some production processes. In 2012, the local MOE office called a Local Poor Air Quality Notice twice. All industries notified complied with the request to curtail activities.

1.4 Emission Sources in Hamilton

The air quality in Hamilton is impacted by a combination of factors (see Figure 2) that do not co-occur in other communities in southern Ontario:

- The roads in and around Hamilton are heavily used by local citizens, commuters passing through Hamilton and long-distance car and truck traffic. As a consequence, the air quality is adversely impacted by the mobile emissions generated by gasoline-powered vehicles and diesel-powered transport trucks.
- Hamilton is home to a large number of small, medium and large industries.
- Hamilton is located at the West end of Lake Ontario and is surrounded by the escarpment; a combination that brings unique meteorological challenges to the area. The local topography (i.e. the escarpment) and prevailing weather conditions contribute to conditions where air pollution levels are usually higher below the escarpment where there are more industries and higher density urban development than above the escarpment.
- A few times a year unusual meteorological conditions can occur that give rise to atmospheric inversion events, which may last from 2 to 12 hours. During these events, pollutant levels can rise dramatically for a short time. These events are most common in the Spring and Fall.
- Hamilton is also affected by transboundary air pollution (primarily ground-level ozone and air particulates from sources in the mid-Western United States). In this respect, Hamilton is no different from many other urban areas, small communities and rural areas in south-western Ontario. It has been estimated that about 50% of the air pollution in Hamilton air comes from long-range transport; the remainder are locally generated combustion emissions.

Figure 2: The Air Pollution Picture

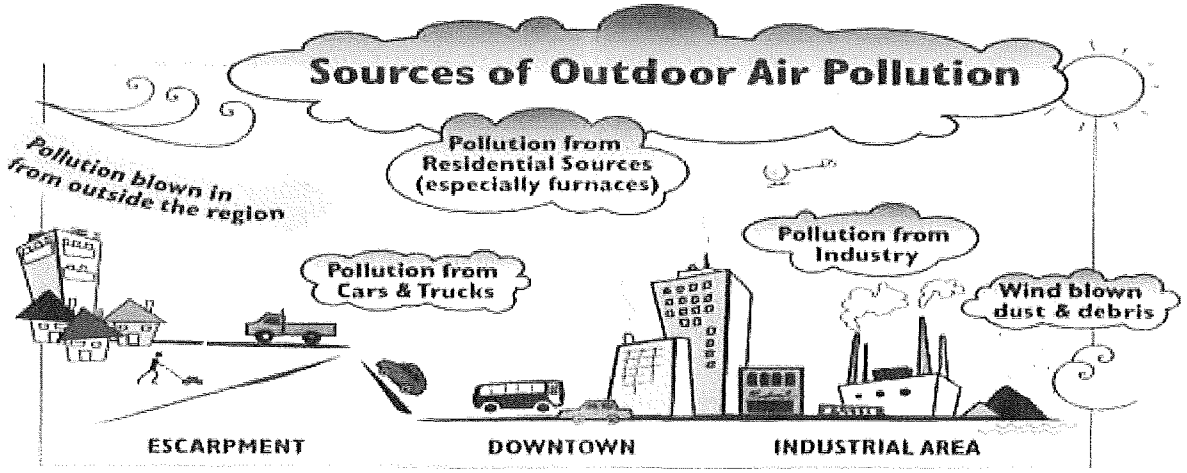
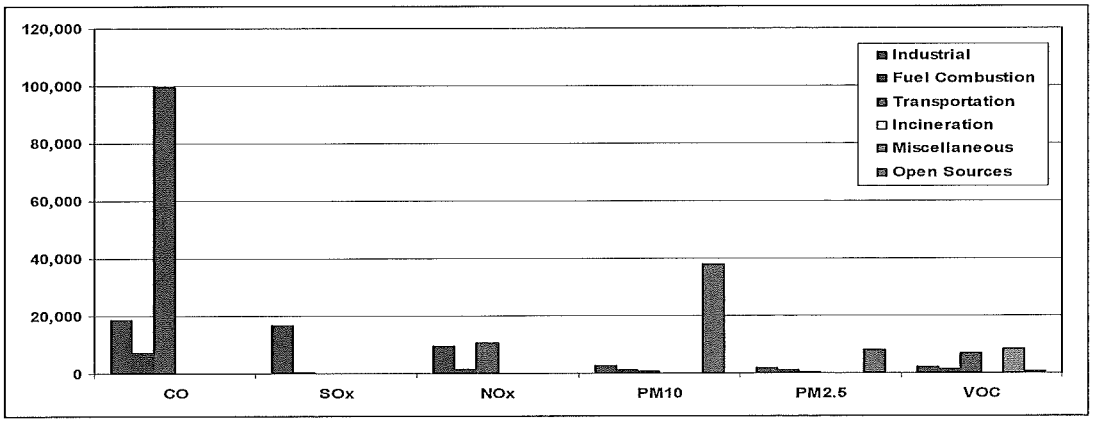


Figure 3 shows the total emissions data from the National Pollution Release Inventory for Hamilton, broken down by source category. These data show that carbon monoxide (CO) is the air pollutant with the largest emissions. Based on available emissions inventory data from the MOE and Environment Canada, it is possible to conclude that:

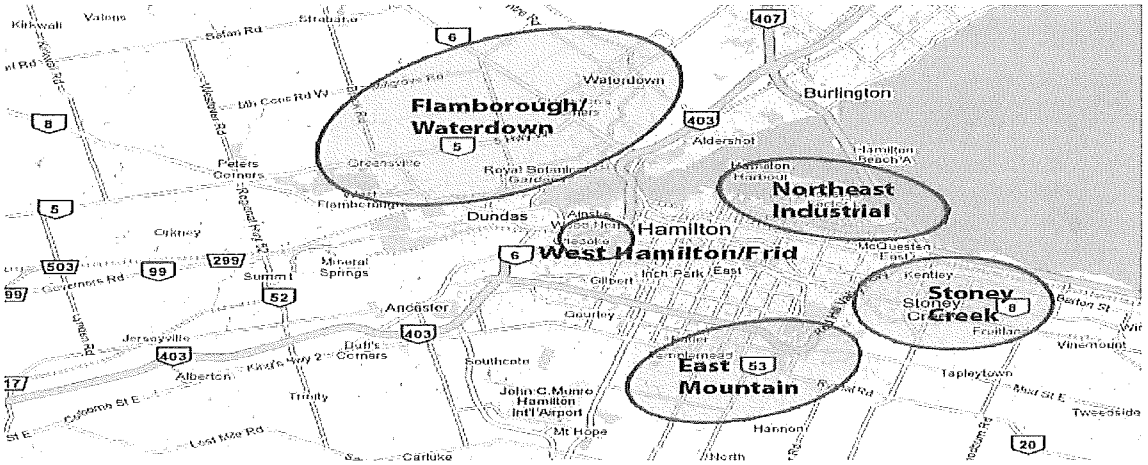
- The transportation sector (i.e., mobile sources, such as cars and trucks) is the leading source of nitrogen oxide (NO) emissions within the City of Hamilton, followed closely by the industrial sector;
- Road dust, construction activities and area sources; such as fireplaces and home heating are primary sources of $PM_{2.5}$ and PM_{10} in Hamilton, followed closely by emissions from the industrial sector;
- The industrial sector is the leading source of SO_2 in Hamilton (~90%);
- The transportation sector is the leading source of CO emissions within Hamilton; and
- The transportation sector is the leading source (~60%) of volatile organic compounds (VOCs); the remaining VOCs are releases due to by-product operations by companies and general solvent use by companies and individuals.

Figure 3: National Pollutant Release Inventory Total Emissions by Contaminant and Source - Hamilton (2008)



Five separate industrial areas have been identified in the greater Hamilton area from mobile air monitoring (Figure 4): Flamborough/Waterdown (aggregates industries), East Mountain (aggregates industries), West Hamilton/Frid (mixed industrial and University), Northeast Industrial Area (heavy and mixed industrial activities) and Stoney Creek (mixed industrial activities and aggregates industries).

Figure 4: Emission Sources by Region in the Hamilton Area

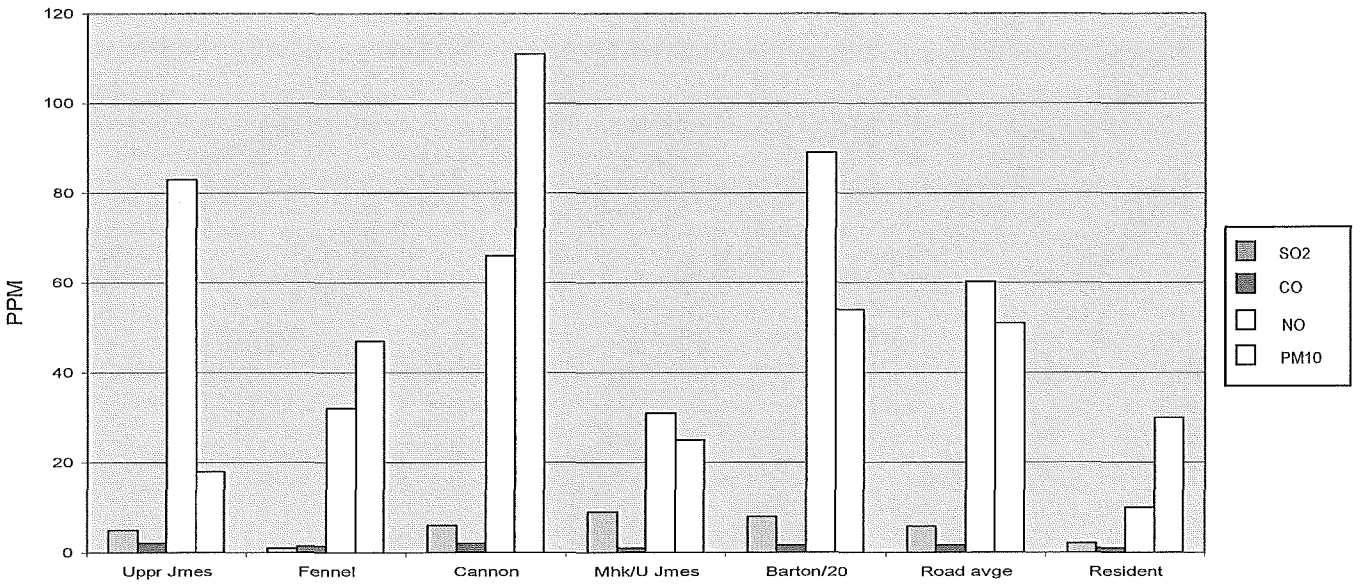


Mobile air monitoring studies were performed by driving a van outfitted with air monitoring equipment in traverses across the City, through selected industrial areas, and at selected major traffic intersections. The industrial point sources monitored included large integrated steel industries, steel by-products processors, recycling/scrap operations, foundries, chemical plants, companies with large storage piles, agricultural materials processing plants, a brick manufacturing operation, university operations, a vegetable oil processing plant, a carbon black manufacturing plant, a rail shunting yard and truck transfer station and a cogeneration natural gas plant.

These mobile air monitoring studies found that overall, the highest concentrations of pollutants were observed near major road intersections and along heavily used roads; particularly roads affected by dirt track-out from industrial sites throughout the City. These high levels of pollutants are attributed to the impacts of traffic emissions from automobiles, light trucks and heavy trucks. Industrial sources made significant contributions, particularly for SO_2, but these contributions were often overwhelmed by local traffic emissions.

Figure 5 shows the levels of four important air contaminants (SO_2, CO, NO and PM_{10}) at seven road locations in Hamilton. The first five locations are values obtained along major roads or at major intersections. The remaining data are the average for all roads in Hamilton (called "Road avge."); and a typical example of data from a street in a residential area of Hamilton (residential areas are at a distance from major roads but are usually within 200-500 m of such roads).

Figure 5: Mobile Monitoring Study - Levels of Four Air Contaminants



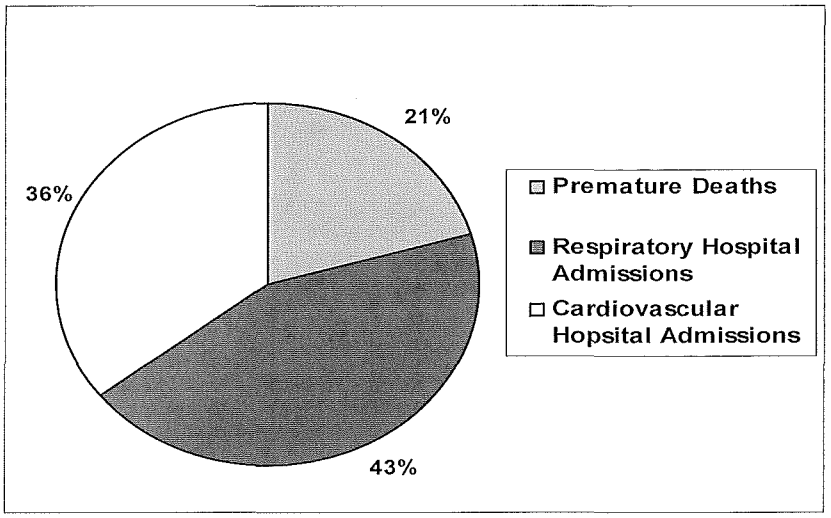
1.5 Health Impacts

Poor air quality is associated with a range of health effects. Some segments of the population; particularly young children and the elderly, are much more susceptible to the adverse health effects of poor air quality.

In 2011, *Clean Air Hamilton* in partnership with PHS updated the two previous health studies (in 2003 and the 1997 Hamilton Air Quality Initiatives report) that had been undertaken and reported by *Clean Air Hamilton*. SENES Consulting agreed to undertake the task of providing a comprehensive review and update of the scientific literature linking air pollutants and health effects, and to use ambient air data from Hamilton to determine the health impacts of air pollution in Hamilton based on the most recent air quality and health reports. Due to improvements in air quality in Hamilton over the last 10 years, there was interest to see if the associated health impacts had also been reduced.

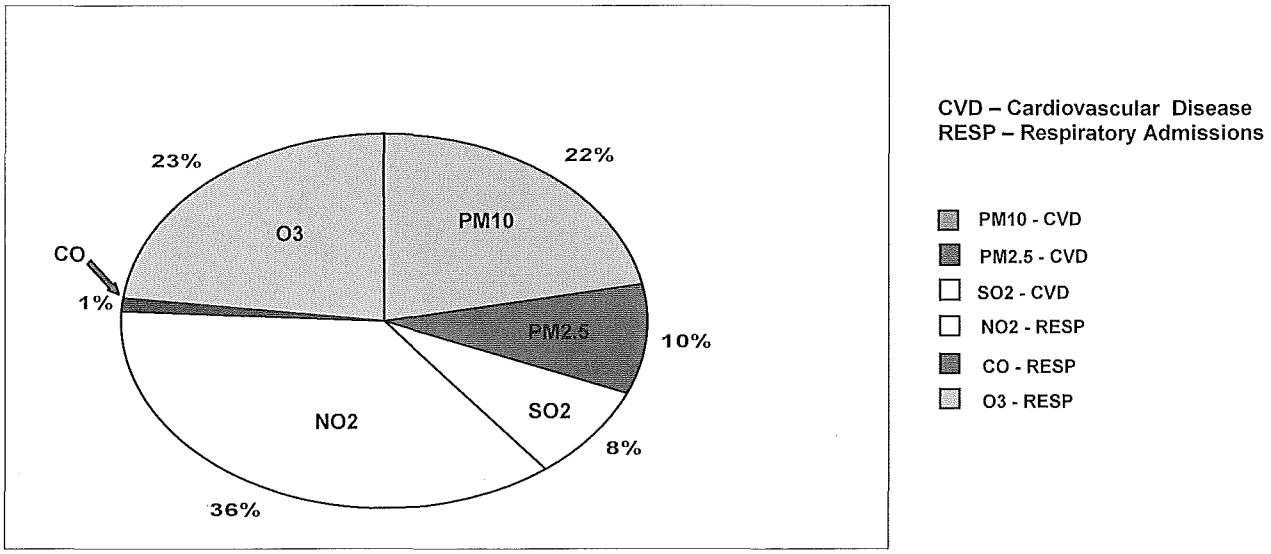
The 2011 Air Quality Health Assessment Study estimated that the six key air pollutants - NO_2, ground-level ozone (O_3), PM_{10}, $PM_{2.5}$, SO_2 and CO contribute to about 186 premature deaths, 395 respiratory hospital admissions and 322 cardiovascular hospital admissions each year in Hamilton (see Figure 6).

Figure 6: Air Pollution Health Impacts in Hamilton



All of these air pollutants contribute to health effects outcomes; however, some health outcomes are linked to exposures to specific air contaminants. For example, the main air pollutants contributing to respiratory admissions to hospitals are O_3, SO_2 and nitrogen oxides. On the other hand, particular matter (both PM_{10} and $PM_{2.5}$) and CO were major contributors to cardiovascular admissions to hospitals. Figure 7 below outlines the relative contributions of air pollutants to health impacts in Hamilton.

Figure 7: Contribution of Air Pollutants to Health Impacts Hamilton (%)



Overall, with the average measured air quality for the Hamilton region improving, the number of hospital admissions associated with respiratory ailments has remained unchanged since the 2003 study. However, hospital admissions associated with cardiovascular effects have decreased significantly since 2003. Overall, deaths due to air pollution decreased from 229 in 2003 to 186 in 2012; a 19% improvement. These values were not corrected for population increases which would further improve the picture.

1.6 Air Quality Health Index (AQHI)

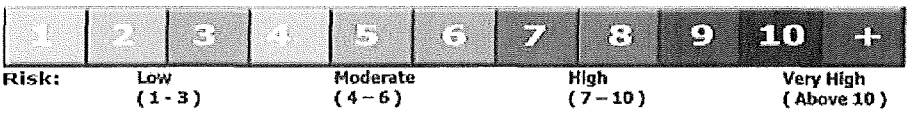
Clean Air Hamilton and PHS have advocated for the development and wide-spread use of a health-based AQI; a well-conceived health index would provide the public with useful information about current air quality conditions and strategies to reduce their exposures. A few years ago, the Government of Canada developed an AQHI and piloted it in selected cities across Canada. Environment Canada began to report daily AQHI reporting for Hamilton on its website in July 2011.

The Government of Canada's new AQHI is calculated in a different manner compared to the MOE's AQI. While the MOE's AQI currently takes into account six air pollutants [$PM_{2.5}$, NO_2, SO_2, CO, total reduced sulphur (TRS) compounds and O_3], the AQI value is calculated based on only one of these six pollutants; depending on which pollutant has the highest value on its own scale.

The impacts of individual air pollutants on humans are additive; in other words an air quality index should be based on the contributions of the health effects of all pollutants measured. The MOE's AQI values do not reflect these additive effects. Health Canada's AQHI is calculated using a formula that combines the concentrations and the relative health impacts of three air pollutants: O_3, $PM_{2.5}/PM_{10}$ and NO_2.

Federal, provincial and municipal governments collaborated to develop the AQHI as a numeric tool that could be used by health professionals and the public to determine the health risks related to air quality at a given time. In Figure 8, the AQHI scale is shown as a continuous, open-ended scale that ranges from low risk levels (one to three), moderate risk levels (four to six), high risk levels (seven to ten) and very high risk levels (greater than ten).

Figure 8: Air Quality Health Index Scale



Source: Environment Canada, 2010

Associated with the AQHI are health messages that are directed at two distinct populations – the "At Risk" population and the "General" population (see Figure 9).

The "At Risk" population includes young children, the elderly and people with chronic diseases (e.g., asthma, chronic obstructive pulmonary disease, previous history of heart attack, congestive heart failure). The "General" population includes all other individuals who do not fall under the "At Risk" population (Environment Canada, 2010).

Those in the "At Risk" category are encouraged to monitor the AQHI regularly since they are more sensitive to air pollution. Individuals are encouraged to develop their own self-calibration points on the AQHI scale.

Figure 9: Air Quality Health Index Health Messaging

Health Risk	Air Quality Health Index	Health Messages	
		At Risk Population*	General Population
Low	1 - 3	**Enjoy** your usual outdoor activities.	**Ideal** air quality for outdoor activities.
Moderate	4 - 6	**Consider reducing** or rescheduling strenuous activities outdoors if you are experiencing symptoms.	**No need to modify** your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High	7 - 10	**Reduce** or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	**Consider reducing** or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High	Above 10	**Avoid** strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	**Reduce** or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation

Source: Environment Canada, 2010

The AQHI is described as a risk communication tool (Abelsohn and Stieb, 2011)[1]. Understanding the essence of risk communication and implementing two-way transfer of information between stakeholders has prompted AQHI outreach in organizations not approached previously in the City of Hamilton. Both planned and prompted AQHI outreach activities and events have targeted members of the "At Risk" populations in Hamilton effectively. To date, over 2,000 individuals in Hamilton have received information on the AQHI and how to protect their health.

Stakeholder feedback indicated that 83% believe that PHS is the best agency in Hamilton to provide AQHI information to the public (City of Hamilton PHS, April 2010)[2]. The reasons why the public supports PHS in this initiative are consistent with risk communication theory and focus on trust and credibility in government (OECD, 2002). Exchange of information between PHS and individuals visiting the AQHI booth at special events has generated requests and resulted in AQHI outreach with other organizations servicing the "At Risk" population.

2.0 Air Monitoring

Air monitors collect information about outdoor air quality data across the City of Hamilton and these data can be compared to provincial and federal air quality standards and to levels at cities across Canada and around the world. Other uses of these data are to identify sources of air pollutants and to evaluate the potential impacts of air emissions on human health.

The air quality monitors in Hamilton are operated by two different organizations. The MOE operates a network of three fixed air monitoring stations, which serve as Provincial AQI monitoring stations. These stations are situated in West Hamilton, on the Mountain and just East of downtown. The Hamilton Air Monitoring Network (HAMN) operates a network of 15 stations that monitor air quality in the industrial sector of Hamilton. This network is fully funded by local industry member companies. The locations of these stations, the pollutants monitored at each station and the data quality are overseen by the local MOE staff. Any exceedences of air quality parameters identified by air monitors in the network are reported immediately (i.e., on an hourly basis) via e-mails to the MOE, and to any member companies who may be the source of emissions leading to the observed exceedence. Public access to all real-time air monitoring data collected by HAMN can be found at a website developed as a partnership between *Clean Air Hamilton*, HAMN, the City and the MOE (www.HAMNair.ca).

2.1 East End Air Monitor (BOH10022)

Between 1985 and 1996, the MOE operated an air monitoring station in Ward 5 at Sam Manson Park. The monitor was named the "East Hamilton AQI Station" and it measured coefficient of haze, ozone, sulphur dioxide and total suspended particulates.

The MOE reported that the former East Hamilton AQI Station was removed in 1996 because the other three Hamilton AQI stations were sufficient to measure smog and long-range pollutants. The decision to remove the East Hamilton AQI station upset many area residents who felt that the east end was no longer being represented by way of air monitoring.

To address this concern, an air monitoring pilot project was initiated by PHS. A portable air monitoring system called an "Airpointer" was installed on November 21, 2012 at Sam Manson Park near Barton Street and Nash Road. This pilot project, scheduled to last one year, began January 1, 2013 (as per report BOH10022, presented to Board of Health on September 27, 2010).

The Airpointer is capable of measuring five common air pollutants on a continuous basis including: SO_2, O_3, $PM_{2.5}$, CO and NO_x. In addition, some meteorological parameters are monitored including wind speed, wind direction, barometric pressure, ambient temperature, relative humidity and rainfall.

Data obtained from the pilot project air monitoring station at Sam Manson Park is managed by HAMN and is made available for public access in real-time on the City of Hamilton's website through a link to the HAMN web site (www.hamilton.ca/airmonitor).

Upon completion of the one-year pilot project, data gathered will be assessed by members of *Clean Air Hamilton* and a summary report along with recommendations provided to the Board of Health.

2.2 Mobile Monitoring

Hamilton is the Canadian pioneer in undertaking a program of mobile air quality monitoring. The mobile monitoring van can roam city-wide and can measure ambient air quality conditions on a minute-by-minute basis at street level. This type of monitoring affords a dramatic, real-time picture of the changing exposures people experience. The first mobile air monitoring in Hamilton was done in 2004 as a pilot project funded by the City and *Clean Air Hamilton*. The monitoring van and the monitoring equipment were brought together as a result of a partnership between *Clean Air Hamilton*, MOE, Environment Canada and Rotek Environmental.

The original motivation for undertaking these studies was to provide a 'street-level view' of air quality in Hamilton and to compare the air quality in different areas and neighbourhoods across the City. Data from earlier mobile air surveys has been presented in previous *Clean Air Hamilton* reports.

2.2 a) Neighbourhood Monitoring

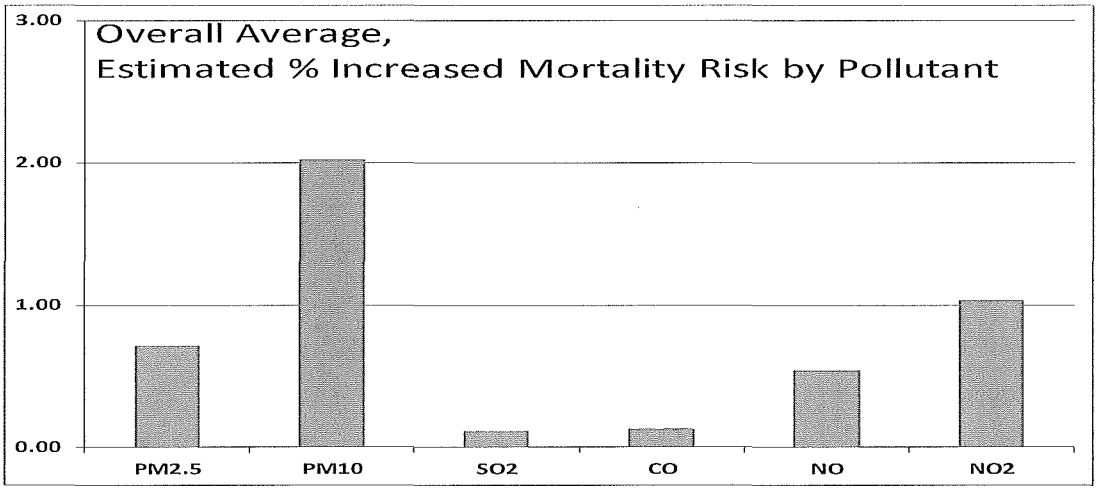
In 2010 and 2011, *Clean Air Hamilton* in partnership with Green Venture, began a mobile monitoring project to measure ambient air quality, to identify potential emissions sources and to determine the potential health impacts of ambient air in various neighbourhoods across Hamilton. Funding for the project was provided by a grant from

ArcelorMittal Dofasco. Neighbourhood groups were encouraged to identify their desire for monitoring through local media and neighbourhood association announcements.

Requests for monitoring came from 26 neighbourhoods in Hamilton; however, only 11 neighbourhoods and sites were selected for 2011 air monitoring, based on limitations of resources and time. The neighbourhoods in the 2010 and 2011 mobile air monitoring study included: Dundas, the area near Limeridge Mall, Red Hill neighbourhoods, Delta, Lawrence Avenue to Burlington Street, North West End, Wentworth North, McAnulty Boulevard, Beach Boulevard/Eastport Drive and Jones Road/Arvin Avenue.

Citizens tend to be most interested in the overall health impacts of air pollution, rather than details of the levels of individual pollutants. To provide the most meaningful results for neighbourhood residents concerned about health effects; as well as, for government officials pursuing air pollution control actions, total health effects due to air pollution exposures were calculated for each neighbourhood using the most recently available risk values from the SENES 2011 Health Study report. These total health impact values were then further structured into values for each individual pollutant (Figure 10), allowing assessment of the health impacts of each contaminant on the health of citizens in each neighbourhood.

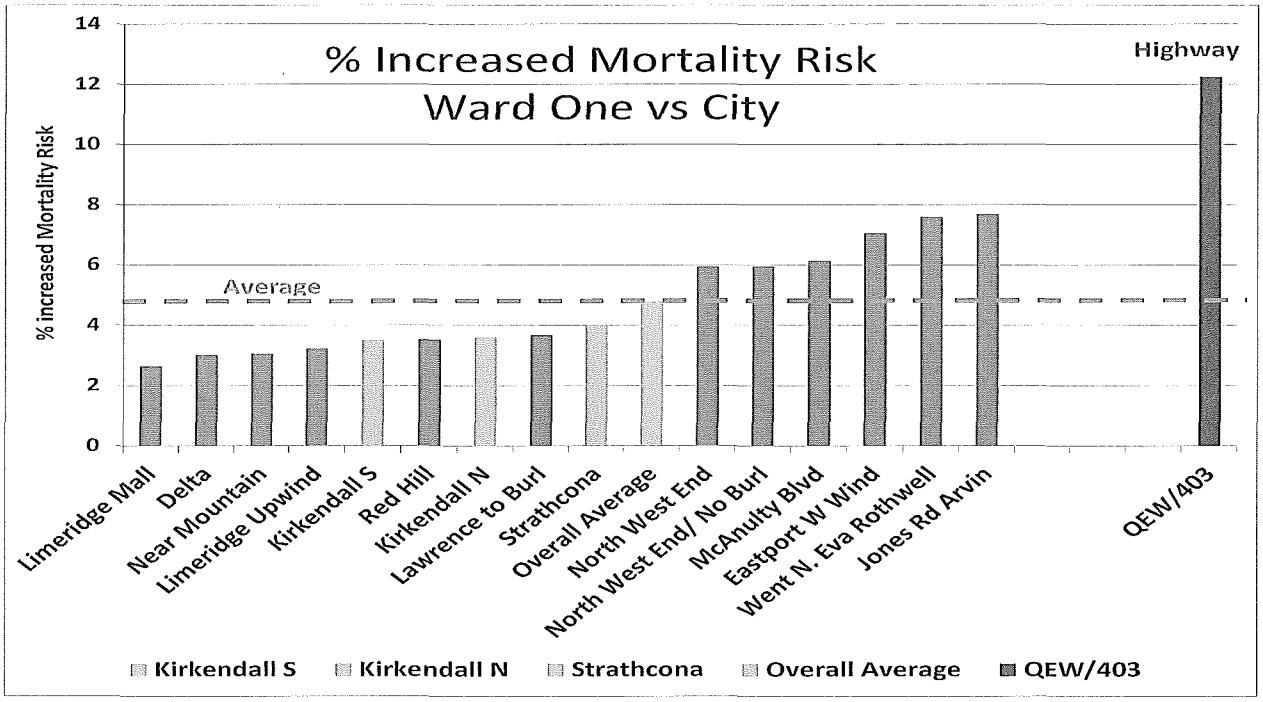
Figure 10: Overall Average Estimated Percent Increased Mortality Risk by Pollutant for the City of Hamilton



The overall average increased mortality risk due to exposure to air pollution in Hamilton was determined to be 4.6% (total of risks in Figure 10). Of the 11 neighbourhoods monitored in 2011, all showed air pollution impacts with risks ranging from 2.5% to 7.7% increased mortality risk. The majority of these health impacts were due to particulate matter and oxides of nitrogen, primarily from transportation sources.

In 2012, a mobile air monitoring survey of three neighbourhoods in the West end of Hamilton, namely Kirkendall South, Kirkendall North and Strathcona was undertaken. This study was performed during November and December 2012. Figure 11 shows the results of all neighbourhoods that have been monitored to date.

Figure 11: % Increased Mortality Risk in Hamilton Neighbourhoods vs. Highway



The "Overall Average" number in Figure 11 refers to the average of the data from the neighbourhoods studied as part of the neighbourhood mobile monitoring study. This average does not include the "Highway" value nor does it include any data from any other sites in Hamilton.

The "Highway" data in Figure 11 was the average value obtained while driving on the Queen Elizabeth Way and reflects the typical exposures drivers and passengers experience within a vehicle on a major highway. The highway exposure is nearly three times the neighbourhood average. Clearly, exposures to air pollutants while driving on the highway are far above any neighbourhood exposures.

Presenting these results to the nieghbourhoods and citizens has led to increased interest in mobile monitoring and more requests from neighbourhoods for air quality and health impacts monitoring. These studies continue as additional funds become available for more research work.

3.0 Land Use Planning – Linkages to Improving Air Quality

The layouts of towns and cities across Canada (and North America) are the net result of many land-use planning decisions over the years. Municipalities approve the location, design and construction of commercial buildings, residential dwellings, sub-divisions, industrial areas, roads, streets, highways, services, etc. within their municipal jurisdiction. There has been increasing recognition that air quality in urban areas is strongly linked to the nature of the built urban environment; or "urban form".

Hamilton is a particularly challenging environment for air quality due a complex mix of vehicular emissions and industrial emissions and a landscape dominated by a U-shaped, 100-metre high escarpment and proximity to a large harbour and one of the Great Lakes.

Clean Air Hamilton believes that there are three key areas where better coordination among decision-makers on land-use will help to reduce air quality impacts in Hamilton and will help to ensure sustainable development decisions where land-use compatibility issues exist:

1. Between industrial and sensitive uses;

2. Between facilities with site specific air standards and sensitive uses; and

3. Between on-road mobile sources and sensitive uses.

Identification of these three issues is based on *Clean Air Hamilton's* collective experience addressing air quality in this unique Hamilton air shed.

Towards implementing these recommendations *Clean Air Hamilton* suggests that the following be considered:

- The MOE, City of Hamilton Planning Department and *Clean Air Hamilton* develop a shared understanding of how municipal planning decisions are coordinated with Environmental Compliance Approvals and site-specific standard setting processes to ensure land-use compatibility between industrial facilities and sensitive land-uses.

- An analysis of options for implementing separation distance and buffer policies regarding industry, roadways and sensitive land-uses.

- Research undertaken by other communities on measures to address emissions from on road vehicles from arterials and 400 series highways be consulted to develop zoning, street design and building standards that minimize the effects of air emissions within Hamilton's unique air shed.

4.0 Air Quality Programs in 2012

Clean Air Hamilton undertook a number of air quality related programs in 2012 to improve local air quality through research, education and communication. Several of these programs were supported and assisted by partnerships with the City and other organizations (MOE, Green Venture). These programs were in line with the nine strategic issues identified by *Clean Air Hamilton* in 2010 related to air quality improvements and climate change to focus on from 2010 to 2013. Examples of these programs are provided below.

4.1 Upwind Downwind 2012 Conference

Every two years *Clean Air Hamilton* hosts the Upwind Downwind Conference. This event highlights the latest in air quality research; particularly as it applies to the human health impacts of air pollution and strategies, and activities to improve air quality on local, regional and national scales. The programs of these conferences have been designed to be accessible to the non-expert and are targeted to the identification of problems and the implementation of practical solutions to improve air quality and public health at the local level.

The 2012 Upwind Downwind Conference: Unlikely Partners was held on Monday, February 27, 2012 at the Sheraton Hotel in downtown Hamilton. The one-day conference aimed to provide a forum to enable an improved understanding of these issues in relation to air quality policy and creating partnerships and understanding amongst groups.

The conference generates many ideas and is an excellent opportunity for Hamilton and other communities to share practical solutions for air quality, transboundary and climate problems in the fields of health, planning, municipal action and partnerships. Approximately 148 planners, health promoters, university/college students, environmental consultants, retirees and citizens participated in the 2012 one-day conference. This resulted in a nice balance between the ages and experiences of the participants at the conference from young professionals and students to retirees and senior professionals.

A free Sunday afternoon talk was also a feature of the 2012 Upwind Downwind Conference. On February 26, 2012 a free talk by author Jay Walljasper was held at the Art Gallery of Hamilton. The focus of the talk was on the concept of "the commons" - the cultural and natural resources accessible to all members of a society held in common and not privately owned. This free public talk attracted 75 individuals.

Presentations from the 2012 Upwind Downwind Conference can be found on the *Clean Air Hamilton* website www.cleanair.hamilton.ca/default.asp?id=47.

4.2 Totally Transit

Since 2007, Green Venture has partnered with the Hamilton Street Railway (HSR) to deliver "Totally Transit" to elementary aged students. Totally Transit is a unique bus education program that teaches Hamilton elementary-aged students how to properly utilize the HSR while making the connection between air quality, climate change and transportation. Through hands-on experience, this one-of-a-kind program empowers students to feel confident about choosing transit and other forms of sustainable and active transportation.

In 2012, 61 Totally Transit lessons were delivered to 1,757 students from 17 Hamilton area schools (primarily grades 4-6). All of these presentations involved using a chartered HSR bus to transport students and to be used as a classroom for lesson delivery.

Since 2007, Green Venture has delivered Totally Transit to more than 3,700 students in 60 Hamilton schools and reached an additional 1,590 students with similar bus education in mini-presentations at school environmental fairs.

Totally Transit for Older Adults 2013 Expansion

In 2012, funding from Metrolinx was received to pilot the expansion of the Totally Transit program from school-aged students to older adults.

The Totally Transit for Older Adults education program, also called "I Ride the HSR!" will help build confidence in our fastest growing demographic and highlight the independence and cost-effectiveness that public transportation can offer.

Workshops were scheduled for early 2013 and will include information on public transit services catered to older adults. Information on effective trip planning is also covered and volunteer-led guided trips will be offered to popular destinations to provide hands-on confidence building.

4.3 Small Engine Equipment

Small engine-powered equipment; such as lawnmowers, string trimmers and leaf blowers are widely used in Hamilton to maintain landscaped areas. Emissions from older two-stroke gasoline engines contribute to poor air quality and produce greenhouse gases. In one hour, the average gas-powered lawnmower produces harmful air emissions equivalent to those emitted by a new personal vehicle traveling 320 km.

The Small Engine Powered Equipment program raised public awareness of the harmful pollutants released by older gas-powered equipment. This program also highlighted cleaner equipment choices and best lawn care practices to reduce air emissions.

In April 2012, Green Venture held three Lawnmower Recycling Events at three Rona locations (Rona Parkdale, Rona Waterdown and Rona Rymal). Over the three recycling events, 165 individuals were engaged and information was provided about small engine pollution. In total, 32 lawnmowers were recycled.

Green Venture staff also researched and revised a Small Engines Fact Sheet, available for download by the public from the Green Venture website: http://air.greenventure.ca/small-engine-powered-tools. Approximately 75 fact sheets were distributed in 2012.

4.4 Hamilton Climate Change Charter

In 2011, Hamilton became the first municipality in Ontario to enact a community Climate Change Action Charter. The purpose of the community Climate Change Action Charter is to engage Hamilton organizations, businesses and individuals in taking individual and collective action and leadership on climate change. The Charter is a voluntary agreement emphasizing that action on climate change is needed. It builds awareness and communication within Hamilton on climate change issues. The Charter can be used by individual citizens, organizations and businesses of all types and sizes.

In 2012, nine organizations signed the Charter joining a group of 30 organizations in the public, private and non-profit sector; that since 2011, have endorsed and signed the Charter; including the City of Hamilton and *Clean Air Hamilton*. Many of these organizations and corporations in the Hamilton area have already developed their own climate change and sustainability programs and endorsed the Charter as a way to show commitment to tackle the causes and consequences of climate change.

5.0 *Clean Air Hamilton* Air Quality Progress Report 2012 – The Recommendations

Air quality improvements in the City of Hamilton will be incremental and will require actions on many fronts. *Clean Air Hamilton* recommends that the City of Hamilton:

- Consider developing a strategy for adopting the principles, approaches and standards outlined in the MOE's D-Series Guidelines. *Clean Air Hamilton* also recommends that the City of Hamilton consider attending all public meetings and provide input and comments on facility applications for site-specific standards under Ontario Regulation 419/05. This would be in an effort to improve land-use planning.

- Work with local industries and the MOE to control both point sources and area sources of air particulate pollution; particularly road dusts, as well as, reducing NO_x and SO_2 emissions from stationary and mobile sources.

- Continue to encourage Hamiltonians to reduce their transportation-based emissions through the use of transportation alternatives including public transit, bicycles, walking, hybrid vehicles, etc.

- Continue to support transportation alternatives through complete streets and transportation demand management policies.

- Examine the benefits of using existing green corridors for active commuting or recreational transportation in Hamilton as a means to encourage improved health and air quality.

- Take measures to educate and encourage the community to reduce their energy consumption at home, business and on the road through energy conservation and demand measures. The energy mapping of Hamilton project can identify neighbourhoods and building types that can be targeted for education and policies.

- Continue to encourage the reduction of greenhouse gas emissions in Hamilton, and consider the implications and risks of climate change to improve the quality of life in Hamilton through climate adaptation policies and planning.

ALTERNATIVES FOR CONSIDERATION

(include Financial, Staffing, Legal and Policy Implications and pros and cons for each alternative)

i) **Contracting out services** provided by *Clean Air Hamilton* is not a recommended approach. Council could contract out the air quality research and policy information provided by *Clean Air Hamilton,* but this would cost tens of thousands of dollars in consultants' fees. It has been estimated that *Clean Air Hamilton's* volunteers provide time and air quality expertise that was worth about $69,000 to the City and the citizens of Hamilton in 2012. The City would also be neglecting the long standing relationship with *Clean Air Hamilton.*

ii) **Discontinuing funding services** provided by *Clean Air Hamilton* would demonstrate and communicate a lack of commitment to improving local air quality to stakeholders, corporate staff and the public. *Clean Air Hamilton* actively cultivates partnerships with organizations (federal, provincial, international and community groups) that have air quality improvement goals that are aligned with those of *Clean Air Hamilton* and the City of Hamilton.

ALIGNMENT TO THE 2012 – 2015 STRATEGIC PLAN:

Strategic Priority #1
A Prosperous & Healthy Community

WE enhance our image, economy and well-being by demonstrating that Hamilton is a great place to live, work, play and learn.

Strategic Objective

1.5 Support the development and implementation of neighbourhood and City wide strategies that will improve the health and well-being of residents.

1.6 Enhance Overall Sustainability (financial, economic, social and environmental).

APPENDICES / SCHEDULES

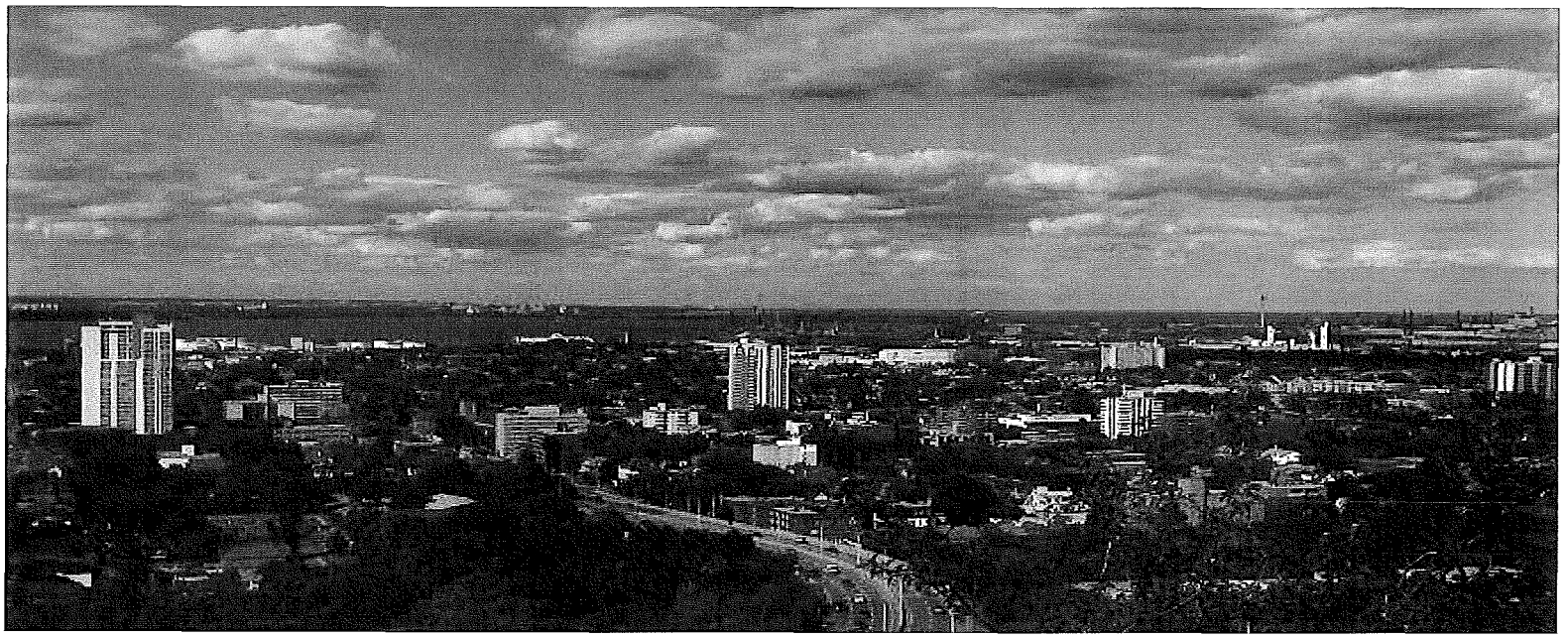
Appendix A – *Clean Air Hamilton* Air Quality Progress Report 2012

References

1. Abelsohn, A., Stieb, D.M. (2011). *Health effects of outdoor air pollution.* Canadian Family Physician, 57,881-887.

2. City of Hamilton Public Health Services. (2010, April). *Risk Communication: City of Hamilton Public Health Services Implementation of the Air Quality Health Index (AQHI).* City of Hamilton Public Health Services.

LEAN AIR HAMILTON CLEAN AIR HAMILTON **CLEAN AIR HAMILTON** CLEAN AIR HAMILTO



CleanAir HAMILTON

AIR QUALITY PROGRESS REPORT 2012

June 2013

Table of Contents

Appendices

Executive Summary

- *Clean Air Hamilton* is a community initiative to improve air quality in the City of Hamilton. It has a diverse membership with representation from environmental organizations, industry, businesses, academic institutions, and different levels of government. Initiated in 1998, *Clean Air Hamilton* works to improve air quality throughout the City of Hamilton and meet all ambient air quality criteria by:
    - Initiating research on air quality;
    - Providing information and advice that decision-makers value;
    - Raising *Clean Air Hamilton*'s visibility in the community and being recognized as the authoritative voice on local air quality issues;
    - Galvanizing broad-based support for actions to improve air quality;
    - Encouraging emission reductions by individuals and companies operating in Hamilton;
    - Influencing decision-makers to choose sustainable practices; and
    - Promoting behavioural changes in companies, government, institutions and individuals in Hamilton that will improve air quality.
- The annual percentage reductions in pollutant levels since the mid-1990s as measured at the downtown air monitoring site (MOE Station 29000) are: total suspended particulate (TSP) levels, 2.8% per year; inhalable particulate matter (PM_{10}), 1.8% per year; respirable particulate matter ($PM_{2.5}$), 3.1% per year: nitrogen dioxide (NO_2), 2.8% per year; sulphur dioxide (SO_2), 2.5% per year; total reduced sulphur odours, 6.0% per year; benzene, 6.0% per year; and PAH (measured as benzo[a]pyrene), 5.3% per year.
- *Clean Air Hamilton* is concerned that, over the past three to four years, the steady downward trends in some air pollutant levels either have levelled off or have shown modest increases. The only pollutant that continues to show a steady decline is NO_2. The annual values for PM_{10}, $PM_{2.5}$, SO_2, benzene and benzo[a]pyrene all have shown slight increases over the past three to four years. These increases are notable compared to the levelling off of these contaminants in other major Ontario cities.
- It is estimated that the six key air pollutants - nitrogen dioxide (NO_2), ground-level ozone (O_3), inhalable particulate matter (PM_{10}), respirable particulate matter ($PM_{2.5}$), sulphur dioxide (SO_2), and carbon monoxide (CO) - contribute to about 186 premature deaths, 395 respiratory hospital admissions and 322 cardiovascular hospital admissions each year in Hamilton (2011 Air Quality Health Assessment Study)
- Mobile air monitoring studies conducted in Hamilton have shown that higher pollutant exposures occur along arterial roads and major highways and at major intersections due to emissions from cars, light duty trucks and heavy-duty trucks. Exposures to air pollutants are significantly lower at distances about 200 metres from arterial roads and major highways. Many residential areas of the city fall into this latter category.

