



Clean Air Hamilton
2014 Air Quality Progress Report
June 2015



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This report and the work of our members is dedicated to the memory of
Dr. Brian McCarry (1946—2013)
Chair of Clean Air Hamilton from 1997—2013

Message from the Chair

I am very pleased to provide the Clean Air Hamilton 2014 report which provides a snapshot of air quality **trends and what we're doing about improving air quality** here in Hamilton.

Clean Air Hamilton (CAH) brings together stakeholders from many different parts of our Hamilton community as well as our federal and provincial partners, all working to make our air cleaner. CAH is the successor to, and outcome of, the Hamilton Air Quality Initiative (HAQI) which was recognized with a United Nations Habitat/Dubai Award for Best Practice Worldwide to Improve City Air Quality.

There have been dramatic improvements in air quality in Hamilton over the years. Our air quality is now about 90% better than it was in the 1970s. This is an amazing achievement. If we even just look at the last 10 years we are seeing about a 50% improvement over this time .

That's the good news. The not so good news is that, as our air quality has gotten better, we have learned more about the health impacts of poor air quality. Too many Canadian citizens die from the impacts of air pollution each year, which can also lead to increased hospital admissions, emergency room **use, doctors' visits, etc.** While these health impacts are experienced in all Canadian cities, it can be particularly challenging in Hamilton with our large industrial presence, unique geography and proximity to major transportation corridors. While we have made great strides, we need to keep improving. We are not yet where we need to be.

To meet these challenges, our strategy has evolved. We began with direct control of point and mobile sources and these are still priorities. However, our pioneering monitoring efforts have shown that there are significant local variations in air quality, as in other cities. We need to inform our citizens of these so they can take their own actions to reduce their exposures.

Our City Council, through the Board of Health, has taken this challenge seriously. It directed Clean Air Hamilton to form an Air Quality Task Force to recommend practical measures to further reduce

the impacts of air pollution in our City. The award winning Task Force Action Plan can be found on our website <http://www.cleanair.hamilton.ca> . You will find more details in this report, including the development of a city wide air quality model, the biannual Upwind Downwind Conference, innovative air quality monitoring and mapping, outreach/ education initiatives and other actions.

The City of Hamilton currently provides an annual contribution of \$56,000/year in support of Clean Air Hamilton and its activities. Descriptions of some of the programs supported by Clean Air Hamilton can be found on pages 9 - 11 in this report.

This annual funding 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 donate their time and expertise, there is a significant amount of in-kind support provided. **It is estimated that Clean Air Hamilton's partners** provide well over \$200,000 in in-kind support annually.

As always, these reports are the work of many talented people but I have to extend particular thanks to Karen Logan whose patience and skill have been outstanding in the assembly of this report in our new format.

We hope you enjoy reading our report and find worthwhile ideas to benefit your own community.

Thank you



Denis J. Corr, Ph.D.
Chair, Clean Air Hamilton

Strategic Activities

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

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.

Air Monitoring:

Monitor local air quality, sources and health conditions to identify sources and track progress. Introduce an airshed approach to Hamilton to model sources and emissions in the local airshed.

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 emissions and climate change impacts in Hamilton.

Communication:

Continue to communicate on the impacts and sources of poor air quality and climate change, encourage behavioural changes, and increase support for the work of Clean Air Hamilton.

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.

Emission Reductions Strategies:

Identify and reduce sources of local fugitive dust. Encourage actions to reduce emissions from small, medium and large-scale sources in Hamilton.

Land Use Planning:

Encourage actions by the City through land use policies to promote reductions of emissions and improvements in air quality and climate change through better planning tools.

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.

Risk Communication:

Aid citizens in understanding the health risk implications of poor air quality.

Smart Drivers:

Reduce unnecessary idling of vehicles, reduce impacts of vehicle emissions, and reduce emissions from driving.



City and Industry partnering on a CAH Recommendation: Building an Airshed Model for Hamilton



In late 2012, the City of Hamilton's Board of Health asked Clean Air Hamilton to establish a working group to investigate and recommend actions the City could take to reduce air pollution in Hamilton. Clean Air Hamilton's Air Quality Task Force (AQTF) met throughout 2013 to evaluate the issues and develop recommendations. In late 2013, the AQTF submitted its report to the Board of Health that included an Action Plan of ten recommendations related to air modeling and monitoring, planning, education and outreach, green infrastructure, and updating of municipal by-laws aimed at decreasing particulate matter in the environment.

The AQTF's report can be found at <http://www.cleanair.hamilton.ca/default.asp?id=72>.

Air quality in Hamilton is influenced by long-range (trans-boundary) and local (energy use, industry, transportation) sources, all impacted by geographic, meteorological and atmospheric conditions. Taking this complexity into account, the AQTF recognized the important role of air modeling as a necessary tool to guide future actions. **The AQTF's first recommendation was for the City to "commit to partnerships with interested stakeholders to fund the development of an advanced airshed model for the City of Hamilton".**

That's exactly what has happened.

