

Annual Air Quality Report 2009

## Table of Contents

	Table of Contents.....	2
	Listing of Figures and Tables.....	3
<b>Section 1</b>	Overview	
	Executive Summary.....	4
	Hamilton Air Monitoring Network Overview.....	5
	HAMN Participating Industries.....	5
	Annual Report Overview.....	5
	Network Enhancements .....	5
	Public Web Based Data Access.....	6
	Enhancements to the Particulate Monitoring Program.....	6
<b>Section 2</b>	Air Quality Summary Data - Pollutant Trends.....	6
	Historical Trend Graphs.....	7
<b>Appendix 1</b>	Wind Frequency Distribution – 2009 Wind Rose.....	15
<b>Appendix 2</b>	Activities and Progress.....	16
<b>Appendix 3</b>	Legend .....	19
<b>Appendix 4</b>	Where do we Measure Air Quality? .....	20
	How do we Measure Air Quality? .....	21
<b>Appendix 5</b>	Ministry of the Environment’s Role in HAMN .....	23
<b>Appendix 6</b>	HAMN Structure .....	26
<b>Appendix 7</b>	Summary Statistics and Data Set – 2009 .....	Attachment

## Figures and Tables

<b>Figure 1</b>	Sulphur Dioxide Annual Trends
<b>Figure 2</b>	Sulphur Dioxide Monthly Trends 2009
<b>Figure 3</b>	Total Reduced Sulphur Annual Trends
<b>Figure 4</b>	Total Reduced Sulphur – Number of Hours Exceeding 10 ppb
<b>Figure 5</b>	Nitrogen Dioxide Annual Trends
<b>Figure 6</b>	Nitrogen Dioxide Monthly Trends 2009
<b>Figure 7</b>	Total Suspended Particulate Annual Trends
<b>Figure 8</b>	PM <sub>10</sub> - Inhalable Particulate Annual Trends
<b>Figure 9a/9b</b>	PM <sub>10</sub> - Inhalable Particulate Monthly Trends 2009
<b>Figure 10</b>	PAH (Benzo[a]Pyrene) Annual Trends
<b>Figure 11</b>	PAH (Benzo[a]Pyrene) Exceedances 2009
<b>Figure 12</b>	Volatile Organic Compounds – Benzene Annual Trends
<b>Figure 13</b>	Volatile Organic Compounds – Benzene Annual Means 2009
<b>Figure 14</b>	Wind Rose Graphics
<b>Figure 15</b>	Hamilton Air Monitoring Network Map
<b>Figure 16</b>	Telemetry System – Data Flow
<b>Figure 17</b>	Rotek Environmental – MOE Audit Record
<b>Figure 18</b>	HAMN Framework

---

<b>Table 1</b>	HAMN Participating Industries
<b>Table 2</b>	Sulphur Dioxide Statistics 2009
<b>Table 3</b>	Total Reduced Sulphur Statistics 2009
<b>Table 4</b>	Nitrogen Dioxide Statistics 2009
<b>Table 5</b>	Total Suspended Particulate Statistics 2009
<b>Table 6</b>	PM <sub>10</sub> - Inhalable Particulate Statistics 2009
<b>Table 7</b>	PAH (Benzo[a]Pyrene) Statistics 2009
<b>Table 8</b>	Volatile Organic Compounds – Benzene Statistics 2009
<b>Table 9</b>	HAMN Air Monitoring Network Configuration

## SECTION 1- OVERVIEW

### Executive Summary

Since May 1<sup>st</sup>, 2003, the industrial air shed monitoring network in the City of Hamilton has been operated, serviced and maintained by Hamilton Air Monitoring Network (HAMN). HAMN is a group of industries that are committed to ongoing measurement of local air quality as part of the Ministry of the Environment (MOE) industrial Source Emissions Monitoring (SEM) program.

Companies participating in the MOE SEM program are required to submit an annual summary report of their air quality monitoring results obtained in the previous calendar year. Three new companies have joined HAMN in 2009. These companies are Westway Terminals Canada Ltd, Newalta and Biox Canada Ltd.

This report contains an overview of the HAMN network, historical trends for major air pollutants and an explanation of the roles and responsibilities of HAMN and MOE in the SEM program. The complete 2009 monitoring results are provided in a separate appendix to this report.