- Mobile air monitoring conducted in neighbourhoods during atmospheric inversion conditions showed potential health risks from exposures to pollutants were double the normal levels for these neighbourhoods and, moreover, were indistinguishable from the health risks experienced on major highways during normal driving conditions or during the inversion episodes. In other words, drivers' and car passengers' exposures to air pollutants while driving on 400-series highways under normal driving conditions is equivalent to pollutant exposures during the worst air pollution days in Hamilton.
- Expansion of the network of fixed air monitoring stations combined with continued mobile air monitoring is useful for identifying air pollution "hot spots" in Hamilton and for enhancing our knowledge of local air emission sources and their impacts. This monitoring work assists in the development of policies, strategies for abatement and initiatives to reduce local emissions in communities and neighbourhoods. The introduction of the East End Air Monitor Pilot Program in Sam Manson Park is an example of expansion of the air monitoring network in Hamilton.
- A well-conceived air quality health index provides the public with useful information about air quality conditions and strategies that citizens can use to reduce their exposure to pollutants. Hamilton's Public Health Services, in partnership with *Clean Air Hamilton* and Health Canada, continues to pilot an air quality health index in Hamilton and raise awareness amongst citizens and "at risk" populations on actions to protect their health.
- Land use planning is an important responsibility of all cities because air quality in urban areas is strongly linked to the municipal decisions that influence the nature of our built environment. *Clean Air Hamilton* recommends that the City of Hamilton consider developing a strategy for adopting the principles, approaches and standards outlined in the Ontario Ministry of Environment's D-Series Guidelines. *Clean Air Hamilton* also recommends that the City of Hamilton consider attending all public meetings and provide input and comments on facility applications for site-specific standards under Ontario Regulation 419/05.
- There are a number of sustainable transportation initiatives in the City. These initiatives range from car sharing, carpooling, driver education and transit education to increased active transportation initiatives such as policies that encourage active living, cycling and walking; the latter are particularly important because they help reduce air emissions and improve individual health by encouraging healthy lifestyles. These initiatives should be encouraged as they promote healthy lifestyles and reduce air emissions from transportation.
- Energy Mapping in Hamilton identifies neighbourhoods and building types that consume large amounts of energy. The mapping helps to improve the targeting of conservation demand management programs and to assist in the reduction of energy consumption by local consumers (residential, commercial, institutional, and industrial) and the associated air and greenhouse gas emissions from non-renewable sources of energy.
- Community greenhouse gas (GHG) emissions in 2010 were just below 20 million tonnes in Hamilton, a reduction of 14.5% from 2006 emissions levels. Hamilton has made progress in reducing greenhouse gas emissions through actions on energy and transportation. Municipal and community involvement in reducing emissions of GHGs (from commercial and personal transportation sources, commercial and residential energy sources, etc.) and preparing for climate change impacts such as extreme weather is still necessary to address the impacts of climate change locally.

- The City needs to maintain support for strategies and actions that will improve local air quality, reduce greenhouse gas emissions, and increase energy conservation. These strategies should be aimed at increasing the level of dialogue between and within community groups on the health impacts of poor air quality on society and on the actions and lifestyle changes that will result in improved air quality for all citizens.
- *Clean Air Hamilton* continues to encourage activities undertaken by the City, industries and citizens to reduce air pollutants and greenhouse gas emissions, and improve local air quality in their operations and transportation choices. *Clean Air Hamilton* actively cultivates partnerships with organizations that have air quality improvement goals that are aligned with those of *Clean Air Hamilton* and the City of Hamilton.

1.0 Introduction

Clean Air Hamilton is pleased to present the 2012 Progress Report on Air Quality to Hamilton Board of Health and Hamilton City Council. This report presents information on local air quality trends and the activities undertaken by *Clean Air Hamilton* in 2012 to improve air quality in the City of Hamilton. This report gives an update on new programs and initiatives and about on-going activities that were started in previous years.

1.1 Background

The former Hamilton-Wentworth Regional Council endorsed the establishment of *Clean Air Hamilton* (then called the Hamilton-Wentworth Air Quality Improvement Committee or HAQIC) in 1998, following the publication of a series of reports by the Hamilton Air Quality Initiative (HAQI) in October 1997.

In 1997, HAQI made 25 recommendations to improve air quality in Hamilton. Over the past 14 years, *Clean Air Hamilton* and its partners have made significant progress in addressing and responding to these recommendations (see the **2008 Clean Air Hamilton Report Appendix A** for a detailed list of these recommendations).

The original air quality reports prepared by HAQI in 1997 and 1998, together with the complete collection of *Clean Air Hamilton* Annual Reports from 2000 to 2011 are available and can be downloaded at: www.cleanair.hamilton.ca/default.asp?id=71

1.2 Impact

Clean Air Hamilton continues to receive regional, national and international recognition for its outstanding leadership and commitment to improving local air quality. The *Clean Air Hamilton* website (**www.cleanair.hamilton.ca**) receives over 1,500 hits a week. Inquiries about *Clean Air Hamilton's* activities are received regularly from organizations and individuals in Ontario, Canada, the U.S. and from around the world. Many innovative projects have emerged, directly and indirectly, from *Clean Air Hamilton's* activities. *Clean Air Hamilton* is viewed as an organization that is a model of how to effect change at the local level.

In February 27, 2012, 148 delegates attended the 2012 Upwind Downwind Conference. The conference was hosted by *Clean Air Hamilton* and the City of Hamilton, and was held at the Sheraton Hotel in downtown Hamilton. The conference title, "Unlikely Partners" aptly reflected the conference goals of sharing practical solutions for air quality improvement, discussing air pollution and climate change issues and highlighting the potential impacts of partnerships in developing actions in the fields of health, planning, community and municipal policy. A free public talk featuring author Jay Walljasper called "What is the Commons?" was held on Sunday, February 26, 2012 at the Art Gallery of Hamilton. The talk attracted 75 people.

Locally, *Clean Air Hamilton* was actively involved in numerous events to promote air quality within the community. Air quality education programs facilitated by Green Venture introduced over 18,000 adults to air quality issues in Hamilton at 12 community events and 68 residents at 2 workshops on active transportation. Green Venture also works with *Clean Air Hamilton* in engaging local media to promote events and highlight steps individuals can take to improve air quality and reduce greenhouse gas emissions.

In collaboration with Cable 14, Green Venture developed various videos highlighting *Clean Air Hamilton's* work in the community. All videos were subsequently posted to YouTube through Green Venture's YouTube channel. A Cable 14 segment entitled Woodburning 101 highlighted air quality concerns related to residential woodburning and methods of mitigating emissions from these sources. This segment was repeatedly aired throughout the month of August 2012.

Social media were strategically used in 2012 to promote *Clean Air Hamilton's* activities and messaging. An estimated 52,000 resident impressions were reached using Green Venture's social media avenues on a variety of air quality related topics including 41 tweets on Twitter, 9 posts on Green Venture's Facebook page, and 5 posts on Green Venture's Wordpress Blog reaching an estimated over 52,000 views.

To see the videos visit: http://www.youtube.com/user/GreenVentureHamilton

***Clean Air Hamilton* has a Facebook Page, visit https://www.facebook.com/#!/pages/Clean-Air-Hamilton/104179449663324?fref=ts**

Print media attention was received for *Clean Air Hamilton*-funded programs including tree planting at a local school with students as part of the High school Heroes program was featured in the Hamilton Community News and another article highlighting Climate Change Action at Home was featured in the Hamilton Spectator (May 2012).

Members of *Clean Air Hamilton* have provided City Council, City staff and the community with science-based information to help them make better decisions that promote and protect air quality. *Clean Air Hamilton* has provided support for issues important to our community including transportation (e.g., EcoDriver, Totally Transit), planning (e.g., mobile monitoring, comments to the Provincial Policy Statement), air monitoring (e.g., mobile monitoring, Hamilton Air Monitoring Network, Sam Manson Air Monitor pilot project), and air quality education and awareness (e.g., 2012 Upwind Downwind Conference, High School Heroes, and the *Clean Air Hamilton* website).

2.0 *Clean Air Hamilton*

2.1 Vision Statement

"*Clean Air Hamilton* is an innovative, multi-stakeholder agent of change dedicated to improving air quality in our community. We are committed to improving the health and quality of life of citizens through communication and promoting realistic, science-based decision-making and sustainable practices."

2.2 Goals of *Clean Air Hamilton*

Clean Air Hamilton has identified the following goals as a guide for future actions:

- To improve air quality throughout the City and to meet all ambient air quality criteria;
- To raise *Clean Air Hamilton*'s visibility in the community and to be recognized as the authoritative voice on local air quality issues;
- To galvanize broad-based support for a process and an action plan to improve air quality;
- To provide information and advice that decision-makers value;
- To influence decision-makers to choose sustainable practices and alternatives; and
- To affect behavioural changes to improve air quality.

2.3 *Clean Air Hamilton* Terms of Reference

In the fall of 2011, *Clean Air Hamilton* created and approved Terms of Reference that address the administration, decision-making and membership components of the group. A copy of the approved Terms of Reference can be found in **Appendix A** of this report.

2.4 *Clean Air Hamilton* Membership 2012

Dr. Brian McCarry (Chair)	McMaster University
Paul Barrett	Green Venture
Michael Brown	ArcelorMittal Dofasco
Dr. Denis Corr	Corr Research/Rotek Environmental
Robert Clackett	Planning & Economic Development, City of Hamilton
Heather Donison	City Manager's Office, City of Hamilton
Jordan Fysh	Green Venture
Frank Harrison	US Steel Canada
James Kaspersetz	Citizen
Matthew Lawson	Public Health Services, City of Hamilton
Brian Lennie	Horizon Energy Solutions Inc.
Karen Logan	Hamilton Industrial Environmental Association
Lynda Lukasik	Environment Hamilton
Samantha Lundy	Horizon Utilities
Marie McKeary	McMaster Institute of Environment and Health
George McKibbon	McKibbon Wakefield
Brian Montgomery	Public Health Services, City of Hamilton
Sally Radisic	Public Health Services, City of Hamilton

Andrew Sebestyen	US Steel Canada
Carl Slater	Ontario Ministry of the Environment
Mark Smithson	Ontario Ministry of the Environment
Peter Topalovic	Public Works, City of Hamilton
Lorraine Vanderzwet	Mohawk College
Pete Wobschall	Green Venture
Anna Yusa	Health Canada

Clean Air Hamilton is dependent upon the voluntary contributions of its members. In order to continue to make air quality improvements in Hamilton, *Clean Air Hamilton* continues to supplement the voluntary contributions of members with renewed and ongoing commitments of funding from key stakeholders, including various levels of government, the City of Hamilton, local industries and academic institutions, as well as recruiting new members into the organization.

Clean Air Hamilton is committed to recruiting new members who have the time, expertise and interest in air quality issues to work in a committee-based format to find ways to improve air quality in the City. *Clean Air Hamilton* is particularly interested in engaging with committed individuals who want to undertake research to improve air quality in Hamilton. *Clean Air Hamilton* is interested in working with individuals and with representatives from industries, schools and school boards, community groups and others who partner on one or more actions identified by *Clean Air Hamilton.*

Interested individuals should contact the City of Hamilton's Air Quality Coordinator by telephone at (905) 546-2424 ext. 1275 or by e-mail: cleanair@hamilton.ca

2.5 Strategic Activities - 2012 and Beyond

Clean Air Hamilton has identified nine strategic issues related to air quality improvements and climate change issues that the committee wishes to focus on over the next 2-3 years. Clean Air Hamilton has identified these issues for research, communication and program activities in collaboration with our partners:

- **Public Health Protection:** With an Air Quality Health Index (AQHI) now in Hamilton, encourage widespread use of the AQHI and produce communications to aid citizens in understanding what actions they can take to mitigate the health effects of poor air quality, particularly on smog days and inversion days.
- **Active and Sustainable Transportation:** Encourage the use of active and sustainable means of energy-efficient transportation and encourage emissions reductions by moving away from single occupancy personal transportation.
- **Smart Drivers:** Reduce unnecessary idling of vehicles, reduce impacts of vehicle emissions, and reduce emissions from driving.
- **Air Quality Communication:** Continue to communicate on the impacts and sources of poor air quality, encourage behavioural changes, and increase support for *Clean Air Hamilton.*
- **Climate Change:** Provide a forum to discuss the linkages between climate change and air quality and encourage strategies and actions that industries, government and citizens can take to reduce climate change impacts in Hamilton.
- **Emission Reductions Strategies:** Develop a plan to reduce emissions from small, medium and large-scale sources on "bad air" days (e.g., smog days).

- **Energy Conservation:** Encourage energy conservation by promoting best practices in energy efficiency and renewable energy, and by encouraging reductions in wasteful use of electricity. This promotion will assist the public and decision-makers to make the connection between climate change mitigation and air quality improvements.
- **Land Use Planning:** Encourage actions by the City through land use policies to promote reductions of emissions and improvements in air quality through better planning tools.
- **Tree Programs:** Develop a tree networking and tree inventory organization for coordination of all tree planting activities across the City.

The 2012 *Clean Air Hamilton* Report presents the actions undertaken in 2012 by members of *Clean Air Hamilton* and our partners to address these strategic issues. Details of these activities can be found in **Appendix B**.

2.6 Financial and In-Kind Contributions

The City of Hamilton currently provides an annual contribution of $56,000/year in support of *Clean Air Hamilton* and its activities. This money is leveraged significantly in two ways: first, *Clean Air Hamilton* uses these funds in partnership with funds provided by other agencies and institutions to develop programs related to air quality; second, since all of the members of *Clean Air Hamilton* are community volunteers who donate their time and expertise, there is a significant amount of in-kind support provided to *Clean Air Hamilton*. In 2012, it is estimated that *Clean Air Hamilton*'s partners and volunteers provided $93,920 in in-kind support. *Clean Air Hamilton*'s 2012 financial report is available in **Appendix C**.

2.7 Upwind Downwind Conference 2012

Every two years *Clean Air Hamilton* hosts the Upwind Downwind Conference, an event which highlights (a) the latest in air quality research, particularly as it applies to the human health impacts of air pollution, and (b) strategies and activities to improve air quality on local, regional and national scales. The programs at these conferences have been designed to be accessible to the non-expert and are targeted to the identification of problems and the implementation of practical solutions to improve air quality and public health at the local level. Sessions in past conferences have been devoted to the health impacts of air pollution, urban planning and urban design strategies to reduce air pollution, energy efficient strategies for homes and industries and local initiatives and success stories from across North America that have led to real improvements in the quality of life of citizens.

The 2012 Upwind Downwind Conference was held in Hamilton, Ontario on Monday, February 27 2012 at the Sheraton Hotel in downtown Hamilton. The 2012 Upwind Downwind Conference: Unlikely Partners was the seventh biennial conference focusing on practical solutions to the air quality, transboundary air and climate change issues and impacts facing urban regions. This one-day conference aimed to provide a forum to enable an improved understanding of these issues in relation to air quality policy and to create partnerships and understanding amongst groups.

The Conference invited 13 speakers from the fields of human health, science, public policy, municipal government, industry and community initiatives. Featured speakers and topics included: Dr. David Mowatt, Medical Officer of Health with Peel Region speaking on healthy and sustainability communities; Dr. Douglas Chambers from SENES Consulting speaking on the updates to health impacts of air pollutants in Hamilton: a municipal panel representing Clean Air Sudbury, the City of Ottawa, Halton Region, and the City of London speaking on their local air quality initiatives and partnerships; and Dr. Denis Corr on recent mobile air monitoring in a number of neighbourhoods across Hamilton.

The 2012 Conference provided an opportunity to discuss the types of actions that governments, industries and citizens will need to take in order to make significant progress to address air quality improvements and health impacts. Approximately 148 planners, health promoters, industry representatives, university/college students, environmental consultants, and citizens participated in the one-day 2012 Conference.

A free-to-the-public, afternoon talk was also a feature of the 2012 Upwind Downwind Conference. On February 26, the prior to the conference, author Jay Walljasper gave an excellent presentation which provoked an extensive question-and-answer session at the Art Gallery of Hamilton. The focus of his talk was on his concept of "the commons". This public talk attracted 75 individuals.

Clean Air Hamilton looks forward to hosting the next Upwind Downwind Conference in 2014.

All conference presentations are available for viewing and/or downloading at:
www.cleanair.hamilton.ca/default.asp?id=47

3.0 Air Quality in Hamilton

3.1 Air Pollution Health Impacts – Hamilton

While the correlation between exposure to air pollution and illnesses and mortality related to these exposures is well established (OMA, 2005), current research efforts are seeking to understand and quantify the impacts on a range of specific health outcomes with specific air contaminants and overall risks such exposures pose to the public.

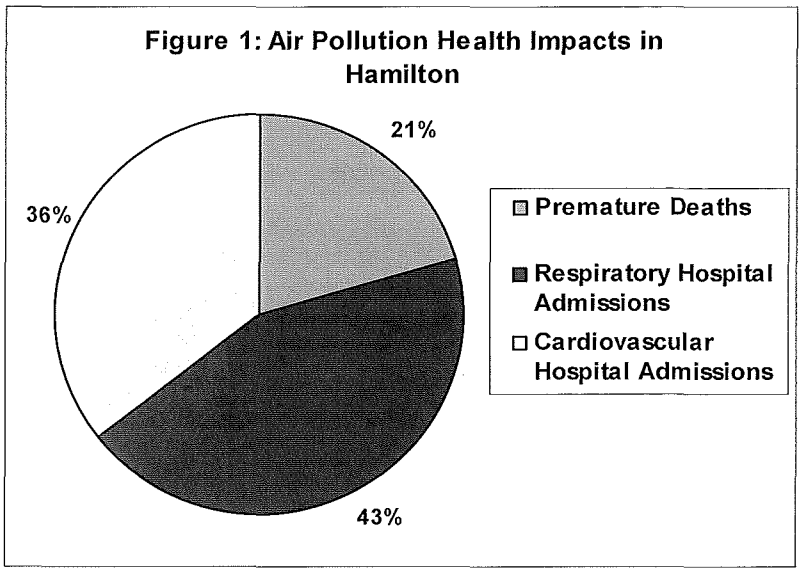
Poor air quality has been associated with a range of health impacts including eye, nose and throat irritation, breathing difficulties, and cardiovascular disease. These insights come from increasingly sophisticated statistical analyses of large-scale epidemiological data sets linking air quality data and health outcomes.

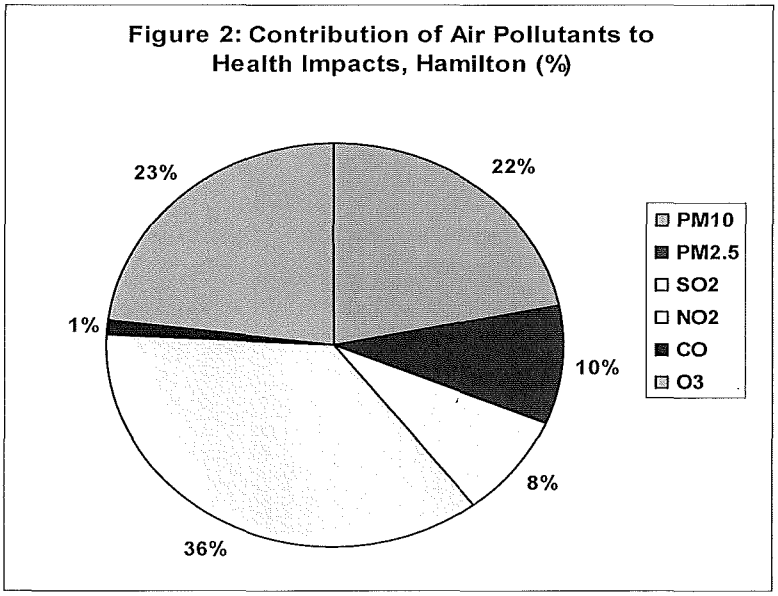
In 2011, *Clean Air Hamilton* in partnership with Hamilton Public Health Services decided that it was time to update the two previous health studies that had been undertaken by *Clean Air Hamilton* and reported in 1997 (as part of HAQI reports) and in 2003. SENES Consulting agreed to undertake the task of providing a comprehensive review and update of the scientific literature linking air pollutants and health effects and to use ambient air data from Hamilton to determine the health impacts of air pollution in Hamilton based on the most recent air quality-health reports.

This study updated the health risks (primarily cardiovascular and respiratory impacts) associated with exposures to air pollutants (specifically, particulate matter, nitrogen oxides, ground-level ozone, sulphur dioxide and carbon monoxide). This report provides the clearest picture to date of the health impacts associated with poor air quality in our City. Due to improvements in air quality in Hamilton over the last 10 years, there was interest to see if the associated health impacts had also been reduced.

The 2011 Air Quality Health Assessment Study prepared by SENES Consulting Inc. estimated that the six key air pollutants - nitrogen dioxide (NO_2), ground-level ozone (O_3), inhalable particulate matter (PM_{10}), respirable particulate matter ($PM_{2.5}$), sulphur dioxide (SO_2), and carbon monoxide (CO) - contribute to about 186 premature deaths, 395 respiratory hospital admissions and 322 cardiovascular hospital admissions each year in Hamilton (see **Figure 1**).

All of these air pollutants contribute to health effects outcomes; however, some health outcomes are linked to exposures to specific air contaminants. For example, the main air pollutants contributing to respiratory admissions to hospitals are ground-level ozone, sulphur dioxide and nitrogen oxides. On the other hand, particulate matter (both PM_{10} and $PM_{2.5}$) and carbon monoxide (CO) were major contributors to cardiovascular admissions to hospitals. **Figure 2** below outlines the relative contributions of air pollutants to health impacts in Hamilton.





Overall, with the average measured air quality for the Hamilton region improving, the number of hospital admissions associated with respiratory ailments has remained unchanged since the 2003 study; however, hospital admissions associated with cardiovascular effects have decreased significantly since 2003. Overall, deaths due to air pollution have remained relatively steady, decreasing from 229 in 2003 to 186 in 2012.[1]

The complete 2011 Health Impacts Study of Air Pollutants in Hamilton can be read online at the *Clean Air Hamilton* website – www.cleanair.hamilton.ca

[1] Not corrected for a 10% population increase in Hamilton since 2003.

3.2 Air Monitoring - Hamilton

Air monitors collect information about outdoor air quality data across the City of Hamilton and these data can be compared to provincial and federal air quality standards and to levels at cities across Canada and around the world (see **Appendix D**). Other uses of these data are to identify sources of air pollutants, and to evaluate the potential impacts of air emissions on human health.

Air quality monitors are located at a number of locations across the City. The air quality monitors are operated by two different organizations. The Ontario Ministry of the Environment (MOE) operates a network of three fixed air monitoring stations that serve as Provincial Air Quality Index (AQI) monitoring stations; these stations are situated in West Hamilton, on the Mountain and just east of downtown. The Hamilton Air Monitoring Network (HAMN) operates a network of 15 stations that serve to monitor air quality in the industrial sector of Hamilton (see **Section 3.2.1**). This network is fully funded by local industry member companies. The locations of these stations, the pollutants monitored at each station and the data quality are overseen by the local Ministry of the Environment (MOE) staff. Two of the MOE's AQI sites serve as sites for equipment owned by Environment Canada as part of Environment Canada's National Air Pollution Surveillance Station (NAPS) network.

Hamilton is the Canadian pioneer in undertaking a program of mobile air quality monitoring. The mobile monitoring van can roam city-wide and can measure ambient air quality conditions on a minute-by-minute basis at street level. This type of monitoring affords a dramatic, real-time picture of the changing exposures people experience. The first mobile air monitoring in Hamilton was done in 2004 as a pilot project funded by the City and *Clean Air Hamilton*. The monitoring van and the monitoring equipment were brought together as a result of a partnership between *Clean Air Hamilton*, the Ministry of the Environment, Environment Canada and Rotek Environmental.

Additional air monitoring is conducted by the local Ministry of the Environment Office and includes routine particulate monitoring and short-term survey work. In 2012, the local Ministry of the Environment staff continued to conduct air monitoring focused on airborne particulates at 8 locations across greater Hamilton.

Air monitoring resources in Hamilton tend to be focussed on the east end industrial sector of the City. As a result of mobile monitoring activities in 2005, additional industrial areas in Hamilton were identified (see **Section 3.7**) that are not actively monitored or connected to the existing monitoring network. In addition, mobile monitoring and health research (see **Section 6.1**) have identified gaps in the capturing of air pollution data and associated health impacts in neighbourhoods and transportation corridors across Hamilton. There is recognition that expansion of the fixed network combined with continued mobile monitoring can identify community "hot spots" in Hamilton and enhance the knowledge of local air emission sources, as well as, their impacts, and assist in the development of policies and initiatives to reduce local emission sources in the community.

The air quality data from the MOE's three AQI stations are available here:
www.airqualityontario.com/reports/summary.cfm

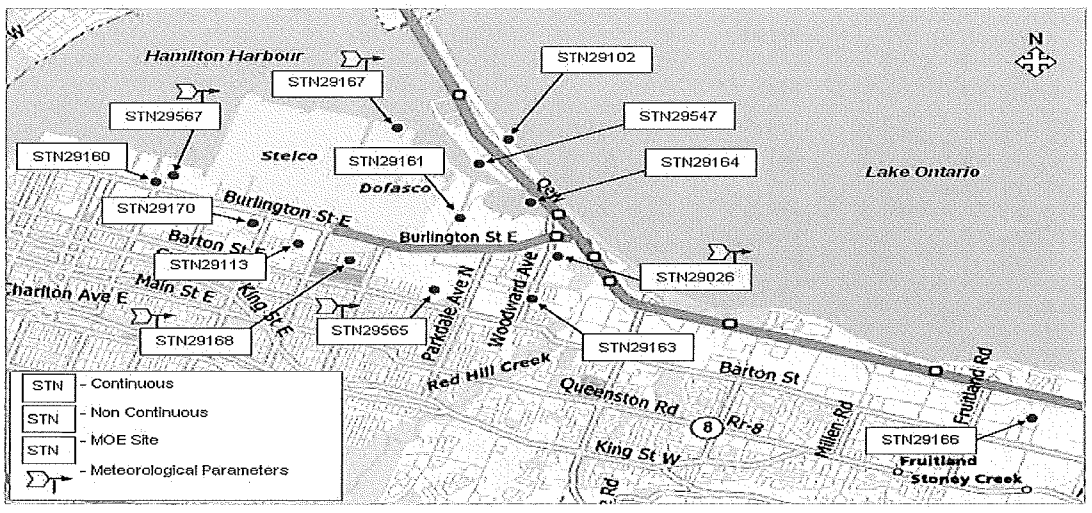
3.2.1 Hamilton Air Monitoring Network (HAMN)

The Hamilton Air Monitoring Network (HAMN) is an industry-funded, local air monitoring network, comprised of 21 local companies who have committed to the assessment of air quality in Hamilton on a regular basis (**Table 1**). A map of the air monitoring network is shown in **Figure 3.** On-going operating costs and expenses related to the upgrading of air monitoring equipment and instruments are borne by the corporate members of the network. The network provides air quality reports to the Ontario Ministry of the Environment (MOE) on a regular basis and to *Clean Air Hamilton*. All air quality data and reports are audited by the MOE to ensure a consistent and high quality data. The MOE also conducts regular audits of the equipment at the HAMN sampling sites.

Table 1: Companies Participating in HAMN

Bartek Ingredients	Harsco Metals Canada	Liberty Energy Inc.
Baycoat Ltd.	Lafarge Canada – Jones Road	U. S. Steel Canada – Hamilton Works
Bunge Canada	Lafarge Canada - Victoria	ArcelorMittal Hamilton East
City of Hamilton	Lafarge Hamilton Slag	Rütgers Canada Inc.
Shell Canada Ltd.	Triple M Metal LP	Vopak Terminals of Canada Inc.
ArcelorMittal Dofasco Inc.	Newalta	Birla Carbon
Federal Marine Terminals	Biox Canada Ltd.	Westway Terminal Canada

Figure 3: Map showing locations of air monitors in the Hamilton Air Monitoring Network



In June 2009, public access *via* the internet was provided to all real-time air monitoring data collected by HAMN (www.HAMNair.ca). This website was developed as a partnership between *Clean Air Hamilton*, HAMN, the City and the MOE.

To access the real-time air monitoring data collected by HAMN visit: www.HAMNair.ca

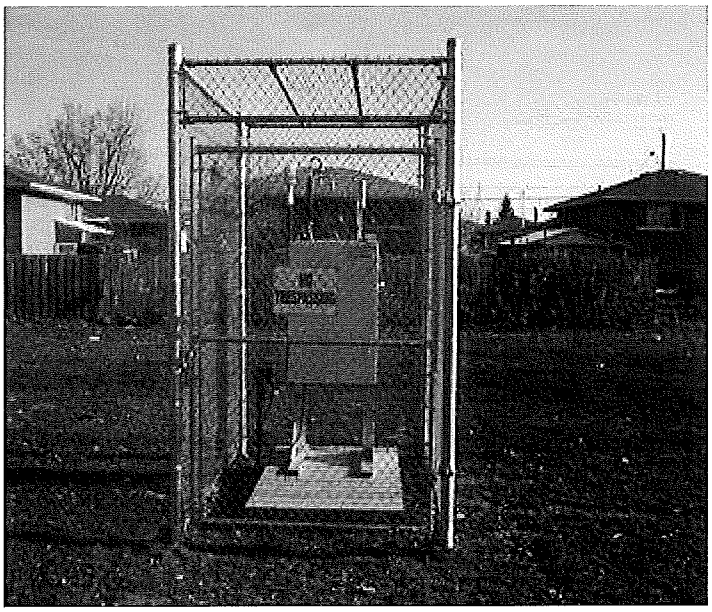
3.2.2 East End Air Monitor

Between 1985 and 1996, the Ontario Ministry of the Environment (MOE) operated an air monitoring station in Ward 5 at Sam Manson Park. The monitor was named the "East Hamilton AQI Station" and it measured coefficient of haze, ozone, sulphur dioxide, and total suspended particulates. AQI stands for Air Quality Index.

The MOE reported that the former East Hamilton AQI Station was removed in 1996 because the other three Hamilton AQI stations were sufficient to measure smog and long-range pollutants. A ministry review of air monitoring in the mid 1990's indicated that the East Hamilton AQI station measured the best air quality of the AQI sites in Hamilton for the contaminants being monitored; due to its location this site provided little data related to industrial source emissions and did not provide information that could readily be used to deal with suspected air quality issues in north and east Hamilton. The decision to remove the East Hamilton AQI station upset many area residents who felt that the east end was no longer being represented by way of air monitoring.

To address this concern, an air monitoring pilot project has been initiated and a portable air monitoring system called an "Airpointer" was installed on November 21, 2012. The Airpointer is situated at Sam Manson Park (see **Figure 4**) near Barton St. and Nash Rd. This pilot project has been scheduled to take place for a one-year period from January 1st, 2013 to January 1st, 2014.

Figure 4: Sam Manson Park Pilot Air Monitor



The location at Sam Manson Park was selected for three primary reasons: 1) this site satisfies the criteria of being located in Hamilton's east end, 2) the former East Hamilton AQI Station was operated from 1985 to 1996 at this site, which allows for comparison of some historical air quality data to newly acquired data and 3) this site already had the electrical power needed to operate the Airpointer.

The Airpointer is capable of measuring five common air pollutants on a continuous basis including: sulphur dioxide (SO_2) , ozone (O_3), respirable air particulate (i.e., particles less than 2.5 microns), carbon monoxide, nitric oxide (NO) and nitrogen dioxide (NO_2). In addition, some meteorological parameters are monitored including wind speed, wind direction, barometric pressure, ambient temperature, relative humidity and rainfall.

Air monitoring allows for the collection of outdoor air quality data that can be used to identify local sources of air emissions and to evaluate the potential health impacts on humans due to exposures. Hamilton has a limited network of fixed air monitors, leaving many areas of the City and a number of emissions sources without the benefit of air monitoring data, resulting in gaps in local knowledge of air quality and air emissions sources.

The City of Hamilton is a supporting affiliate of the Hamilton Air Monitoring Network (HAMN), which is a group that provides air quality monitoring data as part of the MOE's Source Emissions Monitoring program. Data obtained from the pilot project air monitoring station at Sam Manson Park is managed by HAMN and is made available for public access in real-time on the City of Hamilton's website through a link to the HAMN web site (www.hamilton.ca/airmonitor).

Upon completion of the one-year pilot project, data gathered will be assessed by members of *Clean Air Hamilton* and a summary report along with recommendations provided to the Board of Health.

3.2.3 Regulating Air Contaminants

Ontario's local air quality regulation (O. Reg. 419/05: Air Pollution – Local Air Quality) works within the province's air management framework by regulating air contaminants released into communities by various sources, including local industrial and commercial facilities. The regulation aims to limit exposure to substances released into air that can affect human health and the environment, while allowing industry to operate responsibly under a set of rules that are publicly transparent.

The regulation includes three compliance approaches for industry to demonstrate environmental performance, and make improvements when required. Industry can meet an air standard, request and meet a site-specific standard or register and meet the requirements under a technical standard (if available). All three approaches are allowable under the regulation.

Provincial air standards are used to assess a facility's individual contribution of a contaminant to air. They are set based solely on science and may not be achievable by a facility or a sector due to unique technical or economic limitations. In these cases, industries or sectors look to technology and best practices to improve their environmental performance and comply with the regulation.In 2011, MOE set new or updated air standards for an additional nine contaminants – uranium and uranium compounds (PM_{10} fraction), nickel and nickel compounds, chromium and their compounds, hexavalent chromium, benzene, benzo[a]pyrene (as a surrogate for polycyclic aromatic hydrocarbons), 1,3-butadiene, dioxins and dioxin-like compounds, and manganese and its compounds. These standards come into effect July 1, 2016.

In September of 2011, the ministry introduced a modernized approach for issuing instruments formerly called Certificates of Approval (CofA). There are now two streams to obtain approval. One stream is to electronically register for certain discharges that are established through regulation. These are known as Environmental Activity Sector Registrations (EASR). The initial phase of EASR covered certain low risk emission sources such as certain auto repair and finishing and standby electricity generators. Other low risk sources are planned for phase in. The second stream of approval is for Environmental Compliance Approvals (ECA). These are the higher risk, significant source or complex approvals that require careful, thorough assessment and detailed technical review. ECA includes large sewage systems, landfills and waste transfer sites and many air emissions. For an air ECA application, an approval is granted based on the specific facility and the controls proposed for the air emissions. This approval is issued if the facility and the controls are expected to only emit contaminants into the air below the air standards set out in O.Reg 419/05. Since an ECA is required before a facility can be built, the assessment and approval is often based on the modeling of air emissions to determine the air quality at any point off-property. Unless explicitly exempted, most industrial processes and equipment that discharge to the air require an ECA in order to operate.

What is a contaminant?

The term 'contaminant' is defined under the Environmental Protection Act as any solid, liquid, gas, odour, heat, sound, vibration, radiation or combination of any of them resulting directly or indirectly from human activities that causes or may cause an adverse effect. The definition of a contaminant is very broad. Examples include particulate emissions from a process, solvent emissions from a painting line, nitrogen oxides from combustion sources, or sound and vibration from a metal stamping operation. The Ministry of the Environment does not require that compounds have published criteria to be considered contaminants. Unless explicitly exempted, most industrial processes and equipment, and modifications to industrial processes and equipment that discharge contaminants require approval. Under O. Reg 419/05 heat, sound and vibration are excluded.

While the ECA is based on the modeled prediction that air standards or a site-specific standard will be met, there could be circumstances where the operation of the facility or equipment is not able to demonstrate compliance with applicable air standards or site-specific standard. If standards are not met or if conditions on the ECA are not met, the Ministry of the Environment can take action to require that corrective measures be taken to bring the operation into compliance with the regulation and ECA conditions.

For further information on air regulation and standards visit:
www.ene.gov.on.ca/en/air/ministry/index.php#ts

For information on Environmental Compliance Approvals visit:
http://www.ene.gov.on.ca/environment/en/resources/STDPROD_089449.html

The regulation includes three compliance approaches for industry to demonstrate environmental performance, and make improvements when required. Industry can meet an air standard, request and meet a site-specific standard or register and meet the requirements under a technical standard (if available). All three approaches are allowable under the regulation.

Under O. Reg. 419/05, new or more stringent standards are phased in over time. The first of set of new or more stringent air quality standards for industrial facilities in Ontario took effect on February 1, 2010, with the next set phased in on February 1, 2013: the next set is on July 1, 2016. A facility that is not able to meet the standards within the prescribed timeline may request approval for a site-specific air standard, while it implements an Action Plan of projects to reduce emissions and continuously improve. The MOE introduced the site-specific standard process to acknowledge time, technical, and economic factors related to the significant adjustments and investments needed to comply with the Regulation. A site- specific air standard may be approved for a period of five years to ten years. Furthermore, O. Reg. 419/05 provides that a facility may also re-apply for site specific air standard.

Approvals Issued:

- Oxy Vinyls, Niagara: Approved from Jan 2009 to Feb 2017 [Vinyl Chloride]
- ArcelorMittal Dofasco, Hamilton: Approved from July 2010 to Feb 2015 [Suspended Particulate Matter; Total Reduced Sulphur; included review of Benzo-a-pyrene (BaP) and Benzene].
- Xstrata-Copper, Timmins; Approved from Feb 2010 to Feb 2014 [Sulphur Dioxide; Lead]
- Vale, Sudbury: Approved from December 2011 to December 2021 [Nickel]
- Vale, Sudbury: Approved from December 2012 to December 2017 [Sulphur Dioxide]
- Xstrata-Nickel, Sudbury: Approved from August 2012 to December 2022 [Sulphur Dioxide]
- Xstrata-Nickel, Sudbury: Approved from January 2012 to December 2018 [Cadmium]

Requests Submitted and Under Review:

- U.S. Steel Canada, Hamilton Works: Suspended Particulate Matter; Sulphur Dioxide; includes review of Benzo-a-pyrene (BaP) and Benzene
- U.S. Steel Canada, Lake Erie Works – Nanticoke: Suspended Particulate Matter; Sulphur Dioxide; includes review of Benzo-a-pyrene (BaP); and Benzene
- Archer Daniels Midland, Windsor, Ontario: Suspended Particulate Matter

Requests for Renewal Pending:

- Renewal for Xstrata-Copper, Timmins: Sulphur Dioxide
- Renewal for ArcelorMittal Dofasco, Hamilton: [Suspended Particulate Matter; Total Reduced Sulphur]

New Requests Pending:

- Xstrata- Nickel, Sudbury: [Nickel]
- ArcelorMittal Dofasco, Hamilton: [Benzo-a-pyrene (BaP) and Benzene]

A request for the site specific air standard must (at a minimum) include the following information:

- **Emission Summary and Dispersion Modeling (ESDM) Report** –which includes results from a modeling/monitoring study, and an assessment of the magnitude and frequency of exceedence of the standards.
- **Technology Benchmarking Report (TBR)** - assessment and ranking of technical methods for reductions in contaminant concentrations and provide an assessment of feasible technologies.
- **Action Plan** - schedule of dates/timelines.
- **Public Consultation Report** – summary of the mandatory public meeting with the local community.

The request may also include:

- **Economic Feasibility Analysis (Optional)** - cost of technically feasible mitigation options, and comparison to the cost of reductions in off-property concentration of various options.

An important element of the site-specific standards process is public transparency. Therefore, the requestor for a site-specific air standard must engage in public consultation efforts to ensure that:

- Community members are given an opportunity to understand the barriers for the facility in meeting an air standard at this time.
- Stakeholders/Community members are given an opportunity to review the proposed Action Plan.
- Community members understand the regulatory framework and have an opportunity to comment on the proposal by the facility for a site- specific standard and the outcome reached by the facility in terms of corrective actions to address the issue, through the Environmental Registry.
- Stakeholders know where information is available and whom to contact for answers to their questions.

Both ArcelorMittal Dofasco Inc. and U. S. Steel Canada Inc. established community liaison committees (CLCs) in 2010. The CLCs include representatives from the Ontario Ministry of the Environment and Hamilton-area stakeholder organizations, and individual community members.

ArcelorMittal Dofasco's CLC began to meet quarterly to keep the community informed of the environmental implications (air, water, waste) of their operations. The CLCs include representatives of the Ontario Ministry of the Environment and Hamilton-area stakeholder organizations and individual community members.

U. S. Steel Canada's CLC began meeting to discuss actions to reduce emissions being taken under its Environmental Performance Agreement with the Ministry of the Environment as well as concerns raised by the community. Site-specific standard activities have been delayed as a result of production outages.

These CLCs are separate from the Hamilton Industrial Environmental Association's (HIEA) Community Advisory Panel (CAP) that has met since 1998 and acts as a direct link between industry, neighbourhood groups and individuals and local environmental community-based initiatives. HIEA represents twelve companies, including ArcelorMittal Dofasco and U. S. Steel Canada Inc., that aim to improve the local environment – air, land and water – through joint and individual activities, and by partnering with the community to enhance future understanding of environmental issues and help establish priorities for action (see **Section 7.1**).

For further information on ArcelorMittal Dofasco's CLC visit:
http://www.arcelormittal.com/hamilton/dofasco/bins/content_page.asp?cid=315910-1852-341131

For further information on U.S. Steel Canada's Hamilton Works CLC visit:
http://www.ourcommunityourfuture.com/our-committees/

For further information on HIEA Community Advisory Panel visit:
http://www.hiea.org/community-advisory-panel.aspx

A site-specific standard is an air concentration approved by an appointed director of the Ministry of the Environment for an individual facility that is challenged in meeting the air standard. This compliance approach focuses on actions an individual facility can take to reduce emissions to air as much as possible, considering the technology that is available and best operational practices. Economic factors may also be considered.

Under this compliance approach, the individual facility would continue to assess compliance using modelling and/or a combination of modelling and measurement against a site-specific concentration for a particular contaminant.

The site-specific standard approval process follows the ministry's framework for risk management, which was developed in consultation with Ontario public health agencies and other stakeholders. The process sets out the need for timely action to be taken to reduce emissions, where necessary, from key sources of a contaminant, thereby reducing risks to local communities.

Sometimes significant investments may be needed to keep pace with new or updated regulatory requirements. If so, the site-specific standard approved by the ministry allows a facility the time needed to assess and implement technology or operational adjustments to improve their environmental performance within a timeframe approved by the Ministry of the Environment.

In summary, if a facility receives approval for a site-specific air standard, the facility is operating in compliance with O. Reg. 419/05. The site-specific standard becomes the legally enforceable standard for that facility for the time period of the approval. The decision on whether or not to approve a site-specific standard includes an extensive technology benchmarking assessment which compares the facility to other facilities and evaluates best available technologies or practices to minimize emissions. A site-specific standard approval may also include conditions relating to actions to be undertaken by the company to reduce emissions over the duration of the approval. O. Reg. 419 states that the site-specific air standard is only in effect if the facility is complying with the conditions imposed in the approval. There is also authority to issue a notice that revokes the approval of the site-specific air standard. Compliance and/or enforcement action is also possible.

For further information on Site-Specific Standards visit:
www.ene.gov.on.ca/environment/en/industry/standards/industrial_air_emissions/air_pollution/STDPROD_078054.html

A technical standard is a technology-based solution designed for two or more facilities in a sector that may not be able to meet an air standard due to technical or economic limitations. This approach can include technology, operation, monitoring and reporting requirements. Once established, any facility in the sector (that may or may not meet the air standard) may request to be registered under the technical standard.

Technical standards can be used to manage air emissions for multiple facilities within one or more sectors and can include a wide range of contaminants.

When the ministry develops a technical standard, representative facilities in the sector are compared to what other facilities around the world are required or capable of achieving to determine whether or not the same can be required of Ontario facilities.

Development of a technical standard includes a better understanding of the specific sources of contaminants for that sector, benchmarking technology to address the sources of contaminants, and consideration of economic issues that relate to the sector.

The goal is to have a more efficient tool to better manage air emissions and reduce overall exposure from various industrial and commercial facilities in a sector.

There are two types of technical standards:

- Industry Standards regulate all sources of a specified contaminant(s) within an industry sector.

- Equipment Standards address a source of contaminant, but may apply to one or multiple industry sectors.

A facility that meets its obligations under a technical standard is in compliance with the regulation for the registered contaminants.

3.3 Hamilton Air Quality – Trends and Comparisons over Past Ten Years

Examination of the trends in ambient air quality in Hamilton over the last decade (see **Appendix D**) shows that there have been large reductions in the airborne levels of some pollutants.

The annual percentage reductions in pollutant levels over this time period as measured at the downtown air monitoring site (MOE Station 29000) are: total suspended particulate (TSP) levels, 2.8% per year; inhalable particulate matter (PM_{10}), 1.8% per year; respirable particulate matter ($PM_{2.5}$), 3.1% per year: nitrogen dioxide (NO_2), 2.8% per year; sulphur dioxide (SO_2), 2.5% per year; total reduced sulphur odours, 6.0% per year; benzene, 6.0% per year; and PAH (measured as benzo[a]pyrene), 5.3% per year.

The ambient levels of particulate material (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x) and sulphur dioxide (SO_2) have decreased steadily over the past 20 years. These reductions are the result of improved emissions performance of the vehicle fleet (both cars and trucks) and of actions taken by companies in Hamilton to reduce their emissions. Levels of other pollutants have seen real but more modest reductions over the last decade. For example, total suspended particulate material arising from transportation sources, from roadways due to road dust resuspension and from various sources of fugitive dusts has shown less of an improvement compared to other parameters. Year-over-year changes tend to be small and often show both increases and decreases.