As 2014 came to a close, the Hamilton Industrial Environmental Association (HIEA), a member of Clean Air Hamilton, retained Golder & Associates to

build a model of the Hamilton airshed. The City of Hamilton is co-funding the 16-month project, the focus of which will be to determine the contribution and nature of various local and background (e.g., trans-boundary) sources on ambient air concentrations in Hamilton, and to accurately predict the air pollution level at any point in the region. The model will allow:

- characterization of air quality across the Hamilton area;
- determination of the contribution from different emission source sectors to air quality;
- development and prioritization of more effective air quality improvement actions;
- establishment of a tool to assess the impacts of population growth and land use and transportation policies on local air quality; and
- better informed urban planning.

Golder has significant experience in this regard, having developed comparable airshed models for the City of Toronto, Halton Region, and Greater Vancouver Regional District. These studies have all been successful in furthering an understanding of the transport and impact of local, regional, and trans-boundary emissions.

Throughout the project, Golder will report regularly to an Advisory Committee comprised of representatives from local industry, City of Hamilton Public Health Services, Clean Air Hamilton, Ministry of the Environment and Climate Change, and Environment Hamilton.

Hamilton Air Quality & Air Pollution Health Impacts

While the correlation between exposure to air pollution and illnesses and mortality related to these exposures is well established (OMA, 2014), 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 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 updated two health studies undertaken by Clean Air Hamilton and reported in 1997 and in 2003.

The 2011 report provides the most up to date information about the health impacts associated with poor air quality in our City and looked at 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). There is an interest in identifying the potential health improvements that result from decreases in air pollution and improvements in air quality.

The 2011 Air Quality Health Assessment Study prepared by SENES Consulting Inc. estimated that the six key air pollutants - nitrogen dioxide

(NO₂), ground-level ozone (O₃), inhalable particulate matter (PM₁₀), respirable particulate matter (PM_{2.5}), sulphur dioxide (SO₂), and carbon monoxide (CO) - contribute to an estimated 186 premature deaths, 395 respiratory hospital admissions and 322 cardiovascular hospital admissions each year in Hamilton.

All of these air pollutants contribute to adverse health effects; however, some health outcomes are linked to exposures to specific air contaminants. For example, the main air pollutants contributing to respiratory hospital admissions are ground-level ozone, sulphur dioxide and nitrogen oxides. On the other hand, particulate matter (both PM₁₀ and PM_{2.5}) and carbon monoxide (CO) were major contributors to cardiovascular hospital admissions.

Overall, with the average measured air quality for the Hamilton region improving, the estimated respiratory hospital admission rates have remained unchanged since the 2003 study; however, the estimated cardiovascular hospital admission rates have decreased significantly since 2003 and deaths due to air pollution decreased from 229 in 2003 to 186 in 2012³.

¹ Ontario Medical Association of Health (2014), Retrieved from <https://www.oma.org/HealthPromotion/Pages/Smog.aspx>

² 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

³Not corrected for a 10% population increase since 2003.

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

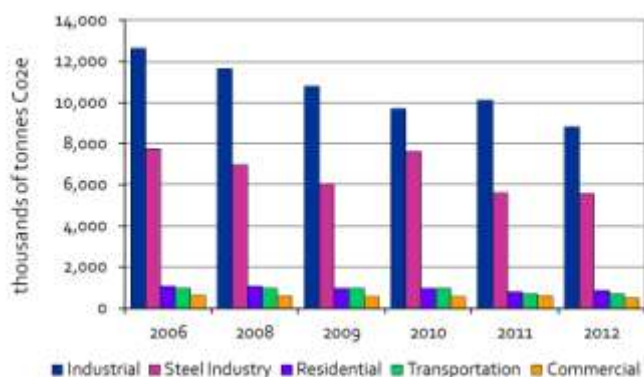
Climate Change

Climate Change refers to the long-term change in average weather patterns identified by changes in temperature, precipitation, wind and other indicators. Climate Change results from the release of substantial amounts of greenhouse gases (GHGs), such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) into the atmosphere; these levels are over and above the natural levels of these substances.

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. The climate is changing – both globally and locally – due to the greenhouse gases that are already in the atmosphere. Even as we work to reduce the GHGs emitted, current GHGs will still persist in the environment and continue to influence climate change and the weather.

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

Hamilton's main GHG sources are: industrial energy consumption, steel production, residential energy consumption, transportation, and commercial energy consumption, while the main sources for Ontario are: transportation, industry, buildings, electricity, agriculture and waste.



In Hamilton these emissions have been declining since 2006 as shown in the chart.

In 2012 GHG emissions were - 29% lower than in 2006 enabling Hamilton to achieve the community GHG emissions target of -20% by 2020. In 2013, a new community emissions target of 80% of 2006 levels by 2050 was established.

To address local sources of GHGs and to prepare the community for the impacts of climate change, the community was engaged in the development of a Community Climate Change Plan and actions to address climate change began early in 2014.