Some of the highlights of this report are:

- Sulphur Dioxide levels continue to decline and remain well below the MOE's annual criteria. The Sulphur Dioxide 2009 annual average was the lowest in 10 years.
- Total Reduced Sulphur (TRS) annual trends for 2009 were the lowest in ten years. There was a decrease in the number of hours over the 10 ppb odour threshold level.
- Nitrogen Dioxide (NO<sub>2</sub>) levels continue to decline in 2009. This year was the lowest in ten years.
- Annual trends for PM<sub>10</sub> have declined in 2009. This could be contributed to a weakened economy. Inhalable Particulate (PM<sub>10</sub>) levels continue to exceed the 24-hour interim AAQC.
- For the second consecutive year, annual total suspended particulate (TSP) trends from three industrial sites have dropped below the MOE annual objective of 60 µg/m<sup>3</sup>. Levels at specific point source stations continue to exceed the 24-hour TSP objective.
- Based on the location of the ambient air monitoring stations and their proximity to local sources, it is evident that road dust and fugitive emissions continue to elevate particulate levels.
- Benzene levels remain slightly above background levels over the last six years.
- Benzo[a]Pyrene (B[a]P) levels were lower than last year. All three sites continue to record periodic exceedances of the 24-hour Ambient Air Quality Criteria (AAQC).

HAMN has surpassed the MOE yearly valid data collection requirement criteria of 95% for seven consecutive years. HAMN has averaged 97% over each of the first five years of operation, with minimal down time.

The MOE performs regular audits of activities and processes related to the collection of air quality data under the MOE Source emission monitoring (SEM) program. The audits provide an indication of the effectiveness of quality control activities used by station operators and data management staff. HAMN meets or exceeds all of the requirements under the MOE SEM program.

HAMN continues to provide resources for network enhancement; 2009 projects include:

- Completion of the particulate monitoring enhancement program in late 2009. HAMN has doubled the number of samplers bringing the network total to 8.

- On June 1<sup>st</sup>, 2009, the new HAMN website was launched and made available to the general public.
- Completion of an auto-notification system to alert HAMN members of elevated readings.

### **Hamilton Air Monitoring Network (HAMN) Overview**

Since May 1<sup>st</sup>, 2003, the point source air-monitoring network in the City of Hamilton has been operated, serviced and maintained by the Hamilton Air Monitoring Network (HAMN).

The Hamilton industrial area is made up of various industrial sectors including integrated iron and steel plants, chemical producers, manufacturing facilities and several recycling facilities. With the close proximity of these facilities to each other, and the complexity of meteorological conditions in Hamilton, assessing sources of industrial emissions has always been a difficult task.

HAMN represents participating industries that are committed to carrying out their own air quality monitoring as part of the MOE’s SEM program. The SEM program is designed to identify, monitor and report the levels of target pollutants near industrial plants.

### **HAMN Participating Industries – Table 1**

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

### **Annual Report Overview**

Companies participating in the MOE’s SEM program are required to submit an annual summary report of their air quality monitoring results obtained in the previous calendar year. This report is HAMN’s annual submission which summarizes HAMN’s 2009 air quality data as per the MOE’s reporting requirements.

This report contains an overview of the HAMN network, historical trends and annual data for major air pollutants and an explanation of the roles and responsibilities of HAMN and MOE in the SEM program. The complete 2009 monitoring results are provided in a separate appendix to this report.

### **Network Enhancements**

The total capital value of HAMN assets now exceeds \$700,000. The HAMN members support the network’s annual operating costs of approximately \$473,000 through user fees. These fees fund the service, repair and maintenance of the monitoring equipment in the HAMN network, as well as the costs of meeting all QA/QC requirements required by the MOE and paying for all laboratory analyses. Approximately 10% of the budget is committed toward the purchase of new equipment or conducting special air monitoring surveys.

## Public Web Based Data Access

On June, 1<sup>st</sup>, 2009, the HAMN website was launched and made available to the general public. Current and historical hourly data from all real-time continuous analysers can be accessed through the HAMN website at ([www.hamnair.ca](http://www.hamnair.ca)). The website provides general information on network operations such as HAMN structure, funding and the MOE's role in HAMN. The website also provides a detailed description of contaminants measured and sampling methodology. HAMN annual reports are posted and made available. In 2009, HAMN was supported by 22 companies that provided funding to support and operate the network.

## Enhancements to the Particulate Monitoring Program

HAMN has been investing new sampling methods for particulate monitoring. HAMN is moving away from traditional non-continuous filter based sampling methods to real-time continuous particulate monitors. A jointly funded enhancement program of \$200,000 by the Ministry of the Environment and HAMN added 4 additional samplers in 2009, for a total of 8 real-time continuous samplers.