In the industrial areas of Hamilton the 2012 levels of benzene and benzo[a]pyrene levels have increased slightly over the past three years. However, concentrations of these parameters in recent years are well below levels measured in the mid-1990s. The levels of ground level ozone (O_3) during the summer months have shown an upward trend. Essentially all of the ozone measured in Hamilton is the result of long-range transport of emissions from sources in the US Midwest. Ozone is created when sunlight reacts with air pollutants. Air masses containing ozone arrive in southern Ontario due to the long-range transport of pollutants from the Ohio Valley region of the US.

However, over the past three to four years, the downward trends in some air pollutant levels either have levelled off or have shown modest increases. The only pollutant that continues to decline steadily is NO_2. The annual values for PM_{10}, $PM_{2.5}$, SO_2, benzene and benzo[a]pyrene all have shown modest increases over the past three to four years. These increases are notable compared to the levelling off of these contaminants observed in other major Ontario cities.

Air pollutant levels in Hamilton are compared to levels of the same pollutants in other southern Ontario communities over the past 10-20 years (see **Appendix D**). From examination of these graphs, one notes that:

- The levels of nitrogen oxides (NO_x) in Hamilton have decreased in recent years and are now similar to other cities in southern Ontario;
- The levels of ground-level ozone (O_3) in southern Ontario during the summer months have varied significantly from year to year, depending on the weather conditions in a given summer. Overall, there has been an increasing trend in ozone levels across Ontario over the past decade. Ozone levels in Hamilton are usually about the same as or lower than levels in the other southern Ontario cities. Some rural areas of Ontario experience surprisingly high ozone levels relative to urban sites; the highest levels of ground-level ozone in Ontario are often

observed at sites adjacent to large lakes, including Turkey Point, Simcoe and the Bay of Quinte;

- The levels of sulphur dioxide (SO_2) in Hamilton tend to be higher than in other southern Ontario communities due to higher emissions from local industrial activities.

The air quality in Hamilton is impacted by a combination of factors that do not co-occur in other communities in southern Ontario:

- The roads in and around Hamilton are heavily used by local citizens, commuters passing through Hamilton and long-distance car and truck traffic. As a consequence, the air quality is adversely impacted by the mobile emissions generated by gasoline-powered vehicles and diesel-powered transport trucks;
- Hamilton is home to a large number of small, medium and large industries;
- Hamilton is located at the west end of Lake Ontario and is surrounded by the escarpment, a combination that brings unique meteorological challenges to the area. The local topography (i.e., the escarpment) and prevailing weather conditions contribute to conditions where air pollution levels are usually higher below the escarpment where there are more industries and higher density urban development than above the escarpment.
- A few times a year unusual meteorological conditions can occur that give rise to atmospheric inversion events, which may last from 2 to 12 hours. During these events, pollutant levels can rise dramatically for a short time. These events are most common in the spring and fall.
- Hamilton is also affected by transboundary air pollution (primarily ground-level ozone and air particulates from sources in the mid-western United States). In this respect, Hamilton is no different from many other urban areas, small communities and rural areas in southwestern Ontario. It has been estimated that about 50% of the air pollution in Hamilton air comes from long-range transport; the remainder are locally generated combustion emissions.

3.4 Smog Advisories and Smog Advisory Days

What is a Smog Advisory?

The Ontario Ministry of Environment (MOE) monitors the air quality in Ontario and provides a rating of the air quality called the Air Quality Index (AQI). A smog advisory is issued by the MOE when the Air Quality Index reaches or exceeds a value of 50; a smog advisory day is declared when it is predicted that it is likely that the AQI may reach or exceed 50 on an upcoming day or the AQI has already reached a value over 50 and is expected to remain above 50 for the advisory period. There are three AQI stations in Hamilton that provide the air quality index data used to calculate the AQI at each site.

Smog advisories are issued to alert the public when widespread elevated levels of air pollution exist (i.e., when AQI values exceed a value of 50). Such conditions exist during persistent smog episodes and are commonly characterized by high levels of ozone (typically in summer months) and/or particulate matter (typically in the fall and spring). Local smog advisories may be issued just for Hamilton, if local emissions are expected to result in AQI values of 50 or higher usually due to particulate matter.

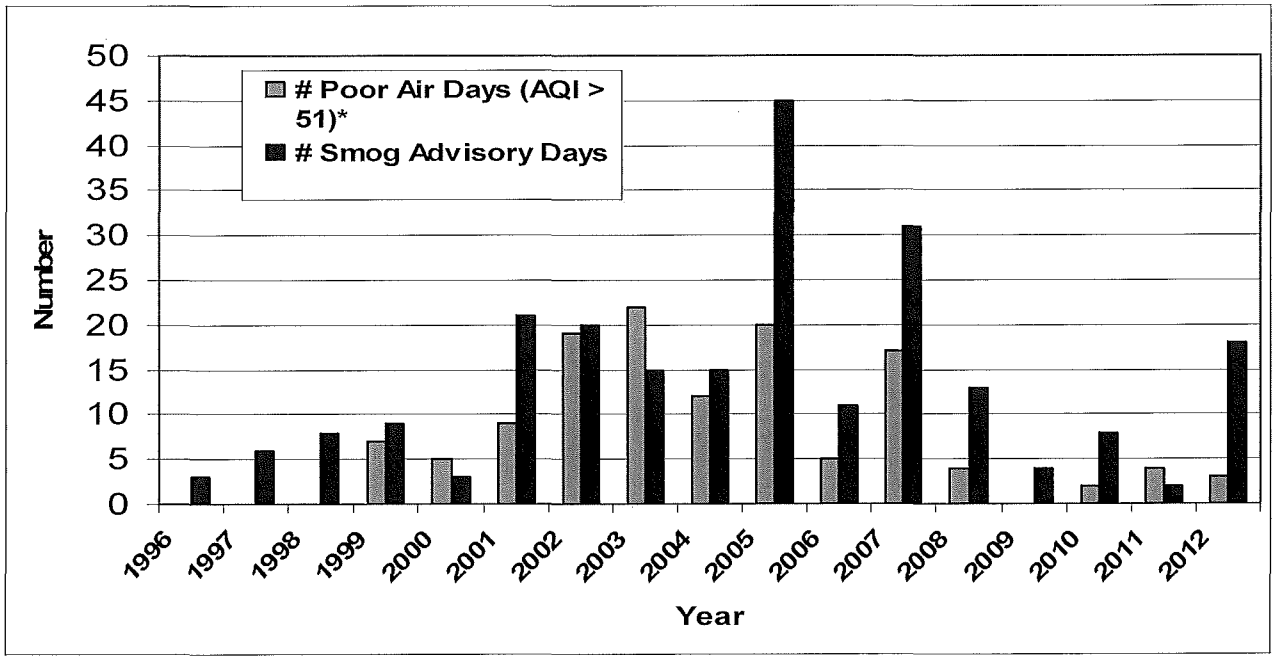
The AQI is determined based on the highest single value of any one of six key air health-related contaminants – fine particulate matter ($PM_{2.5,}$) nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), total reduced sulphur compounds and ground-level ozone (O_3). In the summer months, smog days and air quality advisories are usually issued based on high ozone levels due to regional and long-range pollution sources whereas in the spring and fall smog alerts are issued primarily due to high levels of particulate matter due to local pollution sources.

Gaseous air pollutants such as nitrogen oxides and volatile organic compounds (NO_X, VOCs) can react under the influence of sunlight to afford a complex mixture of chemical products, including ground-level ozone (O_3). This mixture of pollutants is commonly called smog. The ozone that forms one of the constituents of smog is called ground-level ozone to distinguish it from the ozone layer in the stratosphere (i.e., the ozone which is found about 20-40 km above the earth's surface); stratospheric ozone is important in absorbing harmful ultraviolet radiation from the sun and thereby reducing the intensity of ultraviolet light that reaches the earth's surface. Ozone is a severe lung irritant and when inhaled along with respirable particulate matter and other pollutants such as nitrogen oxides, can cause dramatic impacts on the lungs of susceptible individuals, such as the elderly, the young and those with asthma.

There were a total of 18 days in 2012 when the air quality was considered to be poor (i.e., an AQI of 50 or greater for at least 1 hour). In 2012, seven smog advisory days were declared by the Ontario Ministry of Environment (MOE) for the City of Hamilton (see **Figure 5**).

Figure 5 below shows the numbers of smog advisory days and poor air quality days in Hamilton over the past sixteen years. Poor air quality days are defined as days when the Air Quality Index (AQI) was greater than or equal to 50 for at least 1 hour during the day.

Figure 5: Number of Poor Air Quality Days and Smog Advisory Days in Hamilton between 1996 and 2012



Data from Downtown Hamilton Air Monitoring Station

Ontario's Smog Alert Program was enhanced on August 23, 2002 when $PM_{2.5}$ was incorporated into the provincial Air Quality Index (AQI). Prior to this date, smog advisories were issued only for exceedances in ground-level ozone levels.

For further information, consult the MOE's Air Quality site: www.airqualityontario.com

3.5 Air Quality Health Index

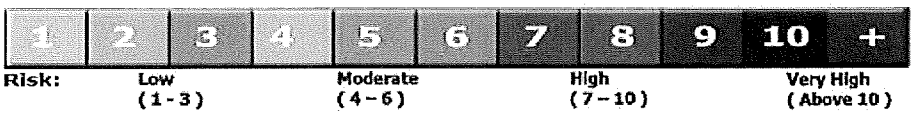
Clean Air Hamilton and Hamilton Public Health Services have advocated for the development and widespread use of a health-based Air Quality Index; a well-conceived health index would provide the public with useful information about current air quality conditions and provide the public with strategies they can use to reduce their exposures. A few years ago, the Government of Canada developed an Air Quality Health Index (AQHI) and piloted this index in selected cities across Canada. Environment Canada began to report daily AQHI reporting for Hamilton on its website in July 2011.

The Government of Canada's new AQHI is calculated in a different manner compared to the MOE's Air Quality Index (AQI). While the MOE's AQI currently takes into account 6 air pollutants [fine particulate matter ($PM_{2.5}$,) nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), total reduced sulphur (TRS) compounds and ground-level ozone (O_3)], the AQI value is calculated based on **only one** of these six pollutants, depending on which pollutant has the highest value on its own scale.

We have known for many years that the impacts of individual air pollutants on humans are additive; in other words an air quality index should be based on the contributions of the health effects of all pollutants measured. The MOE's AQI values do not reflect these additive effects. Health Canada's AQHI is calculated using a formula that combines the concentrations and the relative health impacts of three air pollutants: ground-level ozone (O_3), particulate matter ($PM_{2.5}$/PM_{10}) and nitrogen dioxide (NO_2). According to the Government of Canada, sulphur dioxide (SO_2) and carbon monoxide (CO) were removed from the AQHI formula because in most of Canada these components were not associated with health risks in many areas of Canada.

Federal, provincial and municipal governments collaborated in order to develop the AQHI as a numeric tool that could be used by health professionals and the public to determine the health risks related to air quality at a given time. In **Figure 6** the AQHI scale is shown as a continuous, open-ended scale that ranges from low risk levels (one to three), moderate risk levels (four to six), high risk levels (seven to ten) and very high risk levels (greater than ten).

Figure 6: Air Quality Health Index Scale



(Source: Environment Canada, 2010)

Associated with the AQHI are health messages that are directed at two distinct populations – the "at risk" population and the "general" population (see **Table 2**).

The "at risk" population includes individuals at increased risk due to age or a variety of health conditions; the "at risk" population includes young children, the elderly, people with existing respiratory conditions (e.g., asthma, chronic obstructive pulmonary disease (COPD), including bronchitis, emphysema and lung cancer) and people with existing cardiovascular conditions (e.g., angina, previous history of heart attack, congestive heart failure, heart arrhythmia or irregular heartbeat). The 'general population' includes all other individuals who do not fall under the "at risk" population (Environment Canada, 2010).

Those in the "at risk" category are encouraged to monitor the AQHI regularly since they are more sensitive to air pollution. Individuals are encouraged to develop their own self-calibration points on the AQHI scale. Most people now understand how to use temperature, wind chill, UV Index and Humidex values prior to going outdoors and to make decisions based on these parameters. The AQHI value is yet another factor that individuals will need to calibrate themselves against.

Table 2: Air Quality Health Index Health Messaging

Health Risk	Air Quality Health Index	Health Messages	
		At Risk Population*	**General Population**
Low	**1 - 3**	**Enjoy** your usual outdoor activities.	**Ideal** air quality for outdoor activities.
Moderate	**4 - 6**	**Consider reducing** or rescheduling strenuous activities outdoors if you are experiencing symptoms.	**No need to modify** your usual outdoor activities unless you experience symptoms such as coughing and throat irritation.
High	**7 - 10**	**Reduce** or reschedule strenuous activities outdoors. Children and the elderly should also take it easy.	**Consider reducing** or rescheduling strenuous activities outdoors if you experience symptoms such as coughing and throat irritation.
Very High	**Above 10**	**Avoid** strenuous activities outdoors. Children and the elderly should also avoid outdoor physical exertion.	**Reduce** or reschedule strenuous activities outdoors, especially if you experience symptoms such as coughing and throat irritation

(Source: Environment Canada, 2010)

In 2011, a number of special events served as effective venues for promotional events promoting the use of the AQHI (City of Hamilton Public Health Services, 2011)[2]. AQHI outreach events were conducted at special events in 2012, as well. Special events in the City of Hamilton include community fairs that are typically held in the spring, summer and early fall. Special events are

[2] City of Hamilton Public Health Services. (2011). City of Hamilton Air Quality Health Index (AQHI) Special Events Outreach Report 2011. City of Hamilton Public Health Services.

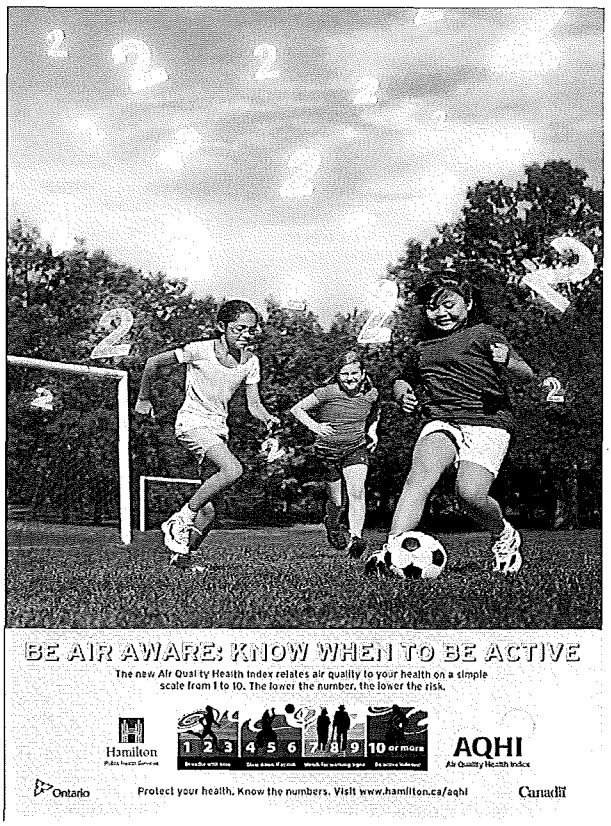
open to the public and take place in various parts of the City of Hamilton that include both rural and urban areas. The graphic used for AQHI promotion is shown in **Figure 7**.

The AQHI was promoted at the following special events for four-hour time periods between the hours of 11 am and 5 pm:

- Dundas International Buskerfest (DIB) (June 2-3, 2012)
- Transportation and Healthy Living Fair (THLF) (June 21, 2012)
- Your Festival Gage Park (YFGP) (June 30 – July 2, 2012)
- Festival of Friends (FF) (August 11-12, 2012)
- Winona Peach Festival (WPF) (August 27-28, 2012)
- Binbrook Fair (BF) (September 15-16, 2012)
- Rockton World's Fair (RF) (October 6-7, 2012).

The AQHI is described as a risk communication tool (Abelsohn and Stieb, 2011)[3]. Risk communication has been defined as two-way transfer of information between stakeholders in order to develop a shared strategy to manage risks (OECD, 2002)[4]. Therefore, AQHI outreach at special events focuses on two-way transfer of information between the City of Hamilton Public Health Services (PHS) and individuals visiting the AQHI booth, in order to discuss the AQHI as a strategy to manage health risks associated with poor air quality.

Figure 7. City of Hamilton AQHI Promotional Graphics
(Source: City of Hamilton, 2011)



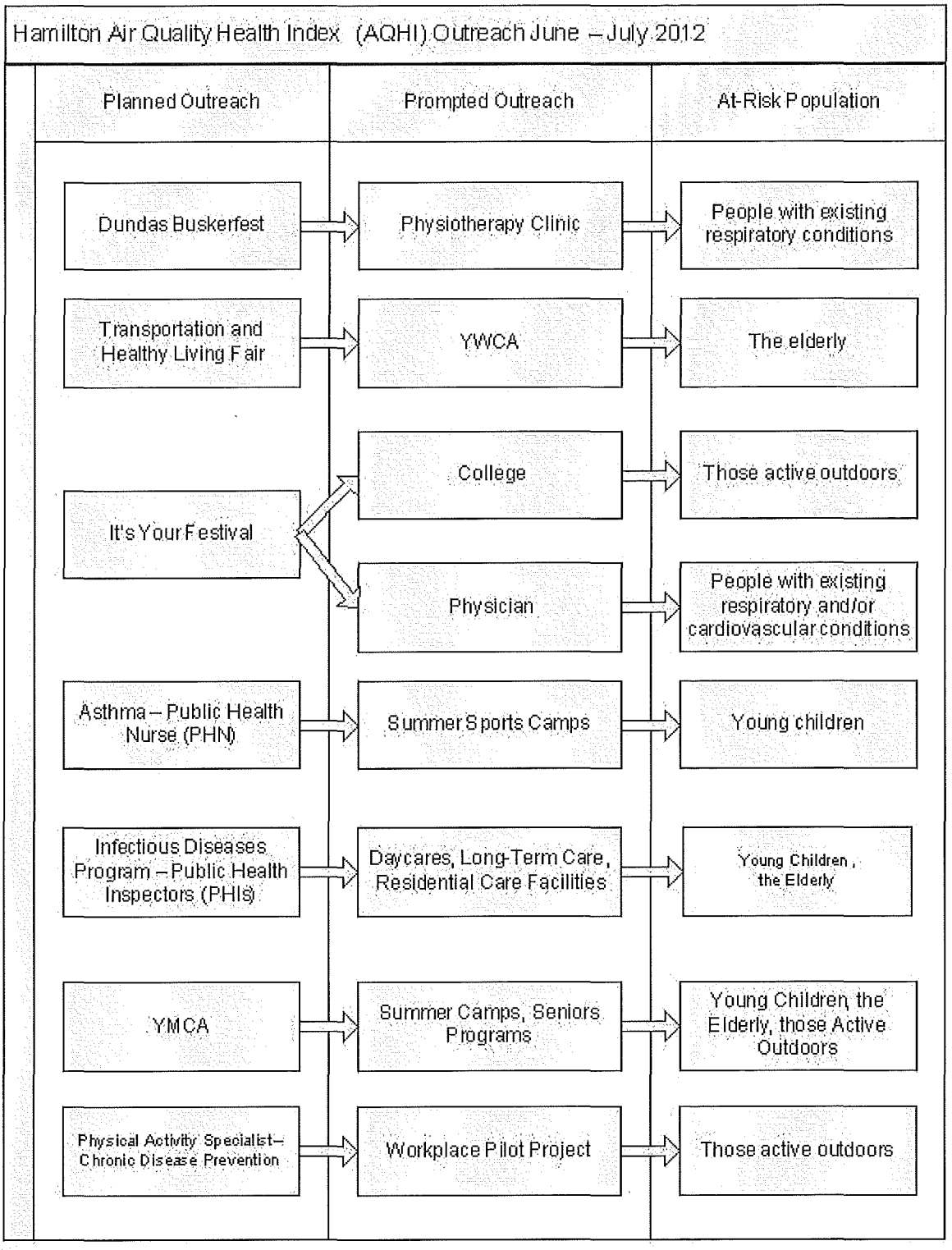
[3] Abelsohn, A., Stieb, D.M. (2011). Health effects of outdoor air pollution. Canadian Family Physician, 57,881-887.
[4] OECD Guidance Document on Risk Communication for Chemical Risk Management. July 2002.

In addition, a key principle of successful risk communication includes trust and credibility between the stakeholder and the organization communicating risk (Hill, 2005)[5]. City of Hamilton's Public Health Services (PHS) recognizes the importance of trust and credibility in all risk communication efforts; therefore, back in April 2010, PHS engaged stakeholders in the City of Hamilton representing "at risk" populations (i.e., young children, the elderly, people with existing respiratory conditions and people with existing cardiovascular conditions).

Stakeholder feedback indicated that 83% believe that PHS is the best agency in Hamilton to provide AQHI information to the public (City of Hamilton PHS, April 2010)[6]. The reasons why the public supports PHS in this initiative are consistent with risk communication theory and focus on trust and credibility in government (OECD, 2002). Exchange of information between PHS and individuals visiting the AQHI booth at special events has generated requests and resulted in AQHI outreach with other organizations servicing the "at risk" population. Therefore, planned AQHI outreach by PHS has prompted further AQHI outreach by stakeholders in the City of Hamilton. The prompted AQHI outreach is stakeholder-driven. **Figure 8** outlines planned and prompted outreach conducted around the AQHI between the months of June and July 2012 including the events attended and activities undertaken to reach "at-risk" populations in Hamilton.

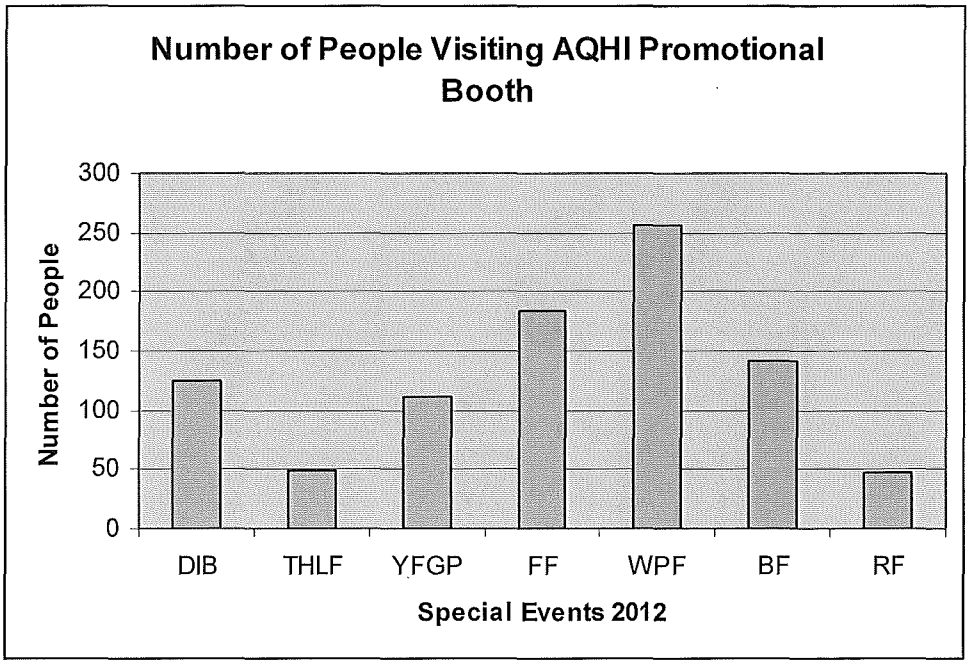
[5] Hill, S. Risk Communication Literature Review: Summary Report. 2005
[6] City of Hamilton Public Health Services. (2010, April). Risk Communication: City of Hamilton Public Health Services Implementation of the Air Quality Health Index (AQHI). City of Hamilton Public Health Services.

Figure 8 Planned and Prompted AQHI Outreach Activities 2012



In 2012, the total number of people that approached the AQHI information booth at the special events was 915. The number of people that approached the AQHI information booth at each of the special events is displayed in **Figure 9**.

Figure 9. Number of People Visiting the AQHI Promotional Booth



Understanding the essence of risk communication and implementing two-way transfer of information between stakeholders has prompted AQHI outreach in organizations not approached previously in the City of Hamilton. AQHI outreach was effective in bringing awareness of the AQHI to individuals who did not have any awareness of the AQHI previously. Both planned and prompted AQHI outreach activities and events have targeted members of the "at risk" populations in Hamilton.

For further information on The Government of Canada's AQHI, visit www.airhealth.ca

3.6 Local Poor Air Quality Notifications

The local office of the Ontario Ministry of the Environment (MOE) has put in place a program whereby about 30 companies are asked to curtail emissions and to control dust-generating activities on days when local air quality is considered to be poor. This system was developed by the MOE in partnership with the City of Hamilton Public Health Services, McMaster University Institute of Environment and Health, *Clean Air Hamilton* and the Hamilton Industrial Environmental Association (HIEA). The system of reporting on and taking action for local poor air quality is exclusive to Hamilton. The protocol is not based on the MOE's Air Quality Index (AQI) in the way that the MOE's current province-wide system of smog alerts is based on the AQI.

Participating local companies are told by the MOE when local air quality is already poor or is likely to become poor due to increased levels of fine particulate matter ($PM_{2.5}$). Participating companies have plans and protocols in place to implement that will reduce emissions of fine particulate matter from their operations. Such notifications serve to help the local air quality situation during poor air events. These notifications do not have any effect on levels of pollutants that arrive in Hamilton due to long-range transport from sources outside Canada.

This poor air quality notification process was put in place because it is possible to decrease the impacts of poor air quality on a local basis even if other areas do not have poor air quality at that time. One of the main reasons for these "Hamilton-specific" poor air quality events is a weather event known as a "temperature inversion". Normally, air near the ground is warmer compared to air at higher altitudes since air temperature decreases with increasing altitude. During the special conditions leading to a temperature inversion, a layer of warm air lies on top of a layer of cooler air and acts as a 'cap' over the cooler ground level air.

During these events the air is usually very still. The 'cap' caused by the warm air traps emissions from industry, transportation or other local emissions sources under the 'cap' and does not allow these emissions to disperse readily as they would normally. The result is that the concentrations of locally generated pollutants build up rapidly in the air underneath the inversion layer or 'cap.' Pollutant levels rise very quickly, often to poor or even dangerous levels. These inversions are unstable and tend to last only 1-6 hours before they break up and the pollutants disperse. During an inversion $PM_{2.5}$ levels have reached and exceeded 100 micrograms per cubic metre.

Temperature inversions happen in Hamilton primarily in the fall and spring due in part to the unique local geography of the Niagara Escarpment and the lake breeze effects from Lake Ontario. In a typical year, Hamilton experiences 1-3 such events lasting hours to a couple of days; however, inversion events lasting up to 5 days have been known to occur.

During a Local Poor Air Quality Event, industries are asked to voluntarily undertake control measures and curtail activities with a strong focus on reducing emissions of particulate matter to the air. Actions to accomplish could include wetting or covering materials piles (e.g., coal, gravel), postponing materials handling activities, increasing property and road cleaning, and curtailing some production processes. In 2012, the local MOE office called a Local Poor Air Quality Notice twice. The first Notification was issued at approximately 1pm on March 20, 2012; the notification remained in effect until 8:30 am on March 22, 2012. The second notification occurred on November 19, 2012 at 2:30 pm. The notification was rescinded at 10:20 pm once atmospheric mixing conditions and improvements in air quality indicated that the notification was no longer required.

The focus of the notification system is on fine particulate matter ($PM_{2.5}$) because there is a significant amount of $PM_{2.5}$ that is locally-generated. Therefore, any local efforts to reduce air pollution in general will be beneficial. When fine particulate matter goes over a certain level, and when the forecast predicts inversion conditions will last for at least 6 hours, and when wind direction is such that emissions from the industrial core are being blown toward populated areas of the city, participating industries will be notified to implement their plans to reduce local sources of fine particulate matter.

3.7 Emission Sources within Hamilton

The task of compiling an accurate and up-to-date inventory of emission sources within an urban area is a significant challenge for a number of reasons. First, not all sources are required to report their emissions and are thus not accounted for in the National Pollutant Release Inventory (NPRI). Second, not all sources of emissions are reported accurately, often because those who report the data do not have the information needed or the skill set to complete an accurate emissions report.

Figure 10: The Air Pollution Picture

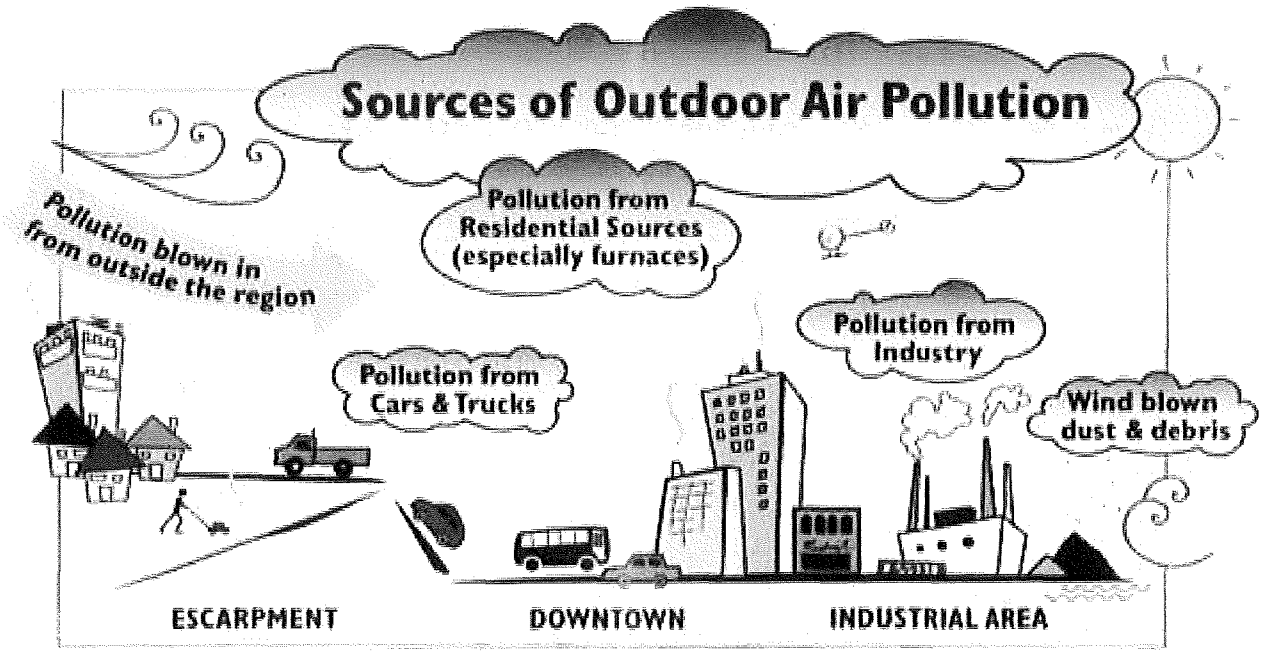


Table 3: NPRI Total Emissions by Source Category for Hamilton (2008)

Source Category	CO	SO_x	NO_x	PM_{10}	$PM_{2.5}$	VOC
Industrial	18,490	16,589	9,585	2,414	1,711	2,019
Fuel Combustion	7,271	415	1,558	1,120	1,104	1,483
Transportation	99,680	76	10,415	604	502	6,732
Incineration	22	20	6	0	0	6
Miscellaneous	56	0	0	144	144	8,333
Open Sources	147	18	75	37,672	7,891	792
Total Tonnes	**125,666**	**17,118**	**21,639**	**41,954**	**11,352**	**19,365**

Figure 11: NPRI Total Emissions by Contaminant and Source (2008)

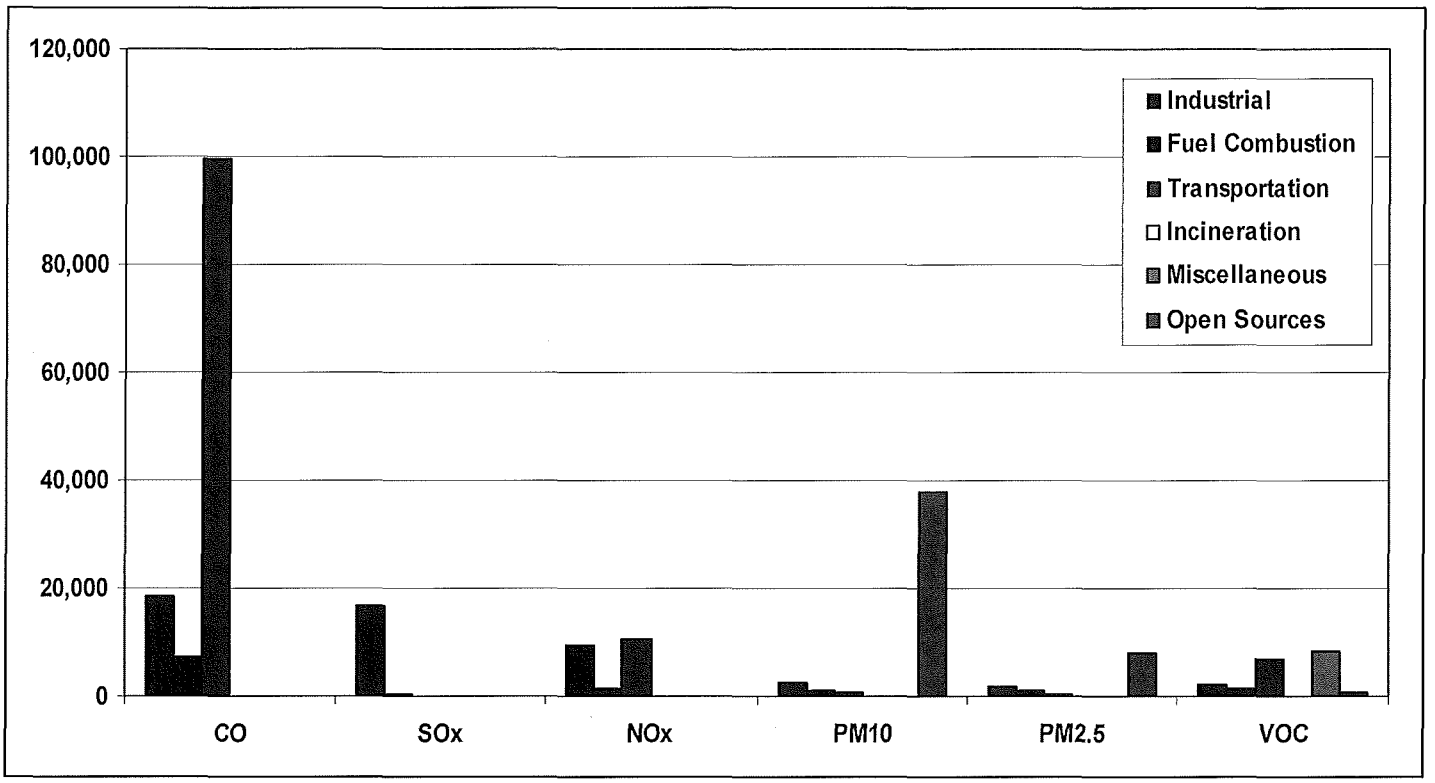
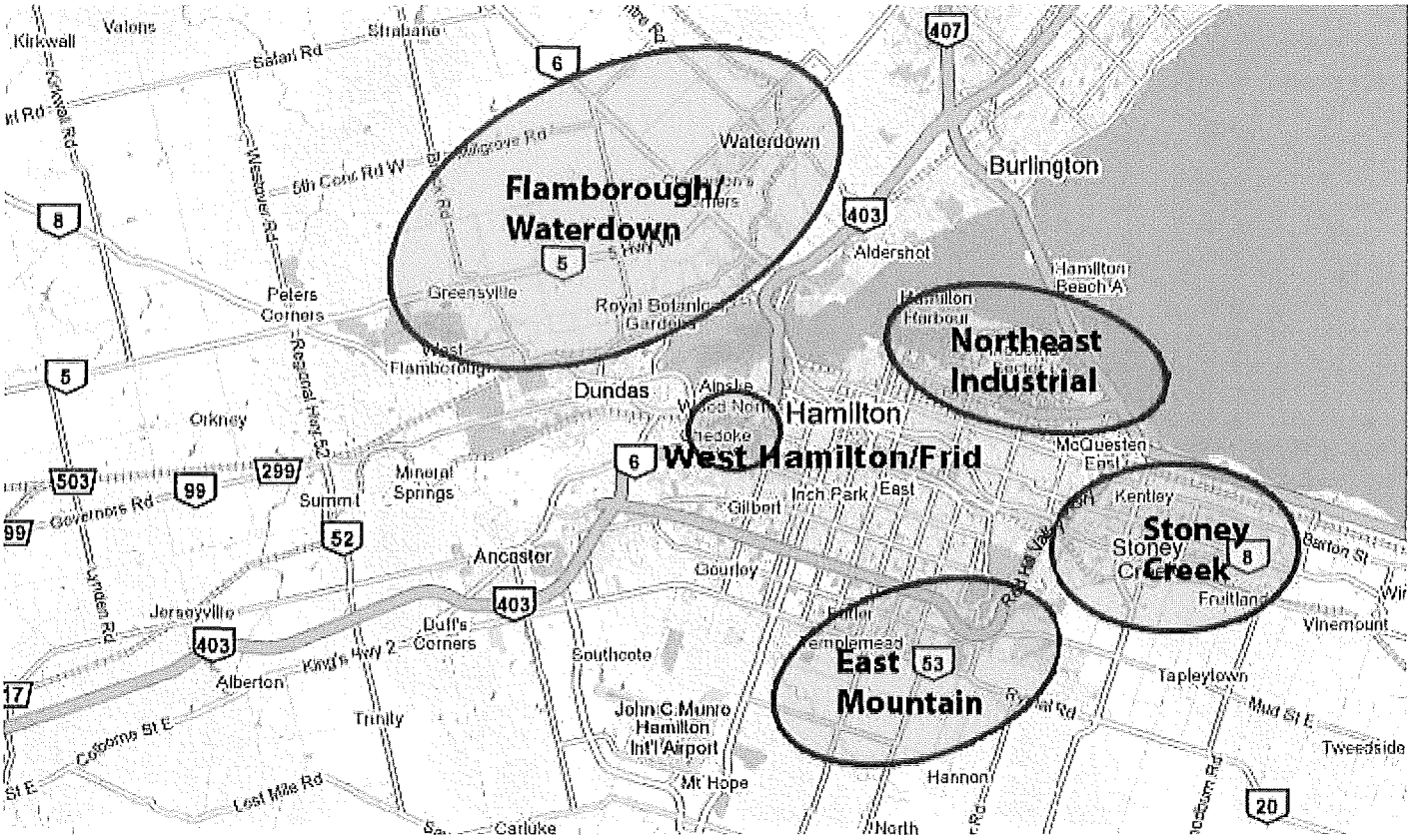


Table 3 and **Figure 11** show the total emissions data from the NPRI, broken down by source category for 2008; these data show that carbon monoxide (CO) is the air pollutant with the largest emissions. Based on available emissions inventory data from the Ministry of the Environment and Environment Canada, it is possible to conclude that:

- The transportation sector (i.e., mobile sources, such as cars and trucks) is the leading source of nitrogen oxide (NO_x) emissions within the City of Hamilton, followed closely by the industrial sector;
- Road dust, construction activities and area sources, such as fireplaces and home heating, are primary sources of $PM_{2.5}$ and PM_{10} in Hamilton, followed closely by emissions from the industrial sector;
- The industrial sector is the leading source of sulphur dioxide (SO_2) in Hamilton (~90%);
- The transportation sector is the leading source of carbon monoxide (CO) emissions within Hamilton; and
- The transportation sector is the leading source (~60%) of volatile organic compounds (VOCs); the remaining VOCs are releases due to by-product operations by companies and general solvent use by companies and individuals.

Five separate industrial areas have been identified in the greater Hamilton area from mobile air monitoring (**Figure 12)**: Flamborough/Waterdown (aggregates industries), East Mountain (aggregates industries), West Hamilton/Frid (mixed industrial and University), Northeast Industrial Area (heavy and mixed industrial activities) and Stoney Creek (mixed industrial activities and aggregates industries).

Figure 12: Emission Sources by Region in the Hamilton Area

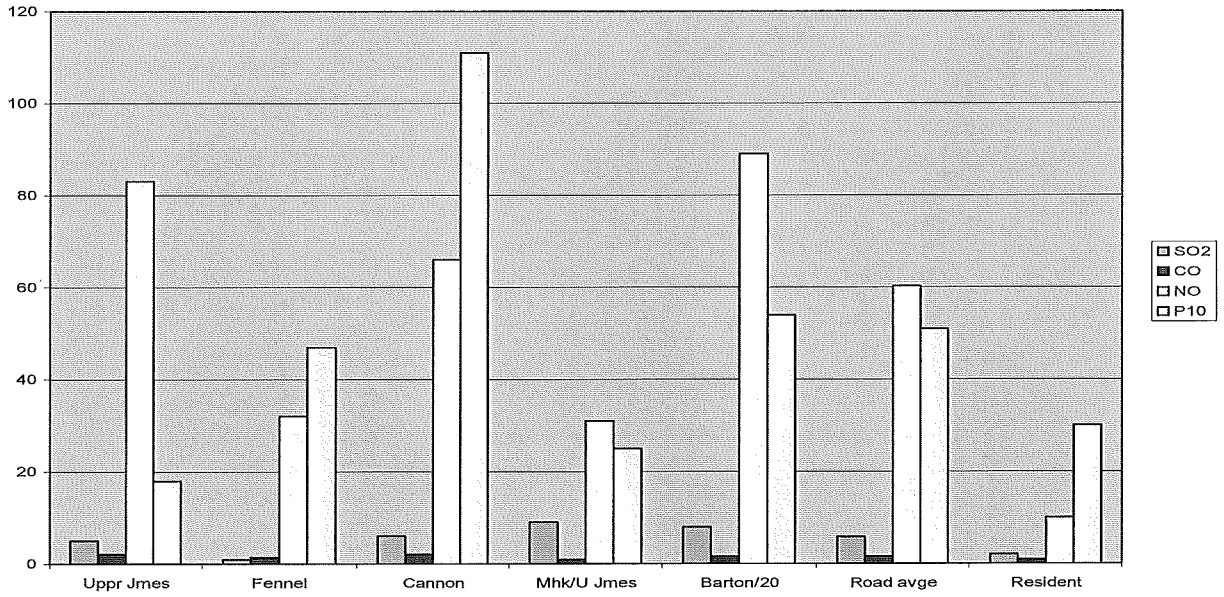


Mobile air monitoring studies were performed by driving a van outfitted with air monitoring equipment in traverses across the City, through selected industrial areas, and at selected major traffic intersections. The industrial point sources monitored included large integrated steel industries, steel by-products processors, recycling/scrap operations, foundries, chemical plants, companies with large storage piles, agricultural materials processing plants, a brick manufacturing operation, university operations, a vegetable oil processing plant, a carbon black manufacturing plant, a rail shunting yard and truck transfer station and a cogeneration natural gas plant.

These mobile air monitoring studies found that overall, the highest concentrations of pollutants were observed near major road intersections and along heavily used roads, particularly roads affected by dirt track-out from industrial sites throughout the City. These high levels of pollutants are attributed to the impacts of traffic emissions from automobiles, light trucks and heavy trucks. Industrial sources made significant contributions, particularly for SO_2, but these contributions were often overwhelmed by local traffic emissions.

Figure 13 shows the levels of four important air contaminants (sulphur dioxide SO_2, carbon monoxide CO; nitric oxide NO and inhalable particulate material PM_{10}) at seven road locations in Hamilton. The first five (on the left in the figure) are values obtained along major roads or at major intersections; the remaining data are the average for all roads in Hamilton (called "Road avge.") and a typical example of data from a street in a residential area of Hamilton; residential areas are at a distance from major roads but are usually within 200-500 m of such roads.

Figure 13: Mobile Monitoring Study - Levels of Four Air Contaminants



Details of these studies are described in previous *Clean Air Hamilton* reports and can be downloaded from the *Clean Air Hamilton* web site – **www.cleanair.hamilton.ca.**

3.8 Small Engines

Small engine-powered equipment, such as lawn mowers, string trimmers and leaf blowers are widely used in Hamilton to maintain landscaped areas. Emissions from older two-stroke gasoline engines contribute to poor air quality and produce greenhouse gases. In one hour, the average gas powered lawn mower produces harmful air emissions equivalent to those emitted by a new personal vehicle traveling 320 km.

The Small Engine Powered Equipment program raised public awareness of the harmful pollutants released by older gas-powered equipment. This program also highlighted cleaner equipment choices and best lawn care practices to reduce air emissions.

In April 2012, Green Venture held three Lawnmower Recycling Events at three Rona locations (Rona Parkdale, Rona Waterdown, Rona Rymal). Over the three recycling events, 165 individuals were engaged. Information was provided about small engine pollution and questions about the event were answered. In total, 32 lawnmowers were recycled. Rona provided in-kind support valued at approximately $1,150.

Green Venture staff also researched and revised the Small Engines Fact Sheet, which has been uploaded to Green Venture's website and is available for download by the public. The fact sheet has also been distributed at events and is available at EcoHouse. Approximately 75 fact sheets were distributed in 2012.

For further information on small engines visit: http://air.greenventure.ca/small-engine-powered-tools

3.9 Air Quality Management Systems (AQMS)

Ontario has been actively engaged in a multi-jurisdictional, multi-stakeholder process to develop the national Air Quality Management System (AQMS) or "the System." On October 11, 2012 at Lake Louise, Alberta, Ministers of the Environment agreed to move forward with the implementation of the System. The proposal includes five key elements:

- **Canadian Ambient Air Quality Standards (CAAQS)** – new ambient air standards for ground-level ozone and fine particulate matter ($PM_{2.5}$).
- **Air Zone Management (AZM)** – a framework for place-based air quality management to be tailored for implementation by each province and territory.
- **Regional Airshed Coordination** – a framework for managing trans-boundary and inter-provincial air pollution issues.
- **Base Level Industrial Emissions Requirements (BLIERs)** – emission standards for smog-causing pollutants for major industrial facilities to be implemented through provincial instruments.
- **Mobile Sources Working Group** – an inter-governmental forum established to propose recommendations to Environment Ministers for reducing emissions of criteria air contaminants from the transportation sector and other mobile sources through collaborative action among jurisdictions.

3.9.1 Air Zone Management

The Air Quality Management System (AQMS) is an integrated system designed to achieve the CAAQS for ground-level ozone and $PM_{2.5}$, and future air quality standards as they are established. It recognizes that there are substantial differences in the nature of air quality issues and challenges across the country, and that these differences can be regional or local in nature.

