



Clean Air Hamilton

2015 Air Quality Progress Report

June 2016

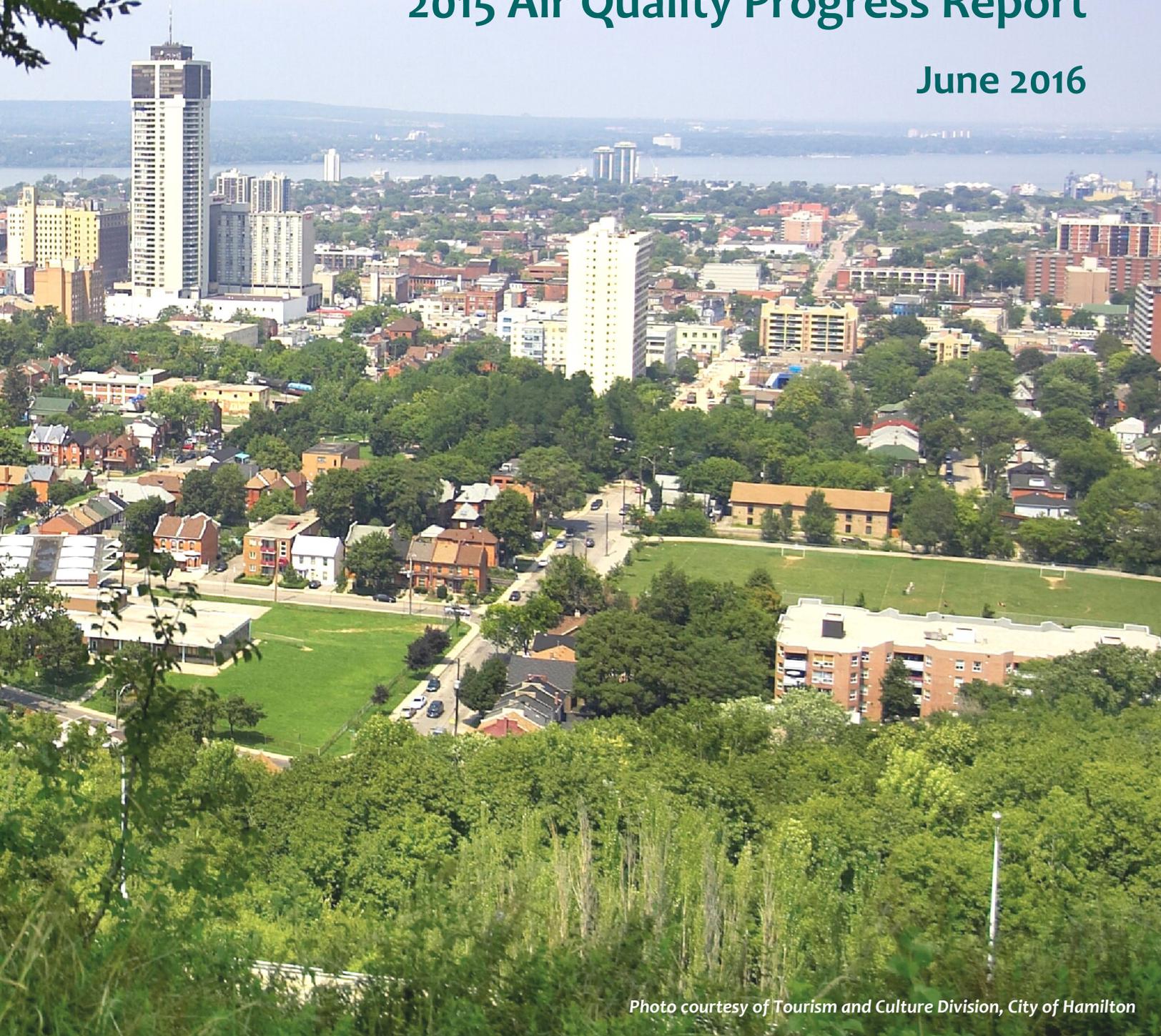


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This report and the work of our members is dedicated to the memory of
Dr. Brian McCarry (1946—2013)
Chair of Clean Air Hamilton from 1997—2013

Message from the Chair

Clean Air Hamilton (CAH) is an award winning organization which 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 and address climate change challenges.

The following is our Clean Air Hamilton 2015 report. This is the second year in our new, slimmed down, more readable, format, which focuses on 2015 related items only. Readers wishing to review previous years' activities can now go to <http://www.cleanair.hamilton.ca>.

It is important to analyze both long term as well as short term trends and in Hamilton there have been dramatic improvements in the long term air quality. Our air quality is now about 90% better than it was in the 1970s which is an amazing achievement. Even in the last 15-18 years we are seeing a range of 30 -99% improvement, depending on the pollutant. It is gratifying to note that the largest improvements have been in locally emitted pollutants.

There is also “not so good” news. As our air quality has gotten better, we have learned more about the health impacts of poor air. About 180 of our citizens are dying each year from the impacts of air pollution, as well as increased hospital admissions, emergency room use, doctors' visits, etc. Although these health impacts are similar to other Canadian cities (as a proportion of population), we need to keep improving. We are not there yet.

We are also approaching a critical time in dealing with climate change, with the very real possibility of non-linear effects leading to accelerating

atmospheric disruption. Here again, Hamilton has shown leadership, having already met our first set of targets (20% by 2020) and already set new targets (80% by 2050).

The Provincial and Federal governments have recognized these needs and are currently actively creating legislation in order to improve air quality as well as deal with the challenges of climate change. Clean Air Hamilton and a number of its members and stakeholders have been very involved in the consultations around this legislation. Fortunately the resulting actions often address both needs, e.g., electric cars both improve air quality and reduce climate change emissions. We look forward to bringing these changes to our City.

Our mandate includes informing our citizens of all these issues and giving sound, science based advice and recommendations. Then we can all work to reduce emissions as well as our personal exposures and live healthier lives.

This report attempts to help us do just that.

We thank Public Health Services and City Council for their ongoing support of Clean Air Hamilton. Special thanks go to Karen Logan and Trevor Imhoff for their hard work and creativity in making our report a reality.



A handwritten signature in black ink that reads "Denis J. Corr". The signature is written in a cursive, flowing style.

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 renewables, 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.