## SECTION 2 - AIR QUALITY SUMMARY DATA - POLLUTANT TRENDS

An important tool used for air pollution data analysis is the evaluation of pollutant trends. Data collected from the HAMN air monitoring sites are summarized and illustrated in the following 'historical trend' graphs. Trend analysis is a fine approach to examine how a pollutant behaves over time and space. Some data trend categories include the following:

- **Hourly data**            How a given pollutant 'behaves' during an average day.
- **Annual data**            How a given pollutant 'behaves' during the course of the year.
- **Seasonal data**        How inversions affect the dispersion of pollutants in the local air shed.
- **Historical data**        How data 'behaves' over several years.

These analyses help in assessing the impacts of emission reductions initiatives, deciding where to deploy monitors and gauging the effectiveness of Provincial pollution abatement and control legislation.

The following graphs and bar charts provide annual trends for the pollutants monitored at selected monitoring locations. Figure 15 in Appendix 4 provides the locations of the individual monitoring stations in the Hamilton area.

A summary table for each pollutant is also provided indicating the Maximum 1-Hr Average Value, the Maximum 24-Hr Average Value, the Number of Hours over the 1-Hr Ambient Air Quality Criteria (AAQC), the Number of Days over the 24-Hr AAQC, the Annual Mean and the Percent Valid Data. All 2009 data is available in the "Summary Statistics and Data Set 2009."

## Air Quality Monitoring – Sulphur Dioxide

### Characteristics

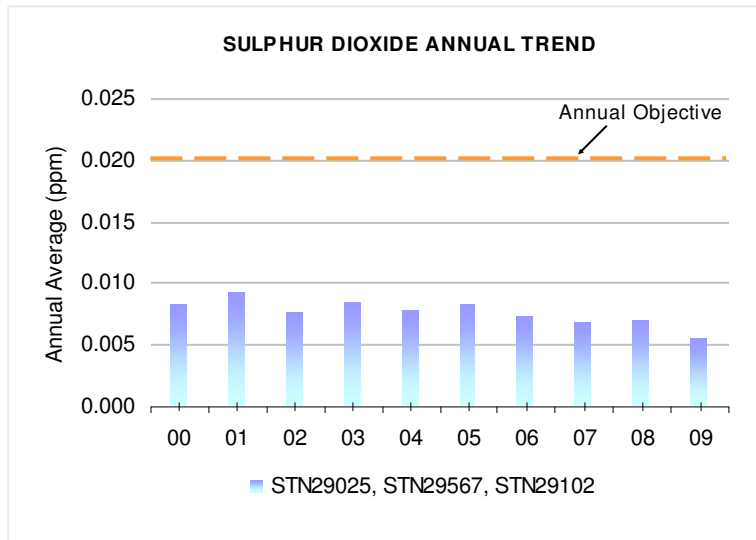
Sulphur Dioxide (SO<sub>2</sub>) belongs to the family of sulphur oxide gases (SO<sub>x</sub>). These gases dissolve easily in water. Sulphur is prevalent in many raw materials including crude oil, coal, and ores that contain common metals like aluminum, copper, zinc, lead and iron. SO<sub>x</sub> gases are formed when fuels containing sulphur, such as coal or oil, are burned, when gasoline is extracted from oil or metals are extracted from ore. SO<sub>2</sub> dissolves in water vapour to form an acid which interacts with other gases and particles in the air to form sulphate particulates and other products that can be harmful to people and the environment.

Over 65% of SO<sub>2</sub> released to the air comes from electric power utilities, especially those that burn coal. Other sources of SO<sub>2</sub> are industrial facilities that derive their products from raw materials like coal and crude oil, or that burn coal or oil to produce or process heat. Examples include the steel industry, petroleum refineries, cement manufacturing and metal processing facilities.

### Ontario AAQC's for SO<sub>2</sub> are:

1 hour average	0.25 ppm
24 hour average	0.10 ppm
Annual average	0.02 ppm

SO<sub>2</sub> levels in Hamilton remain well below the MOE's annual objective. In 2009 the annual mean for STN29102 was 0.007 ppm compared to STN9567 at 0.004 ppm. The highest 1 hour average for STN29102 was 0.146 ppm and 0.142 ppm for STN29567.