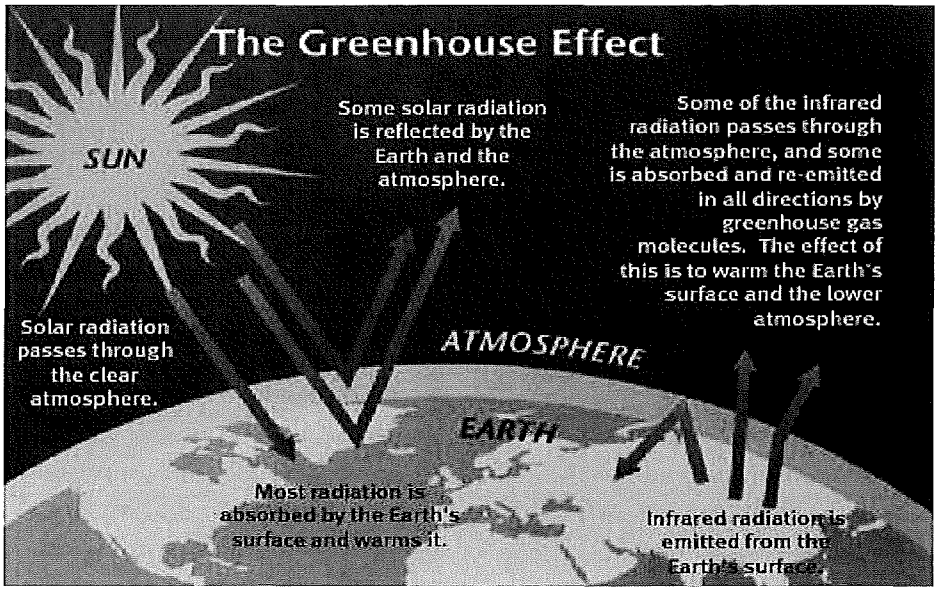
The air zone management portion of the System is intended to serve as guidance for jurisdictions, which are encouraged to implement any measures to support air quality improvement. Ontario's design of an air zone management system will be customized to the province. This approach has the potential to reduce air pollution from multiple sources, resulting in the improvement of air quality and the reduction of emissions that impact climate change.

Details of air zone management governance are still under development. *Clean Air Hamilton* has always worked within an air zone construct and is interested in participating in the development of air zone management systems within the Greater Toronto Area, across Ontario and across Canada.

4.0 Linkages between Climate Change and Air Quality

Climate Change refers to the long-term change in average weather patterns resulting from the release of substantial amounts of greenhouse gases (GHGs), such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) into the atmosphere; these levels are over and above the natural levels of these substances. The increased levels of these infrared-absorbing substances result in an intensification of the earth's natural greenhouse effect (**Figure 14**). These chemicals absorb heat energy very efficiently and transfer this heat energy to the atmosphere, resulting in an increased warming of the atmosphere.

Figure 14: The Greenhouse Effect



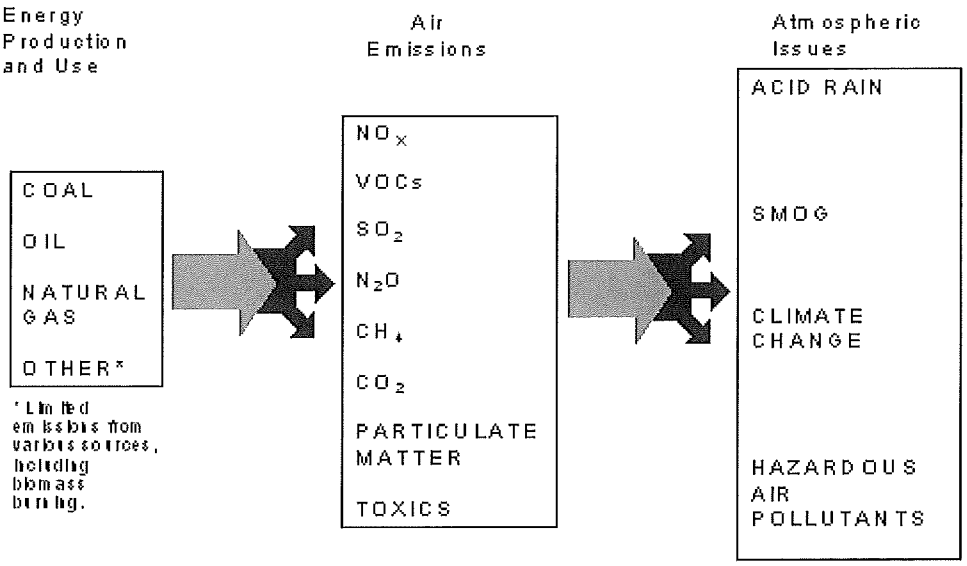
Climate change can be caused by natural processes, such as a change in the sun's strength, and by human activities. Dramatic changes in climate and weather patterns over the past 25 years are a direct result of human activities and the release of carbon dioxide due to the combustion of fossil fuels for transportation, manufacturing, heating, cooling and generation of electricity. This use alone is responsible for 70-90% of greenhouse gasses produced by humans, with the rest coming from land uses such as agriculture and forestry.

Climate change will affect the severity of air pollution. Increased temperatures will exacerbate air pollution through increased chemical reaction rates in the atmosphere and increased smog formation. Climate change may affect air pollution by changing ambient ground-level concentrations of ozone (O_3) and particulate matter ($PM_{2.5}$), two of the primary components of smog.

The most important linkage between climate change and air pollution is the combustion of fossil fuels (see **Figure 15**). The burning of fossil fuels for energy (e.g., in heating and cooling buildings, in personal and commercial transportation, for lighting, etc.) results in emissions of carbon dioxide, sulphur dioxide, nitrogen oxides, volatile organic compounds, black carbon, organic carbon, and particulate matter, all of which contribute to air pollution and the health effects due to air pollution. In other words, reductions in emissions of the major greenhouse gas (carbon dioxide) will result in

a commensurate reduction in the other combustion by-products that contribute to and cause air pollution.

Figure 15: Combustion of Fossil Fuels for Electricity, Home Energy, Transportation, Industry, and Municipalities Results in Air Emissions and Atmospheric Issues



(Chiotti, 2003)

Poor air quality, combined with heat stress during hotter weather, poses serious health challenges to the most vulnerable people in society, the very young and the elderly. Climate change is predicted to have significant impacts on human health. In 2008 Health Canada identified eight significant health concerns related to Climate Change (**Table 4**). They include health effects from increased smog episodes, illnesses and deaths caused by heat and cold waves, water-borne and food-borne contamination, diseases transmitted by insects, health effects of stratospheric ozone depletion and an increased number of extreme weather events.

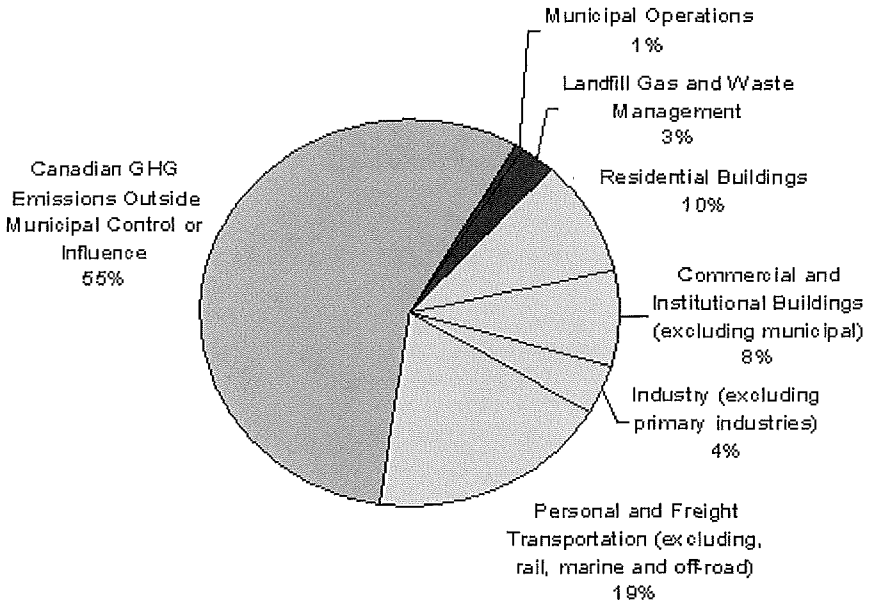
Table 4: Health Impacts from Climate Change and Variability (Health Canada, 2008)

Health Issues	Examples of Health Vulnerabilities
Temperature-related morbidity and mortality	Cold and heat related illnesses, mental health, respiratory and cardiovascular stress, and occupational health stress.
Health effects of extreme weather events	Social and mental health stress due to disasters, injuries, preparedness and population displacements, damaged public health infrastructure, occupational health hazards.
Air pollution related health effects	Respiratory diseases, cardiovascular diseases, cancer, allergens and asthma, changed exposure to outdoor and indoor air pollutants and allergens.
Water and food borne contamination	Enteric diseases.
Vector-borne infections and diseases	Changed patterns of diseases caused by bacteria, viruses and other pathogens carried by mosquitoes, ticks and other vectors.
Health effects of stratospheric ozone depletion	Cancer, cataracts, immune suppression.
Population vulnerabilities in cities and communities	Rural and urban health, seniors, children, homeless and low income, traditional cultures, disabled, immigrant populations.
Health and socio-economic impacts	Loss of income and productivity, social disruption, diminished quality of life, Increased costs to health care.

Adapted from http://www.hc-sc.gc.ca

According to the Federation of Canadian Municipalities (FCM), just less than half of Canada's 2006 greenhouse gas emissions (315 Mt or 315 million tonnes) are under the direct or indirect control or influence of municipal governments. Municipalities directly control decisions that result in only 24 Mt of greenhouse gas emissions from municipal operations, residential waste, and landfill sites; municipalities contribute 7.6% of Canada's greenhouse gas emissions. The remaining 93.4% of Canada's greenhouse gas emissions (or 291 Mt) are not under the direct control of municipal governments (see **Figure 16**).

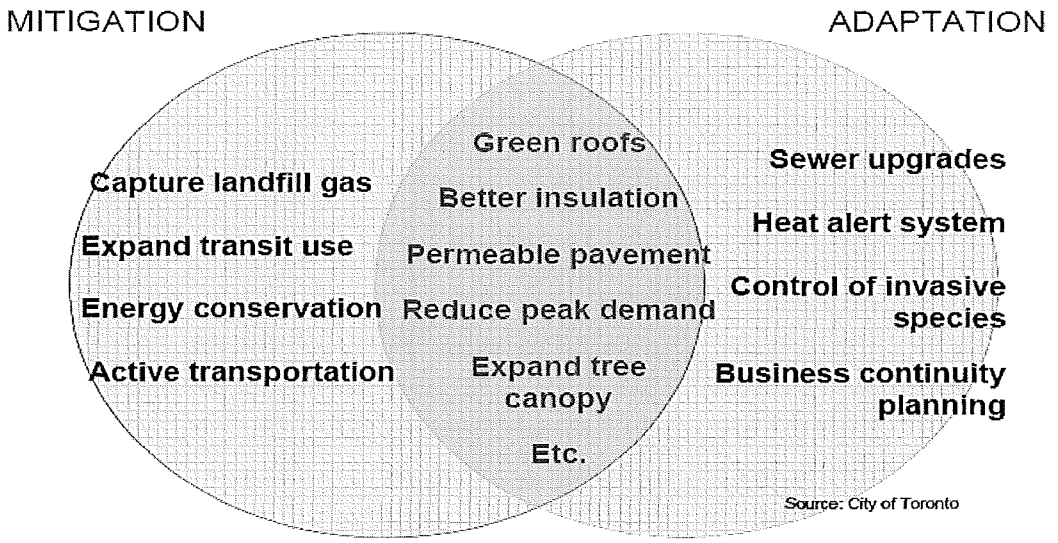
Figure 16: Canadian GHG Emissions Directly & Indirectly Controlled by Municipalities Compared to Total National Emissions (2006)



(Federation of Canadian Municipalities, 2009)

Addressing climate change requires two types of actions: adaptation and mitigation. Adaptation involves actions or planning to minimize citizens or infrastructure's vulnerabilities to the impacts of climate change. Mitigation involves actions aimed at reducing greenhouse gases. Adaptation and mitigative actions are complementary (**Figure 17**).

Figure 17: Actions towards Climate Change



To date, responses to reducing (mitigating) climate change in cities globally can be grouped into five sectors:

1. Urban Development and Design (e.g. land-use planning, regeneration and re-use of lands and buildings, increased density to reduce mobility demand, and promote walking and cycling)
2. The Built Environment (e.g. energy efficient materials and design, retrofitting, energy demand reduction, alternative energy promotion)
3. Transportation (e.g. mass transportation using transit, energy efficient hybrid and electric vehicles)
4. Urban Infrastructures (e.g. renewable and low carbon energy sources, waste recycling)
5. Carbon Sequestration (e.g. tree planting and maintenance, protection of wetlands)

A few global cites have begun to undertake risk management or adaptive actions towards climate change impacts such as extreme weather events.

Key sectors for an urban risk management approach to climate change include:

1. Infrastructure and Settlements (e.g. drainage, storm surge barriers, wetland protection);
2. Water Management (e.g. storage and conservation because of expected shortage of clean water);
3. Transport (e.g. improved design and safety standards); and,
4. Energy (e.g. infrastructure strengthening, source diversification).
5. Health (e.g. Heat alerts, Air Quality Health Index)

Cities are considered the drivers of action on addressing climate change through municipal practices and regulations in their own operations and the services they provide to their communities. Cities are economic engines and climate change will influence those activities from innovation on actions and solutions to energy, transportation, buildings, health, air quality and climate.

Successful cities recognize the synergy between economic growth and climate change is strongest at the local level. Cities that address greenhouse gas emissions also curb local pollution and energy demands – while metro regions that continue to pollute, risk becoming less attractive for investment. Similarly, cities that build resilience into their climate change and energy actions, increase the security of local populations to extreme weather events, which can enhance local safety, health and the quality of life of citizens.

4.1 The City's Climate Change Inventory

In 2008, the City of Hamilton approved an Air Quality and Climate Change Strategic Plan to undertake actions to meet corporate emission targets of a 10% reduction of 2005 greenhouse gas levels by 2012, followed by a further 20% reduction of 2005 greenhouse gases levels by 2020. Community targets were recommended as a 10% reduction of 2006 greenhouse gases levels by 2012, followed by a further 20% reduction of 2005 greenhouse gases levels by 2020.

In 2009, the City of Hamilton undertook a greenhouse gas emissions inventory for its operations and the community as part of the FCM Partners for Climate Protection Program. The inventory was also undertaken to measure how the City was doing in reducing its greenhouse gas emissions compared to the emissions targets.

In 2011, the Corporation reduced its greenhouse gas emissions to 113,778 tonnes, a 16% reduction of emissions from the 2005 baseline of 135,038 tonnes, and is on course for achieving the 20% reduction targets of 2020 by 2012. The reductions in corporate greenhouse gas emissions have arisen from increased energy and fuel conservation efforts by City operations and City staff through buildings, lighting, water and wastewater. Municipal operations contributed only 1% of our community's greenhouse gas (GHG) emissions in 2010 **(Figure 18)**. However, municipal policies influence GHG emissions from waste, transportation, and residential and commercial buildings and to some aspects of industrial emissions.

The total greenhouse gas emissions for Hamilton in 2010 were estimated to be just under 20 million tonnes, a reduction of 14.5% from 2006 emissions levels (estimated at 23.4 million tonnes). These improvements occurred due to reduced energy demand, improved energy efficiencies, conservation actions within the community, and the shift away from coal as a source of electricity generation as part of the Province's phase out of coal in Ontario's energy sources by 2014. **Figure 19** shows the changes in community emissions since 2006.

Figure 18: Total Greenhouse Gas Emissions Corporate and Community (2010)

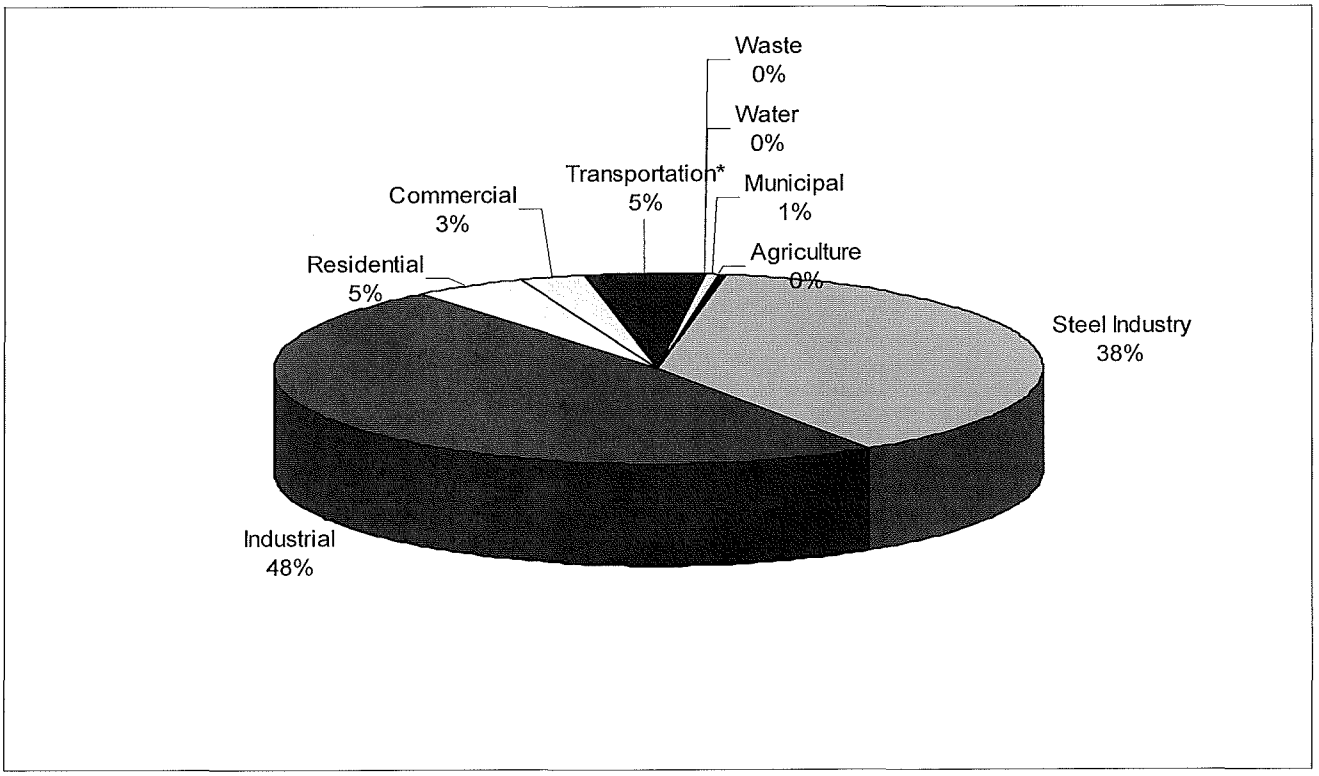
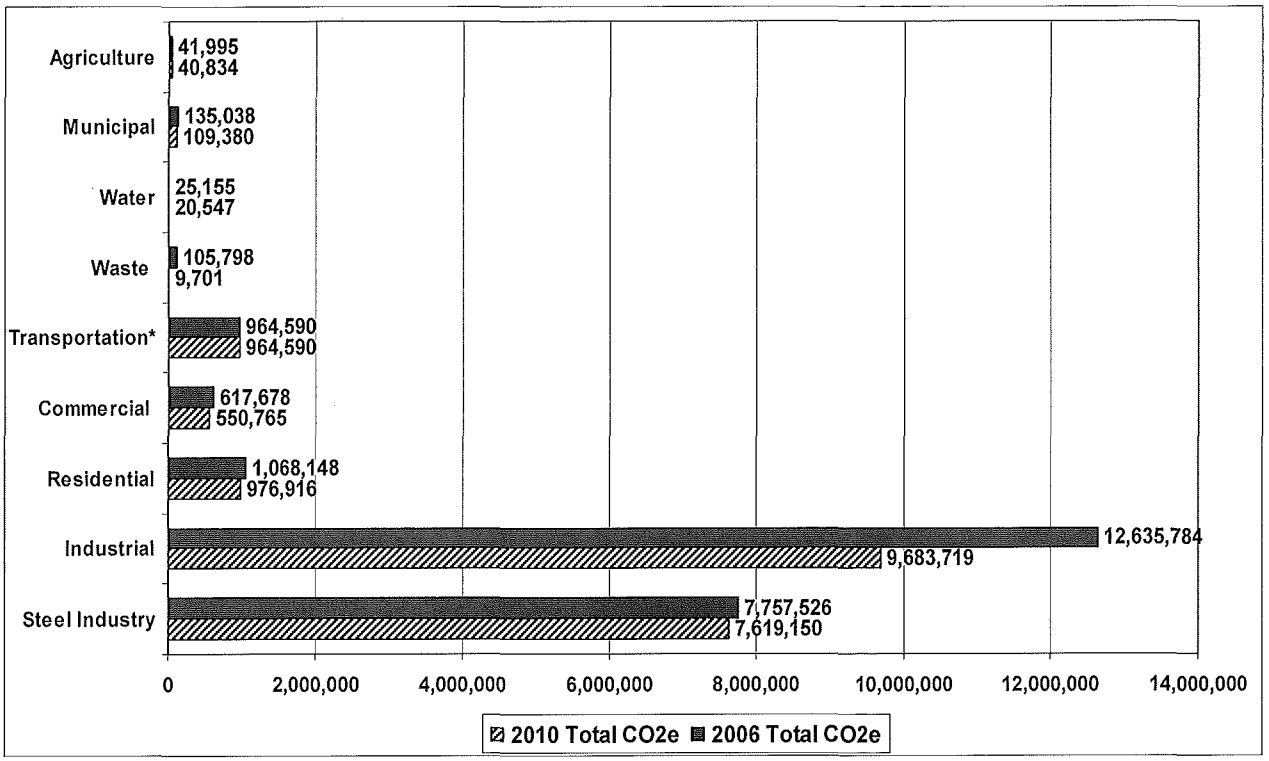


Figure 19: Community CO_2e Emissions in Hamilton in 2006 and 2010



Municipal and community involvement in reducing sources of GHG emissions – commercial and personal transportation, commercial and residential energy usage, land-use development – in Hamilton is critical. Provincial policies on phasing out coal-fired electricity and encouraging renewable alternative energy in the provincial energy mix and the MoveOntario 2020 Rapid Transit Action Plan will also affect the reductions in Hamilton's emissions.

To read the City's actions on Climate Change visit: www.hamilton.ca/climatechange

4.2 Hamilton Climate Change Community Action Charter

In 2011, Hamilton became the first municipality in Ontario to enact a community Climate Change Action Charter. The purpose of the community Climate Change Action Charter is to engage Hamilton organizations, businesses and individuals in taking individual and collective action and *leadership on climate change.*

The Hamilton Climate Change Action Charter is a voluntary agreement that states clearly that action on climate change is needed. The Charter builds awareness and communication within Hamilton on climate change issues; the Charter can be used by individual citizens, by organizations and by businesses of all types and sizes.

Signing the Hamilton Climate Change Action Charter is a way to show commitment to tackle the causes and consequences of climate change. It represents a broad public statement that any Hamilton individual or organization can make. Many organizations and corporations in the Hamilton area have already developed their own climate change and sustainability programs.

In 2012, the following organizations endorsed and signed Hamilton's Climate Change Action Charter:

- Ancaster-Dundas-Flamborough-Westdale Green Party of Ontario
- Giant's Rib Discovery Centre
- Green Smoothie Bar
- Lura Consulting
- MacGreen
- ManoRun Organic Farm
- Refficient Inc.
- Royal Botanical Gardens
- Strategic Interchange

These organizations have joined the following organizations that endorsed and signed Hamilton's Climate Change Action Charter in 2011:

- Beasley Neighbourhood Association
- Blue Green Canada
- The City of Hamilton
- *Clean Air Hamilton*
- Congress of Union Retirees of Canada
- Corr Research
- Council of Canadians - Hamilton Chapter
- Creating Healthy and Sustainable Environments(CHASE)
- Dundas in Transition
- Eco Churches of West Hamilton
- Environment Hamilton
- First Unitarian Church of Hamilton
- Green Venture
- Greening Marketing Inc.
- Hamilton 350
- Hamilton Area Steelworkers
- Hamilton/Burlington KAIROS Committee
- Hamilton CarShare
- Hamilton Conservation Authority
- Hamilton District Labour Council
- Hamilton-Wentworth District School Board
- McKibbon Wakefield Inc.
- McMaster Centre for Climate Change Research

- McMaster University
- Mohawk College
- North End Neighbours
- St. James's Anglican Church
- Sustainable Hamilton
- The Hammer Active Alternative Transportation
- Union Gas

In 2012, as part of the first year celebrations of the Charter, an annual report was issued on the progress of Charter signatories to date on taking action on climate change. This report is available on-line at: www.climatechangehamilton.ca

To learn more about or to sign the Charter visit: http://climatechangehamilton.ca/

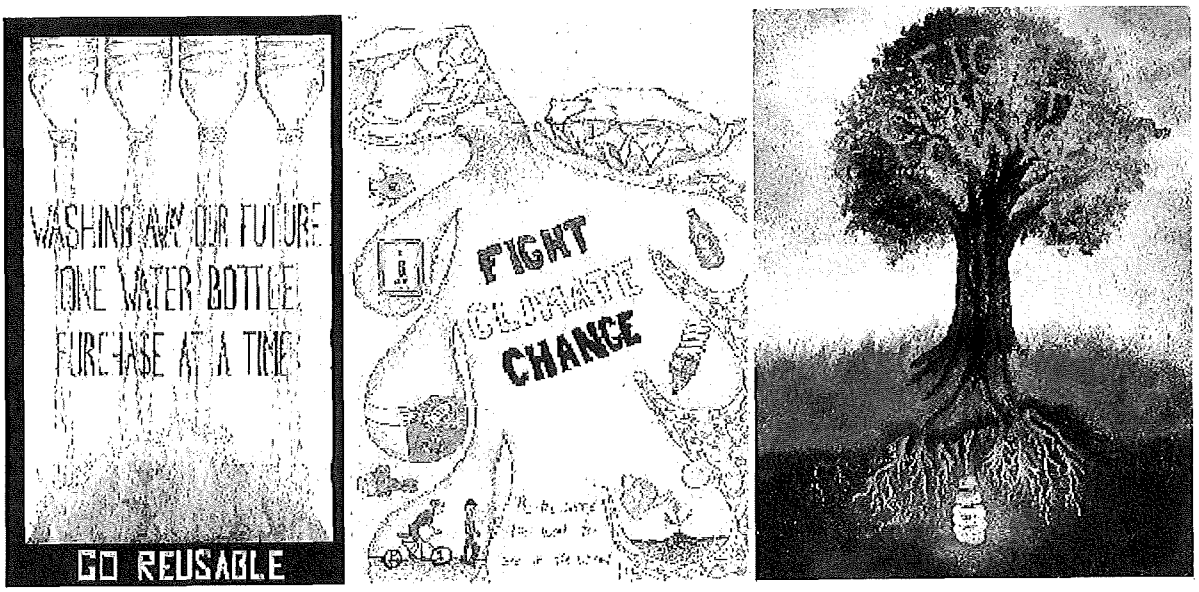
4.3 Hamilton High School Heroes

Hamilton high school students, and the teachers that support them, continue to take environmental action in their schools and communities. Coordinated by Green Venture, and on behalf of *Clean Air Hamilton*, the Hamilton High School Heroes program reaches out to motivated youth and their supportive teachers to connect them with credible information sources, air quality science, the work of *Clean Air Hamilton,* and what we can all do to reduce harmful air emissions.

In 2012, 219 high school students were engaged through the Hamilton Community Foundation's Living the Environment Conference, tree plantings at Cardinal Newman High School, and the second annual Fighting Climate Change poster contest.

Clean Air Hamilton's social media presence was coordinated through Green Venture's social media platforms including Twitter (six Tweets), Facebook (four posts), and Wordpress (one blog article). In addition to the social media presence that has an estimated reach of over 2,500 followers/viewers per post, the Cardinal Newman student tree planting was highlighted in the Stoney Creek News in an article entitled "A Green Effort: Tree Planting" (May 2012)

Figure 20: Winning 2012 "Fighting Climate Change Poster Submissions



Winning poster submissions for the 2012 "Fighting Climate Change" Poster Contest:
First Place: 'Go Reusable' by Aamna Arshad.
Second Place: 'Be the Change' by Eric Bolivong
Third Place: 'Seed' by Chris Walker

The 2nd annual "Fighting Climate Change" poster contest invited high school students to submit original artistic posters depicting actions people can take to fight climate change. The contest reached out to all Hamilton high schools and a public opening of the 45 artists and their entries occurred during the April 13th 2012 Art Crawl at the Hamilton Central Library. Thereafter, the top works travelled to a variety of venues for display and to inspire the artists' peers to take positive action on climate change (**Figure 20**).

5.0 Land Use Planning – Linkages to Air Quality

Context

Since the 1980's there has been increasing recognition that air quality in urban areas is strongly linked to the nature of the built urban environment, often called the 'urban form.' Urban planners now recognize that combustion and fugitive emissions from buildings, houses, industries and, most importantly, the cars and trucks on highways and roads that service urban-industrial landscapes, are responsible to a great extent for poor air quality within and downwind of urban centres.

The layouts of towns and cities across Canada (and North America) are the net result of many land use planning decisions over the years. Municipalities approve the location, design and construction of commercial buildings, residential dwellings, sub-divisions, industrial areas, roads, streets, highways, services, etc. within their municipal jurisdiction. The purpose of this section is to provide an overview of how *Clean Air Hamilton* believes land use planning decision-making may be changed so as to reduce air quality impacts in Hamilton.

Hamilton's Air Quality Challenge

Understanding the factors contributing to air quality in Hamilton, the sources of air pollutants and strategies to improve local air quality lie at the heart of *Clean Air Hamilton*'s mandate. Hamilton is a particularly challenging environment for air quality due a complex mix of vehicular emissions and industrial emissions and a landscape dominated by a U-shaped, 100-metre high escarpment and proximity to a large harbour and one of the Great Lakes (see **Section 3.3** and **Section 3.7**). In June 2012, the City of Hamilton asked *Clean Air Hamilton* to make recommendations on practical ways to improve Hamilton's air quality, particularly in the lower city below the escarpment.

Land Use Planning and Air Quality

Clean Air Hamilton believes that there are three key areas where better coordination among decision-makers will help to reduce air quality impacts in Hamilton and will help to ensure sustainable development decisions where land use compatibility issues exist:

- between industrial and sensitive uses;
- between facilities with site specific air standards and sensitive uses; and
- between on-road mobile sources and sensitive uses.

Identification of these three issues is based on *Clean Air Hamilton*'s collective experience addressing air quality in this unique Hamilton air shed, the discussions (particularly the mobile monitoring discussion) that precede and follow this section, previous land use planning discussions in the 2010 and 2011 Progress Reports, *Clean Air Hamilton* comments on the Provincial Policy Statement Five Year Review (see **Appendix E**) and the Urban Hamilton Official Plan air quality policies (see **Appendix F**).

Clean Air Hamilton Issue 1: Land Use Compatibility Decisions – Application of Provincial Policy Statement 2005 Section 1.7.1 (e)

The current 2005 Provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. Section 1.7.1 (e) of the PPS provides policy direction on land use compatibility by stating that longer–term economic prosperity should be supported by planning so that major facilities (such as air ports, transportation infrastructure and corridors, industrial facilities) and sensitive land uses are appropriately designed, buffered and/or separated from each other to prevent adverse effects.

The Ontario Ministry of the Environment's D-Series Guidelines (available online at http://www.ene.gov.on.ca/environment/en/resources/results/index.htm?txtSearchType=library&txtSearchValue=D-Series%20Guidelines%20[Land-Use%20Policy]) support the PPS policy direction and are the current standard for land use compatibility issues in the province. The Guidelines recommend separation distances and other control measures for land use planning proposals to minimize adverse effects from the encroachment of incompatible land uses where a facility either exists or is proposed. The Guidelines are intended to be used by land use planning agencies when a change in land use is proposed. All land use planning and resource management agencies are to have regard for the implications of their actions respecting the creation of new, or the aggravation of existing, land use compatibility problems.

The ministry expects planning authorities within the province to identify, separate and/or otherwise protect facility and sensitive land uses through various means available to them. The D-Series Guidelines provide a framework which municipalities and other approving authorities may use to make their own informed decisions to reflect local conditions and the available planning mechanisms, including regulations, detailed policies, guidelines and studies. Planning authorities are encouraged to ensure that the principles and objectives of *Guideline D-1: Land Use Compatibility* are applied in the formulation and review of land use plans, policies, guidelines and programs as well as site-specific applications.

Halton Region is an example of an Ontario municipality that has incorporated the principles of the ministry's D-Series Guidelines into its Official Plan. Halton's Regional Official Plan references draft Land Use Compatibility Guidelines (Land Use Compatibility, Air Quality Impact Assessment and Health Community Guidelines) to provide guidance to developers on how land use compatibility issues should be addressed through the planning and development approval process. The Guidelines' primary means of addressing these issues is to ensure adequate separation distances between sources and sensitive land uses. The Guidelines also suggests there are other mitigation measures that may be used.

Clean Air Hamilton Issue 2: Provincial Policy Statement, Land Use Compatibility Guidelines and Industrial Site Specific Standards

All industrial facilities must comply with Ontario Regulation 419/05 in order to operate. Under the regulation, any new, updated or more stringent air standard has a phase-in period. The purpose of the phase-in period is to allow facilities time, if necessary, to achieve compliance with the air standard. A facility that is not able to implement a standard within the phase-in period may request a site-specific air standard. The alteration of standard process was developed to establish interim site-specific standards with the goal of continuous improvement of emissions over time.

The site-specific standard setting process includes important provisions for public communication. In a request for a site-specific standard, a facility must identify key stakeholders (community groups, local environmental groups, municipalities, First Nations, and so on), hold a public meeting, seek input from the public on its application and hold a community informational meeting. The ministry will consider local community comments as well as input from other interested stakeholders in making a final decision on an approval for a site-specific standard proposed by a facility.

Clean Air Hamilton Issue 3: Air Quality Impacts from On-Road Mobile Sources

There are various policy tools in place to address emissions from on-road mobile sources including federal fuel and vehicle emissions standards and a provincial emissions testing program. However, the D-Series Guidelines do not apply to roadways. Section 1.7.1 (e) of the PPS does include transportation corridors as a "major facility" where land use compatibility should be considered. The Ontario Ministry of Transportation has developed a guide for assessing and mitigating the air quality impacts of provincial transportation projects, including provincial highways and freeways. This guide is available online at http://www.mto.gov.on.ca/english/environmental-assessment-and-protection/MTO-Air-Quality-Guide-en-26-01-2012.pdf. A standardized air quality impact assessment approach and methodology for Environmental Assessment projects are outlined in the guide, including an assessment that there is sufficient distance from the highway to sensitive receptors.

While the Ministry of Transportation's guide addresses provincial road infrastructure development, there is an important role for municipalities to play in air quality considerations for proposed sensitive land uses to ensure land use compatibility. For example, Halton Region's Official Plan requires air quality impacts assessments for sensitive land uses proposed within certain distances of major arterial roads or provincial highways and freeways.

Recommendations by *Clean Air Hamilton*:

1. That the City of Hamilton considers developing a strategy for adopting the principles, approaches and standards outlined in the Ontario Ministry of Environment's D-Series Guidelines.

2. That the City of Hamilton consider attending all public meetings and provide input and comments on facility applications for site-specific standards under Ontario Regulation 419/05.

Towards implementing these recommendations *Clean Air Hamilton* suggests that the following also be considered:

1. The Ontario Ministry of the Environment, City of Hamilton Planning Department and C*lean Air Hamilton* develop a shared understanding of how municipal planning decisions are coordinated with Environmental Compliance Approvals and site-specific standard setting processes to ensure land use compatibility between industrial facilities and sensitive land uses.

2. An analysis of options for implementing separation distance and buffer policies regarding industry, roadways, and sensitive land uses.

3. Research undertaken by other communities on measures to address emissions from on road vehicles from arterials and 400 series highways be consulted to develop zoning, street design and building standards that minimize the effects of air emissions within Hamilton's unique airshed.

4. Commenting on the Ministry of the Environment land use compatibility guideline review when and if the review is made public through the Environmental Registry.

6.0 Transportation Emissions - Linkages between Air Quality and Human Health

6.1 Mobile Air Monitoring Research

Mobile air monitoring surveys have been undertaken through funding provided by and to *Clean Air Hamilton* starting in 2004; these studies continue as additional funds become available for more research work. The original motivation for undertaking these studies was to provide a 'street-level view' of air quality in the city and to compare the air quality in different areas and neighbourhoods across the city. Data from earlier mobile air surveys has been presented in previous *Clean Air Hamilton* reports (please see **the 2005 through the 2011 Clean Air Hamilton Annual Reports**). Recent findings are included in this 2012 report.

The reason for undertaking mobile air monitoring surveys is be able to get high quality air monitoring data from sites such as a street corner, a neighbourhood, outside a school, along the length of a street or next to a highway. The idea was quite simple: outfit a van with the same air monitoring equipment that would normally only be available in a fully outfitted fixed air monitoring station and drive the air monitoring van to areas that people live, work and travel. The mobile van, owned by the Ontario Ministry of Environment, West Central Region, can be driven while it is making measurements or it can be set up in fixed locations for periods of time. In this report the monitoring of neighbourhoods across the City is featured; the mobile capabilities of the van allows one to be able to collect air quality data at sites throughout the neighbourhood, allowing comparisons of ambient levels of pollutants throughout the neighbourhood and the City.

For complete information on the mobile monitoring research, please visit:
www.cleanair.hamilton.ca/default.asp?id=26

Top read the mobile monitoring research reports, please visit:
http://www.cleanair.hamilton.ca/default.asp?id=72

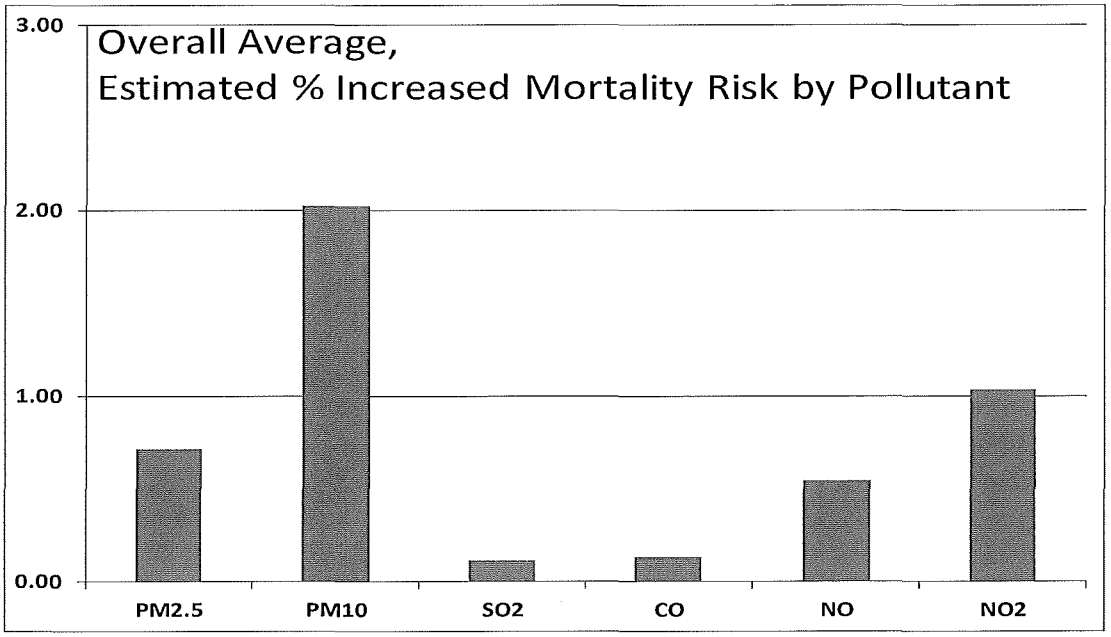
6.1.1 Neighbourhood Monitoring

In 2010 and 2011, *Clean Air Hamilton* in partnership with Green Venture began a mobile monitoring project to measure ambient air quality, to identify potential emissions sources and to determine the potential health impacts of ambient air in various neighbourhoods across Hamilton. Funding for the project was provided by a grant from ArcelorMittal Dofasco to help build the capacity for mobile monitoring in Hamilton and to identify local sources of pollution in neighbourhoods. Neighbourhood groups were encouraged to identify their desire for monitoring through a local media release sent to local media and *via* neighbourhood association announcements.

Requests for monitoring came from 26 neighbourhoods in Hamilton; only 11 neighbourhoods and sites were selected for the first air monitoring campaign, based on limitations of resources and time. The neighbourhoods in the 2010 and 2011 mobile air monitoring study included Dundas, the area near Limeridge Mall, Red Hill neighbourhoods, Delta, Lawrence Ave. to Burlington St, North West End, Wentworth North, McAnulty Blvd, Beach Blvd/Eastport Drive, and Jones Rd/Arvin Ave.

Citizens tend to be most interested in the overall health impacts of air pollution, rather than details of the levels of individual pollutants. To provide the most meaningful results for neighbourhood residents concerned about health effects, as well as for government officials pursuing air pollution control actions, total health effects due to air pollution exposures were calculated for each neighbourhood, using the most recently available risk values from the SENES 2011 Health Study report (see **Section 3.1**). These total health impact values were then further structured into values for each individual pollutant (**Figure 21**), allowing assessment of the health impacts of each contaminant on the health of citizens in each neighbourhood.

Figure 21: Overall Average Estimated Percent Increased Mortality Risk by Pollutant for the City of Hamilton



The overall average increased mortality risk due to exposure to air pollution in Hamilton was determined to be 4.6% (total of risks in **Figure 21**). Of the 11 neighbourhoods monitored, all showed air pollution impacts, with risks ranging from 2.5% to 7.7% increased mortality risk. The majority of these health impacts was due to particulate matter (PM) and oxides of nitrogen (NO), primarily from transportation sources.

Explanatory Note Concerning the Term "Increased Estimated Percent Risk of Mortality":

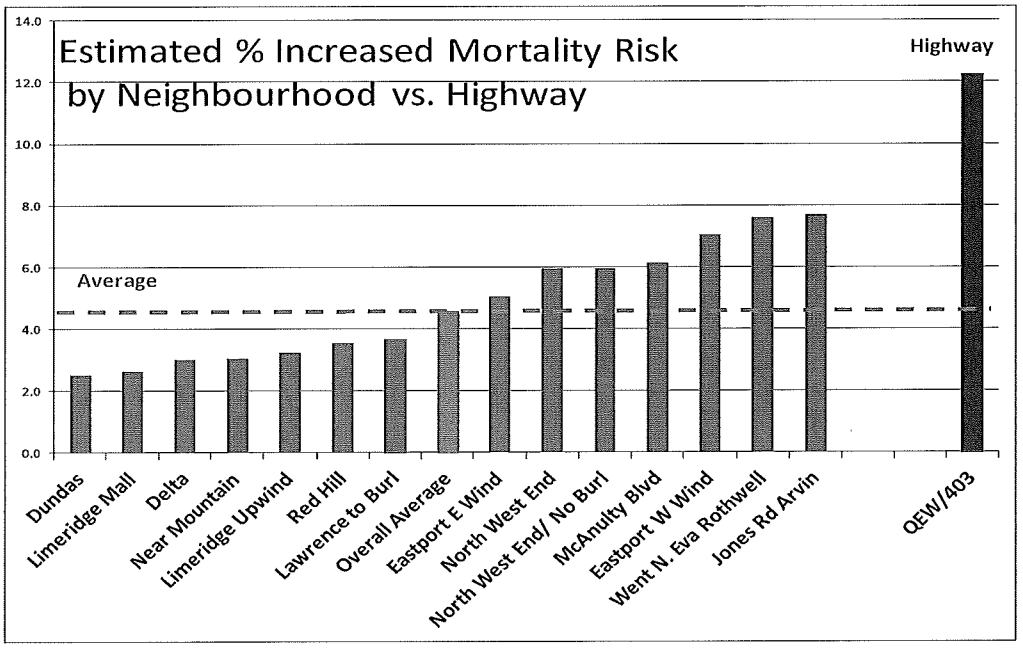
The "mortality calculations" represent the increased risk of mortality due to exposures to air pollutants above a true "zero exposure" to air pollutants. However, even the most remote sites on earth have low but measureable levels of airborne pollutants, notably fine particulate material. In other words, remote sites have low (but non-zero) increased risks of mortality due to exposures to pollutants. These increased risk numbers should be interpreted as general aids to decision-making because they provide comparisons of relative risks between different areas and between different pollutants; increased risk values should not be interpreted as exact representations of the burden of illness due to air pollutants. The 'health risk values' for individuals are influenced by additional factors including air pollutants not measured, personal lifestyle choices, diet, physical fitness and by a variety of personal health conditions that cannot be considered in such general

estimates. Also, mobile monitoring data only provide short term "snapshots" of localized pollutant concentrations; at any location, pollutant concentrations can vary considerably.

As a "reality check" the overall average of 4.6% increased mortality risk due to air pollution in Hamilton was applied to the base rate of approximately 4000 deaths per year, resulting in a calculated mortality rate of 184 deaths per year; this value compares favourably with the 186 mortality rate determined by SENES in their February 2012 report "Health Impacts Exposure to Outdoor Air Pollution in Hamilton, Ontario". The Ontario Medical Association estimate for premature deaths due to air pollution in Hamilton in 2008 was 445 deaths per year; however, this latter number includes long-term health effects as well as the acute effects estimated above.

The results of the health evaluations of the neighbourhoods monitored in 2010 and 2011 are combined in **Figure 22** to show a city-wide ranking of health impacts. Five neighbourhoods showed above average levels of air pollution effects. The "Overall Average" number in **Figure 22** refers to the average of the data from the neighbourhoods studied as part of the neighbourhood mobile monitoring study; this average does not include the 'Highway' value nor does it include any data from any other sites in Hamilton.

Figure 22: Percentage Increased Mortality Risk by Neighbourhood vs. the Mean of Risks Associated with Exposures along Six-lane Highways in Hamilton



The five neighbourhoods that were above the city average were the McAnulty Blvd. area, North West End, Jones Rd./Arvin Ave., Eastport Dr. and Wentworth North. The Jones Rd/Arvin Ave, McAnulty Blvd, NW end, Wentworth N. and Eastport Dr. areas all showed increased particulate effects above city averages, while the NW end, Wentworth N and Eastport Dr. areas showed increased nitrogen oxides impacts.