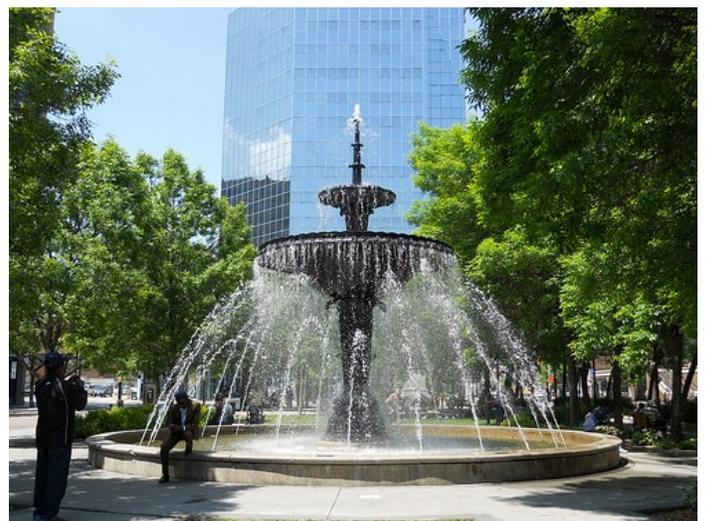


Photo courtesy of Tourism and Culture Division, City of Hamilton

Air Quality Task Force and Hamilton Air Shed Model

The Air Quality Task Force (AQTF) is made up of a mixture of Hamilton City staff, Non-Profit Organizations and Industry representatives tasked by City Council to: “... investigate and make recommendations to the City on actions that can be taken to reduce air pollution in Hamilton.”

This AQTF with their collective and extensive knowledge of air quality developed a list of 10 recommendations on actions that can be taken to reduce air pollution in Hamilton that was passed by City Council in 2014.

Component	Recommendation	Status
Air Monitoring and Modeling	1. Development of an advanced air model for the City of Hamilton	Underway
	2. Strengthen Air Monitoring activities	Underway ¹
Planning	3. Develop appropriate air quality related guidelines for new and redeveloping neighbourhood land use planning	Underway ²
	4. Promote green infrastructure	Underway ²
Education and Outreach	5. Provide individuals with tools to minimize their personal exposure.	Underway ³
	6. Develop and conduct particulate matter control workshops.	Initiated
	7. Expand the Air Quality Outreach Program within Hamilton Schools.	Underway ⁴
Municipal Action	8. Promote programs that encourage community – based environmental monitoring and engagement with the City of Hamilton.	Underway ⁵
	9. Minimize generation & dispersion of airborne particulate matter by revising bylaws.	
	10. Implement strategies to improve street cleaning.	

¹See Clean Air Hamilton website for more information (<http://www.cleanair.hamilton.ca>)

²Community Planning staff continue to implement the policies of the Urban Hamilton Official Plan Section B.3.6.2 (<https://www.hamilton.ca/city-planning/official-plan-zoning-by-law/urban-hamilton-official-plan>)

³Not-for-profit organizations completing work including Environment Hamilton (<http://www.environmenthamilton.org>) and Green Venture (<http://www.greenventure.ca>)

⁴See Clean Air Hamilton (CAH) – 2015 Funded Projects on page 6 of this report

⁵Environmental Hamilton actively runs community-based environmental monitoring programs (<http://www.environmenthamilton.org>)

The Task Force won the prestigious “2014 Grassroots Initiative Award” and “2014 Innovation in Sustaining Places Award” from the American Planning Association for their cutting-edge work. The Airshed Model is currently being developed by Golder Associates Ltd. and is expected to be ready in October 2016. Public Health staff has started and continues to host dust workshops for a variety of organizations.

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

Clean Air Hamilton (CAH) - 2015 Funded Projects

Clean Air Hamilton is an innovative, multi-stakeholder agent of change dedicated to improving air quality in our community. Hamilton Public Health Services provides \$40,000 to fund projects resulting in air quality improvement and

awareness. These projects reach thousands of school aged children and contribute to improving Hamilton's air quality through monitoring and planting of trees. Clean Air Hamilton is proud to support the 2015 funded projects.

Phase 2 Neighbourhood Mobile Monitoring

Fifteen additional Hamilton neighbourhoods were monitored. Air pollution concentrations were lowest during south west prevailing winds. During north east winds higher pollution risk levels were measured in and near the downtown core and industrial areas. Risk decreased greatly the farther

from these areas. Except for the Nebo Road and Fruitland/Barton areas, the best air quality occurred in areas at the southern edge of the city, which are the furthest from the downtown and industrial emissions. Details can be found at:

<http://www.cleanair.hamilton.ca>

Trees for Hamilton

Trees for Hamilton received the CAH funds in September and were able to coordinate 3 fall plantings in October.

During the three events TFH members facilitated the planting of 125 native trees, evergreens and shrubs.

On October 9th 6 Westdale high school students, 2 RBG staff and 2 TFH members planted on RBG property at Churchill Park.

12 volunteers from St John's Lutheran Church youth group, 2 HCA staff and 2 TFH members planted on HCA property at Mount Albion at the West entrance on October 23rd.

On October 29th planting was done with volunteers from Wayside Addiction Recovery Program. 2 staff members and 7 clients from the program as well as 2 HCA staff and 2 TFH members planted on HCA property at Mount Albion at the East entrance.

TFH members are currently negotiating with the city staff that is coordinating the McQuesten Urban Farm project and will be partnering with others to help plant trees and shrubs in their native interpretive gardens in the spring of 2016.

Members are also seeking out additional sites for spring planting.

<http://www.treesforhamilton.ca>



Fresh Air For Kids

The Fresh Air Kids program helps students to see themselves as young scientists and empowered citizens within their community. Corr Research and Green Venture partnered with three Hamilton elementary schools to provide six classes a series of hands-on educational workshops that included

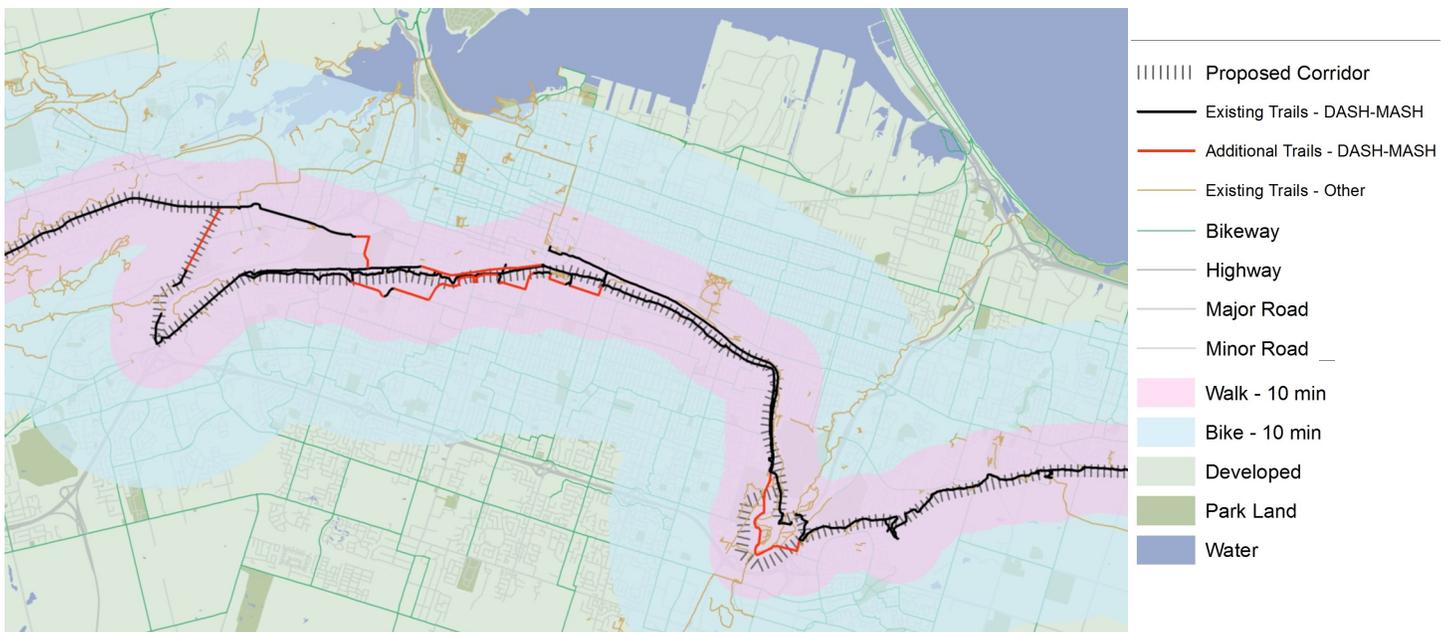
activities inside and outside the classroom. Students were educated on the importance of air quality, the Air Quality Health Index and gained an awareness of how their actions can impact and improve the air in their neighbourhoods. Partner schools included St. Brigid, Mount Hope and St. Joseph, with two classes at each school.