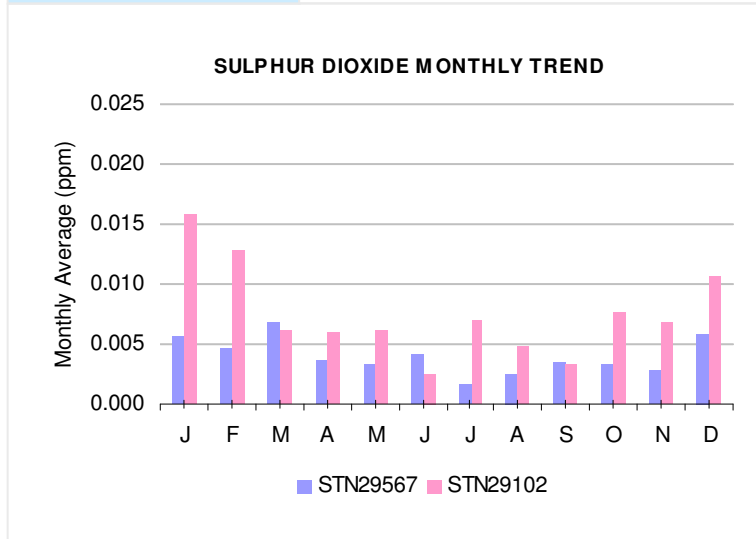


**Figure 1**

Annual average SO<sub>2</sub> trend. STN29025 terminated in '07. The '08 and '09 averages are based on STN29567 and STN29102.

**Figure 2**

Monthly SO<sub>2</sub> trends for 2009. Monthly average concentrations ranged from 0.002 to 0.016 ppm.



Station	Maximum 1 Hr Clock Average	Maximum 24 Hr Running Average	No. of Hrs > Hr AAQC	No. of Events > 24 Hr AAQC	Annual Mean	Percent Valid Data
	ppm	ppm			ppm	
STN29567	0.142	0.050	0	0	0.004	99.1
STN29102	0.146	0.048	0	0	0.007	96.5



## Air Quality Monitoring – Nitrogen Oxides (NO<sub>x</sub>)

### Characteristics

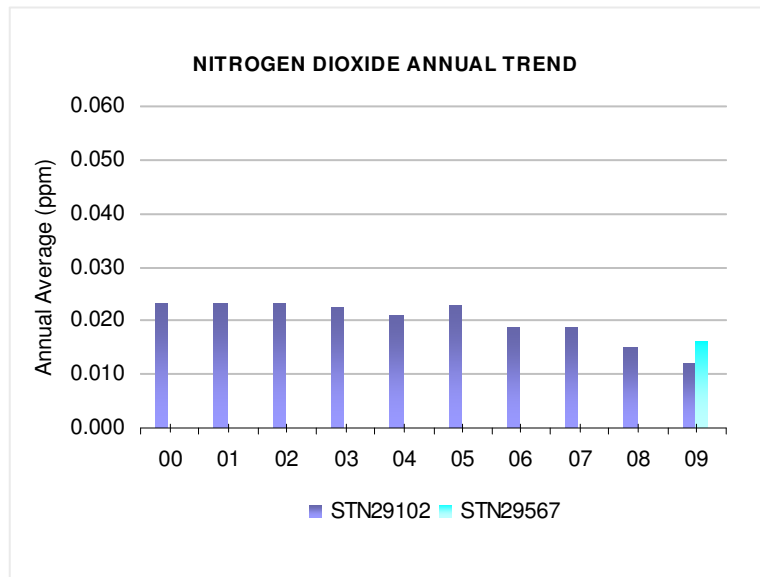
Oxides of Nitrogen (NO<sub>x</sub>) is the generic term used for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. The MOE lists criteria for NO<sub>x</sub> as Nitrogen Oxides which is defined as the sum of nitrogen dioxide and nitric oxide (NO<sub>2</sub> + NO). Nitric Oxide (NO) is colorless and odourless and is emitted from combustion sources. Nitrogen Dioxide (NO<sub>2</sub>) is a reddish-brown gas that causes the brown layer commonly seen over many urban areas.

Oxides of Nitrogen form when air is heated to over 675°C during combustion processes. The primary manmade sources of NO<sub>x</sub> are motor vehicles, electric power utilities and other industrial, commercial, and residential sources that burn fuels. NO<sub>x</sub> can also be formed naturally by lightning. Emissions of NO<sub>x</sub> consist mainly of NO and to a lesser extent NO<sub>2</sub>. In atmosphere NO will convert to NO<sub>2</sub>. The adverse health effects of NO<sub>2</sub> occur at much lower concentrations and so although the AAQC standard is for NO<sub>x</sub>, it is based on the health effects of nitrogen dioxide (NO<sub>2</sub>). NO<sub>x</sub> causes a wide variety of health impacts in humans as well as other environmental impacts.