The "Highway" data in **Figure 22** was the average value obtained while driving on the Queen Elizabeth Way and Highway 403; these data reflect typical exposures drivers and passengers experience within a vehicle on a major highway; the highway exposure is nearly three times the

neighbourhood average. Clearly, highway exposures (i.e., exposures to air pollutants while driving on the highway) are far above any neighbourhood exposures.

The results of this mobile monitoring project were shared with the community at a presentation in January 2012 at the Central Library. Sixty individuals attended this event representing all 11 neighbourhoods in the study. A presentation was also made at the Upwind Downwind Conference in February 2012. These presentations have led to increased interest in the project and more requests from neighbourhoods for air quality monitoring and health impact studies in their neighbourhoods.

In 2012 Ward One Councillor Brian McHattie requested that *Clean Air Hamilton* conduct a mobile air monitoring survey of three neighbourhoods in the west end of Hamilton, namely Kirkendall South, Kirkendall North and Strathcona. This study was performed during November and December 2012. These neighbourhoods had been scheduled for monitoring in a previous study in 2011 but had not been completed due to a traffic accident that resulted in damage to some air monitoring equipment in the vehicle. The study has been completed and the composite results are shown in **Figure 23**.

Figure 23 – Percentage Increased Mortality Risk in Ward One and other Hamilton Neighbourhoods.

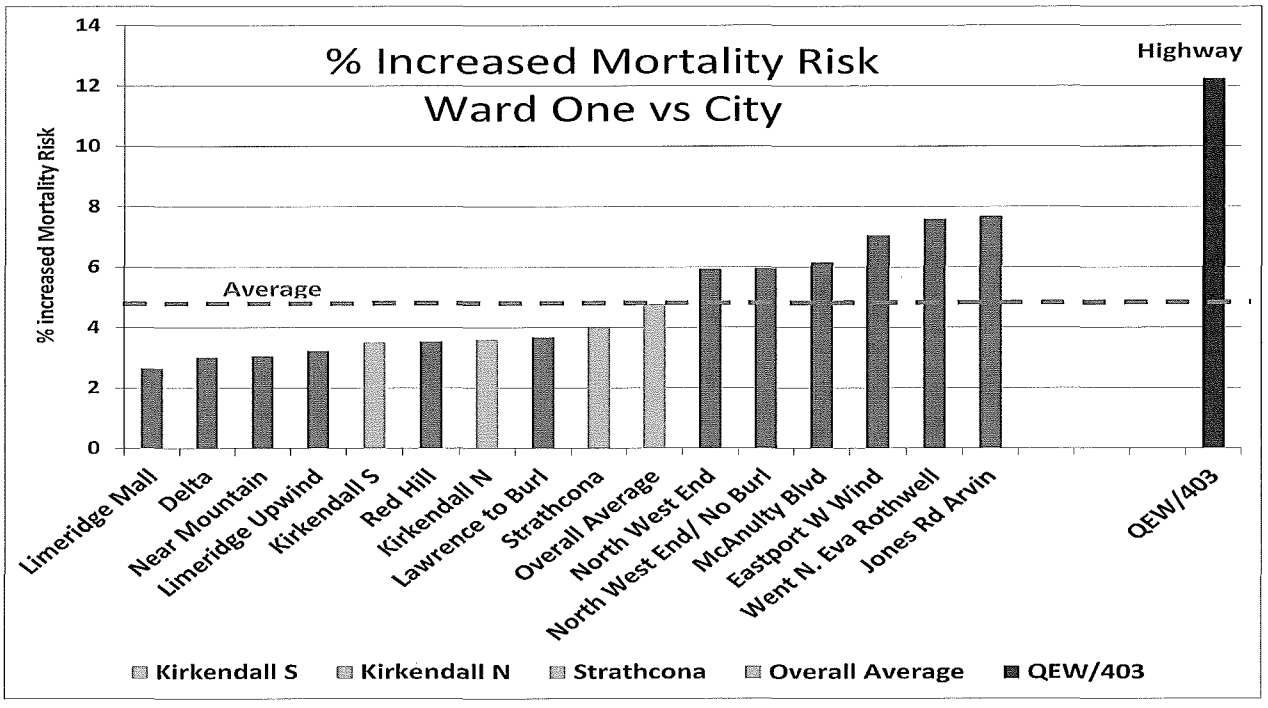
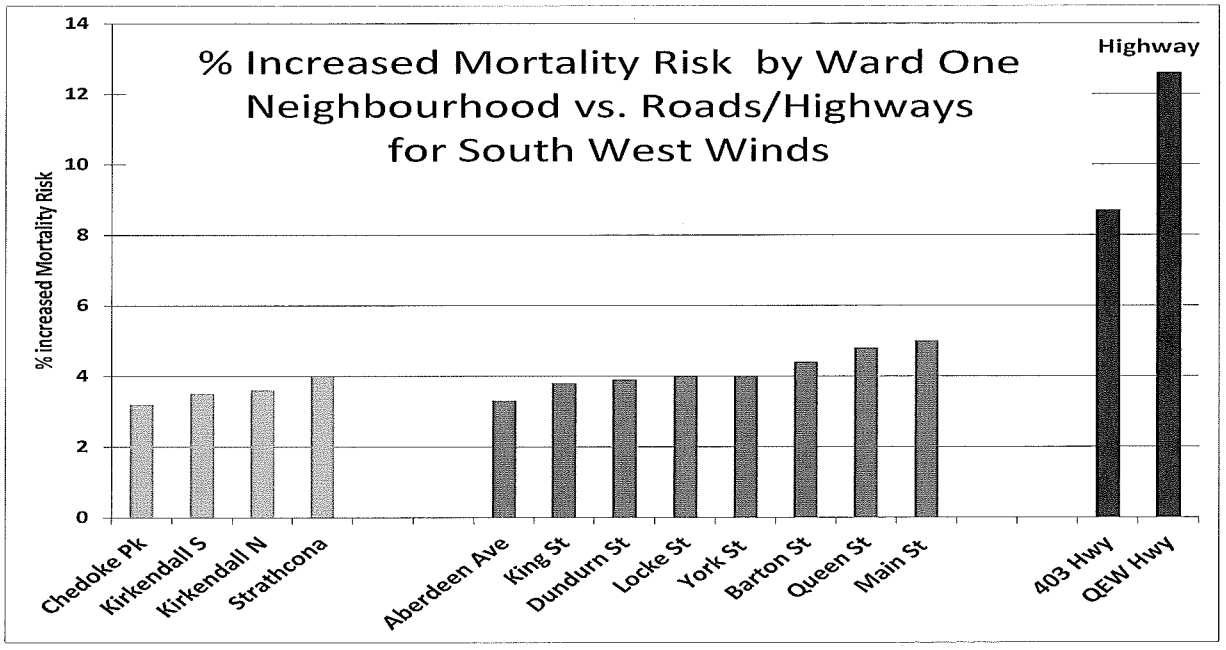


Figure 24 shows a comparison of the increased percentage mortality risks within Ward One for neighborhoods, roads and highways under prevailing southwest wind conditions. As expected, there was an increasing trend in air pollution from neighbourhoods to roads to highways and from south to north in Ward One under these prevailing wind conditions.

Figure 24 – Percentage Increased Mortality Risk in Ward One (Southwest Winds)



Differences in wind direction can result in dramatic differences in exposures to pollutants. During this study, a major atmospheric inversion event occurred that resulted in significantly elevated levels of air pollutants across the city below the escarpment. November 19 and 21, 2012 had the highest levels of Air Quality Index (AQI) readings for the entire year in Hamilton. This atmospheric inversion event presented an opportunity to measure the air quality during such an event in detail (**Figure 25**).

Figure 25 – Percentage Increased Mortality Risk in Ward One, Southwest Winds vs. Atmospheric Inversion Conditions

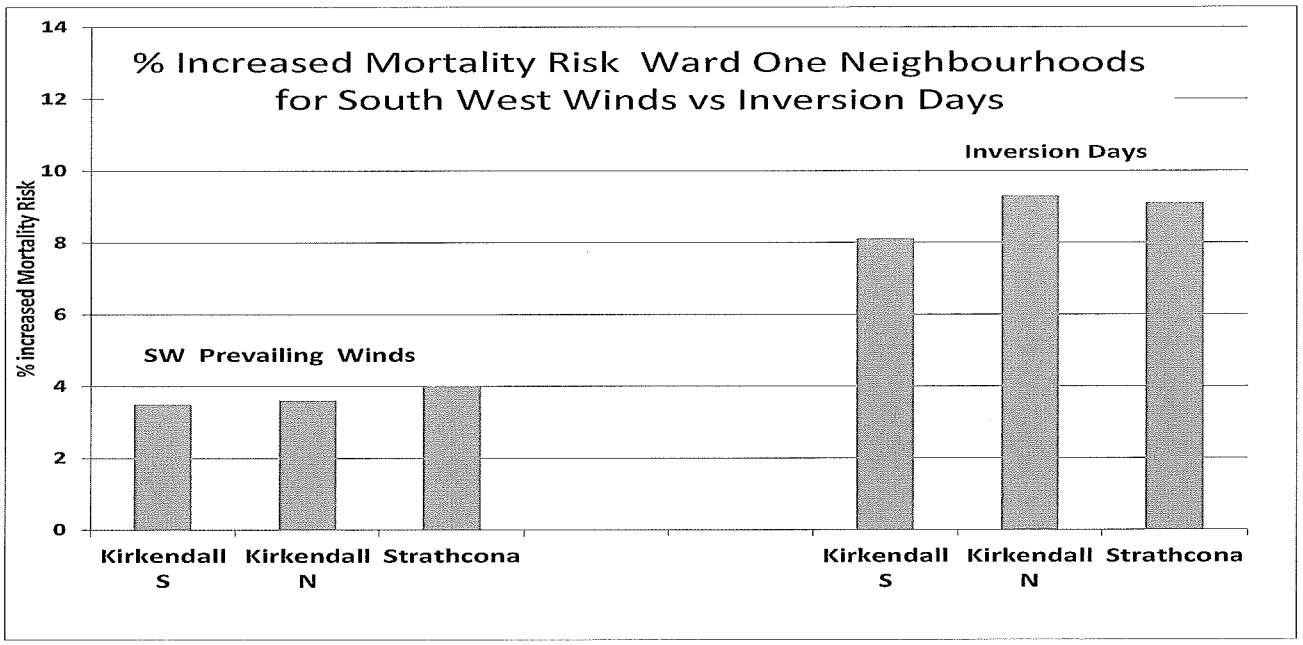


Figure 26 – Percentage Increased Mortality in Ward One during Inversion Conditions

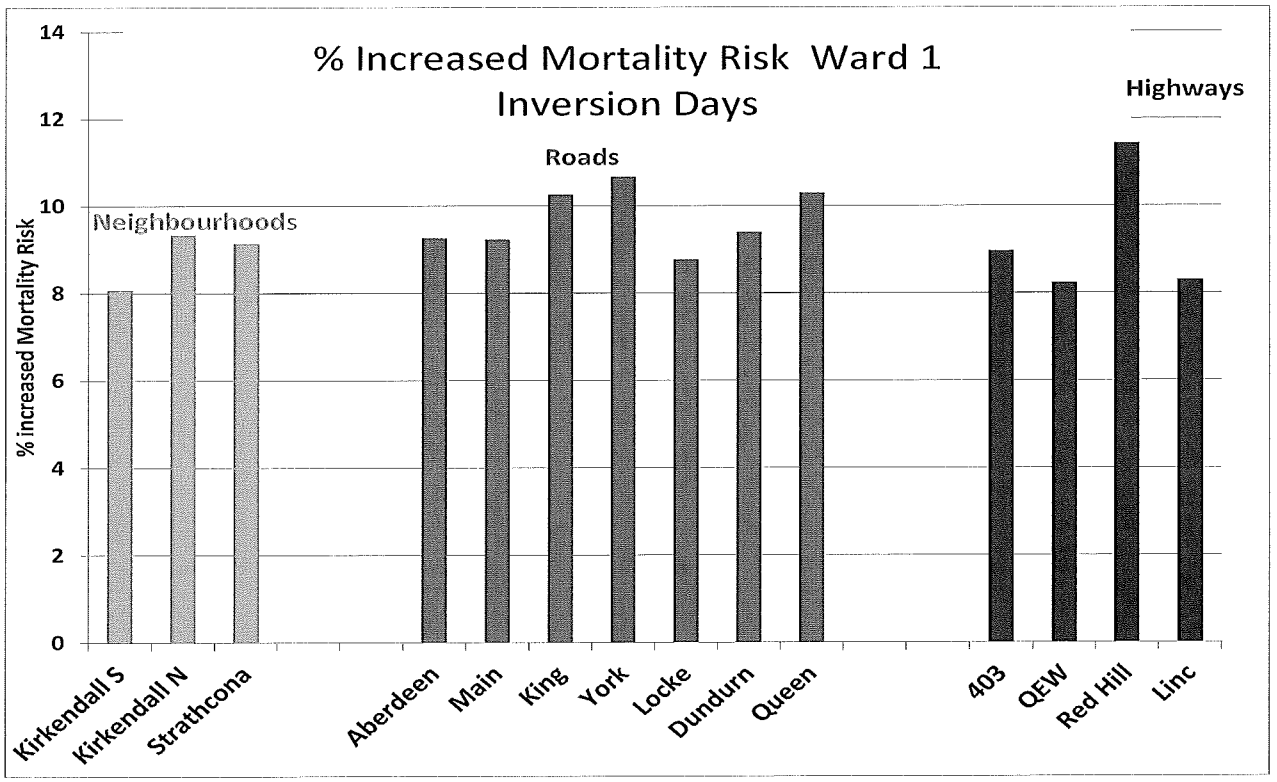


Figure 26 shows the percentage increase in mortality at ten Ward One sampling sites under the severe atmospheric inversion conditions of November 19 and 21, 2012; the calculated increased mortality values for 10 neighbourhood sites within Ward One were at least double the normal risk and were indistinguishable from the risk value calculated from air sampling data along four highways in the Hamilton area during the same inversion event.

In this work, detailed measurements were only made in Ward One and on certain highways. It should be remembered that the whole city, and areas across the city below the escarpment in particular were enveloped in high levels of pollutants during this event. Based on MOE's AQI station measurements below the escarpment during this event, the whole lower city was experiencing similar air quality impacts. In other words, the Ward One data presented here would be similar to conditions across the lower city.

Comparing data in **Figures 24 and 25** it is clear that under normal conditions the increased risk of mortality on the local highways is about 2.5 times greater than along the four-lane streets in Ward One. These data were collected midday and not during the morning or afternoon peak traffic periods. Clearly, highways have their own pollutant 'microclimates.' These data show that driving on a six-lane 400-series highway results in exposures to pollutant that are equivalent to the risks of exposures on the worst air pollution day in a year in Hamilton. The risk of increased mortality on highways did not change as a result of the inversion event; however, the risk of increased mortality increased by about 2.5-fold at the Ward One neighbourhood sites during the inversion event.

Previous mobile monitoring studies in Stoney Creek had shown the significant impacts of pollutant exposures along the Queen Elizabeth Way, a six-lane 400-series highway, and at distances up to 200 metres downwind of the highway. This work had also shown that noise reduction barriers significantly reduced pollutant impacts for residents who lived along the highway. It has been requested that the effects of emissions from vehicles on Highway 403 highway in Ward One be examined to see if there would be benefit from additional noise barriers in the area.

Figures 27 and 28 show upwind vs. downwind percentage mortality risk estimates in Ward One for both the prevailing southwest winds (**Figure 27**) and north to northeast winds (**Figure 28**), as determined by measurements in the Strathcona and Macklin areas, respectively.

Figure 27 – Percentage Increased Mortality at Strathcona Street in Ward One during Southwest Winds

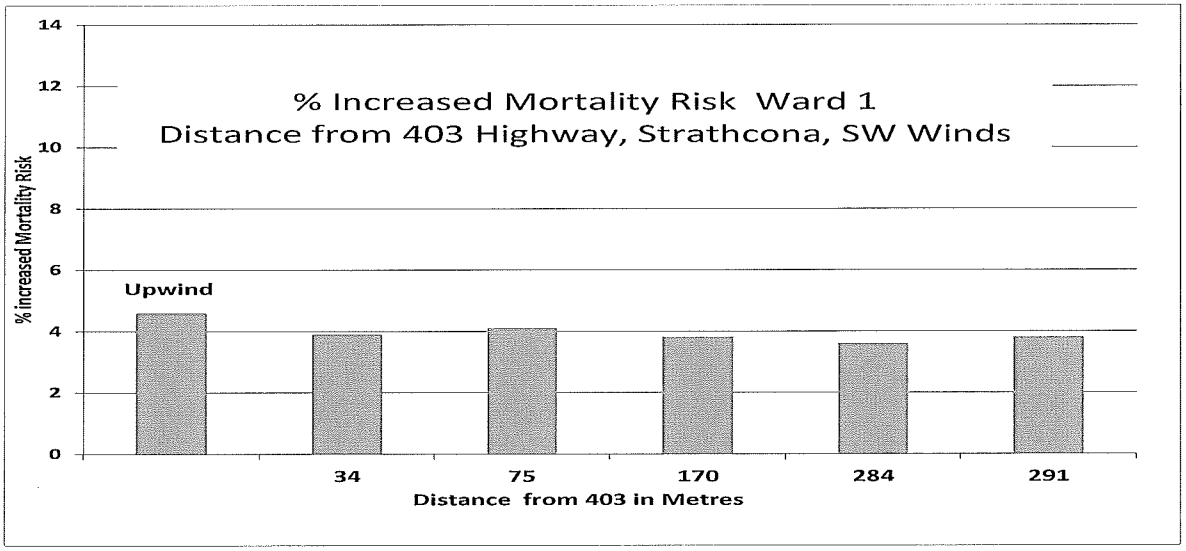
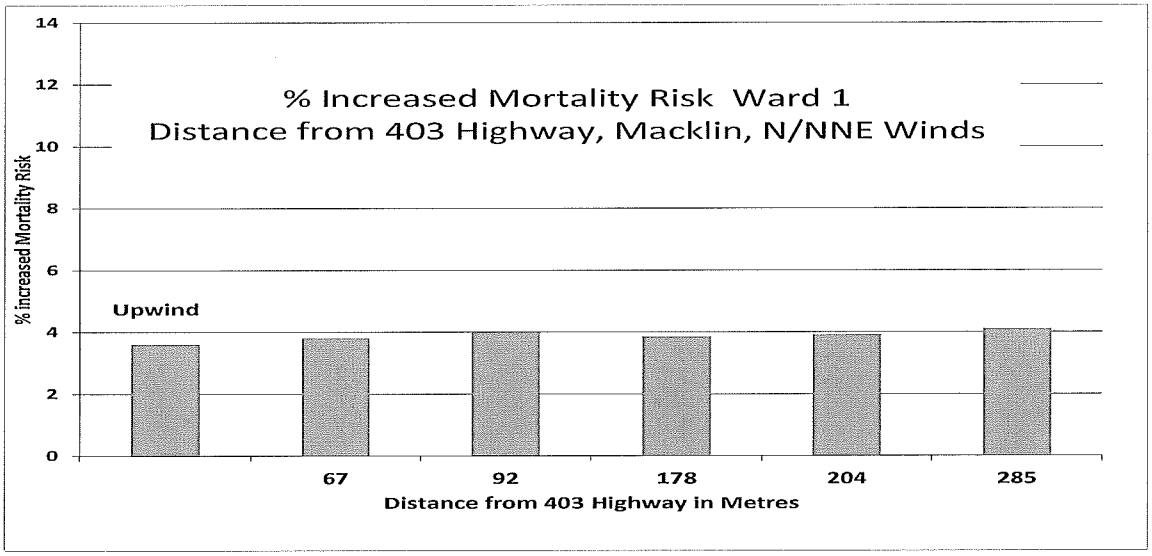


Figure 28 – Percentage Increased Mortality at Macklin Avenue in Ward One during North and Northeast Winds



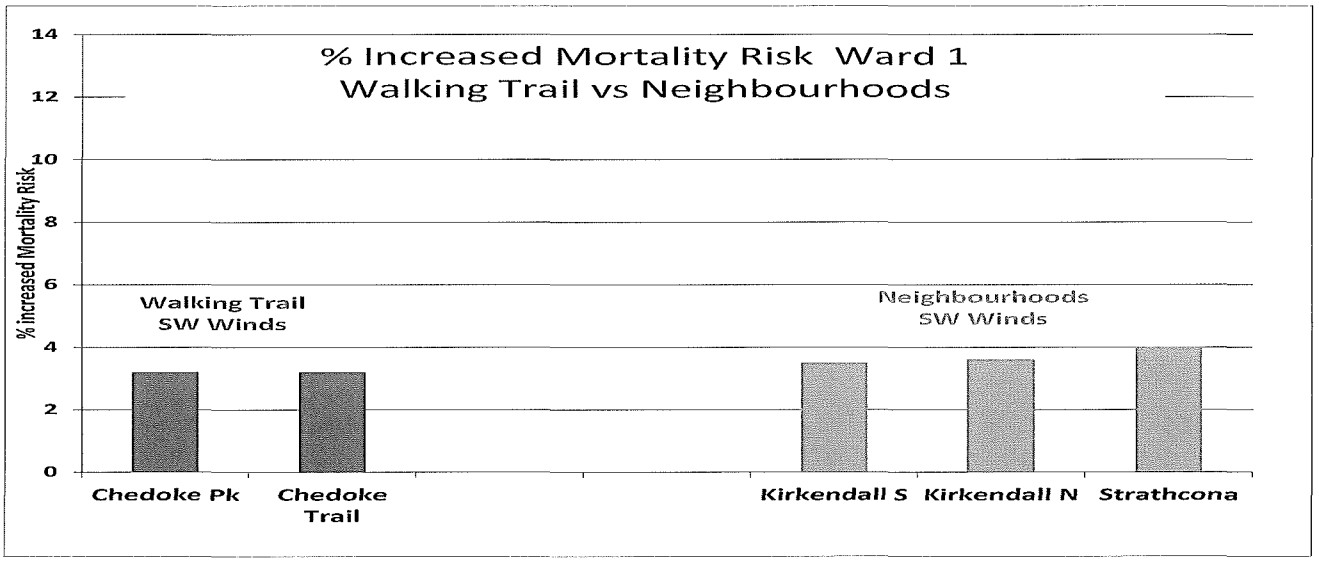
There was very little difference between upwind and downwind measurements of air pollution at these sites and no trend with distance away from Highway 403. These data indicate that air pollution generated by vehicles on Highway 403 has little or no measureable effects on surrounding areas in Ward One. Presumably, as with the Red Hill Creek Expressway, Highway 403 lies in a valley with winds that blow up and down the highway, dispersing pollutants along the highway.

Chedoke Park and Chedoke Radial Recreational Trail

Reducing climate change emissions and our desire to improve our health have encouraged active modes of transportation such as walking, jogging and cycling. The Chedoke Radial Recreational Trail is heavily used for recreation, exercise and commuting and is used for all the active transportation modes.

A potential advantage to such a forest bike trail should be improved air quality along for exercising individuals compared to the air quality along city streets. To test this hypothesis air quality measurements were taken in Chedoke Park and along part of the Chedoke Radial Recreational Trail to determine whether the air is better in these areas. **Figure 29** compares the relative increased risk due to exposure to the air in Chedoke Park and along the Chedoke Radial Recreational Trail to areas in Ward One. The Chedoke Park and Chedoke Radial Recreational Trail had slightly lower percent increased mortality (3.2%) than the residential areas of Kirkendall South (3.5%), Kirkendall North (3.6%) and Strathcona (4%). These risks are significantly lower than if one were biking or walking near the QEW or 403 highways (9-12% increased risk).

Figure 29 – Percentage Increased Mortality between Chedoke Trail/Park and Ward One Neighbourhoods during Southwest Winds



When trees are in leaf, it would be expected that trail areas would have even cleaner air, thus promoting better overall health when used for recreation or active transportation modes of commuting, as well as reducing greenhouse gas emissions. Further study of trail air quality when trees are in leaf, also under inversion conditions would be beneficial.

The full report and the individual neighbourhood reports can be found on the Clean Air Hamilton website, visit: http://www.cleanair.hamilton.ca/default.asp?id=72

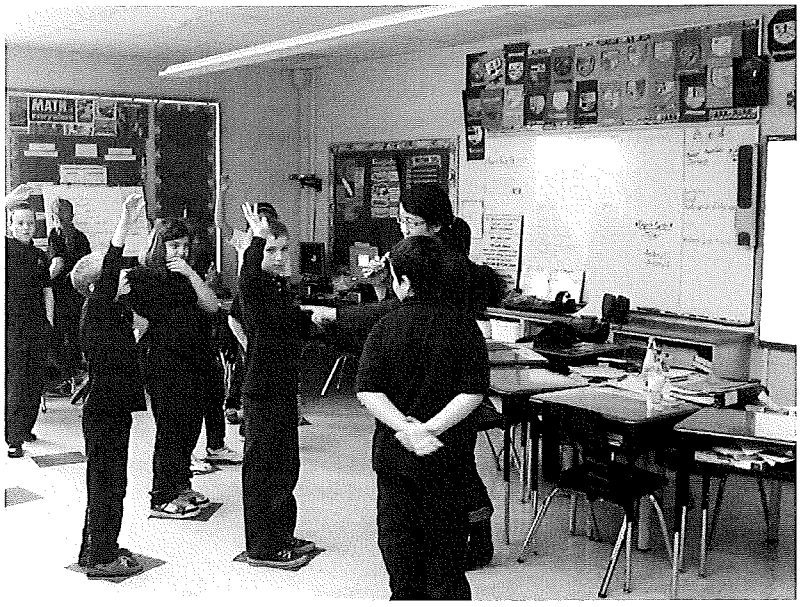
6.1.2 "Fresh Air Kids" School Air Quality Outreach/Mobile Monitoring

The school air quality program, "Fresh Air Kids", aims to raise awareness of the Air Quality Health Index (AQHI) among school-age children, to educate these children about air quality issues and to assist children to develop walking routes to school that would have the lowest pollutant exposures. Another aspect of the program is to encourage students to use active modes of transportation and develop a lifelong commitment to exercise. This innovative program will be undertaken in 2013 at two Hamilton schools - Holy Name of Jesus Catholic Elementary School and St. Lawrence School.

The program is being delivered as a partnership between Green Venture, Rotek Environmental, and Corr Research. Environment Canada's Green Communities Canada program and the Ontario Government's Healthy Community Fund provided funding for this 2013 project. The Ontario Ministry of the Environment, West Central Region, has volunteered use of its mobile monitoring unit for this project.

Initial presentations were made in 2012 to the Grade 5 class at Holy Name of Jesus School and to the Grade 5/6 and 7/8 classes at St Lawrence School. These interactive presentations included explanations of the AQHI, discussions of sources of air pollution, discussions on the need for air quality improvements, the importance of personal actions and discussions of active modes of transportation. Students played an air quality game called Clean Air Shuffle (an air quality version of musical chairs; **Figure 30)** developed by Environment Hamilton.

Figure 30: Clean Air Shuffle



In 2013, the first part of the program will be to make students aware of the importance of developing an active lifestyle. One of the key features is teaching students to look at potential barriers to active transportation that may enhance or restrict their physical activity. Students will be taken on short walks around their neighbourhoods and will fill out a questionnaire (walkability survey) to encourage them to see public spaces from a viewpoint that would encourage them to walk, bike or skateboard to school.

The second part of the program will involve using the mobile air quality monitoring van to monitor air quality in the neighbourhoods of Crown Point (near Holy Name of Jesus Catholic school) and in the North End (near St. Lawrence school). Students will be given tours of the van and staff will explain how the van collects air monitoring data.

The third part of the program will involve a class project whereby each student is provided with an air pollution map of their school and the surrounding neighbourhood based on the data collected by the mobile air monitoring van. This exercise will introduce students to GIS (geographic information system) mapping concepts and how GIS can aid in air pollution monitoring. Students will be asked to identify the location of their home on the map and to draw the 'best' and 'worst' routes to school based on the air quality data. Students will also be asked what actions they could take to reduce air pollution and what actions they could take to reduce their personal exposures.

The results of the "Fresh Air Kids" program will be reported in the 2013 *Clean Air Hamilton* Report and will be shared with the public through presentations and *via* Green Venture's and *Clean Air Hamilton*'s websites.

6.2 Active & Sustainable Transportation

6.2.1 Smart Commute and Transportation Demand Management (TDM)

Smart Commute Hamilton and the City of Hamilton's Public Works Transportation Demand Management (TDM) program were very active with a variety of new programs underway in 2012 (see **Table 5**). The programs vary in nature from new infrastructure programs for carpooling and bikesharing to education, communications and event planning. The office continues to develop and improve relationships with partner organizations including *Clean Air Hamilton*, Public Health Services, Green Venture, Environment Hamilton, McMaster University, Hamilton Health Sciences, St. Joseph's Healthcare, Mohawk College, Horizon Utilities, McMaster Innovation Park, McMaster Downtown Centre, Hamilton Chamber of Commerce, CAA, Redeemer University-College, Hamilton Wentworth Catholic District School Board, Good Shepherd and ILR Industries. In the 2012, Smart Commute Hamilton enjoyed a variety of successes including:

- From November 2012 to March 2013, Smart Commute Hamilton increased the number of carpools formed in the CarpoolZone.ca ride-matching web tool by 35%, and number of registrants by 105%, placing in the top 3 carpooling communities (www.carpoolzone.ca).

- Expanded the Smart Commute Hamilton Transportation Management Association, forming new partnerships with Hamilton-Wentworth Catholic District School Board (HWCDSB), Redeemer University-College, Canada Bread Ltd., Good Shepherd, Hamilton Spectator and Platform 302.

- Awarded the "Most participants to log sustainable commutes" prize in the 2500 – 5000 Employees category (McMaster University) for the Pollution Probe Clean Air Commute Competition which occurred in June 2012, across the Greater Toronto and Hamilton Area. This was achieved for the third year in a row.

- Hosted a National Conference on TDM – the Sustainable Mobility Summit, which focused on integrated mobility and health. The conference proceedings can be found here: http://www.actcanada.com/EN/Default2012.aspx

- Received council support for moving forward with a Request for Proposals process for a public bike share system and operator. This is based on a feasibility study and business plan for a bike sharing strategy developed in partnership with McMaster University and Mohawk College (http://www.smartcommutehamilton.ca/en/bike/hamilton-public-bike-share-and-business-plan).

- Held Transportation and Healthy Living Fair and Open Streets Hamilton events in June and September, paired with Clean Air Commute Week and Smart Commute Week to reward Smart Commute Employers/Employees and engage potential employer-partners.

Table 5: 2011-12 Transportation Demand Management Program Descriptions and Status

Activity	Description	Status
Hamilton Car Share Expansion	Provided Hamilton Car Share with a $150,000 revolving line of credit from the City of Hamilton to expand CarSharing in Hamilton and establish it as a sustainable mode of convenient transportation.	Pre-launch program has begun with 12 employees enrolled in the City of Hamilton corporate program. The full pilot will commence in September 2013 and run for two years. In 2011-12, the CarShare network grew by three vehicles, and now totals 7 cars with 3 more planned for 2013.
Secure Bike Parking	Opened a facility in the City Hall Parking Lot for 32 bikes in 2010 and additional parking in 2012; at Mohawk College in 2011, holding 60 bikes; and St. Joe's Hospital parking construction is scheduled for 2013.	Ongoing construction of new facilities. Demand for current and new facilities is increasing.

Activity	Description	Status
Association for Commuter Transportation (ACT) Canada Sustainable Mobility Summit (November 2012)	National Conference with the theme: "Achieving the Balance", focusing on balancing the needs of all road users. Concepts included integrated, multi-modal transportation strategies, strategic communications.	The conference was a success and the largest in ACT's history with 250 delegates, four pre-conference workshops, two expert panels and breakout sessions which aimed to influence the future of sustainable mobility. Keynote speakers related to the key topics and the full conference proceedings.
Smart Commute Discounted Transit Pass Program Pilot	The Mohawk Discounted Transit Pass 12 month pilot program provides a 25% discount to Mohawk Staff with 12.5% coming from the City and 12.5% coming from the college.	The successful pilot involved over 50 Mohawk employees of which, more than 20% previously drove alone to work for their regular commute mode.
Open Streets Hamilton	Two events were held which aimed to create an urban park, closed to car traffic for 2 Sundays per year (June and September) to support sustainable transportation and healthy communities.	Events were held in June and September 2012 events on James Street North from Cannon (or York) to Guise Street. 15,000 – 18,000 people attended the two events, with similar success as last year.
TDM Framework & Communications Plan	IBI Group and Urban Trans completed a strategy to communicate TDM principles to various groups, wards and communities in Hamilton. In 2012, Phase II commenced with an individualized marketing project in Wards 1, 2 and 8.	The individualized marketing project engaged 5000 households in Wards 1, 2 and 8 and 20% of them filled out the travel survey. Of those who were surveyed 350 received hand delivered materials to help them change their travel behaviour.

Activity	Description	Status
Transportation Management Association (TMA)	Meets monthly to engage community groups, city departments and engaged employers & institutions.	The Hamilton Spectator and Good Shepherd Centres joined the network in 2012.
Active and Safe Routes to School	Undertaking inventories/audits/ walkabouts and assisting in trip/route planning. In addition, in 2012 a point-based system for having schools certified as sustainable transportation schools was developed to sustain the school travel planning efforts developed through the Stepping It Up pilot project.	In 2012, four pilot schools were selected to participate in the certification pilot. The pilot ends in June 2013. Once complete, it is projected that the certification program will be offered to all registered ECO Schools.
Bike Share Implementation Study and Business Plan	Developed a business plan, market analysis and station location analysis and received council approval to move to the RFP stage .	Develop an implementation and sponsorship RFP for system implementation in March 2013.
Emergency Ride Home program (See TDM)	Program to provide employees with the security that they can get home for an emergency and their taxi fee can be recovered.	Advertising the program internally and evaluating its success.

Activity	Description	Status
Rural Roots	Transportation and Food Linkages – using public transit to access farms for food education and purchasing.	Once per month bus service to local area farms with 5 farms visited in 2012 and over 300 participants.
CAN Bike Instruction to Hamilton	Work with Public Health Services and Recreation to establish CAN Bike Courses at various Recreation Centres.	The courses are being piloted again in 2012-13 through the Recreation Department and at McMaster University.
Metrolinx Partnership	Work with Metrolinx to deliver Smart Commute Programs including: Carpoolzone.ca, Discounted Transit Pass, Active Transportation Promotion and GTHA-based Events.	Ongoing work to plan events, work with employers, recruit employers, and report successes through surveys and statistical analysis.
TDM and Land Use	Work began in 2009 across the Greater Toronto and Hamilton region to integrate TDM into the development approvals process. Municipalities and developers were engaged regionally and in Hamilton through a workshop series.	Outcomes from research and workshops informed the development of a draft TDM Study process and draft TDM guidelines/checklist for developments. In 2013, staff will develop a program for integrating TDM more formally in the development application process.

6.2.2 Totally Transit

Totally Transit is a unique bus education program that teaches Hamilton elementary school students how to use the Hamilton Street Railway (HSR) bus network properly while making the connection between air quality, climate change and transportation emissions. Through hands-on experience, this one-of-a-kind program empowers students to feel confident about choosing and using transit and other forms of sustainable active transportation.

In 2012, 61 Totally Transit lessons were delivered to 1,757 students from 17 Hamilton area schools (primarily Grades 4-6). All of these presentations involved using a chartered HSR bus to transport students and to be used as a classroom for lesson delivery.

Three lesson options are available for teachers to choose from and each is closely linked to Ontario school board curriculum:

- **Option 1**: Totally Transit in combination with Green Venture's EcoHouse Sustainability Tours. A chartered HSR bus and a Green Venture staff person meet a class on-site at their school and provide the Totally Transit lesson before departing to, and during transportation to, EcoHouse. After completing a 2-hour EcoHouse Tour of their choice, the HSR bus returns the class to their school.

- **Option 2**: Green Venture offers Totally Transit as part of a full day of programming in conjunction with the Hamilton Museum of Steam and Technology. A chartered HSR bus is used as transportation to and from school, and between the two venues. This option allows for schools to take advantage of a successful educational-based partnership between Green Venture and the Hamilton Museum of Steam and Technology. Both organizations offer quality curriculum-based educational programming and the Totally Transit program facilitates a full day of activities in addition to adding the valuable Totally Transit piece to the students' learning experience.

- **Option 3**: Green Venture offers Totally Transit by bringing a chartered HSR bus to a school or other community venue. This option involves delivering the Totally Transit program on-site and allows for multiple classes to experience the program with no associated transportation costs.

The Totally Transit program continues to resonate with teachers and students alike as it provides hands-on experience to address some of the barriers facing young people (and their families) to choosing transit as their sustainable transportation mode.

Since 2007, Green Venture has delivered Totally Transit to more than 3,700 students in 60 Hamilton schools and reached an additional 1,590 students with similar bus education in mini-presentations at school environmental fairs.

Totally Transit for Older Adults 2013 Expansion

In 2012, funding from Metrolinx was received to pilot the expansion of the Totally Transit program from school-aged students to older adults.

The Totally Transit for Older Adults education program, also called "I Ride the HSR!" will help build the confidence our fastest growing demographic and highlight the independence and cost-effectiveness that public transportation can offer (**Figure 31**).

Workshops are scheduled for early 2013 and will include information on public transit services catered to older adults. Information on effective trip planning is also covered and volunteer-led guided trips will be offered to popular destinations to provide hands-on confidence building.

One deliverable of this pilot program is to develop a handbook to provide step-by-step instructions on planning and implementing a similar public transit program for older adults in other regions of the Province.

Figure 31: Total Transit for Older Adults

For more information on Totally Transit, visit: air.greenventure.ca/totally-transit

6.2.3 EcoDriver

Green Venture's EcoDriver program aims to help drivers of light duty cars and trucks decrease their fuel use. EcoDriver was developed in tandem with Green Communities Canada and was originally funded by Ontario's Ministry of the Environment 'Go Green Fund'. Funding from *Clean Air Hamilton* and significant in-kind support from Human Resources and Skills Development Canada's Summer Jobs program ensured that the important messages of this program continued to be delivered through 2012.

Driving produces tailpipe emissions that reduce air quality and contribute to climate change. EcoDriver encourages drivers to reduce the number of vehicle trips and choose sustainable transportation modes as often as possible. EcoDriver also recognizes that, since people will continue to drive, it is imperative that drivers learn and practice behaviours that will reduce their fuel usage and thereby reduce their vehicles' emissions and impacts on local air quality and global climate change. Through tire pressure clinics, media, static displays, and communication materials, the program encourages drivers to achieve fuel savings and reduce vehicle emissions by promoting the following three core messages:

- Drive Fuel-Efficiently
- Buy Fuel-Efficiently
- Drive Less

The program also has a strong anti-idling component that is consistent with Hamilton's Idling Stinks Campaign (2006-2008) message: engine idling for more than 10 seconds requires more fuel than turning off and restarting the engine.

EcoDriver Tips:

- Try to be 100% fuel-efficient by walking, cycling and using transit whenever possible.
- Turn the engine off when you will be stopped for more than 10 seconds.
- Leave a three-second buffer between you and the next vehicle to maintain a steady speed.
- Anticipate traffic speed changes and coast to decelerate.
- Find the recommended cold tire pressures on your vehicle information placard.
- Drive the speed limit on the highway for best fuel economy.
- Get in the carpool zone.

To drive home the message that underinflated tires waste fuel and create unnecessary emissions, Green Venture partnered with Canadian Tire Auto Services on Barton Street and Upper Gage, and a Shell station on Queenston to host a series of three public Tire Pressure Clinics. Each of these locations were a home base for Green Venture's Clean Air Ambassadors who engaged 125 store visitors, demonstrated how to check tire pressure on their cars, and filled tires when required. Local newspaper articles in the Hamilton Spectator, and View Magazine, in addition to a repeating segment on community television Cable14's For the Record, helped further spread the Clinic's message.

Static displays were set up at area car dealerships, including Upper James Toyota, Red Hill Toyota and Parkway Nissan, and at Canadian Tire Upper Gage and Centre Mall. Static displays provided informational brochures on EcoDriver messages and directed readers to the EcoDriver website for more information.

Social media also played a strong role in raising awareness of EcoDriver including 79 Twitter tweets, 17 Facebook posts, 2 Wordpress blog posts, and 3 YouTube videos. Social media was used to promote EcoDriver messaging including the YouTube videos, which focused primarily on winter driving techniques.

Natural Resources Canada states, "By adopting a few simple driving techniques, the average driver could save $500 per year in fuel costs and prevent more than 1000 kg of CO_2 from needlessly entering the atmosphere." These simple techniques are what EcoDriver messaging communicates.

For more information on EcoDriver, visit: http://www.ecodriver.org/

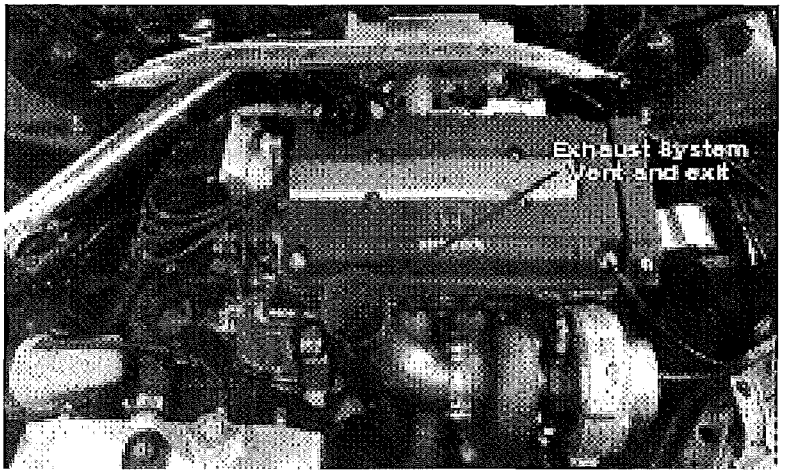
6.2.4 Vehicle Emissions Enforcement Program (VEEP)

Environmental Officers with Ontario's Vehicle Emissions Enforcement Programs conduct roadside inspections of heavy duty and light duty vehicles to ensure compliance with Ontario's motor vehicle emission standards and waste carrier regulations. Officers also conduct inspections on waste carriers to ensure compliance with the provinces waste regulations. This is known as the Vehicle Inspection Program (VIP).

Officers regularly work in partnership with local Police, Ontario Provincial Police (OPP), Royal Canadian Mounted Police (RCMP), Ontario Ministry of Transportation (MTO), Ontario Ministry of Finance (MOF), Ontario Ministry of Natural Resources (MNR), Transport Canada and other agencies to conduct various inspection blitzes across the province. One of the benefits of these multiple agency inspection blitzes is that with a single vehicle stop officers can determine if a vehicle is an environmental health and/or safety risk to the community.

During a Hamilton Police /MTO & MOE compliance initiative in Sept 2012, the owner of the vehicle below (**Figure 32**) removed the entire exhaust system from underneath the vehicle and made a hole in the hood with the exhaust re-routed to exit the vehicle from the hood hole for a potential in horsepower increase for racing. The untreated hot exhaust is released into the atmosphere and could potentially flow into the cab from open windows and vents for this vehicle and other road users nearby. The owner of this vehicle received a Provincial Offence Notice (Ticket) for operation of a motor with the catalytic converter removed and had the plates seized to stop the continuation of the offence.

Figure 32: Exhaust System Re-Routed



In 2012, 312 vehicles were inspected. One hundred ninety (190) vehicles passed inspection; one hundred twenty two (122) vehicles were found to have some degree of deficiency with respect to vehicle emissions.

7.0 Industrial Partners and Actions in Hamilton

7.1 Hamilton Industrial Environmental Association (HIEA)

The Hamilton Industrial Environmental Association (HIEA) is a non-profit association of local private sector industries. HIEA's mandate is "to improve the local environment – air, land and water – through joint and individual activities, and by partnering with the community to enhance future understanding of environmental issues and help establish priorities for action."

In past years, HIEA has published 2 separate reports – an annual newsletter style report to the community that highlighted HIEA's community support and member company environmental projects and a technical report that provided the aggregated environmental performance of its member companies in such important areas as air emissions, water discharges, recycling and waste management, and environmental spending and stewardship. In 2013, these two reports were combined into one document – 2013 Report to the Community – that was released just prior to the HIEA annual meeting on March 27th 2013.

This new format includes HIEA's 2011 Environmental results where trends are evaluated using 1997 as the baseline year and shows a continuing trend of improvement. This performance is evidence of the continuing success of HIEA member companies in improving the environment in the Hamilton community. Some highlights of the association's performance in air emissions include a 33% reduction in Greenhouse Gases, a 47% reduction in Volatile Organic Compounds, a 26% reduction in Nitrogen Oxides, a 70% reduction in Particulate Matter and a 75% reduction in Polycyclic Aromatic Hydrocarbons.

The Report to the Community is presented at the association's Annual General Meeting and to the Community Advisory Panel and is available to the public both in print and on the association's website - www.hiea.org.

Table 6: HIEA Members

Air Liquide	ArcelorMittal Dofasco Inc.	ArcelorMittal Hamilton East
Bitumar	Bunge Canada	Birla Carbon
Lafarge Canada Inc.	Rütgers Canada Inc.	Sanimax
Triple M Metals LP	U. S. Steel Canada – Hamilton Works	Westway Terminal Canada

More information about the Hamilton Industrial Environmental Association can be found at: http://www.hiea.org

7.2 Horizon Holdings / Horizon Utilities / Horizon Energy Solutions

Horizon Holdings Inc. is the owner of Horizon Utilities Corporation, the municipally-owned local electric distribution company, and Horizon Energy Solutions Inc., a multi-disciplined energy services company. Horizon Holdings continues to improve its sustainable development leadership each year. It is owned via holding companies by the City of Hamilton (78.9%) and the City of St. Catharines (21.1%).

In 2012, for the second consecutive year, Horizon Holdings was awarded Sustainability Company of the Year by the Canadian Electricity Association for its overall sustainable development leadership and innovation. Horizon is the first local distribution company (LDC) in Canada to undertake a comprehensive sustainability initiative. Horizon was also recognized in 2012 as a Smart Commute Workplace. Horizon is ISO 14001 certified and ISO 26000 compliant. Horizon is the first LDC in Canada to adopt ISO 26000.

Horizon published its fourth Sustainability-Based Annual Report in 2012 and received "external assurance" of its Global Reporting Initiative (GRI) filing, getting an A+ rating from Ernst and Young. The report focuses on the social, environmental and economic dimensions of Horizon's business while the GRI filing benchmarks its performance against the international standard for sustainability.