<http://www.greenventure.ca>

DASH-MASH Assessment

DASH-MASH: A cross city active transportation superhighway for Hamilton, Ontario.

The assessment identified that the DASH-MASH would span 108 km of multi-use path intersecting 13 of the 15 Hamilton Wards. 78 km of existing multi-use path is included in the DASH-MASH plan.



DASH-MASH: Hamilton’s Downtown and Mountain Active Super Highway Accessibility Map

Corr Research Inc. examined the potential for multi-use trail network that would parallel the Niagara Escarpment connecting Hamilton from Stoney Creek to Dundas, which is termed the Downtown Active Super Highway and the Mountain Active Super Highway (DASH-MASH). A commuter trail network across Hamilton would provide benefits to members of the Hamilton community including: (1) Reduced on-street cycling, which will reduce the competition between vehicles and cyclists on the roads, (2) Improved connection between the upper and lower city, and (3) Increased opportunities for physical recreation.

22 km of existing trail and sidewalk will require conversion. 125,000 Hamilton residents are within a ten-minute walk of the proposed DASH-MASH. 370,000 Hamilton residents are within a ten-minute bike ride of the proposed DASH-MASH. Within the 10-minute biking radius of the DASH-MASH, there are 518 kilometers of bikeways. 113 of the 115 Social Bicycle Hubs are within the ten-minute cycling distance of the DASH-MASH. Only 7.9 kilometers of the network, i.e., 7% of the entire system, will require a complete build to complete the DASH-MASH.

<http://www.cleanair.hamilton.ca/default.asp?id=73>

Clean Air Hamilton - 2015 Funded Projects continued...

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 2015, Totally Transit lessons reached over 4,600 elementary school students while another 5,700 students participated in scaled-down Totally Transit presentations held at various school environmental fairs. The Totally Transit program has reached over 10,300 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 2015, 264 students, representing 16 classes from 7 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 565, mostly Grade 5 students.

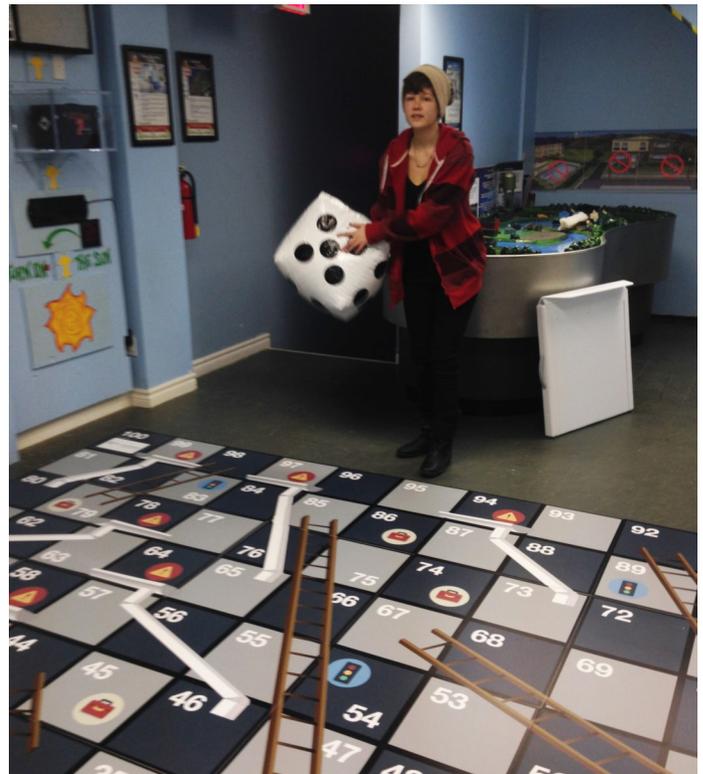
<http://www.greenventure.ca>

Climate Change Hamilton

The Climate Change Hamilton program assists local individuals, businesses, organizations and community groups in managing the environmental impact of their operations through greenhouse gas reductions and adaptation measures. The program achieves this through the Hamilton Climate Change Action Charter, Map Climate Change website, on-going support of charter signatories, providing tools and resources to meet charter commitments, as well as communication and promotion of positive social norms and behaviour.

In 2015, funding from Clean Air Hamilton helped Climate Change Hamilton to reach over 20,000 residents to raise awareness about climate change, local action, and help them reach their adaptation and mitigation goals.

<http://www.climatechangehamilton.ca>



Climate Change

Over the past 25 years weather patterns have dramatically changed as a direct result of human activities and the release of greenhouse gases (GHGs).

Addressing climate change required two types of actions: adaptation and mitigation. Adaptation involves actions or planning to minimize risks of climate change. Mitigation involves actions aimed at reducing greenhouse gases. Hamilton's Community Climate Change Action Plan (2015) recommends actions that address mitigation and adaptation together.