### Ontario AAQC's for NO<sub>x</sub> (as NO<sub>2</sub>) are:

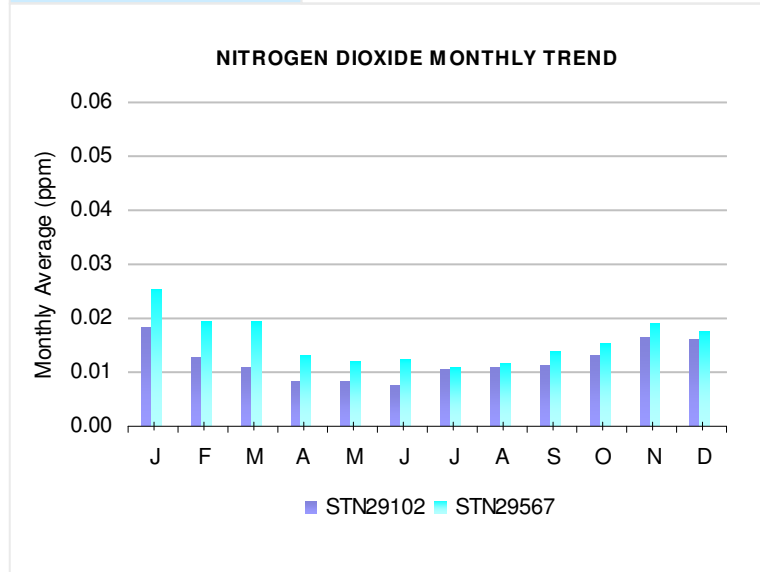
1 hour average                      0.20 ppm  
 24 hour average                    0.10 ppm

Since 2005, Nitrogen Dioxide levels continue to decline with 2009 being the lowest over the past 10 years. Nitrogen Dioxide levels are greater in winter months than summer months. The annual averages for STN29102 (0.012ppm) and STN29567 (0.016ppm) are well below the MOE criterion.



**Figure 5** Annual average NO<sub>2</sub> trend over the past 10 years for station 29102. STN29567 was commissioned in 2009.

**Figure 6** Monthly NO<sub>2</sub> trends for 2009. Monthly average concentrations range from 0.011 ppm to 0.025 ppm



Station	Maximum 1 Hr Clock Average	Maximum 24 Hr Running Average	No. of Hrs > 1 Hr AAQC	No. of Hrs > 1 Hr Threshold	Annual Mean	Percent Valid Data
	ppm	ppm			ppm	
STN29102	0.049	0.031	0	0	0.012	97.5
STN29567	0.070	0.045	0	0	0.016	99.2

## Air Quality Monitoring – Total Suspended Particulate (TSP)

### Characteristics

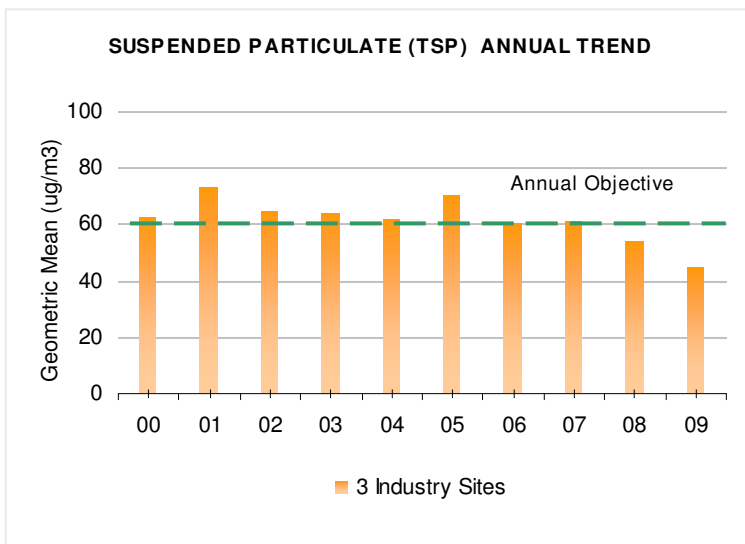
Particle pollution (also called total suspended particulate or TSP) is the term for a mixture of solid particles and liquid droplets found in the air. Some particles such as dust, dirt, soot, or smoke are large or dark enough to be seen with the naked eye. TSP includes all particulate material smaller than 44 µm (44 micrometres or 44 microns) in diameter. The largest TSP particles have diameters similar to the diameter of a human hair (about 50 µm) while others are so small they can only be detected using an electron microscope.

### Ontario AAQC's for TSP are:

24 hour average                      120 µg/m<sup>3</sup>  
Annual mean                              60 µg/m<sup>3</sup>

A substantial portion of TSP is related to industrial activities, road dusts, agricultural dusts and other sources of airborne soils. The TSP values in Figure 7 illustrate the geometric means from 3 industrial monitoring sites and are representative of the impacts experienced by those communities bordering on the industrial area. This is the second consecutive year the TSP annual average was below the MOE criterion of 60 µg/m<sup>3</sup>.