The "Let's Talk About the Weather" campaign of community engagement began in July 2014 and has involved over 200 conversations across Hamilton at 35 locations including coffee shops, branches of the **Hamilton Public Library, local farmer's markets, McMaster University, Mohawk College** and local events including the **Ancaster Agricultural Fair, the Rockton World's Fair, Saturday's at the Creek and James Street North Art Crawl**; 4 workshops with over 150 attendees; and a Twitter page <https://twitter.com/ClimateConvo> to inform the community of activities that has over 250 followers to date.

Community feedback through the climate conversation has shown concerns around flooding, drastic or unpredictable weather patterns, and increased pollution. Hamilton citizens wish to see increased education and awareness, more renewable resources usage and reducing emissions, better infrastructure and reduction of sprawl, and more political intervention to address climate change.

In the development of the Plan, eight themes were established through community feedback and eight task forces involving over 65 representatives from the community were established to develop actions. The eight themes are: agriculture and food, infrastructure, awareness and education, land use, buildings and build form, transportation/mobility, energy, local economy & business, and water & natural heritage.

The community climate change plan will be completed in Fall 2015, if you wish to know more or get involved in local climate actions visit <http://climatechangehamilton.ca/>

Monitoring Hamilton's Air Quality

There are three fixed air monitoring networks in Hamilton.

The Ontario Ministry of the Environment and Climate Change operates a network of three continuous air monitoring stations at the downtown, west end and mountain locations in Hamilton. These stations provide the data for hourly Air Quality Index (AQI)/Air Quality Health Index (AQHI) values as well as determining long term trends in air pollution in the City. A number of special surveys are also carried out by MOECC.



Public Health Services has purchased and operates two moveable stations (Airpointers) which are used to examine different areas in the City where there are air quality concerns.

Hamilton has also pioneered the use of mobile

monitoring to examine neighbourhood variations in air pollution levels. MOECC's emergency monitoring van is being used in partnership with other stakeholders to find local sources of air pollution and inform residents as to the actions they can take to reduce their personal exposures.



The Hamilton Air Monitoring Network (HAMN), a cooperative industry group comprised of 18 local companies (see listing), operates 17 stations (continuous and non-continuous) primarily in the east end industrial core. HAMN members are committed to the assessment of air quality in Hamilton.

2015 HAMN Member Companies

ArcelorMittal Dofasco Inc.	Harsco Metals Canada
ArcelorMittal Hamilton East	Lafarge Canada (2 sites) –
Bartek Ingredients	Jones Road & Hamilton Slag
Baycoat Ltd.	Newalta
Biox Canada Ltd.	Ruetgers Canada Inc.
Birla Carbon	Shell Canada Ltd.
Bunge Canada	Triple M Metal LP
City of Hamilton* (participant)	U. S. Steel Canada
Federal Marine Terminals	Westway Terminals Canada

On-going operating costs and expenses related to the upgrading of air monitoring equipment and instruments owned and operated by HAMN are borne by the member companies of the network. The network provides air quality reports to the Ministry of the Environment and Climate Change (MOECC) on a regular basis and to Clean Air Hamilton. All air quality data and reports are audited by the MOECC to ensure consistent and high quality data. The MOECC also conducts regular audits of the equipment at the HAMN sampling sites.

Since June 2009, the real-time air monitoring data collected by HAMN has been made available to the public and can be accessed through the network website (www.HAMNair.ca). This website was developed as a partnership between Clean Air Hamilton, HAMN, the City and the MOECC.

To check our air pollution levels in Hamilton and Ministry run air monitors visit:

<http://www.airqualityontario.com/>



Air monitors in the Hamilton Air Monitoring Network

A Message from the Ministry of the Environment and Climate Change...

Improving air quality and fighting air pollution is a top priority for the ministry. We are committed to working closely with the community to make sure industry improves its environmental performance and reduces air emissions in Hamilton.

Last year, our environmental officers conducted over 300 inspections of local industry to ensure compliance with our requirements. This work has also resulted in industry making significant investments to replace aging infrastructure, increased maintenance to proactively identify issues and prevent emissions and spills and extensive monitoring and reporting to reduce opacity incidents.

New standards for suspended particulate matter for the coke ovens at Hamilton's iron and steel facilities

were introduced. This move sees us adapting the **United States' coke oven monitoring protocols** to reduce emissions of benzene and benzo(a)pyrene and to ensure consistent air pollution control measures across facilities.

The ministry estimates up to a 30 percent reduction in suspended particulate matter and benzene and benzo[a]pyrene air emissions from these facilities within the first couple of years and up to a 40 percent reduction by 2020.

The ministry looks forward to continuing to work alongside Clean Air Hamilton to further improve air quality in Hamilton and make sure industry is investing in measures to reduce and control air emissions.

Clean Air Hamilton (CAH) - 2014 Funded Projects

Clean Air Hamilton's outreach includes a website (www.cleanair.hamilton.ca) which receives over 1,500 hits a week. Inquiries about CAH's activities are received regularly from organizations and individuals in Ontario, Canada, the U.S. and from around the world. In 2014 our Facebook Page had 54 followers, 40 visits and 26 posts.