The Action Plan recognizes the need to reduce our emissions and adapt to a changing climate by encompassing nine themed areas to focus on:

Agriculture & Food	Awareness & Education	Energy
Infrastructure	Land Use, Buildings & Build Form	Local Economy & Business
People & Health	Transportation /Mobility	Water & Natural Heritage

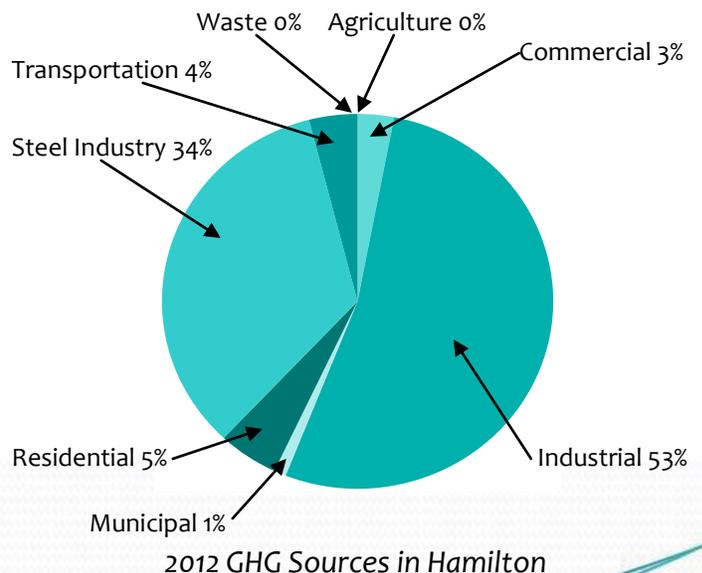


The Plan has also set out 10 priority actions that should be undertaken in the community within the next 3 years to help deal with the growing risks of climate change. The 10 priority actions are:

1. Support local food production/consumption and integrate mitigation/adaption strategies into existing farm and food plans.
2. Establish ongoing education and awareness.
3. Develop a Community Energy Plan.
4. Revise and update municipal guidelines to prioritize Low Impact Development (LID).
5. Secure property to serve as source water storage and preserves wildlife corridors.
6. Create accessible toolkit for business to assist with impact analysis.
7. Conduct local community vulnerability assessment of public health impacts.
8. Expand public transit services to include rapid transit lanes.
9. Establish ongoing oversight and coordination body.
10. Establish variable development charges.

A completed economic analysis suggests a net reduction of about 202,920 tonnes of GHG emissions and avoided costs of \$69.1 million can be expected if all 10 priority actions are completed. If you wish to know more about the Community Climate Change Action Plan or get involved in local climate actions visit:

<http://climatechangehamilton.ca>



Hamilton Air Quality & Air Pollution Health Impacts

The 2011 Air Quality Health Assessment Study prepared by Senes Consulting Inc. in partnership with Clean Air Hamilton and Hamilton Public Health Services estimated six key air pollutants. The 2011 report provides the most up to date information about the health impacts associated with poor air quality in our City.

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

- The six key air pollutants include:
- Nitrogen Dioxide (NO₂);
 - Ground-Level Ozone (O₃);
 - Inhalable Particulate Matter (PM₁₀);
 - Respiratory Particulate Matter (PM_{2.5});
 - Sulphur Dioxide (SO₂);
 - Carbon Monoxide (CO)

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 O₃, NO₂ and Particulate Mater (PM).

Overall, with the average measure air quality for the Hamilton region improving, the estimated respiratory hospital admission rates have remained unchanged since 2003. 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 2012².

¹ 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

²Not corrected for a 10% population increase since 2003.

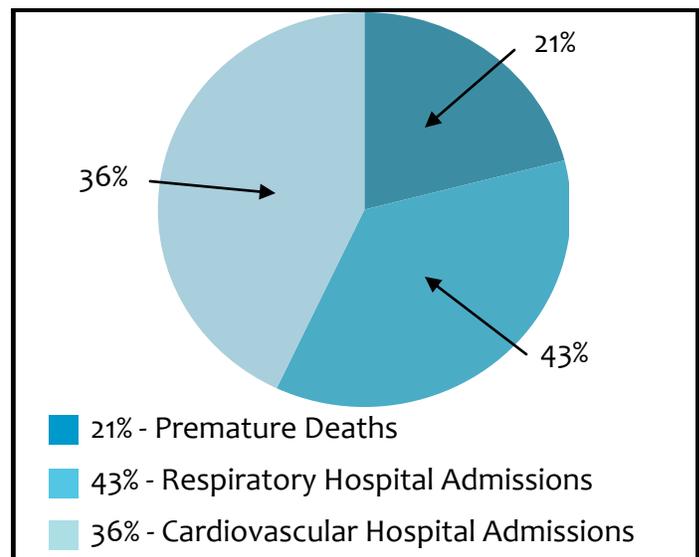


Figure 1: Air Pollution Health Impacts in Hamilton¹

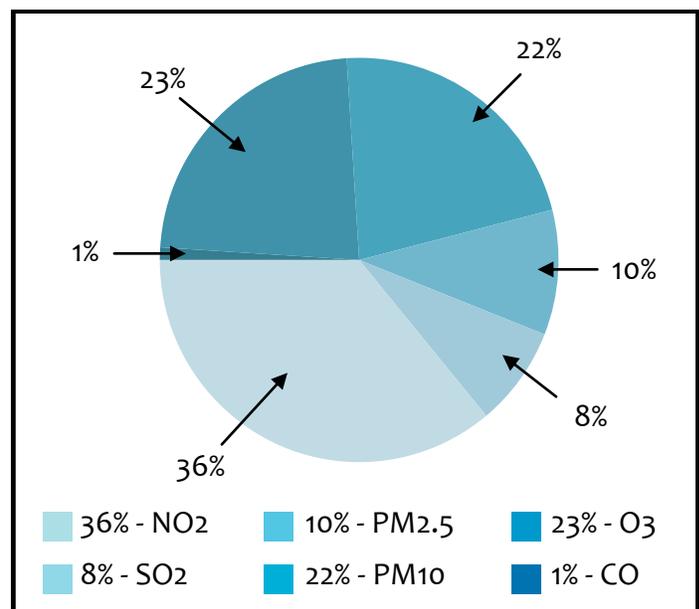


Figure 2: Contribution of Air Pollutants to the Health Impacts, Hamilton (%)¹

City of Hamilton's Air Monitoring Networks

The City of Hamilton has an extensive air monitoring network including:

- The Ontario Ministry of the Environment and Climate Change stations;
- The Hamilton Air Monitoring Network (HAMN); and
- The City of Hamilton's moveable stations (Airpointers) & mobile monitoring.