Horizon Utilities' Sustainability-Based Annual Report can be read at:
http://www.horizonutilities.com/ourCompany/sustainability/Pages/Sustainability-Reports.aspx

7.2.1 Conservation and Demand Management

Horizon Utilities, utilizing Ontario Power Authority (OPA) programs, makes it simple for residents and businesses to conserve energy, which reduces Ontario's need to source electricity from non-renewable, non-nuclear generation types, furthering emission reductions. The following are some of Horizon's Conservation Demand Management (CDM) program highlights for 2012:

- Fridge and Freezer Pickup had successful uptake in 2012 with 1789 old fridges and freezers being picked up.
- In 2012, a total of 640 small businesses received retrofit upgrades for improved indoor lighting, with average savings of $210 per year on their electricity bills under the Small Business Lighting program.
- The saveONenergy^{OM} Retrofit program focuses on lighting, motors, heating, ventilation and air conditioning, and overall electricity systems. In 2012, Horizon Utilities customers achieved a total of 8.78 MW in reductions through the Retrofit program.

For more information on Horizon's CDM initiatives, please visit:

http://www.horizonutilities.com/Conservation/business-conservation/Pages/default.aspx

and

http://www.horizonutilities.com/Conservation/home-conservation/Pages/default.aspx

7.2.2 Energy Mapping

In 2012, Horizon Utilities became the first Ontario LDC to begin correlating its electricity consumption data with MPAC building attributes and Teranet geospatial property data, through a geographic information system (GIS). The project, known as Energy Mapping, has an objective to improve the targeting, effectiveness, and deployment of CDM programs in Horizon's service territory, which encompasses the urban portion of the City of Hamilton and all of the City of St. Catharines.

CDM programs focus on helping Ontario electricity customers reduce their demand for power both overall and at typical peak periods of consumption. All sectors are targeted for CDM – residential, commercial, institutional, and industrial. Lowering this demand helps to improve the air quality of the province overall. Approximately 18% of Ontario's electricity generation in 2012 came from non-renewable, non-nuclear emission sources. Lowering demand helps to lessen these emissions.

The learnings from the project, slated to be fully operational by 2014, will be applicable to all Ontario LDCs and will support and enhance the success of the OPA's CDM initiatives and Ontario's Long-Term Energy Plan. This project was made possible through the financial support of the Ontario Power Authority's Conservation Fund.

Information on Horizon's Energy Mapping project can be found at:
http://www.horizonutilities.com/ourCompany/publications/Documents/Horizon%20Energy%20Mapping%20Pilot%20EDIST.pdf

7.2.3 Horizon Energy Solutions Inc.

Horizon Energy Solutions Inc. (HESI) is an affiliate business to Horizon Utilities that offers a suite of energy services that allow customers to better manage their energy. HESI's main business lines include:

- Metering services
- Streetlight maintenance and upgrades
- CDM services
- Renewable power generation

Located in Hamilton, HESI's central location allows easy access to customer sites across Ontario. HESI's Measurement Canada accredited meter shop is one of the most advanced and has recently undergone extensive refurbishment. Its client base is comprised of numerous large manufacturing companies, LDCs, and generators located across Ontario. HESI provides full Independent Electricity System Operator (IESO) registration and ongoing site maintenance.

In 2011, HESI expanded its service offering to provide turnkey CDM services to Ontario-based LDCs. The CDM program delivery services are conducted on a white-label basis using the OPA's saveONenergy^{OM} programs. HESI helps LDCs attain their mandated conservation goals while their customers may qualify for financial incentives that can offset energy retrofit capital costs.

In 2012, HESI completed construction on five solar PV rooftop generation installations on commercial buildings, for a combined generation capability of 1.6 MW. These systems are emission-free and provide enough energy to power approximately 120 homes, reducing Ontario's dependence on fossil fuel generation improving air quality across Ontario. In 2013 HESI will continue to construct solar PV installations and further its work in CDM, metering and streetlight services.

For more information, please visit:
http://www.horizonenergysolutionsinc.com

8.0 Conclusions and Recommendations

Over the past ten years, there have been dramatic improvements in air quality in Hamilton. These changes will have contributed to better health for citizens as well as improved perceptions of the City.

The annual percentage reductions in pollutant levels since the mid 90s as measured at the downtown air monitoring site (Station 29000) are: total suspended particulate (TSP) levels, 2.8% per year; inhalable particulate matter (PM_{10}), 1.8% per year; respirable particulate matter ($PM_{2.5}$), 3.1% per year: nitrogen dioxide (NO_2), 2.8% per year; sulphur dioxide (SO_2), 2.5% per year; total reduced sulphur odours, 6.0% per year; benzene, 6.0% per year; and PAH (measured as benzo[a]pyrene), 5.3% per year.

Clean Air Hamilton is concerned that, over the past three to four years, the downward trends in some air pollutant levels either have levelled off or have shown modest increases. The only pollutant that continues to decline steadily is NO_2. The annual values for PM_{10}, $PM_{2.5}$, SO_2, benzene and benzo[a]pyrene all have shown increases over the past three to four years. These increases are notable compared to the levelling off of these contaminants observed in other major Ontario cities.

Air quality improvements in the City of Hamilton will be incremental and will require actions on many fronts and continued, concerted actions of individuals, organizations, industries, the City of Hamilton and other levels of government.

Clean Air Hamilton and its members continue to recognize the relationship between air quality and public health through the initiatives supported by the committee. Energy conservation and climate change have been highlighted as topics of significant concern for the future. Transportation emissions are a major source of airborne contaminants and are a substantial determinant of local air quality as well as being a significant source of green house gases.

- Health research continues to confirm that exposure to air borne pollutants ($PM_{2.5}$, PM_{10}, NO_x, and SO_2) may adversely impact human health. The 2011 SENES Health Study undertaken for *Clean Air Hamilton* reflects the current knowledge of the relationship between air quality and public health and the increased health care costs associated with the exposure to increased health care costs to air pollutants.

- There is a need for better communication and understanding of the risks associated with air pollutants and health impacts in the community. The Government of Canada's Air Quality Health Index (AQHI) pilot is one attempt in this type of communication and understanding in Hamilton. *Clean Air Hamilton* in partnership with Hamilton Public Health Services will examine how risk communication on air pollutants can be improved in the community.

- *Clean Air Hamilton* continues to work with its members to encourage the expansion of monitoring efforts to capture new emission source currently not being covered. The information for an expanded air monitoring network will further enhance the capabilities of decision-makers at all levels in the development of policies and initiatives to reduce local emissions within the community and thereby the exposures of citizens. The undertaking of mobile monitoring in Ward One and the introduction of the East End Air Monitor pilot project are examples of the expansion of air monitoring in Hamilton. *Clean Air Hamilton* wishes to

continue the mobile monitoring of neighbourhoods in Hamilton where funding is made available.

- *Clean Air Hamilton* continues to support programs that encourage Hamiltonians to reduce their transportation-based emissions and protect their health. Totally Transit is a program that educates school children on the use of public transportation and "Fresh Air Kids " is a program to educate children about air quality issues and assists them in developing walking routes to school that would have the lowest pollutant exposures are examples of such programs. These programs also support the City's goal of improved Transportation Demand Management in Hamilton.

- Comprehensive Airshed Management has been proposed for improving air quality across Canada. *Clean Air Hamilton* will continue to work with the Ministry of the Environment to partner and provide input towards the development of a place-based airshed management system for Hamilton.

In 2012, Hamilton's Board of Health and City Council requested *Clean Air Hamilton* create an Air Quality Task Force to make recommendations on actions that can b undertaken at the municipal level in improving local air quality. *Clean Air Hamilton* accepted this request and formed the Task Force, the Task Force will report back to Council on its recommendations in 2013.

This report focuses on the actions of *Clean Air Hamilton* in 2012 and makes the following recommendations for the City of Hamilton to focus on:

- Land use planning is an important responsibility of all cities. *Clean Air Hamilton* recommends that the City of Hamilton consider developing a strategy for adopting the principles, approaches and standards outlined in the Ontario Ministry of Environment's D-Series Guidelines. *Clean Air Hamilton* also recommends that the City of Hamilton consider attending all public meetings and provide input and comments on facility applications for site-specific standards under Ontario Regulation 419/05.

- Work with local industries and the Ministry of the Environment to control both point sources and area sources of air particulate pollution, particularly road dusts, as well as reducing NO_x and SO_2 emissions, from stationary and mobile sources.

- Continue to support and encourage Hamiltonians to reduce their transportation-based emissions through the use of transportation alternatives including public transit, bicycles, walking, hybrid vehicles, etc. and in supportive policies such as complete streets and transportation demand management.

- Examine the benefits of using existing green corridors for active commuting or recreational transportation in Hamilton as a means to encourage improved health and air quality. The City should consider increasing and linking green corridors and spaces in Hamilton to improve air quality, reduce greenhouse gases and improve quality of life for citizens.

- Take measures to educate and encourage the community to reduce their energy consumption at home, business and on the road through energy conservation and demand measures. The energy mapping of Hamilton project that helps identifies neighbourhoods and building types that consume high amounts of energy can assist in the reduction of energy consumption by local consumers (residential, commercial, institutional, and industrial) and the associated air and greenhouse gas emissions from non-renewable sources of energy.

- Continue to encourage the reduction of greenhouse gas emissions in Hamilton, and consider the implications and risks of climate change to improve the quality of life in Hamilton through climate adaptation policies and planning.

- Take a broad suite of actions to improve local air quality and combat climate change and to increase the level of dialogue with community groups on the health impacts of poor air quality and the actions and lifestyle changes that will lead to air quality improvements for all.

In 2013, *Clean Air Hamilton* will continue to address air quality issues and their relationships to public health outcomes including the work of the Air Quality Task Force. *Clean Air Hamilton* will continue to develop relationships with City staff to ensure that air quality goals are integrated into the decision-making processes across divisions within the City. *Clean Air Hamilton* will continue to cultivate partnerships with organizations that have goals that are consistent with those of *Clean Air Hamilton* and the City.

Appendix A: *Clean Air Hamilton* Terms of Reference

Clean Air Hamilton Coordination Committee Terms of Reference

Mandate:

The Clean Air Hamilton Coordination Committee (CACC) is a voluntary committee established in 1998 to advise on air quality and related issues in the City of Hamilton and provide an authoritative voice and resource on local air quality issues.

Vision:

Clean Air Hamilton is an innovative, multi-stakeholder agent of change dedicated to improving air quality in our community. We are committed to improving the health and quality of life of citizens through communication and promoting realistic, science-based decision-making and sustainable practices.

Goals:

- To improve air quality throughout the City and to meet all ambient air quality criteria;
- To raise *Clean Air Hamilton*'s visibility in the community and to be recognized as the authoritative voice on local air quality issues;
- To galvanize broad-based support for a process and an action plan to improve air quality;
- To provide information and advice that decision-makers value;
- To influence decision-makers to choose sustainable practices and alternatives; and
- To effect behavioural changes to improve air quality.

Functions:

Clean Air Hamilton was established in 1998 as an air quality advisory group to the City of Hamilton following publication in 1997 of the Hamilton Air Quality Initiative report. *Clean Air Hamilton* serves to improve local air quality in Hamilton through:

- Acting as a clearing house for information on local, regional and transboundary air quality issues that impact Hamilton;
- Facilitating information sharing and exchange on local, regional and transboundary air quality issues that impact Hamilton;
- Identifying emerging areas and issues related to local, regional and transboundary air quality issues;
- Undertaking local research to gather information on local air quality and impacts in Hamilton;
- Tracking the annual changes in local air quality and reporting to the City, other levels of government, and the public;
- Providing recommendations to the City of Hamilton to address local air quality issues;

- Identifying and seeking partners and change agents to implement programs and policies that improve local air quality;
- Cultivating partnerships with organizations that have air quality improvement goals that align with those of *Clean Air Hamilton* and the City of Hamilton;
- Educating the public about local air quality and promoting attitudes and actions that promote improvements to local air quality;
- Prepare an annual year-end report documenting the work of the Committee. This report may include recommendations by the Committee on policy issues or related concerns in the implementation of City policies related to air quality and related health and environmental issues. This report is presented to Hamilton City Council and the community every year;
- Endorse City actions to improve local air quality;
- Communicating information on air quality to the public on the Clean Air Hamilton website – www.cleanair.hamilton.ca;
- Hosting the biannual Upwind/Downwind Conference which highlights (a) the latest in air quality research and (b) strategies and activities to improve air quality on a local, regional and national scale, and;
- Developing an annual Work Plan and a Strategic Plan every 3 years that furthers the work of *Clean Air Hamilton*, its vision and its goals.

Roles & Responsibilities:

At the September meeting of each year, the Chair will declare his/her intentions to re-new or resign. CACC will then nominate a Chair.

Chair

The Chair is a CACC member and is expected to uphold the same responsibilities as all CACC members.

Responsibilities of the Chair include:

- Being the public spokesperson for *Clean Air Hamilton*;
- Furthering the Vision and Goals of *Clean Air Hamilton* and promote improved air quality in Hamilton;
- Facilitating information sharing and exchange on programs that address air quality;
- Identifying and seeking partners and change agents to implement programs and policies that improve local air quality;
- Providing input and direction into the *Clean Air Hamilton* Strategic Plan, Work Plan and Annual Reporting on Air Quality, and reviewing *Clean Air Hamilton*'s progress in implementing the goals of *Clean Air Hamilton* and the Strategic Plan;
- Presenting the annual, year-end report documenting the work of CACC to City Council;
- Chairing the meetings of the CACC;
- Co-ordinating meeting agendas and items with the Air Quality Co-ordinator;
- At meetings, the Chair will opening meetings and manage the agenda within the time frame allotted; ensure discussions are focused on critical items; solicit input from all and provide

adequate opportunity for each member to share their views/questions/concerns and close meetings ensuring all items have been discussed, and;
- Reviewing monthly meeting minutes and associated items distributed by E-mail.

Air Quality Co-ordinator

The Air Quality Co-ordinator is a City of Hamilton-funded position and serves to co-ordinate and administers the work of *Clean Air Hamilton* and the Committee. The Air Quality Co-ordinator is a CACC member and is expected to uphold the same responsibilities as all CACC members.

Responsibilities of the Air Quality Co-ordinator include:

- Being the public voice of *Clean Air Hamilton* and/or Chair Committee meetings on behalf of the Chair, where requested;
- Responding to requests for information from members, City Council, and the public on *Clean Air Hamilton* and the Committee;
- Co-ordinating meeting agendas and items with the Chair and CACC members;
- Distributing agendas and items for discussion at meetings to CACC members;
- Recording and distributing minutes of meetings to CACC members.
- Preparing the annual year-end report documenting the work of the Committee;
- Communicating information on air quality to the public on the Clean Air Hamilton website – www.cleanair.hamilton.ca;
- Assisting in the development and management of the biannual Upwind/Downwind Conference;
- Assisting in the development of the Strategic Plan and Work Plan;
- Assisting in the co-ordination of meetings of working groups;
- Seeking out and applying to external funding opportunities for *Clean Air Hamilton*, and;
- Identifying and seeking partners and change agents to implement programs and policies that improve local air quality.

CACC Members

Members are expected to further the Vision and Goals of *Clean Air Hamilton* and promote improved air quality in Hamilton through:

- Facilitating information sharing and exchange on programs of their organizations that address air quality;
- *Clean Air Hamilton* members must attend all meetings – or provide a back-up or notification to the Air Quality Co-ordinator if unable to participate when members cannot attend due to vacations, etc.;
- *Clean Air Hamilton* members who do not attend more than 3 consecutive meetings must contact the Air Quality Co-ordinator and Chair through a written or electronic communication on their absence and intent to continue as a member;
- Work with the Air Quality Co-ordinator to monitor the work of *Clean Air Hamilton*, and work with the Air Quality Co-ordinator and other CACC members between meetings to carry out the business of Clean Air Hamilton;

- Identify and seek partners and change agents to implement programs and policies that improve local air quality;
- Provide input into the *Clean Air Hamilton* Strategic Plan, Work Plan and Annual Reporting on Air Quality, and review *Clean Air Hamilton*'s progress in implementing the goals of *Clean Air Hamilton* and the Strategic Plan;
- Bring forward items for meeting agendas – ensure items and materials are ready for discussion/decision with adequate time for pre-circulation;
- Show up on time for meetings and keep the meeting on track in terms of time
- Keep comments and discussions on-topic at meetings;
- Review monthly meeting minutes and associated items distributed by E-mail, and;
- Input and involvement by some members may be limited for particular topics and decision-making due to their organizational responsibilities outside of CACC. Members are supported in not always providing input for this reason.
- There will be no more than one vote per member organisation.

Memberships:

Clean Air Hamilton is open to anyone who has the time, expertise, experience and interest in air quality issues to work in a committee-based format to find ways to improve air quality in the City through facilitation of solutions, partnerships and educating the public in a voluntary capacity.

Membership should represent a balanced range of disciplines and interests in air quality including, **but not limited to,** health, planning, transportation, engineering, policy, energy, monitoring, research, education, finance, communication and outreach, and community development.

Members also represent key stakeholders or change agents with interest, programs and policies that address air quality. Members include all levels of government (local, provincial and federal), local industry, local utilities, local academics (university and college), non-profits and non-governmental environmental organizations, consultants, and local citizens with an interest and role in improving air quality in Hamilton. CACC members may invite others to join.

There are two levels of membership in *Clean Air Hamilton*:

a. **CACC members**

CACC members are directly responsible for attending monthly meetings, providing advice and input into the *Clean Air Hamilton* Strategic Plan, Work Plan and Annual Reporting on Air Quality, and review *Clean Air Hamilton*'s progress in implementing the goals of *Clean Air Hamilton* and the Strategic Plan. Responsibilities of CACC members are outlined in these Terms of Reference. CACC members attend *Clean Air Hamilton* meetings and are involved in decision-making at meetings as outlined in these Terms of Reference.

b. **Corresponding members**

Corresponding members are individuals interested in keeping informed of the work of *Clean Air Hamilton*, events, news and information as it relates to air quality and related health and environmental issues. Corresponding members may attend *Clean Air Hamilton*

meetings, but are not involved in decision-making. Correspondence with such members will be electronic.

Interested and invited members should contact the Air Quality Co-ordinator and the Chair to outline their interest in joining the CACC and their potential contributions to furthering the Vision and Goals of *Clean Air Hamilton*. Interested and invited members are required to attend at least two CACC meetings and declare their intent to join. The CACC will confirm membership after two meetings.

Members may resign from *Clean Air Hamilton* through a written or electronic communication to the Chair and the Air Quality Co-ordinator.

Clean Air Hamilton is dependent upon the voluntary contributions of its members to make air quality improvements in Hamilton. *Clean Air Hamilton* supplements the voluntary contributions of members with renewed and ongoing commitments of funding from key stakeholders, including various levels of government, the City of Hamilton, local industries and academic institutions, as well as recruiting new members into the organization.

Operating Budget and Funding:

Clean Air Hamilton's operating budget is administered by the Planning and Economic Development Department and is reviewed annually in consultation with the Committee. *Clean Air Hamilton*'s operating budget, programs and sources of funding are reported on annually through the *Clean Air Hamilton* annual report.

Additional funding for programs that assist in furthering the Vision and Goals of *Clean Air Hamilton* and improved air quality in Hamilton are sought out and communicated with CACC members. Applications for external funding are coordinated between the Air Quality Co-ordinator, the Chair and CACC members.

Any additional funding received outside of the City's annual operating budget for programs are held in the *Clean Air Hamilton*'s operating budget and are administered by the Planning and Economic Development Department in consultation and partnership with *Clean Air Hamilton*, the Chair, and CACC members.

Decision-making:

Principles of Decision-making

1. The Clean Air Hamilton Coordinating Committee (CACC) provides advice.
2. This advice is reached by consensus among its members.
3. Members are expected to be collegial in any discussions and business undertaken by the Committee.
4. To the extent possible, all the applicable sciences are to be represented in the discussions and business undertaken when the Committee develops advice.
5. To the extent possible, evidence-based analysis is to be used in reaching conclusions as to the advice to be given.

6. To the extent possible, opportunity will be afforded to all points of view to be expressed during discussions and business when the Committee develops advice.

The Clean Air Hamilton Coordination Committee (CCAC) meets monthly and members at these meetings make decisions on activities and the work of Clean Air Hamilton. A facilitative process is used to achieve consensus-based decisions and actions. Action items are clearly articulated and assigned during the meeting. Outcomes are recorded in the meeting minutes. These minutes, which list the action items, are distributed to all members of *Clean Air Hamilton* through E-mail. For maximum public transparency, the minutes are also posted on the *Clean Air Hamilton* website.

Conflict of Interest:

Conflicts of interest must be disclosed by CACC members concerning any matter that comes before the Committee and are recorded in the meeting minutes. Any CACC member may raise the question of a conflict of interest and the CACC member in question must satisfy the group that no conflict exists. The Chair may determine a conflict exists and so declare. Where a conflict exists, a CACC member must not take part in any discussions or participate in any decisions on activities or resolutions of the Committee pertaining to the issue.

Meetings:

Clean Air Hamilton meets on a monthly basis on the second Monday of the month from 3pm to 5pm at Hamilton City Hall. Meetings are open to the public. Agendas and any accompanying meeting materials are set and distributed through E-Mail to CACC members by the Air Quality Co-ordinator the week before the monthly meeting. Changes or additions to meeting agendas, meeting locations and meeting times are communicated either at meetings or through E-Mail to all CACC members, the Chair and the Air Quality Co-ordinator. E-mail will be used to communicate ongoing information sharing amongst CACC members between monthly *Clean Air Hamilton* meetings.

Minutes are taken by the Air Quality Co-ordinator during meetings. Meeting minutes are circulated via E-mail to CACC members up to 3 days after meetings and before the following monthly meeting to ensure CACC members have time to review and communicate any errors or need for clarification. Minutes of the previous meeting are reviewed and approved at the monthly meeting. Approved minutes are posted to the *Clean Air Hamilton* website – www.cleanair.hamilton.ca, for the public to view.

Presentations at Meetings:

Any presentations by outside organizations for *Clean Air Hamilton* meetings are arranged through the Air Quality Co-ordinator the month before the *Clean Air Hamilton* meeting at which the presentation will be shown. In cases where presentations have information of an immediate nature, they will be shared via E-Mail to all CACC members. Presentations at monthly meetings will be no more than 30 minutes and allow sufficient time for discussion by Committee members. Copies of presentations will be made available for viewing on the *Clean Air Hamilton* website (www.cleanair.hamilton.ca) with the permission of the presenter and distributed to members of *Clean Air Hamilton.*

Working Groups:

At times, issues or topics identified by the CACC in the *Clean Air Hamilton* Strategic Plan and annual Work Plan or in the research, education and communication work that *Clean Air Hamilton* undertakes in addressing air quality in Hamilton requires the formation of ad hoc working group made up of members of *Clean Air Hamilton*.

Terms of Reference for these working groups will be created to identify the tasks and responsibilities of the working group and circulated to members of *Clean Air Hamilton* for their interest and participation in groups. Working groups may be open to outside agencies/organizations and individuals outside of *Clean Air Hamilton* members who have expertise in the area or issue identified.

Working groups are required to report back to *Clean Air Hamilton* on activities at monthly meetings as set out in their respective Terms of Reference.

Appendix B: 2012-2013 *Clean Air Hamilton* Strategic Plan

CAH = *Clean Air Hamilton*; City = City of Hamilton; EC = Environment Canada; EH = Environment Hamilton; GV = Green Venture; HAMN = Hamilton Air Monitoring Network; HC = Health Canada; Horizon = Horizon Utilities; HSR = Hamilton Street Railway; McMaster = McMaster University; Rotek = Rotek Environmental; MOE = Ministry of the Environment; NRCan = Natural Resources Canada; PH = Public Health; TDM = Transportation Demand Management; UHI = Urban Heat island

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Public Health Protection	Heat Alert, Corporate Smog Plan	Concern for the public health in regards to air quality; expand health base for Air Quality Index (AQI)	HC, PH	Air Quality Health Index (AQHI)	How individuals can avoid health problems tie health based AQI	Introduce AQHI to Hamilton	On-going
			PH, school boards, Parks & Recreation; GV		Create a standard package for the community and corporate areas so they know what to do to protect health during inversion or smog days	Community Smog Plan	On-going
			PH, McMaster, Rotek, MOE, City	Air Quality Health Mapping		Air Quality Health Mapping on website, collaborate data with existing air monitors and mobile monitoring with health qualifiers	2014

	Health Impacts		PH, McMaster, Hospitals		Special package alerts for physicians and health care providers	Community Smog Plan	On-going

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Public Health Protection	Health Impacts		PH, McMaster	Update 2003 CAH Health Study			Completed

Active & Sustainable Transportation	Smart Commute Hamilton; Transportation Management Association; TDM (City); Active & Safe Routes to Schools (PH); Metrolinx; Events: Open Streets Hamilton, Clean Air Commute, Transportation Fair, Walk and Bike to Work Day, Car Free Day, Carpool Week, Carpool Incentive Program	Encourage the use of active and sustainable means of healthy transportation, reduce emissions from personal transportation, increase the liveability of the city and citizen health by integrating exercise into daily routines through active transportation	Planning & Economic Development, Public Works (TDM), Cycling Committee, Public Health, Metrolinx, Smart Commute, local industry and businesses, local schools, institutional partners: McMaster, Mohawk College, Hamilton Health Sciences, St. Joe's Hospital, as well as: Horizon Utilities, CAA, McMaster Innovation Park, ILR Industries and others.	Bike Share Feasibility Study; Car Share Expansion Program; Feasibility to provide corporate telework; secure bike parking construction, cycling racks & amenities; preferential carpool parking; insurance rate reductions; subsidised transit pass programs; emergency ride home programs; TDM and Land use research and workshops; Environmental Pricing Reform	Event Promotions, Transportation Fair, Community Information Booths, Open Streets Hamilton; Transportation Summit, Cycling workshops/event; overall promotion of sustainable mobility options; education and awareness of single occupancy vehicles, negative environmental impacts; use of the web including the promotion of carpoolzone.ca, emergency ride home program and EC transit pass promotions	Establish a Local TDM Association – Best practices for Hamilton businesses and schools on promoting active and sustainable transportation; Travel Demand Analysis for workplaces using an employee survey and customized demand management plans; Policy Analysis and Advocacy; Events and Programs to reduce SOV use; education programs including Stepping It Up	On-going

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update

Active & Sustainable Transportation		Reduced emissions from driving year round. Prioritize building on success and momentum.	GV, Commuter Challenge participants, Chamber of Commerce, HSR, School boards, GV, EH		Smart driving communication program- EcoDriver	Promote behavioural shift	2009 – 2012
	Cycling	Encourage cycling in Hamilton	Hamilton Cycling Committee, Hamilton Cycling Master Plan, GV, City		Letters of support for cycling lanes implemented under Hamilton Cycling Master Plan	Hamilton Bike Share	On-going
	Totally Transit	Transit -change drivers into riders, get young people before they become drivers, make sure riders stay as riders	HSR, School boards, GV, EH			School bus education program at schools; promote behavioural shift	2008 - 2012
	Electric bikes and vehicles	Ebikes and vehicles already coming in the market, but confusion around rules and usage.	Public Works, Province, Hamilton Police, GV	What are electric bikes and vehicles? What are the rules around usage?			Under Review

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Smart Driver	Idling Stinks campaign, NRCan Idle free program, Idle by-law	Reduce unnecessary vehicle idling in Hamilton	GV, City		Information on idling and by-law	Promote behavioural shift. Enforcement needed	*On-going*
	Drive Clean; Smog Patrol; Mobile Monitoring	Local impacts of diesel truck traffic	MOE, MTO, Public Works	Get data on diesel emissions from vehicles (mobile monitoring)	Outreach with truck industries; Smog Patrol	Smog Patrol Enforcement Blitz, remove diesel engines, have a form of regulation that would not allow dirty diesel engines within city boundaries	On-going
	Eco-driver	Promote green driving habits to drivers	GV, City, Green Communities		Green driving tips	Eco-driver program	2009- 2012

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Air Monitoring	HAMN required for industries to monitor industrial area of airshed	All emitting industries should participate in HAMN	HAMN, MOE		Provide HAMN data online via HAMN web site, HAMNair.ca	Encourage MOE to undertake monitoring requirement in CofA	On-going
		Mobile Monitoring	MOE, EC, City	Inversion days, health impacts data, health mapping, construction and fugitive dust		Continue mobile monitoring-health mapping, begin Neighbourhood Air Monitoring 2010-2011 Look into funding for more monitoring.	2004-2008, 2009-2012
	Air Zone Management	Pilot an airshed zone management approach in Hamilton.	MOE, City, Public Health, Public Works			Work with MOE to pilot approach. More air monitors in Hamilton.	On-going
Air Quality Communication	CAH Annual Report; CAH website; Upwind Downwind Conference; Displays; brochures	School boards involved; potentially get a representative on CAH committee	School boards, Mohawk, Reedemer	Indicators of local action on air quality that could be reported in addition to air quality parameters	Work that Clean Air Hamilton and partners undertake air quality data to students for projects.	School board and Mohawk rep on committee. Upwind Downwind 2012	On-going

		Educate the public: what are the problems? How do they affect you? What can you do?	GV				On-going

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Air Quality Communication		CAH is effective and efficient –must maintain support	City, MOE, EC, HC		Meetings, displays, presentations	Seek awards, seek funding, and orientate local politicians and councillors of work.	On-going
	CAH website	Update and current, user-friendly and informative	Planning & Economic Development		Update material		On-going
Climate Change	Corporate Air Quality (AQ) & Climate Change (CC) Plan; Climate Challenge (EH)	The linkages to AQ	Environment Canada, MOE, McMaster	Research linkages to AQ (CO, NO_x) and actions	Outreach on AQ & CC linkages	Air Pollutant and GHG Inventory	On-going

		Subcommittee to look at city-wide CC issues	City, McMaster, GV, EH, Conservation Authority		Presentations, Discussion Papers, Meetings with stakeholders.	Create a Community CC Action Plan	Underway

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Emissions Reductions		Develop Local Poor Air Quality Notification system that can trigger immediate actions by industries in poor air quality situations; Drive action when needed; Protect health			Local Poor Air Quality Notification System (MOE)	Local Poor Air Quality Notification System (MOE)	On-going
	Fugitive dust - construction areas	Addressing construction sources and industrial sources of fugitive dust	City, MOE, Rotek, Hamilton Construction and Development Associations	What are others doing? Mobile monitoring	Website	Dust Abatement Workshop II	Air Quality Taskforce (2013)
	Mow down pollution programs, Leaf blower education	Reduce usage of two-stroke engines, tie in with pesticide education	GV, Home Depot, Lowes, Home Hardware	Impacts of small engines	Small engine alternatives	Encourage alternatives to small engines, small engines exchange program	2010- 2012

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Energy Conservation	Horizon programs; Energy roundtable	Promotion / energy conservation & *alternatives*	Public Works, NRCan, Horizon, GV			Promotion / energy conservation & alternatives	On-going
	Energy Audits	Energy conservation and savings (low income neighbourhood)	GV				On-going
Land Use Planning	Urban Official Plan; Provincial Policy Statement; Places to Grow; Greenbelt	Density, infilling, community planning, air quality impacts.	Planning & *Economic* Development, Public Works, GV	Impacts on air quality of infilling and development		Guidelines, Planning directions for development to mitigate impacts. Require air quality monitors and air quality to be factored into development - industrial, commercial,, residential	On-going

	Hamilton Community Energy Collaborative	Energy mapping in the community					Completed

Strategic Issue	Activity in the Community	Purpose, Opportunities, Pressures	Proposed Partners	Research	Communication	Actions	2012 Update
Tree Programs	Numerous tree planting programs in City (Red Hill Valley, Councillors, Street Planting, Earth Day, Ikea), Hamilton ReLeaf Committee	Trees improve air quality, fight climate change, lower heating and cooling costs, reduce water demand and store rainwater, increase happiness, slow traffic	GV, Conservation Authority, Public Works, Earth Day Hamilton, businesses	Develop a tree planting inventory for Hamilton; fill in gaps (i.e., low income neighbourhood)		Develop a tree networking body --Tree Roundtable to consolidate efforts = Hamilton ReLeaf Network	Completed

Appendix C: 2012 *Clean Air Hamilton* Financial Report

In 2012, the Air Quality Budget for the City of Hamilton and *Clean Air Hamilton* was $56,000. In-kind contributions including volunteer time and advisory role of *Clean Air Hamilton* members on programs was $93,920

2012 *Clean Air Hamilton* Financial Report				
Project/Program	**Clean Air Hamilton Contribution ($)**	**Other Contribution ($)**		**Total ($)**
		Financial	**In-Kind**	
Eco-Driver	$2,000	$2,000 – Shell Canada's Fuelling Change	$1,200– volunteer time Volunteer/Students time ($15/hr) at TP Clinics =$1,350 Cdn Tire Promos and Space =$500 GCC tire pressure gauges for distribution = $200 Rubber Assoc of Canada (gauges and swag) = $400	$7,650
Totally Transit	$5,500	$2,000 – Metrolinx – I Ride the HSR! Bus orientation for older adults program	$3,150 - Hamilton Street Railway service and $150 - volunteer time $5,000- Hamilton Street Railway service	$15,800
Clean Air is a Yard Away	$4,500		RONA promos and printing $500	$5,650

			RONA rebates $500 Green Cycle Recycling $150	
Clean Air Hamilton Events and Communications	$7,500		$600 – volunteer time of Green Venture's volunteers at tabling events (10 events X 4hrs X$15)	$8,100
Mobile Monitoring "Fresh Air Kids"	$10,000	$10,000 – Province of Ontario Healthy *Communities* Fund $2,000 – Environment Canada through Green Communities Canada	$6,000 – Ministry of the Environment *mobile* monitoring vehicle and equipment. Corr Associates - $5,000 *in-kind* time planning program and conducting data collection and analysis.	$33,000
Hamilton High school Heroes	$6,500		Reduced price on trees from Connon Nurseries - $100 Student volunteer time – 8 hours at $15 per hour = $120	$6,720
Climate Change Champions	$20,000			$20,000
Advisory			$69,000 – Members	$69,000
TOTALS	**$56,000**	**$16,000**	**$93,920**	**$165,920**

On February 27 2012, *Clean Air Hamilton* and the City hosted the 2012 Upwind Downwind Conference: Unlikely Partners at the Hamilton Convention Centre. The total cost of the 2012 Upwind Downwind Conference was $24,300. The total revenue was $21,500 that included $9,500 from registration fees and $12,000 from funding (see **Table 3**). A sum of $2,800 was drawn from the $26,000 Upwind Downwind Conference Reserve Fund to cover the difference. This Reserve Fund was established through revenues accrued from previous Conferences and can be used to cover any shortfalls that may arise in future Conferences. City of Hamilton provided staff resources to procure sponsorship, coordinate logistics, facilitate meetings, process registrations and promote the Conference agenda ($30,000). Planning Committee members helped determine the focus of the conference, identify and confirm speakers and facilitate Conference sessions. Volunteers helped on the registration desk during the conference.

2012 Upwind Downwind Conference Funds/Grants

Organizations	Amount
Hamilton Planning Department	$30,000 **in-kind**
Hamilton Public Health Services	$5,000
Mohawk College	$2,500
Health Canada (Exhibitor Booth)	$2,500
Hamilton Industrial Environmental Association (HIEA)	$1,000
McKibbon-Wakefield Inc.	$500
McMaster Institute of Environment and Health	$500
TOTAL – CASH	$12,000
TOTAL – IN-KIND*	$30,000
Total	**$42,000**

The revenues generated at the Upwind Downwind Conference are used in the planning and administration of future conferences organized by *Clean Air Hamilton*.

Appendix D: Air Quality Indicators - Trends and Comparisons over Time

Air Quality Trends in Hamilton

The graphs in this Appendix illustrate trends in key air quality parameters in Hamilton over the past 10-22 years. Earlier long term trends from about 1970 (when air quality measurements were first made in Hamilton) to the mid-1990s can be found in the 1997 HAQI reports.

For information on Hamilton air quality from 1970 to the mid-1990s, visit:
www.cleanair.hamilton.ca/downloads/HAQI-Environmental-Work-Group-Final-Report-Dec-97.pdf

Since the mid-1990s, the levels of air pollutants in Hamilton (except for the long-range air pollutant, ozone) have shown steady downward trends year over year. The annual percentage reductions in pollutant levels over this time period as measured at the downtown air monitoring site (Station 29000) are: total suspended particulate (TSP) levels, 2.8% per year; inhalable particulate matter (PM_{10}), 1.8% per year; respirable particulate matter ($PM_{2.5}$), 3.1% per year: nitrogen dioxide (NO_2), 2.8% per year; sulphur dioxide (SO_2), 2.5% per year; total reduced sulphur odours, 6.0% per year; benzene, 6.0% per year; and PAH (measured as benzo[a]pyrene), 5.3% per year

Clean Air Hamilton is concerned that over the past three to four years the downward trends in some air pollutant levels either have levelled off or have shown modest increases. The only pollutant that continues to decline steadily is NO_2. The annual values for PM_{10}, $PM_{2.5}$, SO_2, benzene and benzo[a]pyrene all have shown increases over the past three to four years. The increases in PM_{10}, $PM_{2.5}$ and SO_2 in Hamilton are in contrast to recent trends in other major Ontario cities.

Pollution abatement technologies and strategies continue to be implemented by companies within the industrial sector. *Clean Air Hamilton* strongly recommends that all stakeholders evaluate their air pollution control equipment on a regular basis and make every effort to install the most efficient technologies when upgrading their pollution control equipment, when constructing new facilities or when retrofitting existing facilities. The goal should be to achieve or exceed the highest international standards of best practice. *Clean Air Hamilton* recommends that all citizens critically evaluate the fuel and energy efficiencies of any energy-consuming appliances, passenger vehicles and trucks when they are making purchases of appliances and vehicles.

In most of the graphs in **Appendix D**, one line represents the average ambient air levels in residential areas of the City, based on data from two or more air monitoring stations located at City sites. The other line represents the average ambient air levels near industrial sites, based on data from two or more air monitoring stations located near Industry Sites. Also included are data that compares Hamilton to other cities in Canada and around the world.

A 2005 report from the Ontario Ministry of the Environment showed the results of modeling estimates of the impacts of U.S. sources on Canada. These estimates were based on the analysis of large-scale weather patterns and detailed estimates of emissions from sources in mid-western U.S. states. These results clearly demonstrated that about 50% of all contaminants in the air in southern and southwestern Ontario (and in Hamilton) were the result of long-range transport from sources in the U.S. These sophisticated modeling studies were consistent with the estimates

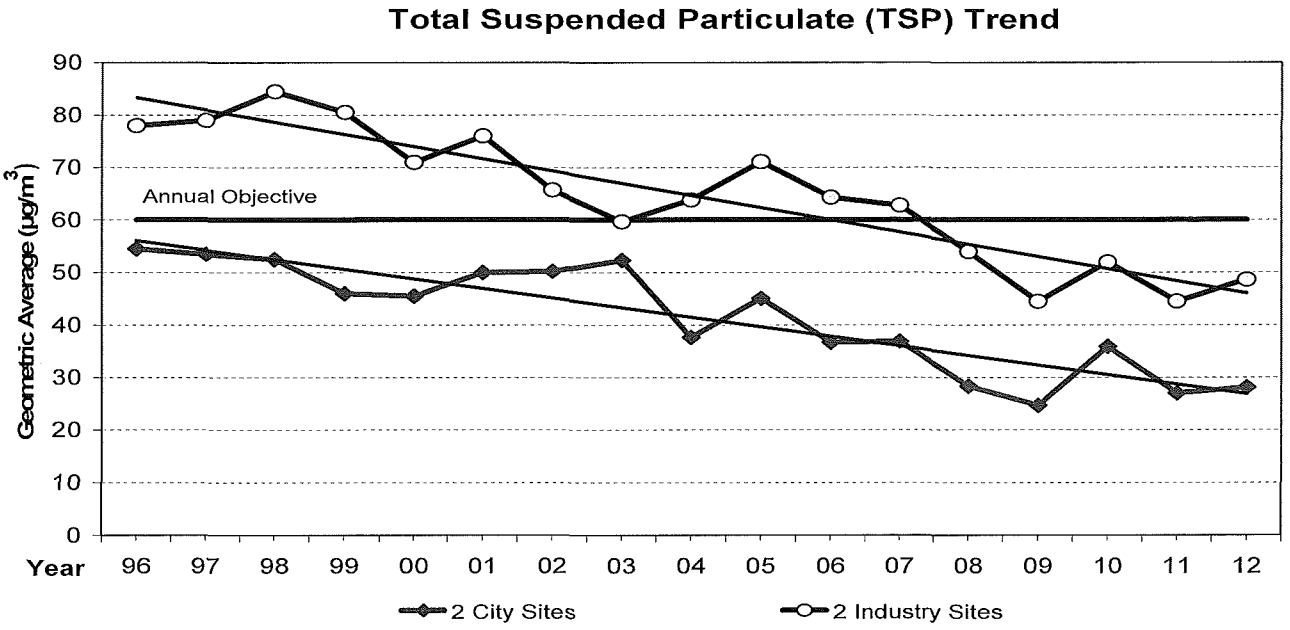
provided in the original HAQI study reports and to estimates done by Clean Air Hamilton more recently.

Particulate Material: Total Suspended Particulate (TSP)

Total suspended particulate (TSP) includes all particulate material with diameters less than about 45 micrometers (μm). A substantial portion of TSP is composed of road dust, soil particles and emissions from industrial activities and transportation sources. TSP levels have been decreasing steadily since the mid-1970s. Over the past decade, the TSP levels have decreased, on average, by about 3 $\mu g/m^3$ per year in the industrial areas and by about 2.3 $\mu g/m^3$ per year within the City. These decreases correspond to reductions between 40% and 45% over the past decade alone. These reductions have been realized due to a range of activities directed toward the reduction of industrial dusts, road dusts, track out from industries with unpaved sites, etc.

Included within the TSP category are inhalable particulates (PM_{10}) and respirable particulates ($PM_{2.5}$). It is possible to determine the net amount of particulate material in the air with sizes between about 45 μm and either 10 μm or 2.5 μm, by subtracting the PM_{10} or the $PM_{2.5}$ value respectively, from the TSP value. The material in the air with diameters between 10 and 45 μm is due almost exclusively to fugitive industrial emissions and road dust re-entrained by car and truck traffic.

The particulate levels in some cities around the world are significantly higher than Hamilton. For example, the average weekly TSP level at a site in southeastern Beijing between August 2005 and August 2007 was 370 $\mu g/m^3$! In the late autumn and winter during the dust storms, the TSP levels averaged about 500 $\mu g/m^3$ while the summer had the lowest TSP levels at about 250 $\mu g/m^3$. By contrast, Hamilton in 2006 had TSP levels of about 40 and 60 $\mu g/m^3$ at the downtown site and at an industrial site, levels that are about 6 and 9-fold lower than the Beijing annual average. The mean annual TSP value in an industrial area of Rio de Janeiro was 87 $\mu g/m^3$.

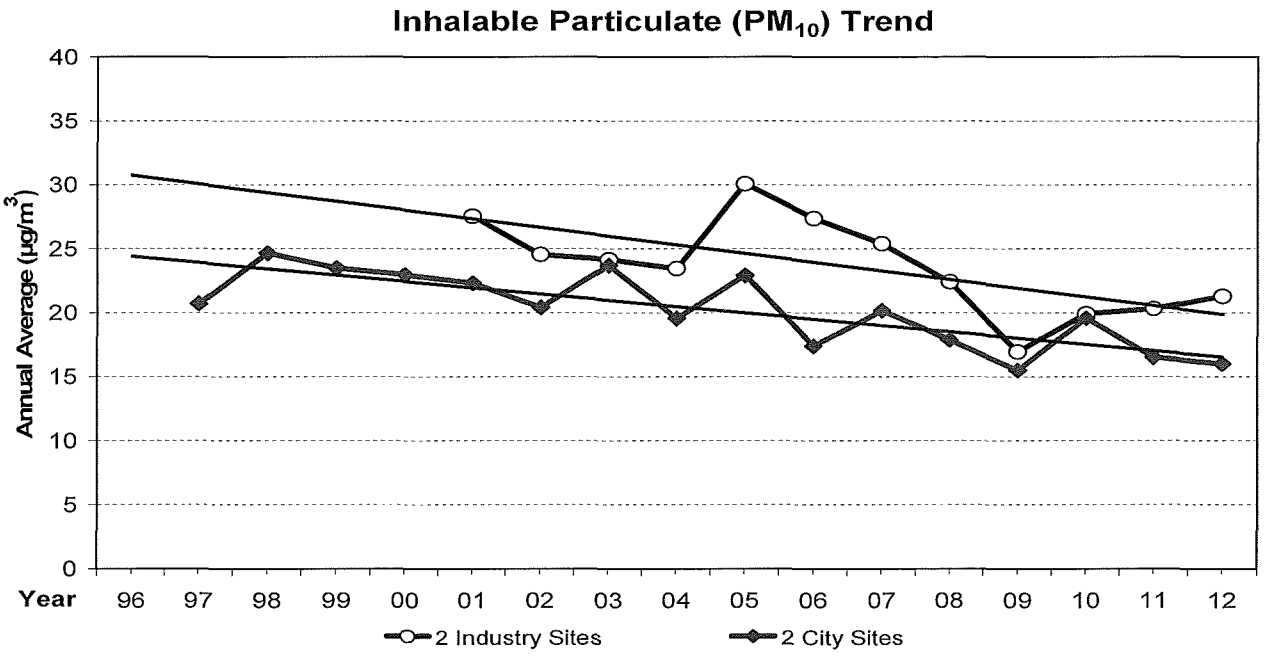


Particulate Material: Inhalable Particulate Matter (PM_{10})

Inhalable particulate matter (PM_{10}), the airborne particles that have diameters of 10 µm or less, is a portion of total suspended particulate (TSP). PM_{10}, which makes up about 40-50% of TSP in Hamilton, has been linked to respiratory, cardiovascular and other health impacts in humans. As with the TSP trend discussed above, ambient levels of PM_{10} at the City sites have decreased about 30% over the past decade, from about 25 µg/m^3 to about 15 µg/m^3. In areas near the industrial sectors, the levels of PM_{10}, while higher than in the downtown area, have shown the same steady decrease areas as in the downtown area.

PM_{10} is derived primarily from vehicle exhaust emissions, industrial fugitive dusts, and the finer fraction of re-entrained road dust. While car and truck traffic counts have remained roughly constant over the past decade the deceasing trend of PM_{10} is likely the result of a combination of better performance of the vehicle fleet, better management of dust track-out by industries, and the use of better street sweepers and street sweeping practices by the City. The vehicle fleet performance will have improved primarily due to lower particulate emissions from modern engines and the removal of some of the worst polluting vehicles under the provincial Drive Clean program. While the impact of the Drive Clean program is difficult to assess from a local emissions perspective, the removal of "smoking vehicles" from the road is one of the expressed goals of the program, in addition to ensuring that the Ontario vehicle fleet is performing efficiently.