CAH also partners with Green Venture in face-to-face community outreach efforts and in 2014 was present with a table at 4 events - Upwind Downwind 2014 (February 2014), Mohawk Sustainability Fair

(February 2014), Doors Open Hamilton (May 2014), and the GALA/Sherman BBQ (August 2014) where 450 people came to the table to learn about air quality in Hamilton and the work and research that CAH undertakes.

CAH is frequently asked to do presentations to local organizations and associations and approached by local media on enquires involving local air quality. Funding selected community projects is also how CAH provides outreach support.

Hamilton Air Quality Health Index Mapping Project

Air quality health indices (AQHI) are commonly used to describe real-time risk for the mixture of air pollutants existing in Canadian cities.



People use these AQHI values to make informed decisions about air quality risk and take appropriate actions. However the current system only gives one AQHI value for the entire city, while our mobile monitoring measurements in Hamilton have shown big differences in air pollution levels between neighbourhoods, roads and highways.

In order to give a better, more localized estimate of air pollution risk to assist our citizens, it was decided to produce a real-time, web based air pollution and AQHI map for Hamilton.

Two different types of air monitoring are used in order to generate real time (hourly), yet geographically detailed, internet maps of air quality in Hamilton. The maps are based on both mobile and fixed station monitoring and are available online at www.hamiltonaqhi.com. Functionality on the maps include:

- variation of pollutants across Hamilton
- hourly updates
- zoom in and out
- postal code locate
- AQHI/pollutant explanations

- mobile friendly - easily view the map on PC, Mac, tablet or mobile device
- resource links, including Clean Air Hamilton, Environment Canada, Air Quality Ontario.

Background

Fixed station monitoring of air pollution is ongoing at three MOECC stations in Hamilton (plus Burlington and Chatham), and these data are used to drive the current maps. Meanwhile a mobile monitoring dataset from 2005 to 2013 covering areas with diverse land uses, together with historical MOECC data, was used to develop the models and maps.

Current System

In the current version, Hamilton was separated into zones (polygons) based on the major factors that drive air pollution variation in space, which included transportation, land use and meteorology.

In Hamilton, there are major transportation corridors surrounding the city, i.e., the QEW, 403, the Lincoln Alexander Parkway, and the Red Hill Expressway. Hamilton has an industrial core, a high-density downtown and suburban development surrounding the downtown. All of this information was incorporated when defining the zones.

The current system models and shows on the web map SO₂, NO, NO₂, NO_x, PM_{2.5}, Increased Percent Mortality Risk, and the AQHI. For more information on AQHI check their website (www.airhealth.ca).

Fresh Air For Kids



The Fresh Air Kids program helps students to see themselves as young scientists and empowered citizens within their community. They are challenged to think critically about their right to clean air and the significant role they can play by

taking action. In the classroom, students learned about the Air Quality Health Index and teamed up to play a trivia game that reflected the information in the presentation. They also used a colour coded map to pinpoint where they live and the cleanest air route to school. Outside, the students collected real-time data on the levels of PM 2.5 and PM 10 around their schools and around their neighbourhood.

Corr Research and Green Venture partnered with four Hamilton elementary schools to provide six classes a series of hands-on educational workshops that included activities inside and outside the classroom. Students were educated on the importance of air quality, gained an awareness of how their actions can impact and improve the air in their neighbourhoods. Partner schools included Queen Victoria Elementary School (grade 5 students), Cathy Wever Elementary School (2 classes of grade 3 and 4 students) Wilfred Laurier Elementary School (2 classes of grade 5 students) Lake Avenue Elementary School (grade 2 students).

Upwind Downwind Conference 2014



The 2014 Upwind Downwind Conference was held in Hamilton on February 24th at the Sheraton Hotel. The Conference is further evidence of the leading role that Hamilton has taken in air, transboundary and climate initiatives, with elements focusing on health,

transportation and the built form. The Conference is hosted every two years by the City of Hamilton and Clean Air Hamilton. The Conference generates many ideas and is an excellent opportunity for communities to share practical solutions for air quality, transboundary and climate problems in the

fields of health, planning, municipal action and partnerships. Approximately 166 health promoters, planners, university/college students, environmental consultants, industry, municipal, provincial and federal staff, retirees and citizens participated in the one-day 2014 Conference. This resulted in a nice balance and mixture between the ages and experiences of the participants at the conference from young professionals and students to retirees and senior professionals.

The conference also included a free afternoon talk by Yale University professor and author Dr. Stephen Kellert at the Art Gallery of Hamilton. Almost 140 people heard Dr. Kellert discuss the concept of "biophilia"- the inherent need to connect to and benefit from nature.

More projects on page 12

Clean Air Hamilton - 2014 Funded Projects continued...

Totally Transit

Totally Transit Kids



The Totally Transit for Kids program introduces elementary students to the HSR and provides the information and tools required to build their confidence and influence their transportation choices. Between 2007 and 2014, Totally Transit lessons reached over 4,400 elementary school students while another 4,200 students participated in scaled-down Totally Transit presentations held at

various school environmental fairs. The Totally Transit program has reached over 8,600 students in total. In addition to introducing potential riders to the HSR, the Totally Transit program provides awareness of the positive environmental, health and community benefits that can be achieved through their use of active and sustainable transportation.