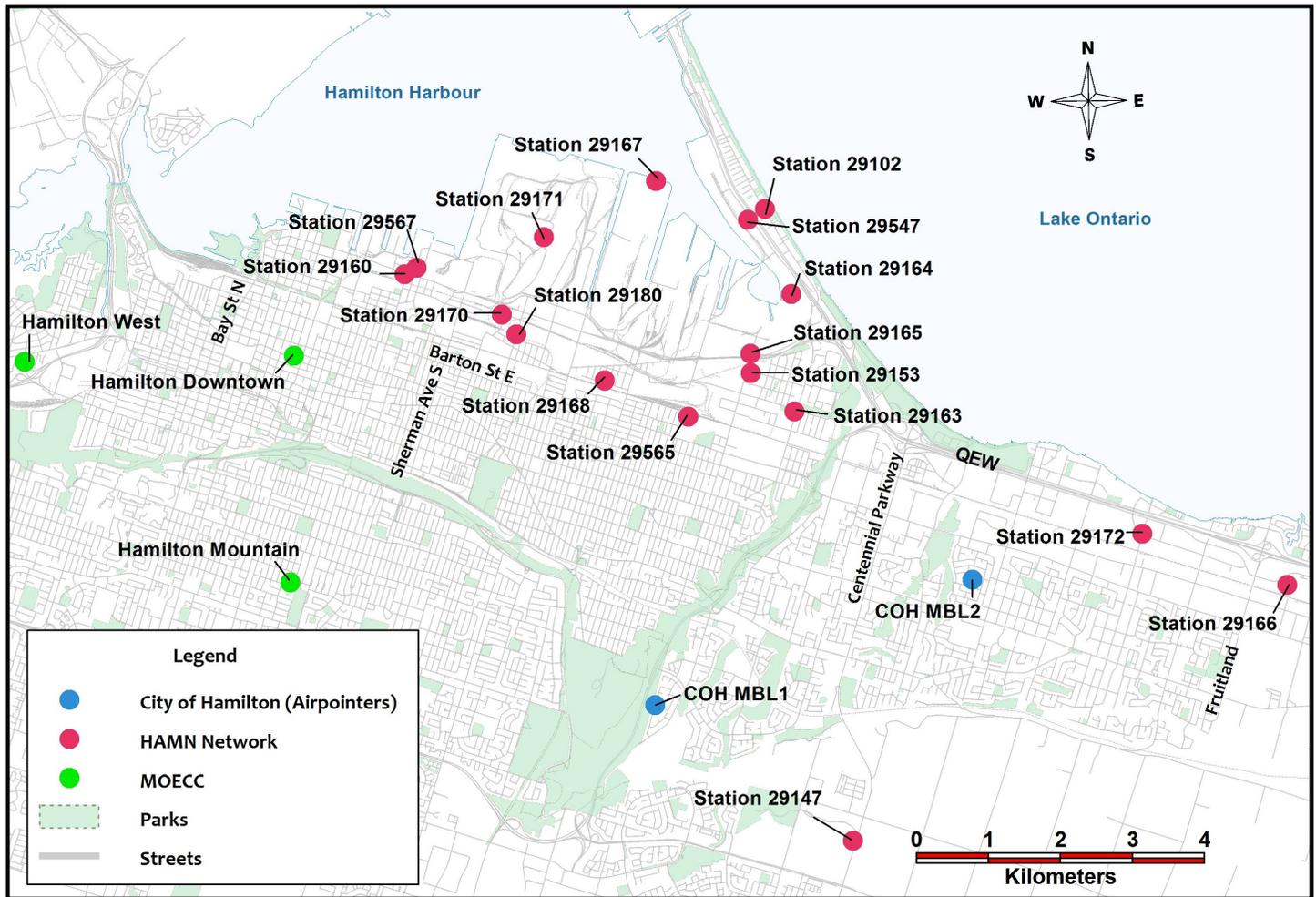


Figure 1: City of Hamilton's Air Monitoring Networks

The Ministry of the Environment has 3 continuous air monitoring stations highlighted by the green dots in the map above. These stations provide data to calculate 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 the MOECC. Please visit the websites below for more information.

Continued on page 12

Air Monitoring Networks *continued...*

The City of Hamilton's Public Health Services has purchased and operates two moveable stations (Airpointers) which represents the blue dots in the map above and are used to examine areas where potential air quality concerns exist. Hamilton has also pioneered the use of mobile monitoring to examine neighbourhood variations and inform residents on actions they can take to reduce their exposures.



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

The Hamilton Air Monitoring Network (HAMN) contains both continuously and non-continuously air monitoring stations which are owned by a cooperative industry group. HAMN members are committed to the assessment of air quality in Hamilton.

<http://www.airqualityontario.com>

<http://www.hamnair.ca>

Message from the Ministry of the Environment and Climate Change & Air Quality Trends

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 - 59% total reduction over 19 years;
- Inhalable Particulate Matter (PM₁₀) levels - 30% total reduction over 18 years;
- Respirable Particulate Matter (PM_{2.5}) levels - 24% total reduction over 16 years;
- Nitrogen Dioxide (NO₂) levels - 51% total reduction over 19 years;
- Sulphur Dioxide (SO₂) levels - 44% total reduction over 19 years;
- Total Reduced Sulphur odours - 99% total reduction over 19 years;
- Benzene levels - 87% total reduction over 16 years; and
- PAH (measured as benzo[a]pyrene) levels - total 72% total reduction over 19 years.

Message from the Ministry of the Environment and Climate Change & Air Quality Trends *continued...*

Improving air quality and combating air pollution is a top priority for Ontario. Over the last 10 years, we have seen significant decreases in harmful pollutants such as sulphur dioxide, nitrogen dioxide, carbon monoxide and fine particulate matter. We are committed to working closely with community members and local industry to ensure continued improvements in reducing air contaminants from all sources in Hamilton and across the province.

In 2015, ministry environmental officers in Hamilton conducted over 400 inspections of local industry. These inspections, along with reactive incident response, ensure that industry continues to make significant investments to improve its environmental performance. These investments include:

- replacement of aging infrastructure;
- newer, more modern environmental controls;
- increased and improved maintenance activities; and
- extensive monitoring and reporting to reduce the frequency of environmental incidents.

Implementation of new environmental standards for suspended particulate matter for the coke ovens at Hamilton's iron and steel facilities is continuing.

Local facilities have adapted more stringent American coke oven monitoring best management practices. Daily audits assess emissions and work

to reduce emissions of benzene, benzo(a)pyrene (BAP) and particulate to ensure consistent air pollution control measures across facilities.

The ministry has increased monitoring of other local sources of particulate in the industrial core to encourage a further reduction in these emissions. Ministry staff are participating in Clean Air Hamilton's particulate subcommittee along with local industry to identify and encourage voluntary measures to reduce particulate.

As these facilities progress through the new coke oven monitoring protocols and towards increasingly stringent ministry limits, we expect to see a 30% reduction in suspended particulate matter, benzene and benzo[a]pyrene air emissions from the Hamilton facilities within two to three years and to up to a 40% reduction by 2020. As the updated air standards related to benzene, BAP and other contaminants are coming into effect in July of 2016, the ministry is focused on ensuring industrial and commercial facilities are taking appropriate actions to meet the requirements of the air regulation.

The ministry looks forward to continuing its work alongside Clean Air Hamilton, the community and local industry to further improve air quality in Hamilton and to ensure industry continues to improve their environmental performance and make our air cleaner.