As a point of comparison to Hamilton, the PM_{10} levels in non-industrial city of Porto, Portugal in 2004 were reported between 35 and 50 µg/m^3 at four 'urban traffic' and two 'suburban background' sites. These levels are roughly double those in Hamilton; moreover, all site experienced between 73 and 136 days a year when 24-hour PM_{10} levels exceeded 50 µg/m^3.

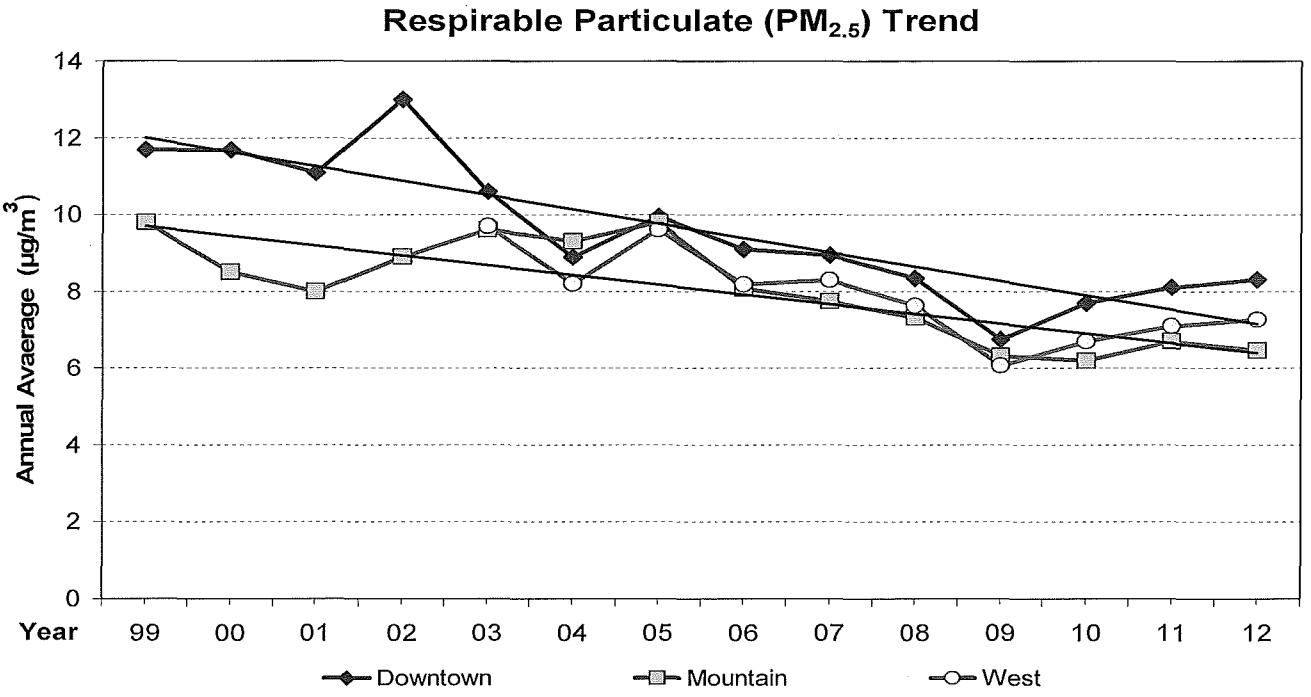


Particulate Matter: Respirable Particulate Matter ($PM_{2.5}$)

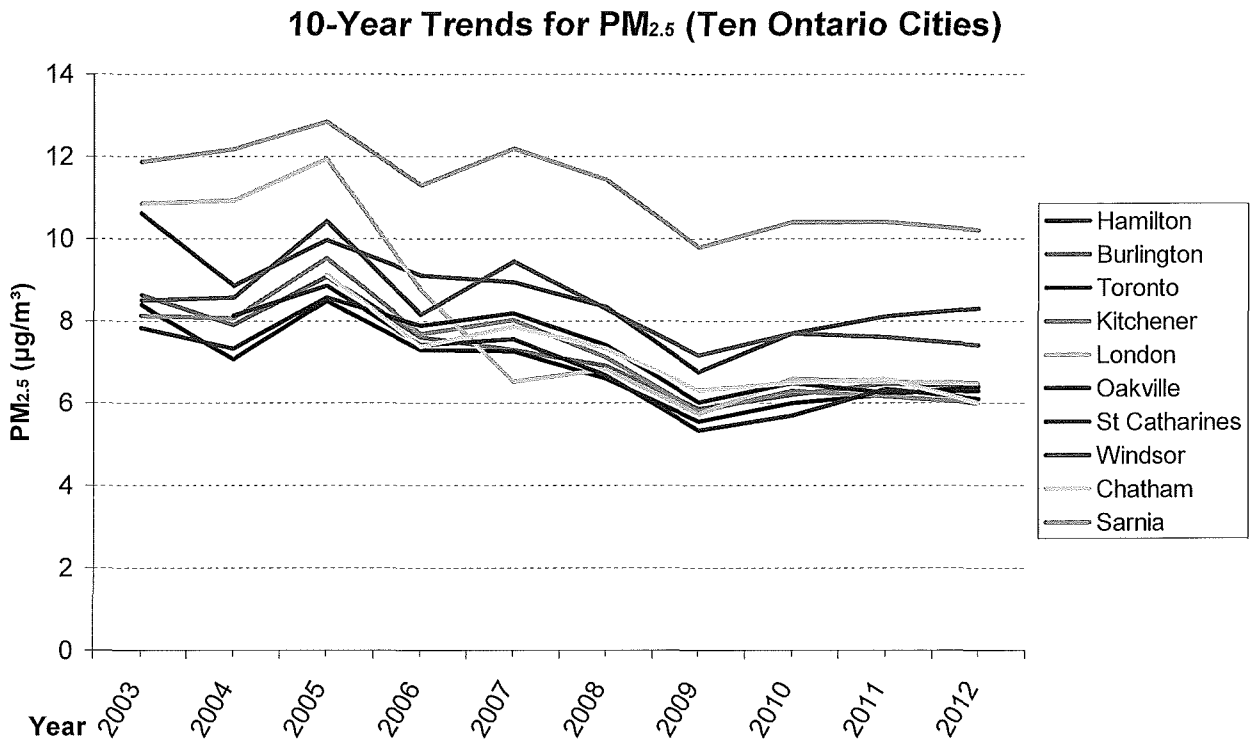
The Province of Ontario monitors respirable particulate matter ($PM_{2.5}$), airborne particles with a diameter of 2.5 µm or less. $PM_{2.5}$, which makes up about 60% of the PM_{10} in the air, has been more strongly linked to health impacts than PM_{10}. The Ontario government started measuring levels of $PM_{2.5}$ across Ontario in 1999; prior to this date there was little data on $PM_{2.5}$. In Hamilton $PM_{2.5}$ data is collected at the three Air Quality Index (AQI) monitoring stations.

The trend in $PM_{2.5}$ showed a 3.5% per year decrease from 1999 until 2009 at the downtown and mountain AQI sites (consistent with decreasing trends in TSP and PM_{10} levels). Over the past three years, however, there have been increases in $PM_{2.5}$ levels at the downtown and Hamilton West AQI monitoring sites while levels at the mountain AQI site have remained unchanged. The $PM_{2.5}$ levels in cities across Ontario have remained unchanged over the past three years following several years of steadily declining levels. Since most of the $PM_{2.5}$ in cities is derived primarily from vehicular emissions, it appears that the increased distances being driven in Ontario are offset by the improvements in emissions from the vehicle fleet.

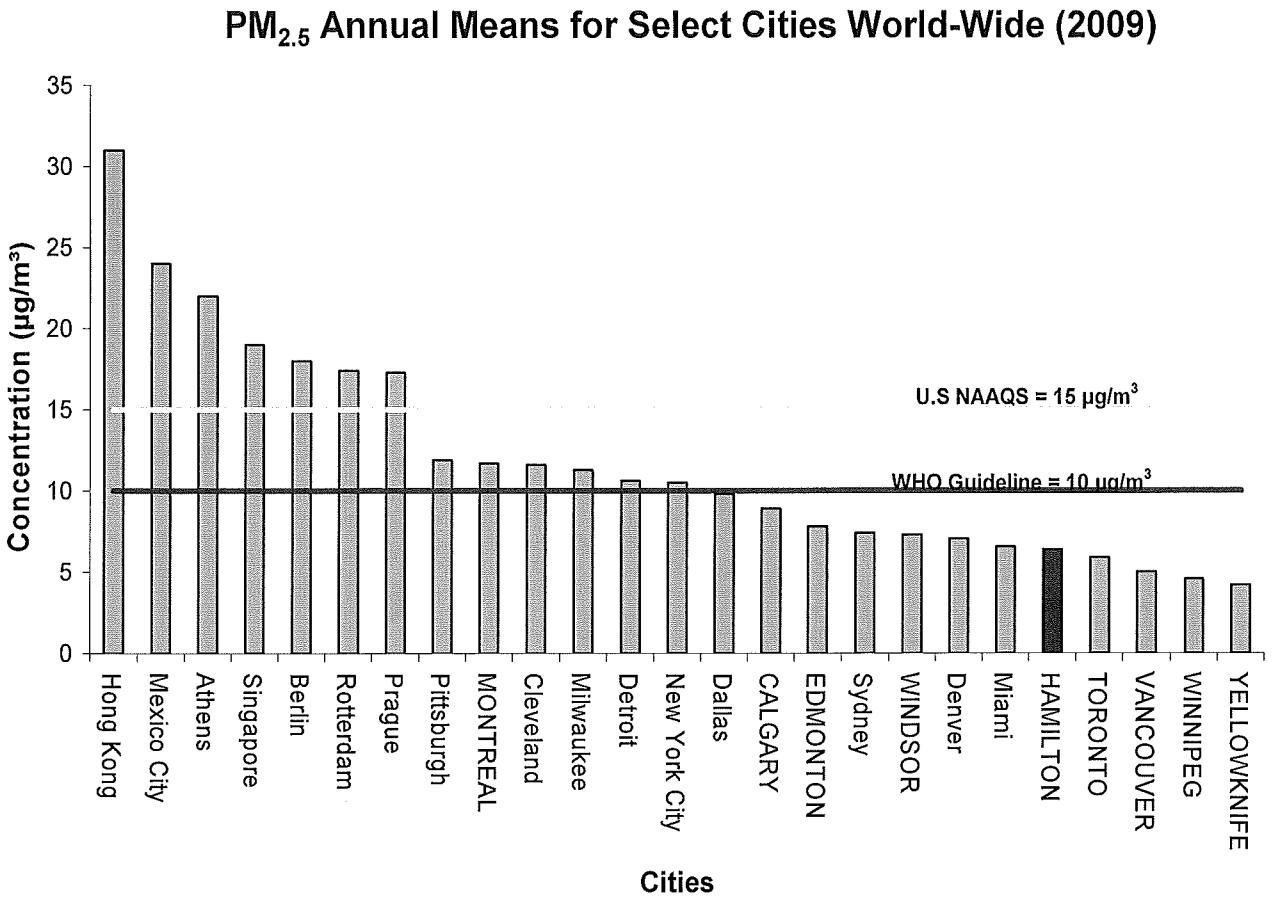
There has been a scientific debate over just what causes the health impacts in humans due to exposure to the $PM_{2.5}$ fraction – the particles themselves or the chemicals on these particles. It is known that the $PM_{2.5}$ fraction contains over 95% of all particle-bound organic compounds in the air along with a substantial burden of metals. Most scientists now agree that exposure to the small particles and the organic substances is the likely cause of the observed respiratory and cardiovascular health impacts attributed to particulate material exposures.



The graph below shows a comparison of ten-year trends in respirable particulate matter ($PM_{2.5}$) levels in ten Ontario cities. The decreasing trend in $PM_{2.5}$ in Hamilton is mirrored at other locations across southern Ontario.



The figure below compares the annual mean levels of $PM_{2.5}$ in Hamilton with 25 other Canadian and global cities for 2009. Of the Canadian cities compared, Hamilton registered the fifth highest $PM_{2.5}$ annual mean reading, with Windsor, Edmonton, Calgary and Montreal registering higher readings. Hamilton's annual mean levels of $PM_{2.5}$ remain below the World Heath Organization (WHO) air quality guidelines and the U.S. National Ambient Air Quality Standards (NAAQS). Out of the 25 cities compared, the five lowest annual mean levels of $PM_{2.5}$ were recorded in Canadian cities including Hamilton. The $PM_{2.5}$ levels in Hamilton and Toronto are comparable, and are about one-half the levels in non-industrial European cities such as Prague and Berlin. The data used for this figure were provided by the Ontario Ministry of Environment.

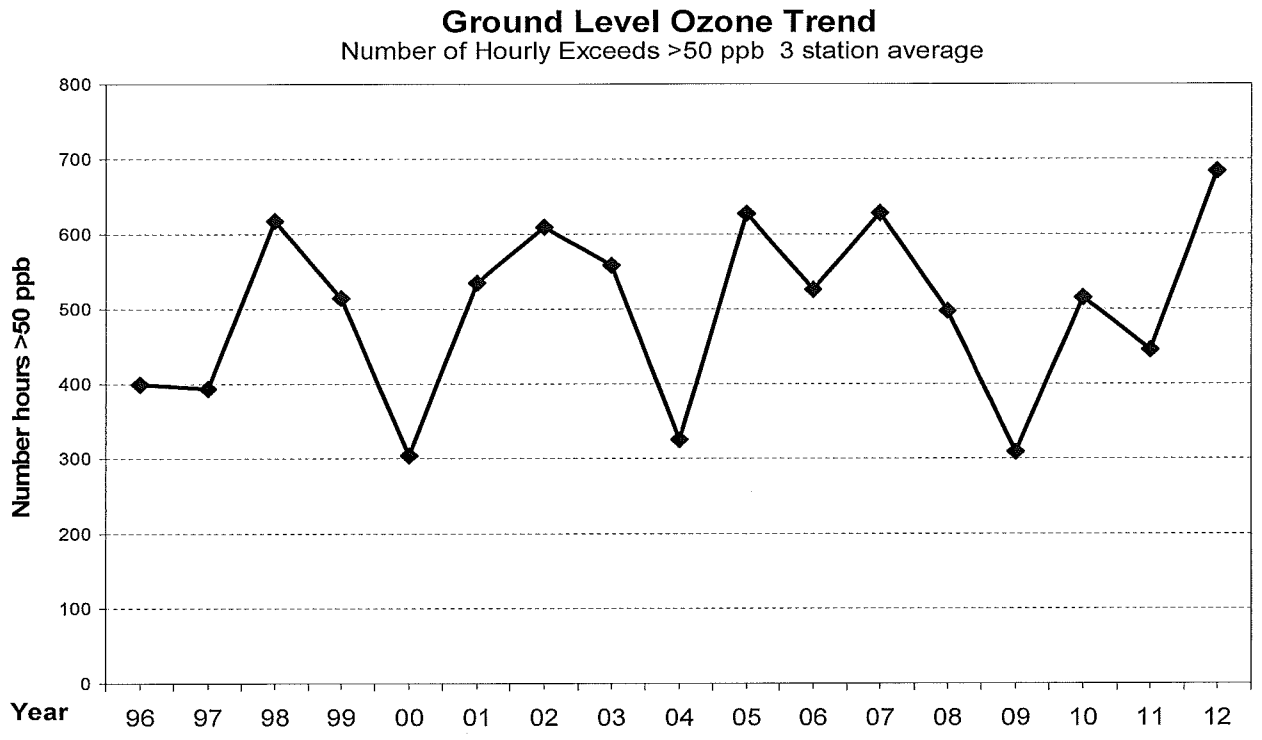

PM2.5 Annual Means for Select Cities World-Wide (2009)
Concentration (µg/m3)
35
30
25
20
15
10
5
0
U.S NAAQS = 15 µg/m3
WHO Guideline = 10 µg/m3
Hong Kong
Mexico City
Athens
Singapore
Berlin
Rotterdam
Prague
Pittsburgh
MONTREAL
Cleveland
Milwaukee
Detroit
New York City
Dallas
CALGARY
EDMONTON
Sydney
WINDSOR
Denver
Miami
HAMILTON
TORONTO
VANCOUVER
WINNIPEG
YELLOWKNIFE
Cities

Ground Level Ozone (O_3)

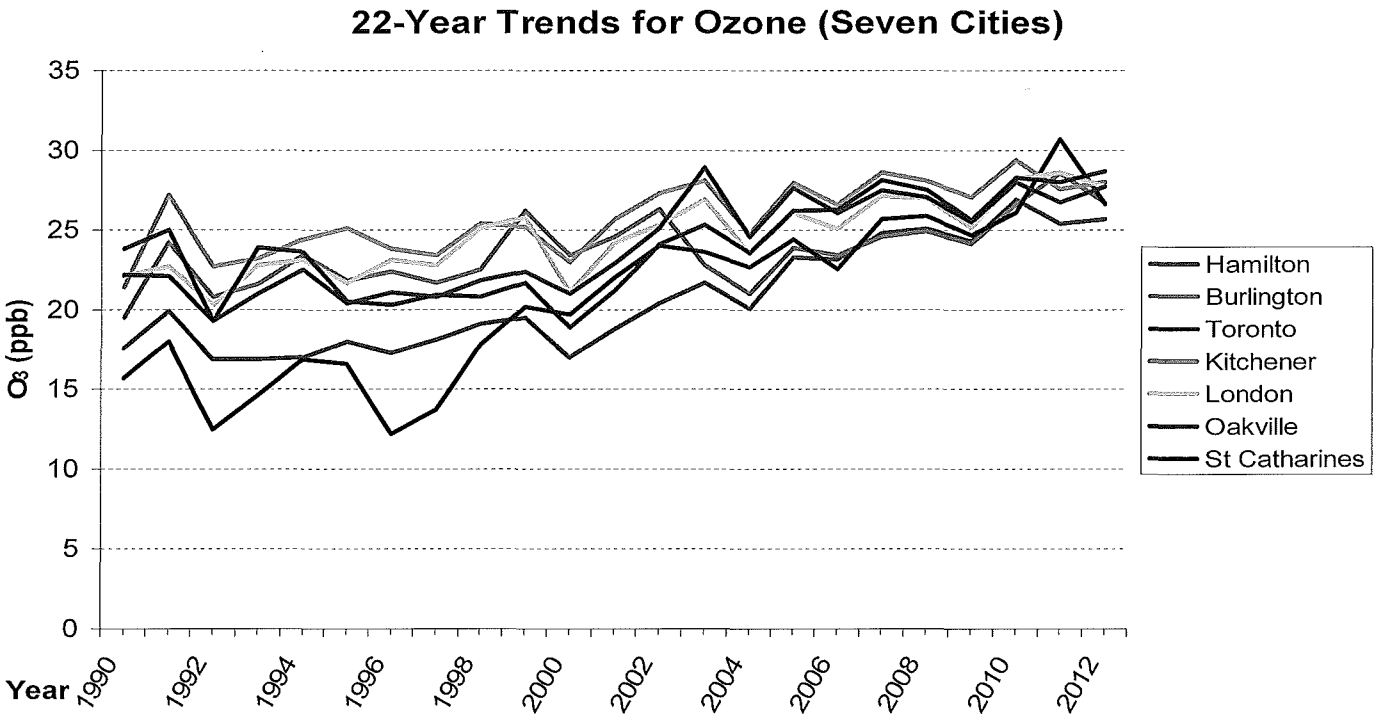
Ground level ozone (O_3 or tropospheric ozone) is formed in the atmosphere when air pollutants such as nitrogen oxides (NO_X) and volatile organic compounds (VOC) react in the presence of sunlight. Air levels of O_3 are higher in warmer seasons than in cooler seasons because the sunlight is more intense in the summer and the temperatures are higher. The trend in O_3 shows an increase has been highly variable over the past 10 years. Overall, the trend line for ozone is flat or increasing slightly.

Unlike all other pollutants almost none of the O_3 measured in Hamilton was generated from Hamilton-based pollution sources. The formation of O_3 takes several hours once the pollutants have been released to the atmosphere. Thus, the O_3 measured in Hamilton was produced from emissions released from sources upwind of Hamilton. Conversely, emissions from sources within Hamilton will result in the formation of O_3 in areas downwind of Hamilton. A substantial portion of the O_3 that affects southern Ontario during smog episodes in the summer months is known to originate from sources in the United States, primarily from coal-fired power plants, vehicles and urban activities in the Ohio Valley region in the Midwest.

Ground level ozone should not be confused with "stratospheric ozone" or "ozone layer". The ozone called "stratospheric ozone" is produced and destroyed in the stratosphere at an altitude of 30-60 km above the Earth. The stratospheric ozone is commonly known as the ozone layer because over 91% of the ozone in Earth's atmosphere is present here. The term "ozone depletion" refers to a decrease in the levels of stratospheric ozone due to man-made emissions, particularly halogenated refrigerants that have now been banned. Stratospheric ozone and changes in the ozone layer have not yet been linked to impacts of combustion emissions.

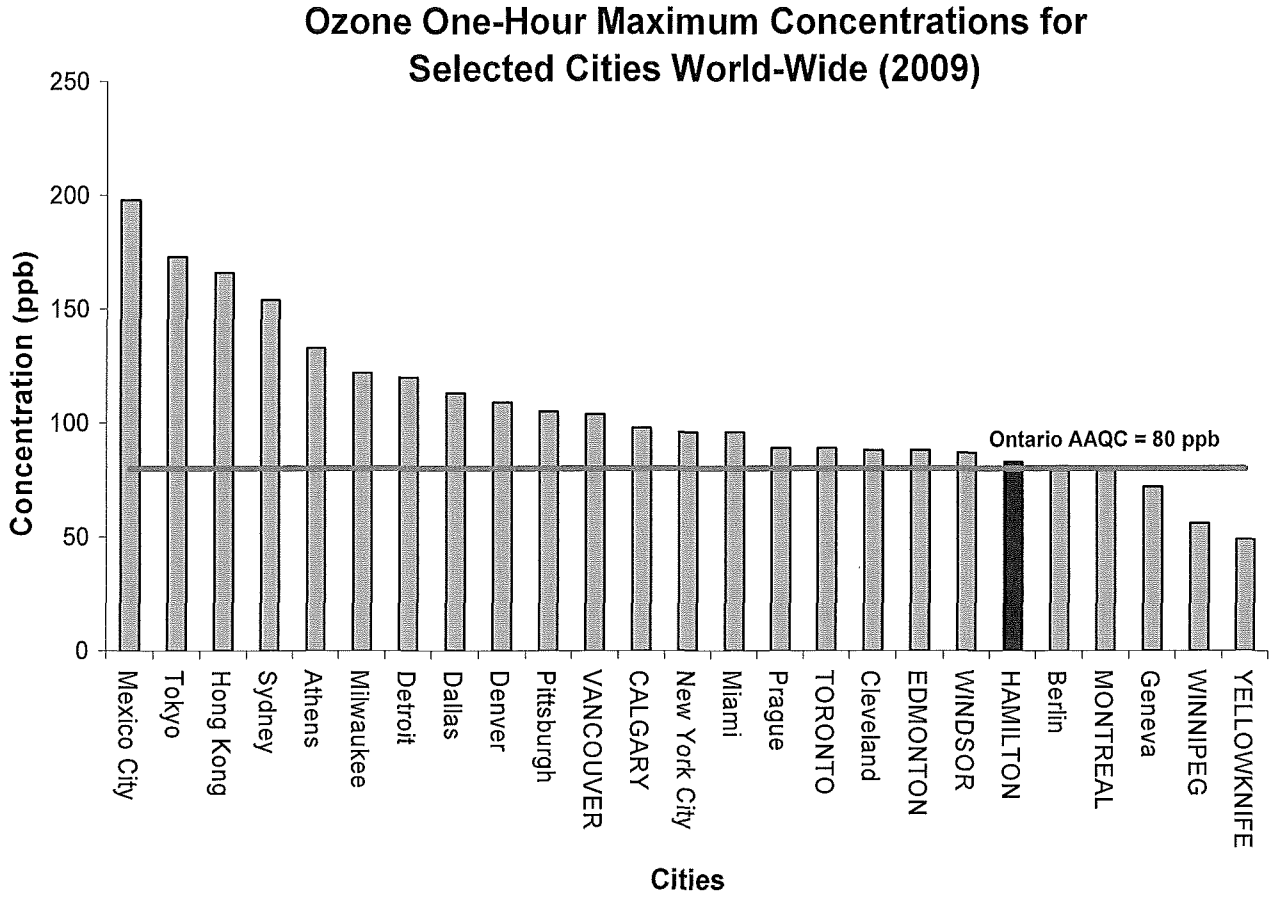


The trend in O_3 in Hamilton is mirrored at other locations across southern Ontario. Over the past 22 years, the concentrations of O_3 across southern Ontario have increased between 10 and 30%, depending on the city. The levels of O_3 observed across southern Ontario in recent years are consistently higher and more similar than what was observed one and two decades ago. This trend is somewhat worrisome given the detrimental health effects impacts associated with increased O_3 exposures.



As discussed previously, the formation of O_3 results from chemical transformations of pollutants generated outside Hamilton and southern Ontario. Pollutants generated within Hamilton contribute to ozone levels in areas downwind of Hamilton. In the figure below, the cities with higher one-hour maximum ozone concentrations (e.g., Windsor, Detroit, and Cleveland) are located near the Ontario/US border. These higher levels are consistent with sources in the Midwest of the U.S. as being significant contributors to O_3 levels in cities and areas proximate to the US-Canada border. The Ontario Ambient Air Quality Criteria (AAQC) of 80 ppb for O_3 has been unmet by the three Ontario cities compared below. Only four of the 25 cities compared were able to meet these criteria. Addressing O_3 pollution in cities remains a significant air quality challenge and will require serious collaborative efforts between Canada and the U.S.

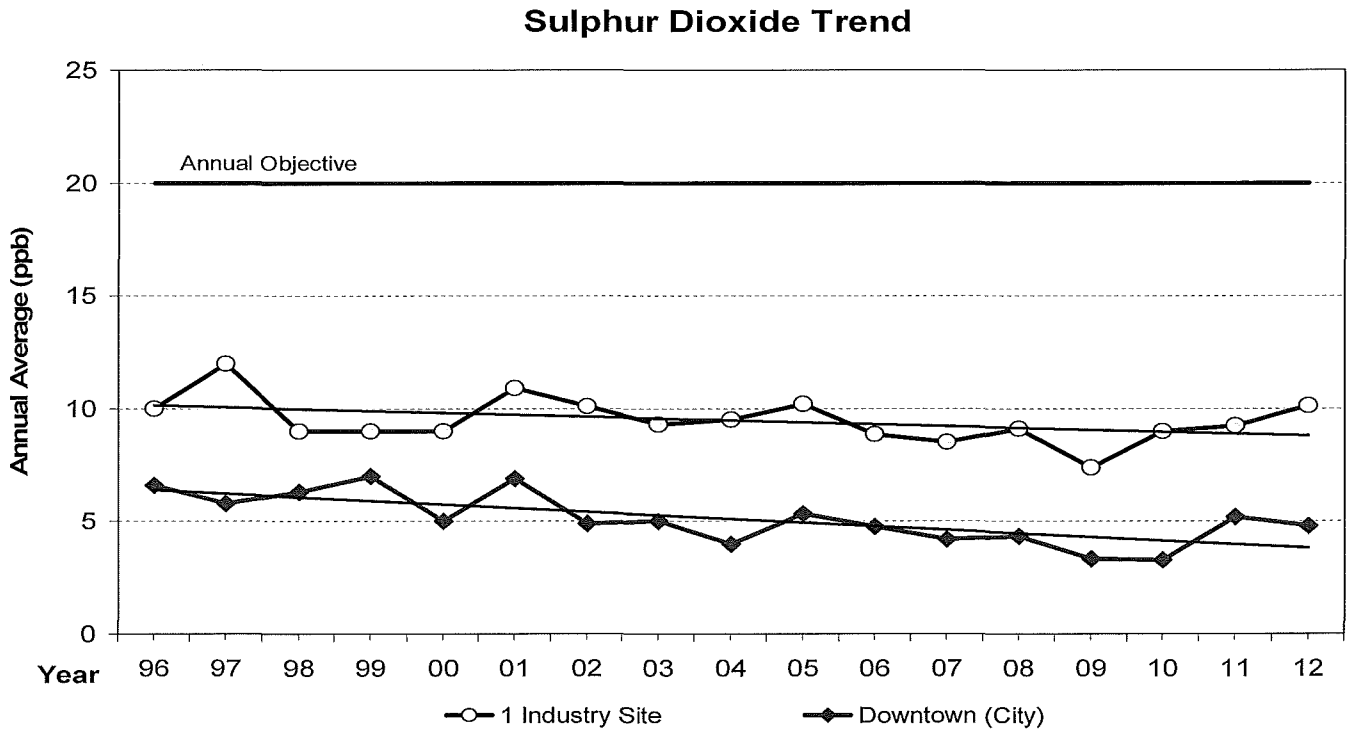
Interestingly, Vancouver, Calgary and Edmonton exceeds the Ontario AAQC guideline; however, all of the O_3 measured in Vancouver and Calgary is generated from local emissions sources, not from long-range- transport. The take-home message for southern Ontario is that about one-half of the O_3 in southern Ontario is generated from local sources, i.e., sources over which we have some control. The data used for this figure was provided by Ontario Ministry of Environment.



Sulphur Dioxide (SO_2)

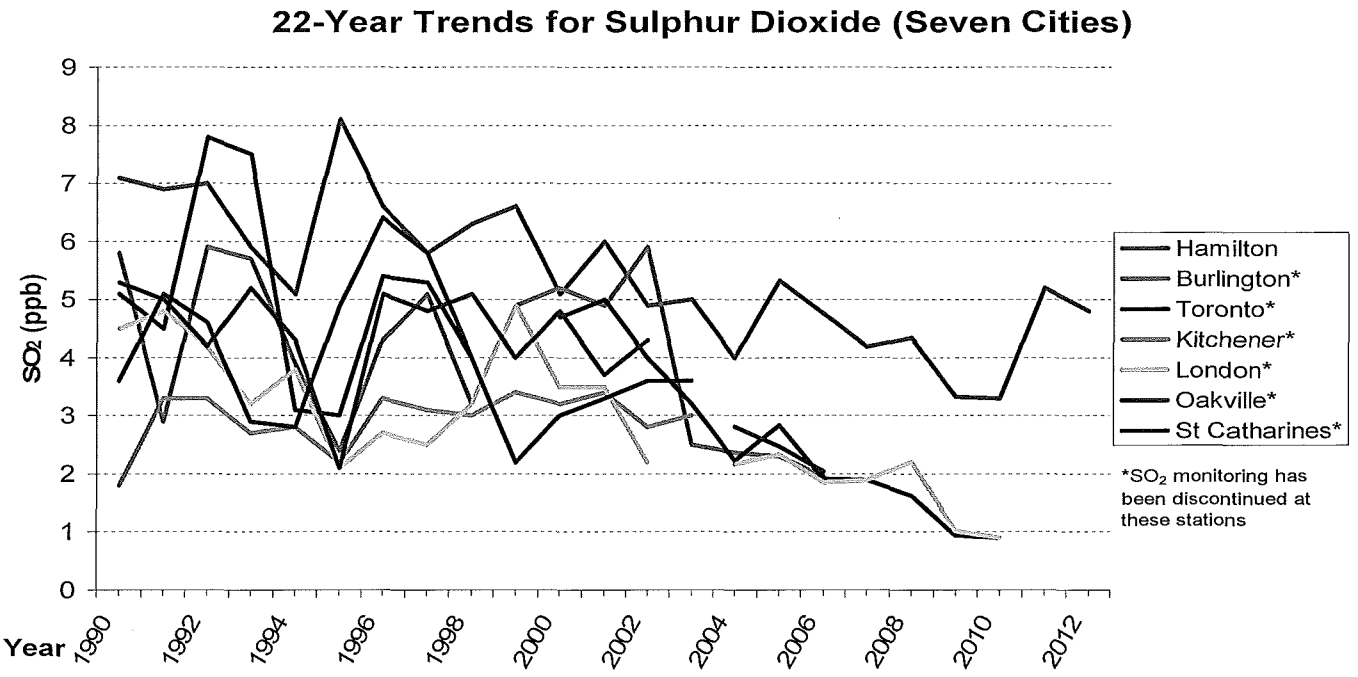
Over 90% of the sulphur dioxide (SO_2) in the air in Hamilton is the product of industrial activities within the City. The only other city in Ontario that has sulphur dioxide issues is Sudbury where nickel sulphide smelting emissions are the primary pollutant. Significant reductions in air levels of SO_2 were made in the 1970s and 1980s. Since 1998, there has been a gradual and continuous decline in air levels of SO_2. However, in the past two years, there have increases in the sulphur dioxide levels; it is not clear whether this recent increase is just a fluctuation in an overall decreasing trend or whether this is a change from past trends. Prior to the past two years SO_2 levels had decreased by about 40% in the downtown area and by about 30% in the industrial areas over a 15-year period. These reductions reflect actions taken to reduce SO_2 emissions from the steel industry. Clean Air Hamilton would like to see the levels of sulphur dioxide return to the decreasing trend observed previously. Combustion of diesel fuel and home heating oil was a major source of SO_2 in Canada until federal regulations enacted in 2007 reduced the sulphur content in diesel fuel and home heating oil to 15 parts per million (ppm) from average sulphur contents of about 350 ppm prior to 2007.

Sulphur dioxide is not only a respiratory irritant but is converted in the atmosphere over several hours to sulphuric acid (H_2SO_4), which is then converted into sulphate particles. These particles average about 2 µm in diameter and constitute part of the respirable particulate fraction ($PM_{2.5}$) in the air. These particles tend to be acidic in nature and cause lung irritation when inhaled. Thus, the health concerns associated with SO_2 exposures are linked to the gas itself as well as to the sulphate particulate derived from it. During summer months, about 25% of the mass of $PM_{2.5}$ in the air in southern Ontario is sulphate particulate. Another 25% of the $PM_{2.5}$ mass are nitrate salt particulates.

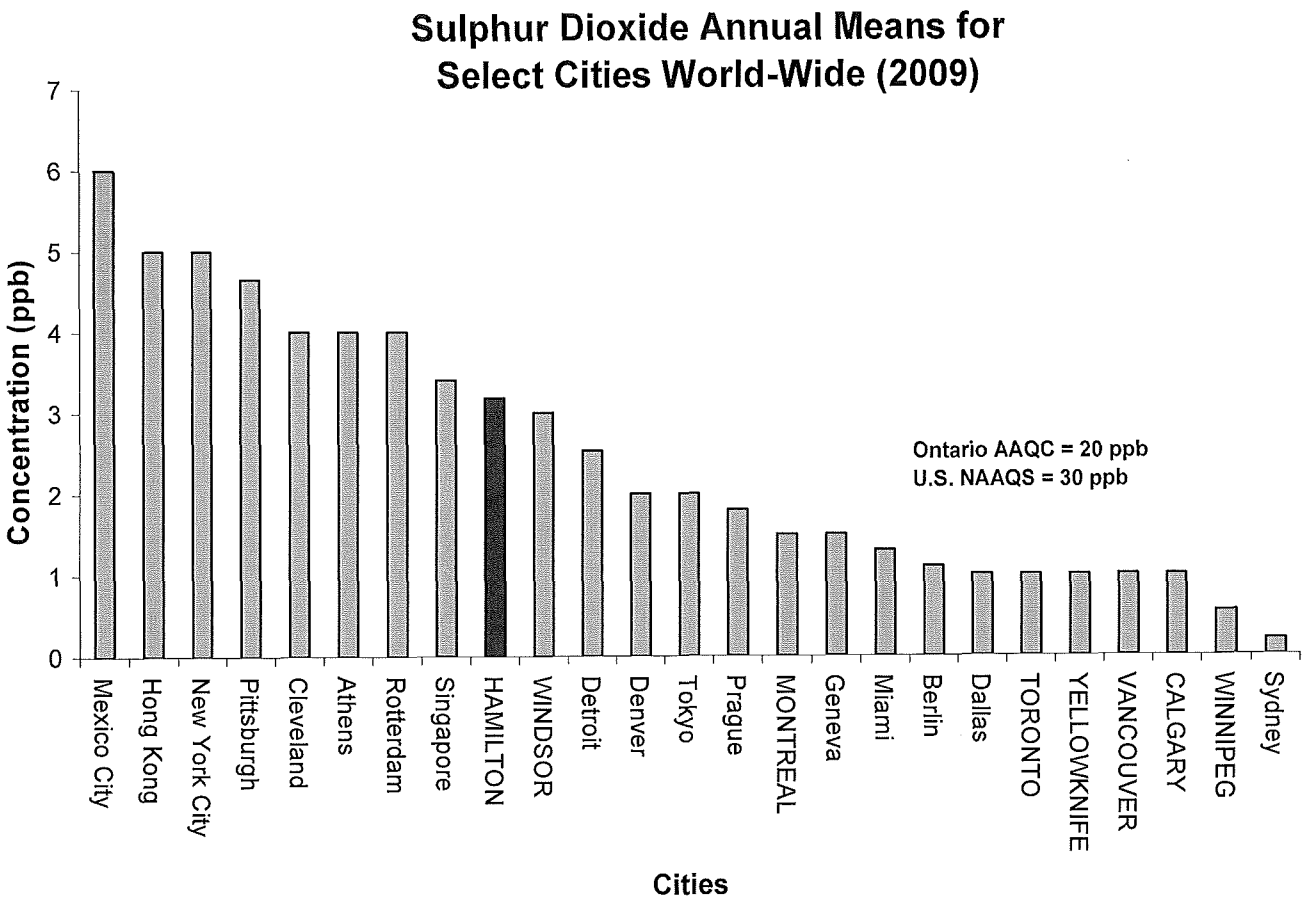


The graph below shows a comparison of the 22-year trends in SO_2 levels in seven southern Ontario cities. There have been dramatic decreases in SO_2 levels across southern Ontario over the past two decades. These reductions reflect the actions to reduce sulphur levels in diesel fuel (since 2007), the closure of local coal-fired power plants and the steady reduction of sulphur in combustion materials. The SO_2 levels in Hamilton are higher than the other southern Ontario cities due to the industrial sources that are unique to Hamilton.

When viewing the figure below, please note that some data points contain values based on a partial year. These data may not be as representative of annual SO_2 levels. Please view this figure as an approximate representation of SO_2 data from these cities.



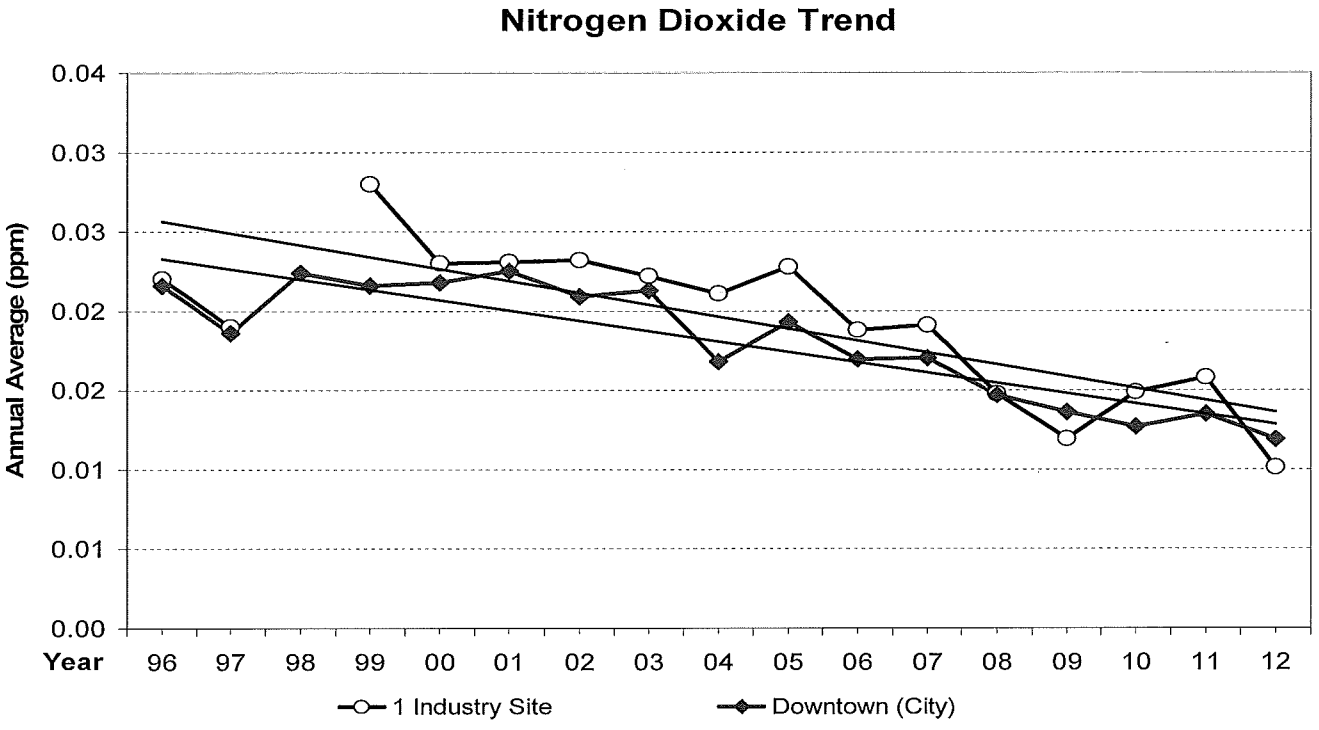
As discussed previously, Hamilton's industrial processes contributed to higher levels of SO_2 in the air. Hamilton recorded the highest annual mean reading of SO_2 in 2009 when compared to the other Canadian cities. Other cities, with a similar industrial base as Hamilton, such as Cleveland, Pittsburgh and Windsor also recorded annual means values which were higher than most of the other cities. This demonstrates the significant effect industrial emissions have on air levels of SO_2. Despite having higher air levels of SO_2 in comparison with other cities, Hamilton's continual improvement in reducing SO_2 emissions have resulted in 2009 air levels of SO_2, which are well below Ontario Ambient Air Quality Criterion of 20 parts per billion (ppb) and even further below the U.S. National Ambient Air Quality Standard of 30 ppb. All 25 cities had 2009 annual means of SO_2 that were considerably below Ontario and U.S. SO_2 ambient air standards.


Sulphur Dioxide Annual Means for
Select Cities World-Wide (2009)
Concentration (ppb)
0
1
2
3
4
5
6
7
Ontario AAQC = 20 ppb
U.S. NAAQS = 30 ppb
Mexico City
Hong Kong
New York City
Pittsburgh
Cleveland
Athens
Rotterdam
Singapore
HAMILTON
WINDSOR
Detroit
Denver
Tokyo
Prague
MONTREAL
Geneva
Miami
Berlin
Dallas
TORONTO
YELLOWKNIFE
VANCOUVER
CALGARY
WINNIPEG
Sydney
Cities

Nitrogen Dioxide (NO_2)

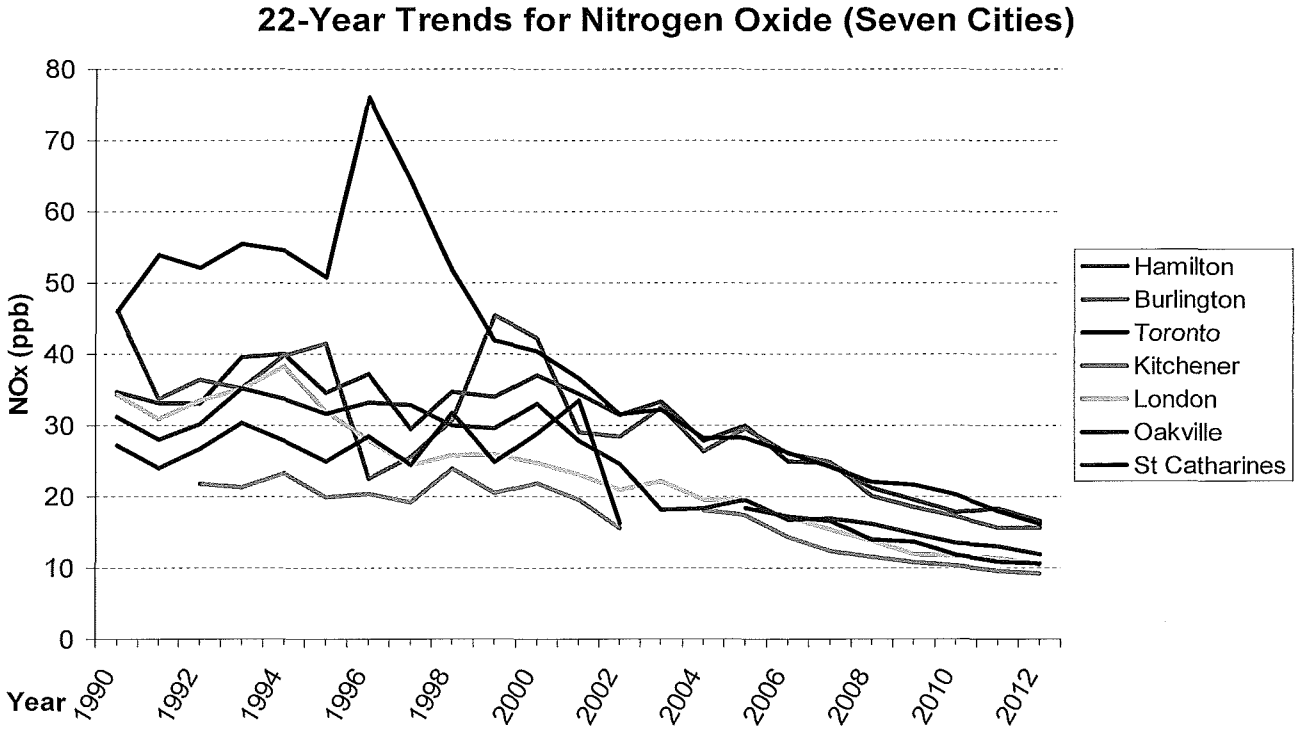
Nitrogen dioxide (NO_2) is responsible for a significant share of the air pollution-related health impacts in Hamilton. NO_2 is formed in the atmosphere from nitric oxide (NO) that is produced during the combustion of fuels such as gasoline, diesel, coal, wood, oil and natural gas. The leading sources of NO_2 in Hamilton are the transportation sector followed by the industrial sector. The level of vehicle use across Hamilton has increased slightly during the past decade, while the overall emissions of NO (and hence NO_2) from new vehicles continue to decrease due to improved engine technologies. Since NO is the precursor of NO_2, both NO and NO_2 are routinely measured and their sum is reported as NO_x to reflect the presence of both species in urban areas. All of the NO is ultimately converted into NO_2. The NO_2 ultimately reacts with water in the atmosphere to produce nitric and nitrous acids (HNO_3 and HNO_2, respectively); these acids are converted into nitrate salts that constitute about 25% of the mass of fine particulate material or $PM_{2.5}$. The fact that 25% of the $PM_{2.5}$ mass in urban centres is due to nitrate salts is a clear testament to the impacts of auto and diesel exhaust emissions on the atmosphere.