In 2014, 252 students, representing 19 classes from 5 schools, participated in the Totally Transit for Kids program, which includes a chartered HSR ride to EcoHouse and a tour. Green Venture also delivered Totally Transit presentations to 1529 mostly Grade 5 students.



Totally Transit for Older Adults



In 2014, 103 adults participated in the Totally Transit for Older Adults program. Funding was leveraged to include additional funds from the Edith Turner foundation, which meant that an additional 84 older adults participated in eight workshops and 19 participants took guided bus rides. Additionally,

over 100 impressions were garnered from community events outreach.

Workshops were designed to equip older adults with the knowledge and skills required to confidently navigate public transit. Each workshop was broken into two sections. The first was 45 minute in length and included topics such as local bus routes, bus fare and passes, seniors' discounts, and trip planning. The second was 15 minutes in length and included using the Internet to plan public transit trips. Workshop participants were also provided with an opportunity to complete a trip planning request form and receive transit directions to and from two destinations of personal importance. An important component of the workshops was an opportunity for participants to sign up for a guided bus trip with a trained transit guide at a scheduled time following the workshop.

Ambient Air Quality Trends and Comparisons

Ambient air quality in Hamilton has improved significantly since the mid-1990's with large reductions in the airborne levels of many pollutants. The annual percentage reductions in pollutant over this time period as measured at the downtown air monitoring site (MOECC Station 29000) are:

- Total Suspended Particulate (TSP) levels - 2.9% reduction per year for a total 52% over 18 years;
- Inhalable Particulate Matter (PM₁₀) levels - 1.7% reduction per year for a total 30% over 17 years;
- Respirable Particulate Matter (PM_{2.5}) levels - 1.9% reduction per year for a total 32% over 15 years;
- Nitrogen Dioxide (NO₂) levels - 2.7% reduction per year for a total 49% over 18 years;
- Sulphur Dioxide (SO₂) levels - 2.0% reduction per year for a total 35% over 18 years;
- Total Reduced Sulphur odours - 5.6% reduction per year for a total 99% over 18 years;
- Benzene levels - 5.4% reduction per year for a total 87% over 16 years; and
- PAH (measured as benzo[a]pyrene) levels - 4.9% reduction per year for a total 78% over 16 years.

The ambient levels of particulate material (TSP, PM₁₀ and PM_{2.5}), nitrogen oxides (NO_x) and sulphur dioxide (SO₂) 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), the reduction of re-suspended material from roadways and various sources of fugitive dust, and of actions taken by companies in Hamilton to reduce their emissions. Clean Air Hamilton does note that air quality can be variable at a local neighbourhood level and some areas of Hamilton can be impacted more than others by air pollutants.

However, over the past three to six 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 NO₂. The annual values for SO₂, benzene and benzo[a]pyrene all have shown modest increases over the past three to six years. Additionally, in the industrial areas of Hamilton, the 2013 levels of benzene and benzo[a]pyrene levels have increased over the past five or six years. However, the concentrations of these pollutants in recent years are well below levels measured in the mid-1990s and appear to be decreasing again.

The province continues to work on improving air quality in Ontario. New standards set out in O. Regulation 419/5 for a number of air pollutants in

Ontario including benzo(a)pyrene and benzene come into effect in 2016. These new standards significantly tighten the current benchmarks for air quality. Clean Air Hamilton supports and encourages the continued efforts of the Ministry and industry to reduce air borne contaminants in the City of Hamilton and the Province of Ontario.

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 features 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 *continued on page 14...*

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 or longer. 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 emissions.

The graphs on the following pages illustrate trends in key air quality parameters in Hamilton over the past 12 to 25 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 on the website:

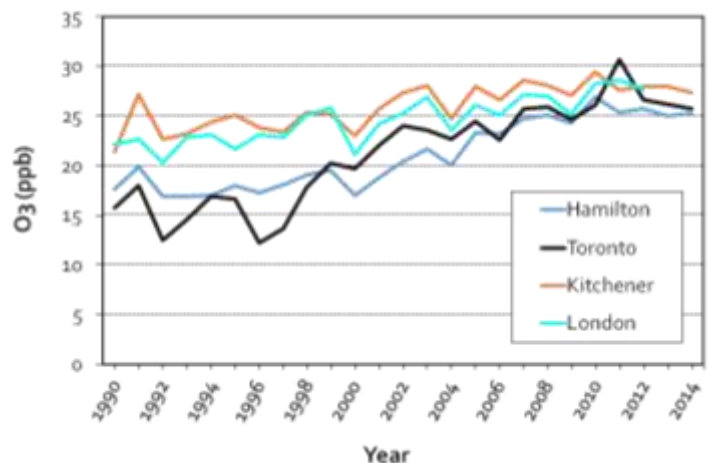
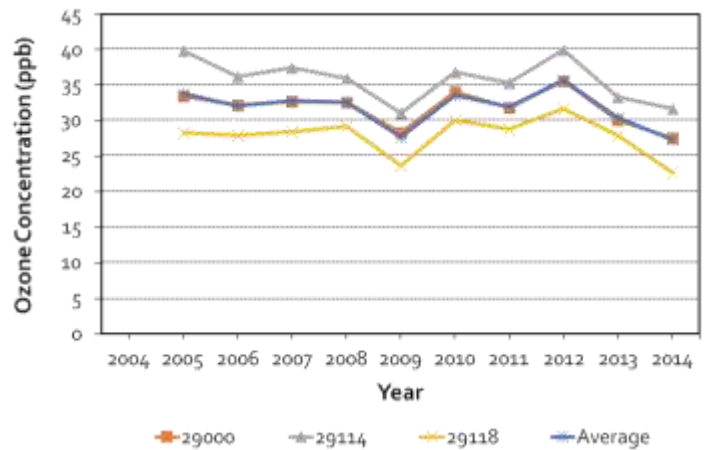
www.cleanair.hamilton.ca/downloads/HAQI-Environmental-Work-Group-Final-Report-Dec-97.pdf.

In most of the following graphs 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 Ontario.

Ground Level Ozone (O₃)

Ground level ozone (O₃ 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 O₃ are higher in warmer seasons than in cooler seasons because summer sunlight is more intense and the temperatures are higher. The trend in O₃ shows that the concentrations have 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 O₃ measured in Hamilton was generated from Hamilton-based pollution sources. The formation of O₃ takes several hours once the pollutants have been released to the atmosphere. Thus, the O₃ 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 O₃ in areas downwind of Hamilton. A substantial portion of the O₃ 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 Midwest Ohio Valley region.



Particulate Material: Inhalable Particulate Matter (PM₁₀)

Inhalable particulate matter (PM₁₀), the airborne particles that have diameters of 10 µm or less, is a portion of total suspended particulate (TSP).

PM₁₀, which makes up about 40-50% of TSP in Hamilton, has been linked to respiratory, cardiovascular and other health impacts in humans. PM₁₀ is derived primarily from vehicle exhaust emissions, industrial fugitive dusts, and the finer fraction of re-entrained road dust.

Ambient levels of PM₁₀ at the City sites have decreased about 21% over the past decade.



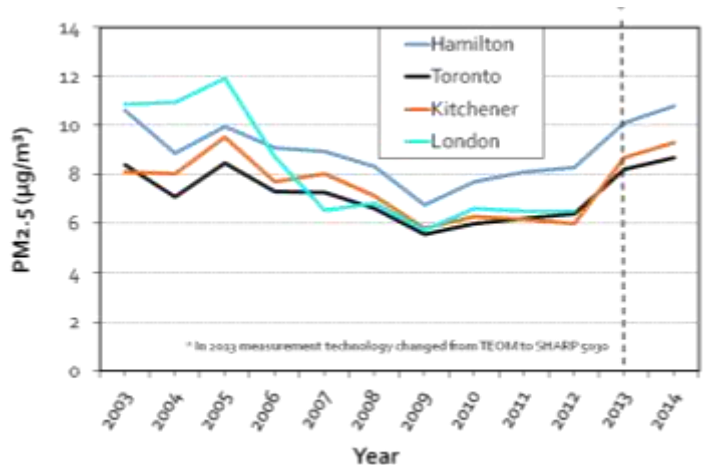
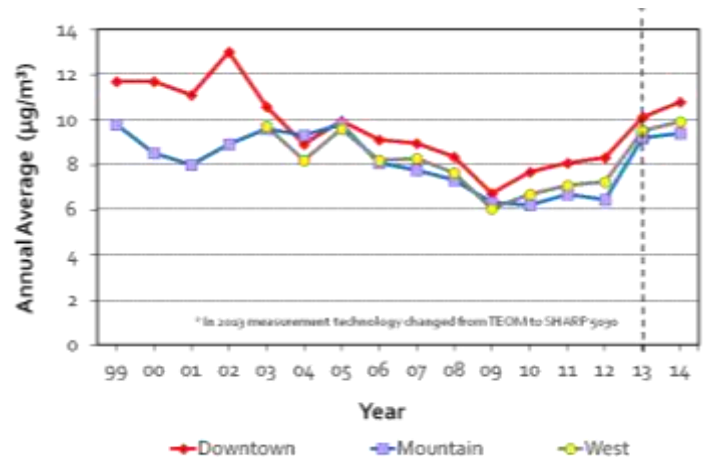
Particulate Matter: Respirable Particulate Matter (PM_{2.5})

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 PM₁₀ in the air, has been more strongly linked to health impacts than PM₁₀.

Most of the PM_{2.5} in cities is derived primarily from vehicular emissions.

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 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 PM₁₀ levels). Over the past three or four years, however, these levels have remained relatively unchanged in cities across Ontario. The apparent increase in 2013 is not reflective of a change in air quality but is result of the change in PM_{2.5} monitoring technology.