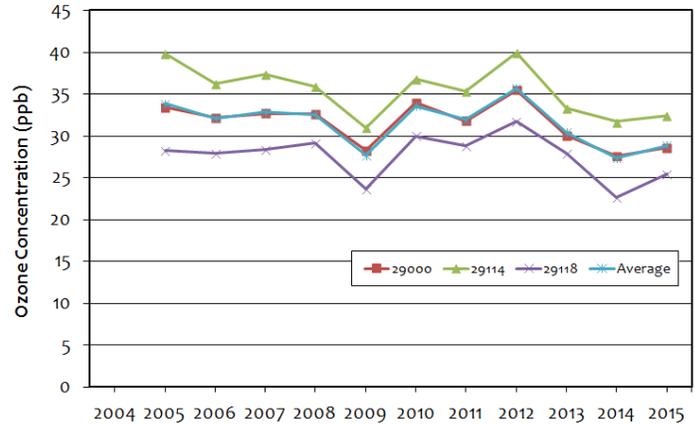
Ambient Air Quality Trends and Comparisons

Ground Level Ozone (O₃)

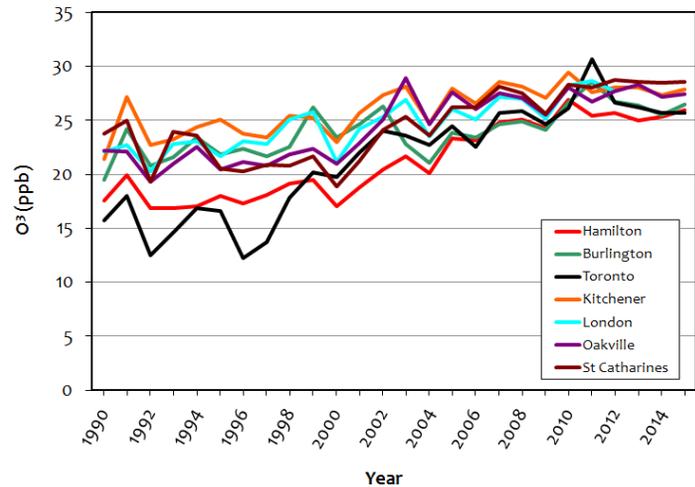
Ground level ozone (O₃ or tropospheric ozone) is formed when pollutants are emitted and react with the presence of sunlight. This is why O₃ concentrations are higher during summer months. Sources include: coal-fired power plants, vehicles and urban activities.

The trend in O₃ shows that concentrations have been highly variable in the past 10 years with the trend line flat. O₃ is a main contributor for Hamilton's smog days and unlike other pollutants the majority of O₃ comes from sources upwind of Hamilton and are expected to originate in the Midwest Ohio Valley region. Sources from Hamilton contributing to O₃ pollution will affect areas downwind of Hamilton which makes lowering O₃ emissions very important. The Government of Ontario has been dedicated to lowering O₃ precursor emissions by eliminating all coal-fired power plants in Ontario.

Ground Level Ozone Trend



25-Year Trends for Ozone (Seven Cities)

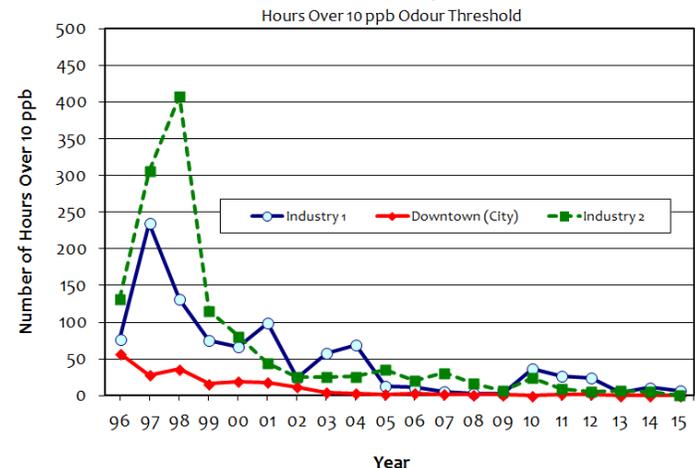


Total Reduced Sulphur (TRS)

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. 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 in which measurements exceed 10 ppb have been reduced by over 90% since the mid-1990s. This is due to significant changes in the management and operation of the coke ovens, blast furnaces and slag quenching operations associated with steel mill operations.

Total Reduced Sulphur Trend

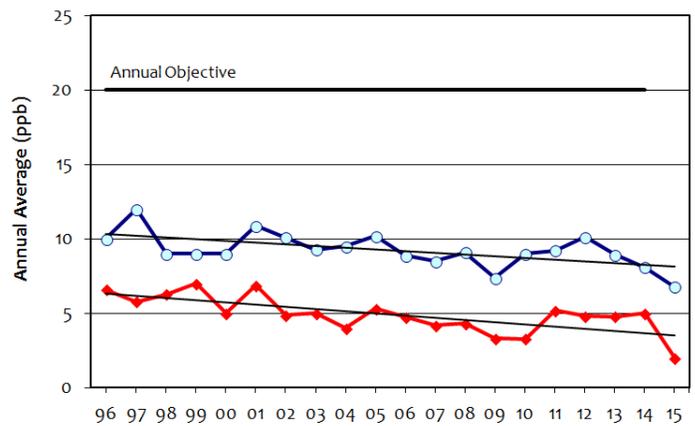


Sulphur Dioxide (SO₂)

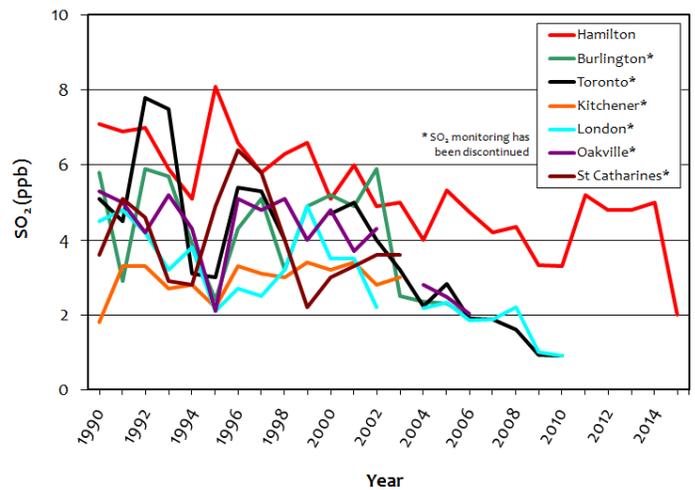
Sulphur Dioxide is the product of industrial activity with over 90% generated within the City. SO₂ is not only a respiratory irritant but is converted in the atmosphere over several hours to sulphuric acid (H₂SO₄), which is then converted to sulphate particles. These particles tend to be acidic in nature and cause lung irritation.

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

Sulphur Dioxide Trend



25-Year Trends for Sulphur Dioxide (Seven Cities)



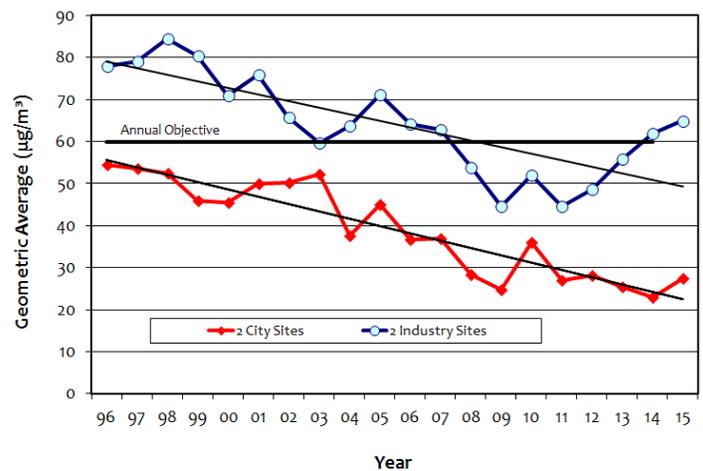
Particulate Material: Total Suspended Particulate (TSP)

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.