There has been a steady decline in the annual average levels of NO_2 in Hamilton over the past decade, both at the downtown site and at a site downwind of the industries. Overall, improvements in vehicle emissions performance coupled with better industrial practices have resulted in an overall improvement in NO_2 levels of about 40% over the past ten years. For example, within the City the annual average NO_2 level was 22 parts per billion (ppb) a decade ago; today the annual average is 13 ppb.

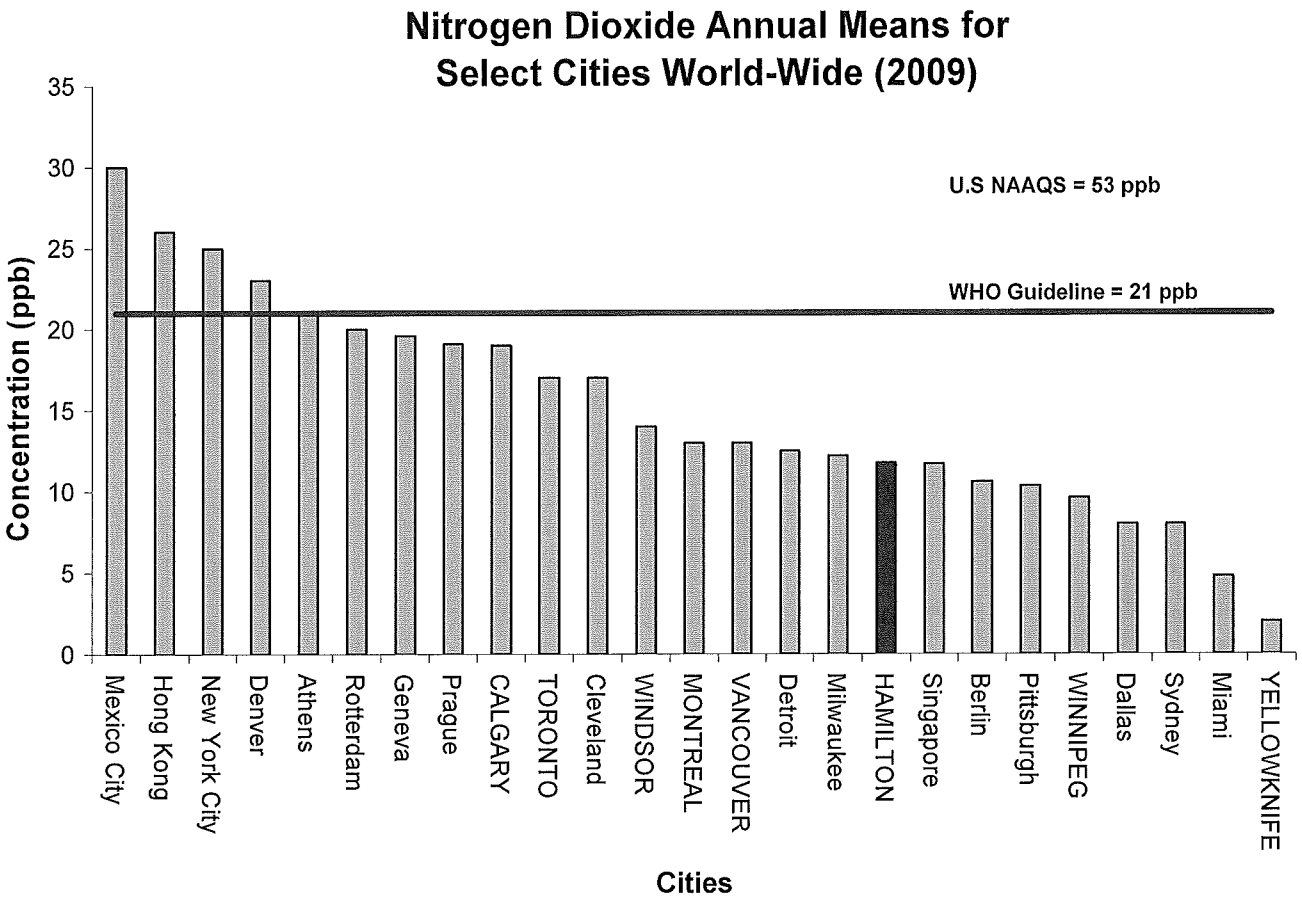


When we compare the 22-year trends in air levels of NO_x in Hamilton to NO_x levels in other Ontario cities, we note that all cities have seen a steadily decreasing trend over the past decade. Toronto, which has no significant industrial NO_x contributors but significant vehicular NO_x emissions, has shown the largest decrease. Since the 1990's both Toronto and London have seen reductions in NO_x levels of approximately 60%. Hamilton's NO_x levels have decreased by approximately 46% since 1990. The NO_x levels in Hamilton have decreased more slowly than in cities such as London and Toronto during this period, due presumably to contributions from sources other than vehicles. The NO_x level is the sum of the levels of NO and NO_2. The decrease in the average NO_x levels is a reflection of improvements in emissions performance of the vehicle fleet in Ontario over the past decade.

When viewing the figure below, please note that some data points contain values based on a partial year. This data may not be as representative of annual NO_x levels. Please view this figure as an approximate representation of NO_x data from these cities.



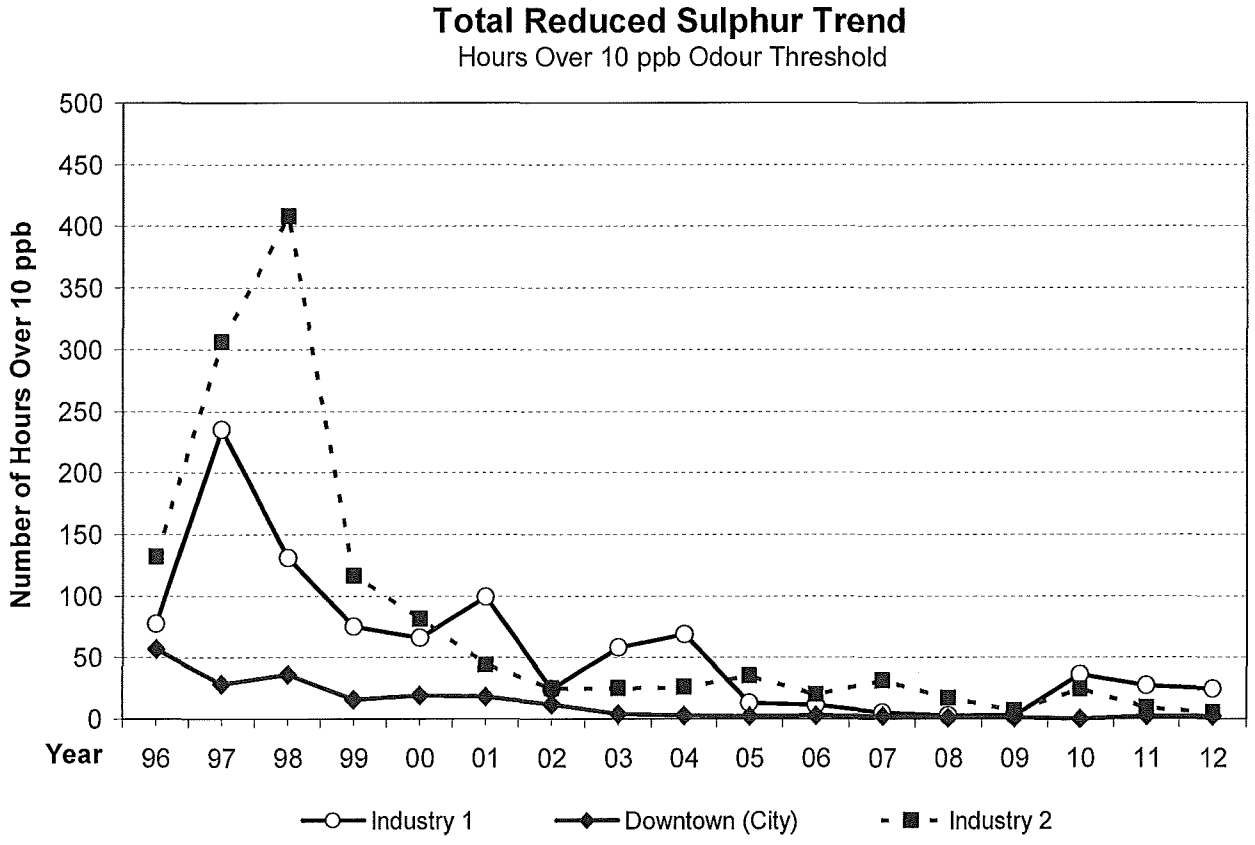
The figure below compares the annual mean levels of NO_2 levels in Hamilton with 25 Canadian and other cities around the world in 2009. Hamilton had the sixth highest NO_2 annual mean reading compared with other Canadian cities. Calgary, Toronto, Windsor, Montreal and Vancouver were the three Canadian cities with higher NO_2 annual mean values. Hamilton's annual mean levels of NO_2 remain below the World Health Organization air quality guidelines and the U.S. National Ambient Air Quality Standards. Despite being below these guidelines, Hamilton has recorded higher NO_2 annual means in comparison with cities with a similar industrial base, such as Milwaukee, Detroit and Pittsburgh.


Nitrogen Dioxide Annual Means for Select Cities World-Wide (2009)
Concentration (ppb)
35
30
25
20
15
10
5
0
U.S NAAQS = 53 ppb
WHO Guideline = 21 ppb
Mexico City
Hong Kong
New York City
Denver
Athens
Rotterdam
Geneva
Prague
CALGARY
TORONTO
Cleveland
WINDSOR
MONTREAL
VANCOUVER
Detroit
Milwaukee
HAMILTON
Singapore
Berlin
Pittsburgh
WINNIPEG
Dallas
Sydney
Miami
YELLOWKNIFE
Cities

Total Reduced Sulphur (TRS)

Total Reduced Sulphur (TRS) is a measure of the volatile, sulphur-containing compounds that are the basis of many of the odour complaints related to steel mill operations, particularly coke oven emissions, blast furnace emissions and slag quenching operations. An odour threshold has been set at 10 parts per billion (ppb) TRS because at this level about one-half of any group of people can detect an odour similar to the smell of rotten eggs. There is a wide range of sensitivities to odours within the population. A common measure of odour impact on the population is the number of hours per year that TRS levels exceed the 10 ppb (parts per billion) threshold level.

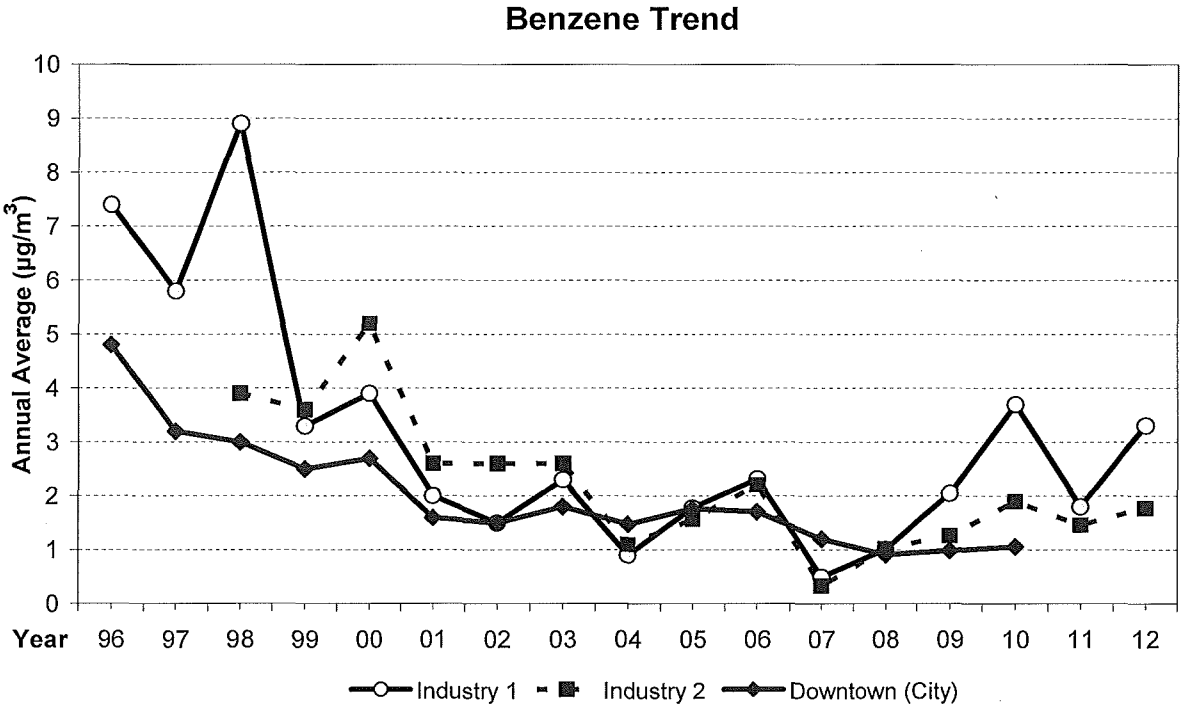
The number of hours per year during which there were exceedences of the 10 ppb odour threshold have been reduced by over 90% since the mid-1990s due to significant changes in the management and operation of the coke ovens, blast furnaces and slag quenching operations. In particular, changes to slag procedures from quenching (using water) to pelletizing (using air cooling) have had a dramatic effect on reducing odour-causing emissions from slag handling operations. Odour threshold exceedences have been below 10 hours per year in the downtown area over the past 8 years. Over the past three years at the industrial sites that is closest to the slag quenching operation the number of hours of odour exceedences has risen from less than 5 hours to 20-30 hours per year.



Benzene

Benzene is a volatile organic pollutant that is capable of producing cancers in humans, particularly leukemias. Benzene is emitted from some operations within the steel industry, specifically releases from coking ovens and from coke oven by-product plant operations. Air levels of benzene have been reduced dramatically since the late 1990s, due to significant upgrading of the coking plant operations, improved operating procedures at the coke plants, and improved control of release of benzene vapours from the coke by-products plants.

Benzene is also a significant component of gasoline; benzene concentrations in gasoline can be up to 5%. In other words, since benzene is volatile, benzene vapours can be detected in the air in areas where gasoline is pumped and distributed. Thus, all cities in Canada have low but measurable levels of benzene in the air primarily due to the pumping of gasoline; whenever a person fills a gasoline tank, the gasoline vapours in the tank (which contain benzene) are displaced out of the tank into the atmosphere, potentially exposing anyone near the filled tank. The State of California has had a system for many years on all gasoline and diesel pumps at filling stations whereby the displaced vapours from the gas tank during filling are transferred back to the in-ground tank from which the gas or diesel fuel has been pumped. The reductions in volatile organics emissions (including benzene) to the air in California due to this practice are enormous. The levels of benzene in the air at the downtown Hamilton air monitoring site have now dropped to levels comparable to those in other Canadian and Ontario cities of similar size; these other cities do not have coking operations but do have gasoline stations that produce benzene emissions.

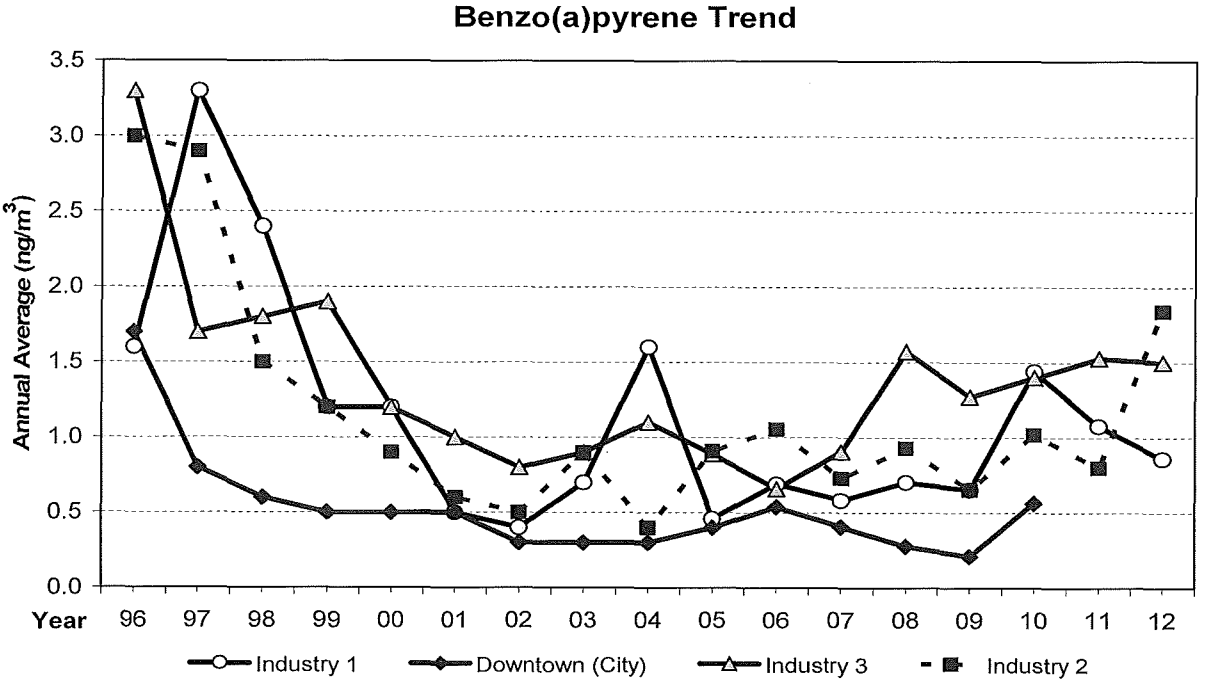


Benzo[a]pyrene

Benzo[a]pyrene (BaP) is a pollutant capable of causing cancer in animals and humans. BaP is one member of a large class of chemical compounds called polycyclic aromatic hydrocarbons (PAH). PAH are emitted when carbon-based fuels such as coke, oil, wood, coal and diesel fuel are burned. The principal sources of BaP in Hamilton are releases from coke oven operations within the steel industry. The significant decreases in ambient BaP levels since the late 1990s are the result of improvements to the infrastructure of coke ovens themselves and increased attention to the operation and maintenance procedures for proper operation of the coke ovens.

While BaP is only one of many PAH released from coking operations, BaP is the most potent single PAH in the air and the most thoroughly studied of all PAH carcinogens (cancer-causing agents) in the scientific literature. As a result of the extensive amount of chemical analysis, toxicological research and occupational exposure research done with this compound, BaP has become the primary PAH carcinogen by which exposures to many PAH-containing mixtures, such as vehicular emissions, coke oven emissions, barbecued foods, coal tar exposures, etc. are measured.

The recent increase in BaP levels at the three industrial sites relative to levels observed at the same sites in 2005 and 2006 is of some concern. In the decade prior to 2005-2006, considerable progress had been made such that BaP levels had decreased over three-fold to values that were at or below the MOE guideline for BaP of 1.1 ng/m^3. Two of the three industrial monitoring sites now exceed that guideline.



Appendix E: Provincial Policy Statement 2012 Submission

In 2012, *Clean Air Hamilton* reviewed the proposed draft policies of the Provincial Policy Statement from the Ontario government and commented on policies protecting sensitive land uses (e.g., residences and schools) from air contaminants from major facilities.

General Comments: *Clean Air Hamilton* believes this draft is very thorough and a significant improvement on the PPS 2005. The authors should be commended for their excellent work. Our comments are organized around the questions the Ministry requested responses to.

Question #1: Do the draft policies provide sufficient direction to effectively protect provincial interests in land use planning?

1: Under the policy "*Consider Specific Policy Language",* where "*shall"* is used one must address the policy whereas where "*should, promote and encourage"* are used these words are described as enabling or supportive. There are instances where identical policy is addressed with both language that is directive and language that is enabling. An example seems to exist in Policy 1.7.1 k where the word "*minimize"* is used where climate change is concerned and in the next major section on climate change, 1.8.1 uses the work "*shall".* Either there is some inconsistency here or additional explanation is required.

2a. This series of comments apply to both Questions 2 and 3. "*Major facilities and sensitive land uses* ***should*** *be planned...."* The wording begs the question when should they not be planned to prevent adverse effects from various nuisances such as air quality, minimize risks to public health and safety and ensure long-term viability of major facilities. Does this qualify the application of other policies (i.e., policy 1.3.2.1) where employment uses are concerned where significant nuisance effects need to be addressed if the employment uses are to remain viable? Additional wording is required.

For example, the Environmental Protection Act regulations provide for compliance by alternative standard setting or the development of industry or technical standards using public processes where an industrial operation cannot comply with new air quality standards. Alternative standard setting processes are not that unusual and their usage will become more common in the future. Where these compliance approvals are in place, municipal planning decisions should not be introducing sensitive land uses within the vicinity of industrial operations where alternative standards apply.

Additional attention should also be given to the science that applies to land use compatibility both from a health risk perspective and from the perspective of what is cost and technology prohibitive where source mitigation is concerned. Perhaps additional wording that would suggest when applying this policy, consideration should be given to the Environmental Protection Act compliance approvals that exist, and the costs and technology available to mitigate nuisances achieve land use compatibility where sensitive uses are proposed to be introduced in closer proximity to employment uses.

2b. Should there be additional policy that addresses approvals under the Clean Energy Act? Where commercial wind turbines have been sited, municipal planning decisions should not permit sensitive uses within the buffers established when the turbines were approved under the Environmental Protection Act regulation that address renewable energy approvals. The same provision may also be required where other forms of renewable energy projects have been approved.

3. In 3.0 Protecting Public Health and Safety, new policy 3.1.3 addresses climate change induced risks but the balance of the discussion, with the exception of the discussion on wildfires, addresses flooding risks in the manner addressed previously.

One potential effect of climate change is the storm frequencies change with more severe flooding taking place more frequently. Yet where special policy areas are addressed, no new policy is added that would handle a transition between the design flood standards and site specific policies of the past and new standards and policies that will need to be used if consistency with the consideration of climate change impacts may require. Some additional policy is needed to manage the transition.

The Niagara Peninsula Conservation Authority has begun updating their flood plain mapping to address these changes and is meeting resistance because the mapping covers larger areas that now become regulated areas. Other authorities are beginning to remap their flood plains. Some policy direction would be helpful on how this transition is to be managed.

Question #2: Are there additional land use planning matters that require provincial policy direction and which are not included?

1. With respect to the emerging agreements between the Federal and Provincial Governments on air shed and air quality management, a "*stay tuned*" policy may be required that says emerging agreements etc. will very much define how the PPS applies in practice. Provision is needed to encompass these changes as they occur as opposed to awaiting a Five-Year Review to make necessary changes.

2. There has been considerable work on the chronic disease risks associated with residential uses along 400 series highways and major arterials. Some municipalities are developing sensitive use guidelines to address these risks. Some discussion is needed.

Question #3: Do you foresee any implementation challenges with the draft policies?

1. There are significant bodies of scientific literature emerging on healthy communities and climate change where air quality and emissions are concerned. Researchers are analyzing this literature using accepted evaluation practices and introducing built environment standards to address what the science tells us. The PPS is a policy driven document. Where this science is applied to decisions, unless there is approved PPS policy in place, the weight given to it is questionable, if any weight is given at all! There needs to be a general policy in the implementation section that states that the science on healthy communities and climate change

needs to be used where appropriate when decisions are made in addition to the approved policy no matter whether policy exists or not.

There also needs to be a statement in Part 3 that states that other legislative and policy responsibilities exists that should be addressed as well as an emerging science on climate change and healthy communities that needs to be balanced with the user's reading of the Provincial Policy Statement policies.

Question #4: Is additional support material needed to help implement the Provincial Policy Statement?

1. Section 1.1.3, Settlement Areas: The emphasis on active transportation is excellent. If the intent of this emphasis is to be realized, coordination is required with the administration of the Highway Traffic Act, the transportation engineering profession and the public works department. There is an inconsistency between the policy pronouncements contained in the Provincial Growth Plan and the PPS and the various policy manuals produced to implement the Provincial Highway Traffic Act that could be addressed by a complete streets policy that had the approval of Municipal Affair and the Transportation ministries.

There are significant limits to what planners can do where active transportation is concerned if there isn't collaboration between planners, engineers and public works officials and better direction from a traffic design and management perspective between the Provincial Traffic and Planning Acts where streetscapes are concerned.

Question #5: Do you think that the legislated Provincial Policy Statement review cycle should be extended from the current 5-year period?

Many of the policy matters addresses in the PPS are changing as the science emerges and as our economy changes. Provided there is provision for focused reviews that address these changes where adjustment or additional policy is needed, the timing of a complete review cycle could be extended.

We wish to thank the Province for allowing *Clean Air Hamilton* to provide these comments on the Provincial Policy Statement (PPS) that helps shape planning in Ontario and building strong communities.

Appendix F: City of Hamilton Official Plan – Land Use Compatibility

Section 3.6.3.18 of the Urban Hamilton Official Plan (UHOP, the Urban Hamilton Official Plan is currently under appeal before the Ontario Municipal Board and not in full force and effect) addresses land use compatibility where sensitive uses are concerned. The City *shall ensure* all development or redevelopment with the potential to create conflicts between sensitive land uses and point source or fugitive air emissions such as noise, vibration, odours, dust, and other emission complies with applicable provincial legislation, provincial and municipal standards, and provincial guidelines, and *shall have regard to* municipal guidelines.

Proponents may be required to submit studies prior to or at the time of application submission, including the following: noise feasibility study; detailed noise study; air quality studies and odour, dust, and light assessments.

Section 3.6.3.19 of the Official Plan outlines examples of development or redevelopment that may create conflicts between sensitive uses and point source or fugitive air emissions such as noise, vibration, odour, dust and other emissions:

a) Development or redevelopment of sensitive land uses in the vicinity of commercial or other uses with the potential to produce point source or fugitive air emission such as noise, vibration, odour, dust and other emissions, including those with a higher number of deliveries, loading areas, and other noise generating features such as a drive-through speaker or car wash.

b) Development or redevelopment of new employment (industrial) facilities including railway yards in the vicinity of sensitive land uses;

c) Commercial or any other uses with the potential to produce point source or fugitive air emission such as noise, vibration, odour, dust and other emissions, including those with a high number of deliveries, loading areas, and other noise generating features such as a drive-through speaker, or car wash, in the vicinity of sensitive land uses; and,

d) Development or redevelopment of sensitive land uses in the vicinity of significant employment (industrial) facilities including railways yards.

The General Provisions of the Employment Area Designation within the UHOP (Section 5.2.7) state sensitive uses within Neighbourhoods, Institutional or Commercial and Mixed Use designations *shall be protected* from potential adverse impacts of heavy industrial uses within the lands designated Employment Area, and industrial uses shall be protected from sensitive land uses as follows:

a) The City shall *have regard for* provincial guidelines concerning compatibility between industrial facilities and sensitive land uses, and in mitigating the potential adverse impacts not addressed by the guidelines;

b) The proponent of either a new sensitive land use within Neighbourhoods, Institutional or Commercial and Mixed Use designations, or a new industrial facility in an Employment

Area designation, shall be responsible for addressing and implementing mitigation measures to the City's satisfaction.

c) The preferred approach to mitigation shall be the establishment of a separation distance and/or appropriate transitional and use. In some cases, noxious manufacturing uses may be prohibited in the Zoning By-law.

d) Other mitigation that may be appropriate including: screening, barriers, landscaping, mechanical or other technological mitigation, traffic mitigation, and lighting control.

The Plan recognizes existing heavy industrial uses are located in Employment Area designations in proximity to sensitive uses. The plan recognizes their historical development, their importance as major employers, and to encourage the retention of some, these industrial uses may be recognized as legal non-conforming or permitted uses in the Zoning By-law.

The UHOP also deals with air quality monitoring.

In policy 3.6.2.4, the City shall undertake an air pollutant and greenhouse gas emissions inventory and assess the conditions of Hamilton's local air quality and climate to inform actions to reduce emissions of air pollutants and greenhouse gases generated in the City. The City (Policy 3.6.2.5) may partner with other organizations to monitor, track, and assess the conditions of Hamilton's local air quality and climate to identify local emission sources and take action to reduce air pollutant and greenhouse gas emissions at these sources.

The City (3.6.2.6) shall monitor and reduce air pollutants and greenhouse gases generated by the City's corporate activities and services to achieve the targets set out in the Corporate Air Quality and Climate Change Strategic Plan. The City (3.6.2.7) shall prepare an annual Air Quality and Climate Change report to monitor the City's progress toward its goals and to increase awareness of air quality and climate change.

3.6.3 Noise, Vibration, and Other Emissions

Noise, vibration, and other emissions such as dust and odours from roads, airports, railway lines and stationary sources have the potential to negatively impact the quality of life of residents. The objective of the policies in the Official Plan is to protect residents from unacceptable levels of noise, vibration, and other emissions and to protect the operations of transportation facilities, commercial, and employment (industrial) uses.

Where conflict exists between noise sensitive land uses and provincial highways, parkways, minor or major arterial roads, collector roads, truck routes, railway lines, railway yards, airports, or other uses considered to be noise generators, all applicable provincial and municipal guidelines and standards shall apply.

Land use arrangements which minimize the impact of noise and vibration shall be considered in the formulation of plans of subdivision and condominium, official plan amendments, severances and zoning By-law amendments.

The Official Plan also sets out requirements for noise and vibration attenuation measures for both indoor and outdoor spaces.

The use of new noise and vibration abatement technologies will be encouraged as it becomes available.

Road and Railway Traffic Noise and Vibration

The Official Plan requires a noise feasibility study where residential development occurs:

a) 100 metres from a minor arterial road;

b) 400 metres from a major arterial road;

c) 400 metres from a truck route;

d) 400 metres from an existing or proposed parkway or provincial highway (controlled access);

e) 400 metres from a railway line.

Proponents of development proposals for which noise studies are submitted shall satisfy all of the decibel level requirements and conditions in accordance with provincial guidelines and to the satisfaction of the City.

Design of Mitigation Measures Adjacent to Roads

Design of noise mitigation measures adjacent to collector roads, or major or minor arterial roads shall address streetscape quality through compliance with policies laid out in the Official Plan.

Futures Roads, Provincial Highways, and Parkways

The City may require various conditions as per the Official Plan where new development precedes the construction of planned roads, provincial highways or parkways, where noise mitigation measures are anticipated.

Railway Corridors and Yards General Policies

Noise feasibility studies or detailed noise studies are required by the Official Plan where a residential or other noise sensitive land use will be located within 400 metres of a rail yard.

Also, appropriate safety measures are required (setbacks, berms, security fencing) where a proposed development will be situated adjacent to railways or railway yards.

Conditions of approval of development applications shall include appropriate warning clauses included in lease or rental agreements, agreement of purchase and sale, and within development agreements where noise or vibration studies are required as a consequence of proximity to railway lines or railway yards,

Noise, Vibration and other Emissions from Stationary Sources, Including Railway Yards

The City shall ensure that all development or redevelopment with the potential to create conflicts between sensitive land uses and point source or fugitive air emissions such as noise, vibration, odour, dust, and other emissions complies with all applicable provincial legislation, provincial and municipal standards, and provincial guidelines, and shall have regard to municipal guidelines. The City may require proponents of such proposals to submit studies prior to or at the detailed noise study; air quality study; odour, dust and light assessment; and any other information and materials identified in Section F.1.19 of the Official Plan.

Development or redevelopment with the potential to create conflicts between sensitive land uses and point source or fugitive air emission such as noise, vibration, odour, dust, and other emission may include:

a) Development or redevelopment of sensitive land uses in a vicinity of commercial or any other uses with the potential to produce point source or fugitive air emission such as noise, vibration, odour, dust and other emissions, including those with a high number of deliveries, loading areas, and other noise generating features, such as a drive-through speaker, or car wash.

b) Development or redevelopment of new employment (industrial) facilities including railway yards in the vicinity of sensitive land uses;

c) Commercial or any other uses with the potential to produce point source or fugitive air emission such as noise, vibration, odour, dust, and other emissions, including those with a high number of deliveries, loading areas, and other noise generating features such as a drive-through speaker, or car wash, in the vicinity of sensitive land uses; and,

d) Development or redevelopment of sensitive land uses in the vicinity of significant employment (industrial) facilities including railway yards.

Appendix G: Glossary of Terms

Abatement – process of putting an end to, or reducing, the amount of harmful substances released into the environment.

Acute effects - An adverse health effect that is caused suddenly, rapidly or within a short timeframe after exposure.

Air Quality Health Index (AQHI) – a national health protection tool designed to help you make decisions to protect your health by limiting short-term exposure to air pollution and adjusting activity levels during episodes of increased air pollution. The AQHI is presented on a scale from 1 to 10+ to indicate the level of health risk associated with air quality. It is calculated based on the relative health risk presented by a mixture of three air contaminants: ground-level ozone, particulate matter, and nitrogen dioxide. The AQHI provides specific advice for at-risk populations as well as for the general public as to what actions they should take based on the value of the AQHI. For more information visit: www.airhealth.ca

Air Quality Index (AQI) - an indicator of air quality, based on hourly pollutant measurements of some or all of four air pollutants: sulphur dioxide, ozone, nitrogen dioxide, and fine particulate matter. However, only the highest relative value of one these four pollutants is used to calculate the AQI by the Ministry of the Environment. For more information visit: www.airqualityontario.com or http://www.ene.gov.on.ca/environment/en/subject/air_quality/STDPROD_076121.html

Asthma – a respiratory condition in which the airway constricts when triggered; go to The Asthma Society of Canada at www.asthma.ca / Canadian Lung Association at www.lung.ca for more information.

BaP – See benzo[a]pyrene

Benzene – a volatile organic compound (VOC) found in coke oven emissions and gasoline that is capable of producing cancer in humans.

Benzo[a]pyrene (BaP) – pollutant capable of causing cancer in animals and humans; BaP is one member of a large class of chemical compounds called polycyclic aromatic hydrocarbons (or PAH). BaP and other PAH are products of incomplete combustion of carbonaceous fuels such as wood, coal, oil, gasoline, diesel fuel, etc. BaP and PAH are major constituents of coal tar and coke oven emissions.

Carbonaceous Fuels – fuels that are rich in carbon.

Cardiovascular – refers to the heart and associated blood vessels.

CarShare – a model of car rental where people rent cars for short periods of time, often by the hour. They are attractive to customers who make only occasional use of a vehicle, as well as others who would like occasional access to a vehicle of a different type than they use day-to-day. The organization renting the cars may be a commercial business or the users may be organized as a democratically-controlled public agency, cooperative, or *ad hoc* grouping.

CarPool - is the shared use of a car by the driver and one or more passengers, usually for commuting. Carpoolers use member's private cars, or a jointly hired vehicle, for private shared commuting to and from work or appointments. The vehicle is not used in a general public transport capacity such as in car shares, shared taxis or taxicabs.

Chronic Obstructive Pulmonary Disease (COPD) - a lung disease characterized by chronic obstruction of lung airflow that interferes with normal breathing. The more familiar terms 'chronic bronchitis' and 'emphysema' are no longer used, but are now included within the COPD diagnosis.

Climate Change – refers to the long term change in average weather patterns resulting from the release of substantial amounts of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, etc. into the planet's atmosphere. These emissions alter the chemical composition of the atmosphere, resulting in intensification of the earth's natural greenhouse effect.

CO_2e – stands for "carbon dioxide equivalent"; a unit of measurement used to compare the relative climate impact of the different greenhouse gases. The CO_2e quantity of any greenhouse gas is the amount of carbon dioxide that would produce the equivalent global warming potential.

CO – carbon monoxide; a toxic, colourless, odourless, and tasteless gas; produced as a by-product from the combustion of carbon-containing compounds.

Contaminant – refer to "What is a Contaminant" on page 19.

Criteria Air Contaminant (CAC) – an air pollutant such as PM_{10}, $PM_{2.5}$, SO_x, NO_x, VOC, CO, and NH_3 (Ammonia).

Enteric Diseases – are infections caused by viruses and bacteria that enter the body through the mouth or intestinal system, primarily a result of eating, drinking and digesting contaminated foods or liquids.

Environmental Registry (EBR) – an electronic filing cabinet (www.ebr.gov.on.ca) containing "public notices" about environmental matters being proposed by all government ministries covered by the Environmental Bill of Rights (i.e., new laws, regulations, programs, proposals, etc.). Each notice allows users to comment. When final decisions are made, the EBR will tell users what kind of comments were made, as well as the impact, if any, the comments had on the decision. The user will also be told whether and how they can appeal and challenge the decision.

Epidemiology - Branch of medicine that deals with the study of the causes, distribution, and control of disease in populations.

Fugitive Dusts – dusts that arise from non-point sources including road dusts, agricultural dusts, dusts that arise from materials handling, construction operations, outdoor storage piles, etc.; fugitive dusts are significant sources of fine particulate matter.

Geographic Information System – a collection of computer hardware, software, geographic data, methods, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

Global Positioning System – a navigational system involving satellites and computers that can determine the latitude and longitude of a receiver on Earth by computing the time difference for signals from different satellites to reach the receiver.

Greenhouse Gases (GHGs) – gases in the atmosphere that reduce the loss of heat into space and therefore contribute to increasing global temperatures through the greenhouse effect.

Idling – when vehicles are left running while parked; produces pollution, which contributes to problems like climate change and smog.

Micron – shortened term for micrometre; one millionth of a metre, often abbreviated as "µm".

µg/m^3 – *micrograms per cubic metre; a measure of the concentration of a chemical or substance* in the air.

Mobile monitoring – air sampling protocol used to make continuous measurements of air levels of contaminants using monitoring equipment that is moveable or mobile. Traditional air monitoring uses air monitoring equipment that is fixed in one location. Mobile monitoring allows measurements of air emissions to be performed at various locations while traveling across a City or parts of a City. The mobile monitoring unit can also be parked to make longer term measurements at one or more locations.

MOE – Ministry of the Environment; for more information visit: www.ene.gov.on.ca

Mobile sources – *vehicles (cars and trucks) that emit pollutants into the air.*

Morbidity - A measure of illnesses within a geographic area (can be a numerical count or a calculated rate).

Mortality - A measure of deaths within a geographic area (can be a numerical count or a calculated rate).

National Ambient Air Quality Standards (NAAQS) – established by the United States Environmental Protection Agency under authority of the 1970 Clean Air Act that address outdoor air; for more information visit: www.epa.gov/air/criteria.html

National Pollutant Release Inventory (NPRI) – Canada's legislated, publicly-accessible inventory of pollutants released, disposed of and sent for recycling by facilities across the country; for more information visit: www.ec.gc.ca/pdb/npri/npri_data_e.cfm.

NO_x – nitrogen oxides; nitrogen dioxide (NO_2) and nitric oxide (NO) are the two nitrogen oxides that are classified as common air contaminants. NO is released directly by vehicles and can be used as a tracer for vehicle combustion emissions. NO is readily converted into NO_2 in the atmosphere. Nitrogen dioxide (NO_2) reacts with water in the atmosphere to create nitric and nitrous acids. These acids are converted into their respective salts in the atmosphere. Nitrate salts can account for up to one-quarter of the mass of PM_{10} in Hamilton during summer months. These salts, along with sulphate salts, constitute the majority of the chemicals that come to Hamilton *via* long-range transport from the Midwest of the US.

Non-traumatic mortality - Death not causing, caused by, or associated with trauma and especially traumatic injury.

O. Reg. 419/05 – Ontario Regulation 419/05. In 2005, the Province of Ontario enacted Regulation 419/05 as the new framework for local air quality. This regulation is an 'effects-based' standard which incorporated more sophisticated dispersion modeling to determine the health and environmental impacts of a given pollutant source. The regulation replaced Regulation 346. See http://www.ecoissues.ca/index.php/Ontario_Regulation_419/05_%28Air_Pollution_%E2%80%93_Local_Air_Quality%29 for more details.

O_3 – Ground-level ozone; component of smog; severe lung irritant; generated when combustion emissions such as nitrogen oxides and volatile organic compounds react in the presence of sunlight, *via* a complex set of chemical reactions.

PM_{10} – inhalable particulate; airborne particles that have mean aerodynamic diameters of 10 µm (micrometers) or less; has been clearly and consistently linked to respiratory and cardiovascular health impacts in humans.

$PM_{2.5}$ – respirable particulate; airborne particles with mean aerodynamic diameters of 2.5 µm (micrometers) or less; has been more strongly linked to health impacts than PM_{10}.

PM_1 – very small particulate; airborne particles with mean aerodynamic diameters of 1 µm or less.

$PM_{0.1}$ – ultra-fine particulate; airborne particles with mean aerodynamic diameters of 0.1 µm or less. $PM_{0.1}$ is currently being studied for its links to health impacts.

Point of Impingement – A defined point or points on the ground or on a receptor, such as nearby buildings, set at a defined distance from a facility, located outside a company's property boundaries, at which a specific limit for air pollutants must be met. This term is used in conjunction with Ontario Regulation 419/05.

Polycyclic Aromatic Hydrocarbons (PAH) – chemical compounds emitted when carbon-based fuels such as coke, oil, wood, coal and diesel fuel are burned. Some PAH are known to be carcinogens. PAH are also major constituents of coal tar and coke oven emissions.

ppb – parts per billion; one part per billion is one weight unit of chemical in one billion (10^9) weight units of water, soil, etc. For example, if you added 10 drops of vodka (40% ethanol) to the water in an average backyard swimming pool (16 feet by 32 feet containing 80,000 litres of water), the concentration of ethanol in the pool when fully dispersed in the pool would be approximately 1 part per billion.

ppm – parts per million; one part per million is one weight unit of chemical in one million (10^6) weight units of water, soil, etc. This is equivalent to one drop added to 50 liters (roughly the fuel tank capacity of a compact car).

Prevailing Winds – trends in speed and direction of wind over a particular point on the earth's surface; upwind is the direction the wind is coming from; downwind is the direction that the wind is blowing toward.

Smog – the brownish-yellow haze that typically hovers over urban areas during the summer. Its two main contaminants are ground level ozone (O_3) and small airborne particles; the word comes from a combination of the words 'smoke' and 'fog'. Smog events can occur during any season of the year particularly due to inversion events.

Smog Advisory – see 'What is a Smog Advisory?' on page 25.

Stratospheric Ozone – also known as the ozone layer; see the Ground Level Ozone analysis of Appendix D on page 104.

SO_2 – sulphur dioxide; a respiratory irritant principally emitted by industrial processes that combust sulphur or sulphur-containing compounds.

Temperature Inversion – state in which cooler, denser air underlies warmer, lighter air and is thus prevented by gravity from vertical mixing and dispersion. Such a condition acts to trap air pollutants near the ground. Temperature inversions are inherently unstable and tend to last only for short periods such a two to twelve hours and rarely longer than a day.

Total Reduced Sulphur (TRS) – a measure of the sulphur-containing compounds that are the basis of many of the odour complaints related to steel mill operations, particularly coke oven emissions, blast furnace emissions and slag quenching operations. At 10 parts per billion (ppb), most people can detect an odour similar to the smell of rotten eggs.

Total Suspended Particulate (TSP) – includes all particulate material with aerodynamic diameters less than about 45 micrometers (45 µm).

Transboundary Air Pollution – originating from sources in the mid-western United States, pollutants are brought to Ontario by prevailing winds.

Transportation Demand Management (TDM) – a wide range of policies, programs, services and products that influence how, why, when and where people travel to make travel behaviours more sustainable. See Section 6.2.1

VOCs – volatile organic compounds; organic chemical compounds, some of which may have long or short-term health effects. Sources of VOCs include solvents in enamel paints, solvents, the contents of spray cans, gasoline, etc.; major natural sources of VOCs are plants and trees.

World Health Organization (WHO) – a United Nations agency to coordinate international health activities and to help governments improve health services. For more information visit: www.who.int/en/

REFERENCES

Abelsohn, A., Stieb, D.M. (2011). Health effects of outdoor air pollution. Canadian Family Physician, 57,881-887.

Air Quality Ontario. (2010). Frequently asked questions. Retrieved from www.airqualityontario.com/press/faq.cfm

Canadian Medical Association. (2008). No breathing room; National illness costs of air pollution (NICAP) summary report. Retrieved from www.cma.ca/index.php/ci_id/86830/la_id/1.htm

Center for Science in the Earth System & ICLEI. (2007). Preparing for climate change: A guidebook for local, regional, and state governments. Retrieved from cses.washington.edu/db/pdf/snoveretalgb574.pdf

Chiotti, Q. (2003). *Pollution Probe* (presentation to GTA Clean Air Forum) [PowerPoint Slides]. Retrieved from York University.

City of Hamilton Public Health Services. (2010, April). Risk Communication: City of Hamilton Public Health Services Implementation of the Air Quality Health Index (AQHI). City of Hamilton Public Health Services.

City of Hamilton Public Health Services. (2011). City of Hamilton Air Quality Health Index (AQHI) Special Events Outreach Report 2011. City of Hamilton Public Health Services.

Environment Canada (2010). AQHI website. Retrieved from www.ec.gc.ca/cas-aqhi/default.asp?lang=En&n=065BE995-1

Federation of Canadian Municipalities. (2009). Act locally: The municipal role in fighting climate change. Retrieved from www.fcm.ca/CMFiles/FCM_Climate_En_Final1RSG-1272009-2598.pdf

Health Canada (2008). Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. Retrieved from http://hc-sc.gc.ca/ewh-semt/climat/eval/index-eng.php

Hill, S. Risk Communication Literature Review: Summary Report. 2005.

OECD Guidance Document on Risk Communication for Chemical Risk Management. July 2002.

Ontario Medical Association (OMA). (2005). The illness costs of air pollution (ICAP): 2005-2026 health and economic damage estimates. Retrieved from www.oma.org/health/smog/report/ICAP2005_Report.pdf

Ontario Medical Association (OMA). (2008). Ontario's doctors: Thousands of premature deaths due to smog. Retrieved from http://www.oma.org/media/news/pr080606a.asp

SENES Consulting Ltd. (2011). Health Impacts Exposure to Outdoor Air Pollution in Hamilton, Ontario . Retrieved from www.cleanair.hamilton.ca/downloads/2011%20Clean%20Air%20Hamilton%20-%20Health%20Impacts%20FINAL%20.pdf

CleanAir
HAMILTON

***Clean Air Hamilton*, June 2013**

Production: Public Health Services
City of Hamilton

For further information, please contact:

Brian Montgomery
Air Quality Coordinator
Public Health Services
City of Hamilton
1 Hughson Street North, 3rd Flr
Hamilton, Ontario
L8R 3L5
Phone: 905-546-2424 Ext. 1275
E-mail: cleanair@hamilton.ca

Or visit us on our website:

www.cleanair.hamilton.ca