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.

Although monitored TSP emissions at industry sites show a recent increased as opposed to the declining trend at city-sited monitors, this is likely caused by increased transportation emissions in the area of the monitors rather than industrial emissions. Total TSP emissions by Hamilton industrial facilities are essentially flat in recent years, down significantly from 2010.

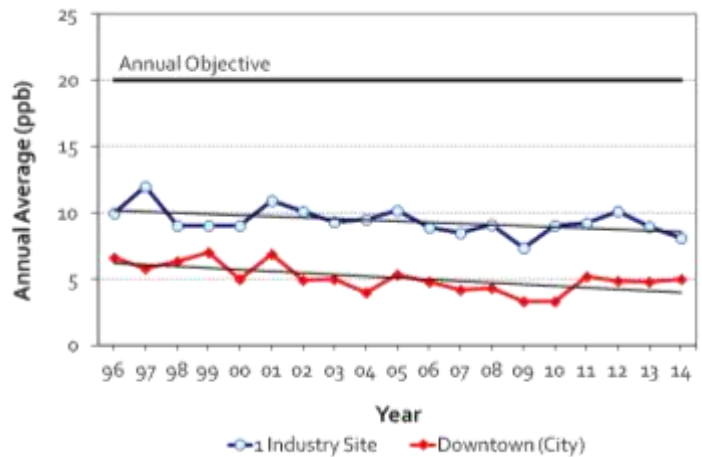


Sulphur Dioxide (SO₂)

Over 90% of the sulphur dioxide (SO₂) in the air is the product of industrial activities within the City.

Sulphur dioxide is not only a respiratory irritant but is converted in the atmosphere over several hours to sulphuric acid (H₂SO₄), 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.

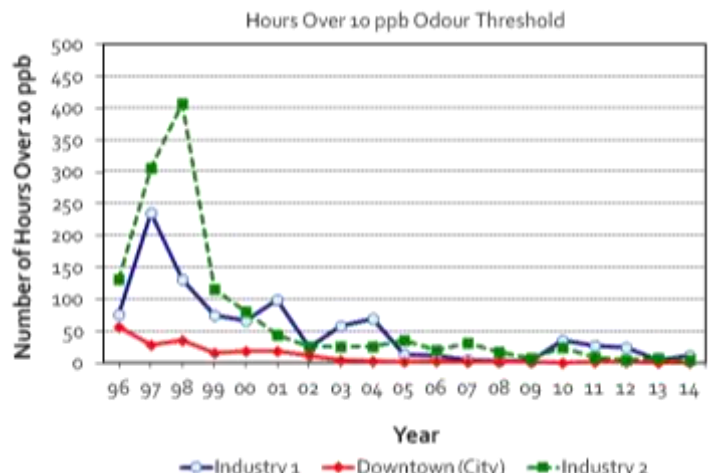
Significant reductions in air levels of SO₂ were made in the 1970s and 1980s. Since 1998, there has been a gradual and continuous decline in air levels of SO₂.



Total Reduced Sulphur (TRS)

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.

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.



Nitrogen Dioxide (NO₂)

Nitrogen dioxide (NO₂) is responsible for a significant share of the air pollution-related health impacts in Hamilton. NO₂ 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 NO₂ in Hamilton are the transportation and industrial sectors. The level of vehicle use across Hamilton has increased slightly during the past decade, while the overall emissions of NO (and hence NO₂) from new vehicles continue to decrease

due to improved engine technologies. Since NO is the precursor of NO₂, both NO and NO₂ 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 NO₂. The NO₂ ultimately reacts with water in the atmosphere to produce nitric and nitrous acids (HNO₃ and HNO₂, 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.

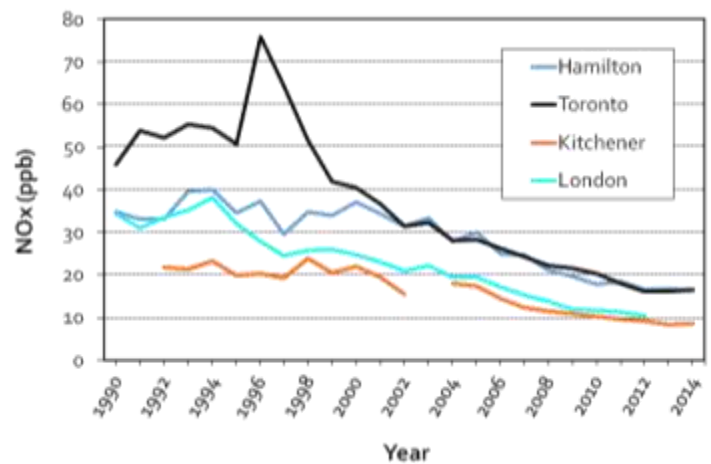
There has been a steady decline in the annual average levels of NO₂ in Hamilton over the past decade, both at the downtown site and at a site downwind of the industries. Overall, improvements in vehicle emissions performance coupled with better industrial practices have resulted in an overall improvement in NO₂ levels of about 40% over the past ten years.