There has been a steady decline in TSP at City sites while levels have risen in recent years at industry sites. It is unknown why monitored TSP values at industry sites have shown a recent increase.

Included in the TSP category are inhalable particulates (PM₁₀) 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 10 µm, by subtracting PM₁₀ from the TSP value.

Total Suspended Particulate (TSP) Trend

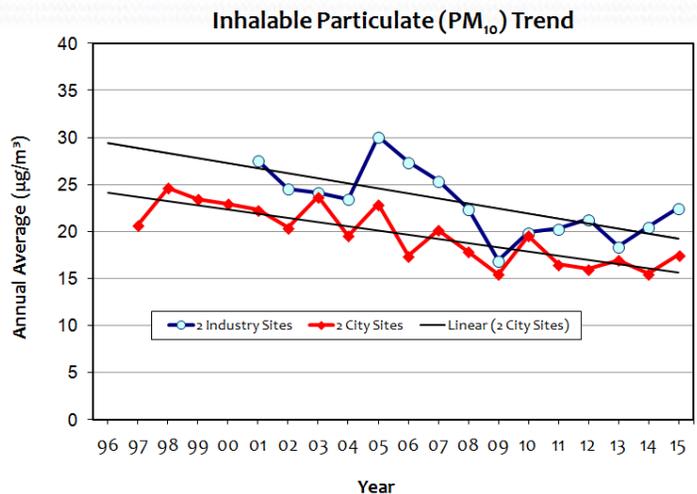


Particulate Material: Inhalable Particulate Matter (PM₁₀)

Inhalable particulate matter (PM₁₀) has a diameter of 10 µm or less. PM₁₀ makes up 40-50% of TSP in Hamilton and has been linked to respiratory, cardiovascular and other health impacts in humans.¹

PM₁₀ is primarily derived from vehicle exhaust emissions, industrial fugitive dusts, and the finer fraction of re-entrained road dust.

PM₁₀ at City sites has decreased by about 21% over the past decade. This is likely a combination of better performance of vehicle fleets, better management of dust track-out by industries, and the use of better street sweepers and street sweeping practices by the City.



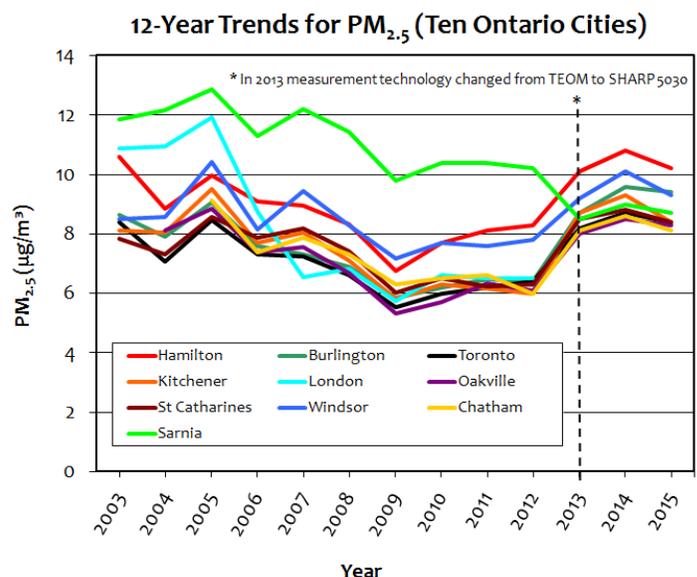
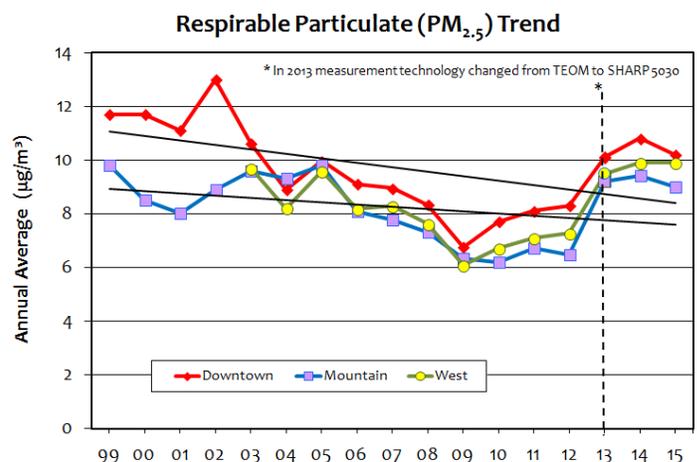
Particulate Matter: Respirable Particulate Matter (PM_{2.5})

The Ontario government started measuring PM_{2.5} across Ontario in 1999. PM_{2.5} makes up about 60% of PM₁₀ and is mostly derived in cities from vehicle emissions.

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 exposure.¹

The trend in PM_{2.5} showed a 3.5% decrease per year since 1999 until 2009 at the downtown and mountain AQHI sites. The apparent increase in 2013 is not reflective of a change in air quality but is a result of change in monitoring to a more sophisticated and sensitive PM_{2.5} monitoring technology.

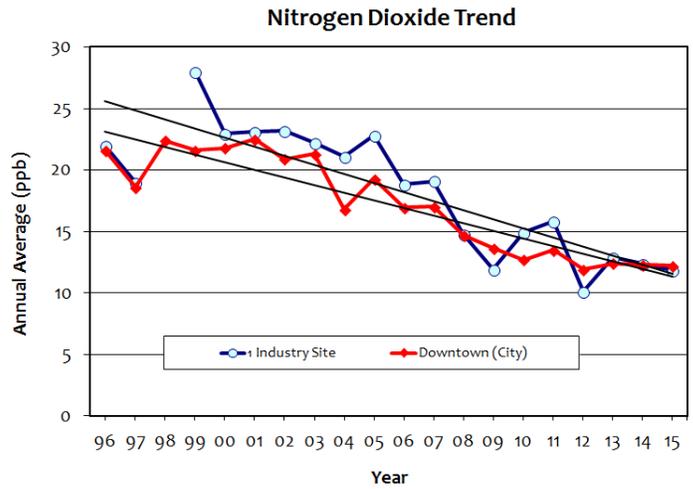
¹ SENES Consulting Ltd. (2011). *Health Impacts Exposure to Outdoor Air Pollution in Hamilton, Ontario*. Retrieved from www.cleanair.hamilton.ca/downloads/2011%20Clean%20Air%20Hamilton%20-%20Health%20Impacts%20FINAL%20.pdf (i.e. Inhalable particulate matter (PM₁₀) is the airborne particles that have diameters of 10 µm or less. PM₁₀ makes up 40-50% of TSP in Hamilton and has been linked to respiratory, cardiovascular and other health impacts in humans.¹)



Nitrogen Dioxide (NO₂)

Nitrogen Dioxide (NO₂) is formed in the atmosphere from nitric oxide (NO) which is produced during combustion of fuels (i.e gasoline, diesel, coal, wood, oil and natural gas) and is responsible for a significant share of the air pollution-related health impacts in Hamilton. The leading sectors producing these emissions are the transportation and industrial sectors. The level of vehicle use across Hamilton has increased slightly during the past decade, however overall NO levels have decreased most likely due to improved engine technologies.