Table 5 summarizes the 2009 statistics for seven TSP monitoring sites. STN29161 was the only station to exceed the 60 µg/m<sup>3</sup> annual criterion. Local road traffic is the major source of particulate at this location.



**Figure 7**

Annual average TSP trend over the past 10 years. Years '00 through '07 are based on the combined averages of STN29025, STN29113 and STN29102. STN29025 was terminated in '07. STN29567 was used for the '08 and '09 average calculations.

**Table 5**

**Total Suspended Particulates (TSP) Statistics for 2009**

Station	Number of 24 Hr Samples	Maximum 24 Hr	No. of Days > 24 Hr TSP AAQC	No. of Days > 24 Hr Metals AAQC	Annual Mean µg/m <sup>3</sup>	Percent Valid Data
		µg/m <sup>3</sup>				
STN29102	60	324	3	0	49	98.4
STN29113	59	140	2	0	40	96.7
STN29160	59	265	3	4 (Mn)	53	96.7
STN29161	61	301	17	4 (Fe)	90	100.0
STN29164	59	139	1	1 (Fe)	53	96.7
STN29567	60	131	1	0	46	98.4
STN29166	59	105	0	---	32	96.7

## Air Quality Monitoring – Inhalable Particulate Matter (PM<sub>10</sub>)

### Characteristics

Particulate Matter (PM) is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components including acids (such as nitrates and sulphates), organic chemicals, metals and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. There is concern about particles that are 10 micrometers in diameter or smaller (PM<sub>10</sub>) because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.

Some particles, known as primary particles, are emitted directly from a source such as construction sites, unpaved roads, fields, smokestacks or fires. Other particles are formed in complex reactions in the atmosphere from gases such as SO<sub>2</sub> and NO<sub>x</sub> that are emitted from power plants, industries and automobiles. These particles, known as secondary particles, make up most of the fine particulate pollution in the country.

### Ontario Interim AAQC for PM<sub>10</sub> is:

24 hour average                      50 µg/m<sup>3</sup>

**Figure 9a** – Historical stations

**Figure 9b** – New stations for 2009

No observed 24Hr AAQC exceedances were reported for STN29565 and STN29567 in 2009.

PM<sub>10</sub> exceedances reduced in June and remained low through to the end of the year for the historical stations. This was likely a result of a weakened economy.

### Notes:

STN29168 commissioned April, 2009.

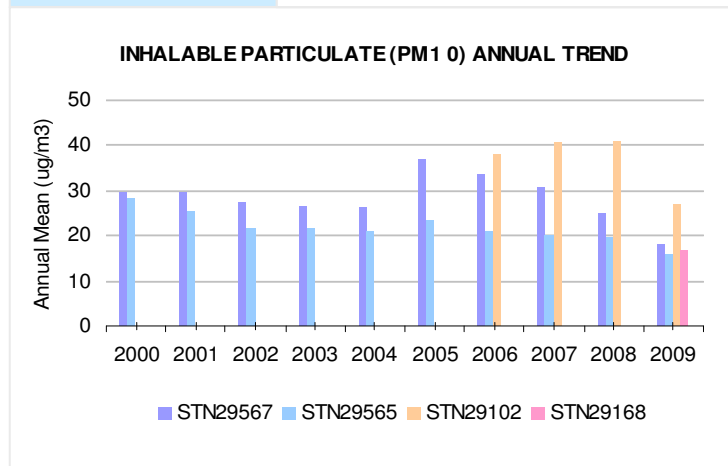
STN29113 commissioned July, 2009.

STN29170 commissioned June, 2009.

STN29153 commissioned October, 2009.

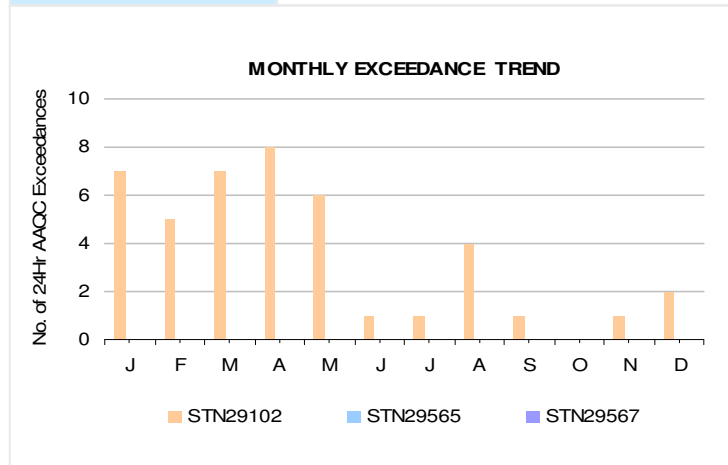
**Figure 8**

Annual average PM<sub>10</sub> trend over 10 years.