Nitrogen Oxide (NO_x)

All cities, including Hamilton, have seen a steadily decreasing trend in NO_x levels 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% while Hamilton's NO_x levels have decreased by approximately 46%.

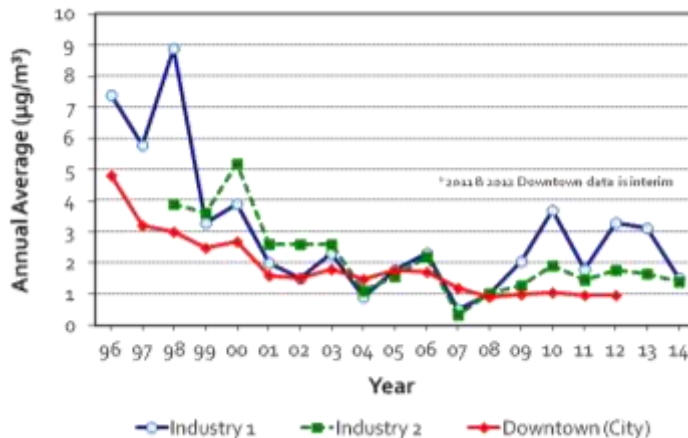
The NO_x levels in Hamilton have decreased more slowly than in cities such as London and Toronto during this period, due presumably to contributions from sources other than vehicles. The NO_x level is the sum of the levels of NO and NO₂. The decrease in the average NO_x levels is a reflection of improvements in emissions performance of the vehicle fleet in Ontario over the past decade.



Benzene

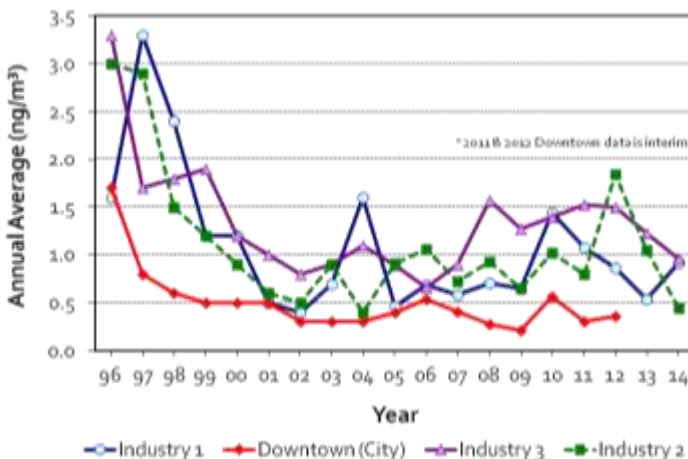
Benzene is a carcinogenic volatile organic pollutant emitted from some operations within the steel industry, specifically coke ovens and coke oven by-product plants. Air levels of benzene have been reduced dramatically since the late 1990s.

Benzene is also a significant component of gasoline; benzene concentrations in gasoline can be up to 5%. 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.



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's 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. There have been significant decreases in ambient BaP levels since the late 1990s.



Air Quality - Additional Resources

Actions on Air Quality:

To learn about Hamilton Public Health Services and actions on air quality visit: <http://preview.hamilton.ca/public-health/health-topics/air-quality-pollution-smog>

To learn about the Province of Ontario's actions on air quality visit www.airqualityontario.com/

To learn about the Government of Canada's actions on air quality visit <http://www.ec.gc.ca/Air/default.asp?lang=En&n=14F71451-1>



Conclusions

Clean Air Hamilton continues to press for air quality improvements and climate change actions in the City of Hamilton. Dramatic improvements in air quality in the past, while noteworthy achievements, do not mean that the task is finished. We are fortunate to have the support of all levels of government and local stakeholders, particularly our City government, as we promote actions to improve the short term and long term health of our community. While the pace of these reductions in some air quality parameters has slowed in recent years, we are confident that the application of new

legislation, combined with local actions, will bring us significantly better air quality in the years to come. We will also continue our outreach and education to all sectors of our community, building the political consensus and support for actions that need to be taken, as well as allowing our citizens to make well informed personal choices to protect their own health as well as their neighbours.

Denis J. Corr, Ph.D.
Chair, Clean Air Hamilton



Who we are...

"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."

2014 MEMBERS

Denis Corr, *Chair* - *Corr Research*

Brian Montgomery - *Air Quality Coordinator* - *Clean Air Hamilton*

ArcelorMittal Dofasco

Citizens

City of Hamilton - *Community Initiatives**

City of Hamilton Planning - *Community Planning*

City of Hamilton Public Works - *Energy Office*

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Environment Hamilton

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McKibbon Wakefield Inc.

McMaster Institute for Healthier Environments

Ministry of Environment and Climate Change (MOECC) -
Hamilton Regional Office

Mohawk College*

Ontario Environmental Assessment Corporation (OEAC)

U.S. Steel Canada

** indicates "observing member"*



Clean Air Hamilton, June 2015

Production: Public Health Services
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