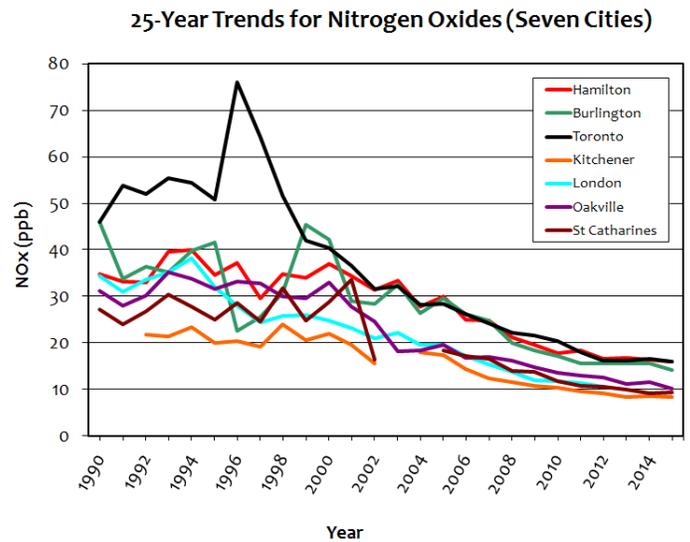
Both NO and NO₂ are routinely measured and their sum is reported as Nitrogen Oxide (NO_x) to reflect the presence of both species in urban areas. Ultimately all of the NO is converted to NO₂ which reacts with water in the atmosphere to produce nitric and nitrous acids (HNO₃ and HNO₂, respectively); these acids are converted into nitrate salts that constitute about 25% of the mass of fine particulate matter or PM_{2.5}.



Nitrogen Oxide (NO_x)

This chart displays the steadily decreasing trend of Nitrogen Oxide (NO_x) in all the cities, including Hamilton. 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.

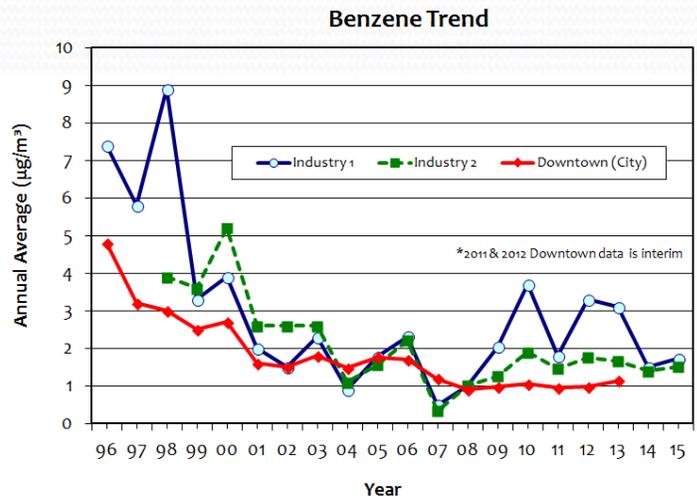
The slower decrease of NO_x levels in Hamilton is presumably due to the fact that Toronto and London do not have other sources (ex. industrial emissions) that contribute to overall NO_x levels that Hamilton has. The decrease in NO_x levels is a reflection of improvements in emission performance of the vehicle fleets in Ontario over the past decade.



Benzene

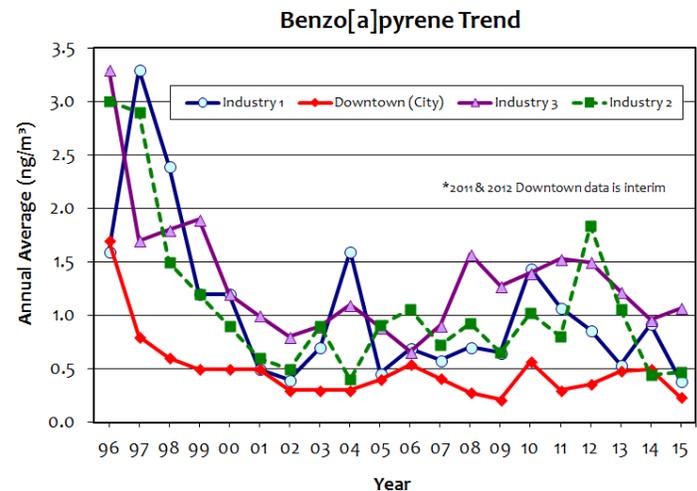
Benzene is a carcinogenic (cancer causing agent) volatile organic compound (VOC) that is emitted from some operations within the steel industry, specifically coke ovens and coke oven by-product plant operations. Benzene is also a significant component of gasoline which can be up to 5% benzene. Vapours containing benzene are released during pumping at gasoline stations.

Air levels of benzene have been reduced dramatically since 1990s, due to significant upgrading of the coking plant operations, improved operating procedures and improved control of release of benzene vapours from the coke by-products. More work remains to be done to reduce low concentration exposures of benzene.



Benzo[a]pyrene

Benzo[a]pyrene (BaP) is also a carcinogen and capable of causing cancer in both animals and humans. BaP is a member of a larger class of chemical compounds called polycyclic aromatic hydrocarbons (PAHs) which are emitted when carbon-based fuels such as coke, oil, wood, coal and diesel fuel are burned. The principle sources of BaP in Hamilton are released from coke oven operations within the steel industry. There have been significant decreases in BaP levels since the late 1990s.



Conclusions

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

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

Air Quality - Additional Resources

To learn more about Clean Air Hamilton and our work visit www.cleanair.hamilton.ca or follow us on Facebook.

Air Quality and Health

To learn about how to protect your health visit: www.airhealth.ca

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>

Government Actions on Air Quality

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>

Air Quality Monitoring

For a detailed model of hourly concentrations for a variety of pollutants across Hamilton visit:

<http://www.hamiltonaqhi.com>

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

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

To check out the Hamilton Air Monitoring Network visit: <http://www.hamnair.ca/>



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."

2015 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*

City of Hamilton Public Works - *Transportation Demand Management**

Environment Canada*

Environment Hamilton

Green Venture

Hamilton Conservation Authority

Hamilton Industrial Environmental Association

Hamilton Public Health Services

Health Canada*

Horizon Utilities

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 2016

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