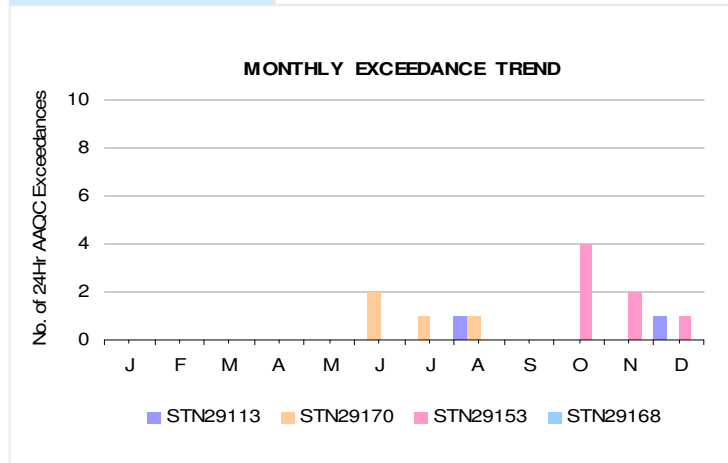
**Figure 9a**

Monthly PM<sub>10</sub> exceedance trends for 2009.



**Figure 9b**

Monthly PM<sub>10</sub> exceedance trends for 2009.



<b>Table 6</b>		<b>Inhalable Particulate Matter (PM<sub>10</sub>) Statistics for 2009</b>			
Station	Maximum 1 Hr Average	Maximum 24 Hr Average	No. of Days > 24 Hr AAQC	Annual Mean	Percent Valid Data
	µg/m <sup>3</sup>	µg/m <sup>3</sup>		µg/m <sup>3</sup>	
STN29102	967	149	43	27	98.0
STN29565	300	39	0	16	99.0
STN29567	172	48	0	18	98.0
STN29168	209	49	0	17	99.0
STN29113	93	54	2	N/A	85.0
STN29170	176	58	4	N/A	98.0
STN29153	490	73	7	N/A	85.0

**Note:**

Annual means for STN29113, STN29170 and STN29153 did not meet the MOE annual reporting criteria of 75% available data.

STN29154 was installed in December, 2009 and commissioned in January, 2010.

## Air Quality Monitoring – Polycyclic Aromatic Hydrocarbons (PAH)

### Characteristics

Benzo[a]Pyrene (BaP) is a compound representative of a class of chemicals called Polycyclic Aromatic Hydrocarbons (PAH). BaP is a known carcinogen and is produced by the combustion of carbonaceous fuels (gasoline, diesel fuel, wood, coal, etc.) and tobacco. PAH is present in the atmosphere predominantly in particulate form. A less significant formation mechanism is the volatilization of lightweight polycyclic organic matter, which occurs in the production and use of naphthalene.

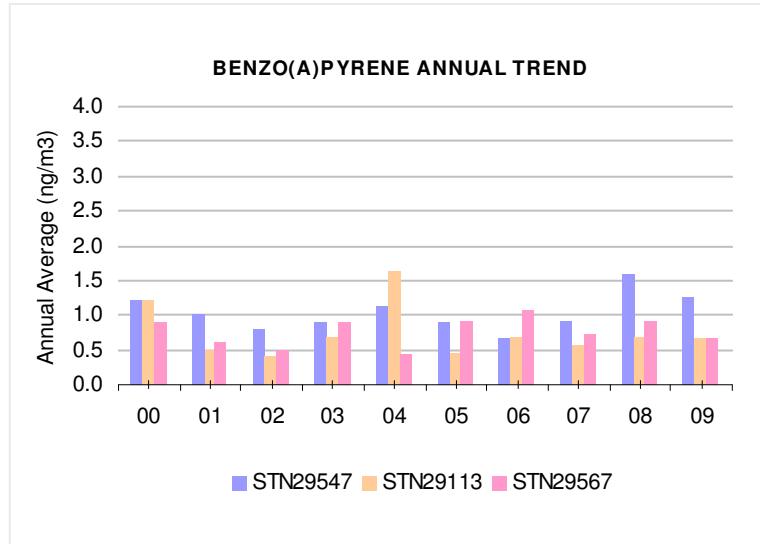
### Ontario AAQC's for Benzo[a]Pyrene:

24 Hour Average            1.10 ng/m<sup>3</sup>  
 Annual Mean                0.22 ng/m<sup>3</sup>

The principal sources of BaP in Hamilton are vehicle and coke oven emissions. Improvements made to the coke oven operations have led to dramatic reductions (65-85% since the mid-1990's) in the ambient BaP levels near and away from the industries.

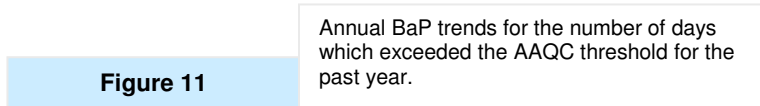
Trends for both STN29113 and STN29567 remain unchanged over the last ten years. STN29547 has increased over the last two years.

In 2009, 24 exceedances of the MOE 24 hour criterion were recorded.



**Figure 10**

Annual average BaP trend over the past 10 years for STN29547, STN29113 and STN29567.



**Figure 11**

Annual BaP trends for the number of days which exceeded the AAQC threshold for the past year.

<b>Table 7      Benzo[a]Pyrene (BaP) Statistics for 2009</b>					
Station	Number of 24 Hr Samples	Maximum 24 Hr	No. of Days > 24 Hr AAQC	Annual Mean	Percent Valid Data
		µg/m <sup>3</sup>		µg/m <sup>3</sup>	
STN29567	30	3.2	4	0.65	100.0
STN29113	29	2.6	6	0.65	96.7
STN29547	30	5.6	12	1.27	100.0

## Air Quality Monitoring – Volatile Organic Compounds (VOC)

### Characteristics

Benzene is a volatile organic compound that has been classified as a human carcinogen. It is a non-threshold toxicant, a substance for which there is considered to be some probability of harm for critical effects at any level of exposure. The main sources of benzene are wood combustion (including forest fires and residential wood combustion), transportation, natural gas dehydrators, steel industry and petroleum distribution and refining.

Industrial Benzene emissions arise primarily from the coke ovens and the associated by-products plants in the steel industry. Improvements in the control of benzene vapours at the by-products plants have resulted in large reductions (60-80%) at a monitoring site near the steel mills over the past several years. Background benzene levels measured by Environment Canada have dropped below  $2 \mu\text{g}/\text{m}^3$ .

Benzene trends remain the same over the last six years. Readings are close to background levels.

Note:

A new sampling method and analysis was implemented in April 2008. HAMN initiated the collection of VOC samples with evacuated stainless steel canisters rather than sampling sorbent tubes.

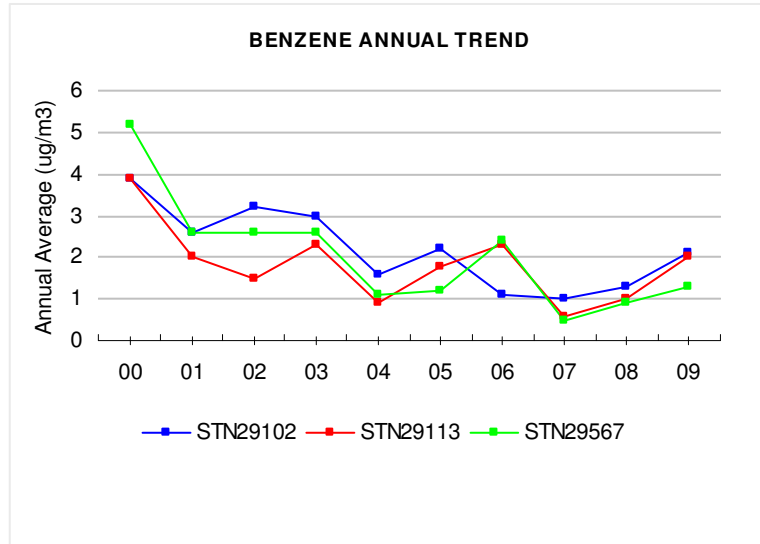


Figure 12

Annual average Benzene trends over the past 10 years for STN29102, STN29113 and STN29567.

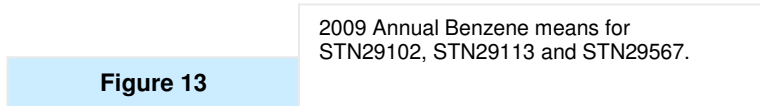


Figure 13

2009 Annual Benzene means for STN29102, STN29113 and STN29567.

Table 8		Volatile Organic Compounds – Benzene Statistics for 2009			
Station	Number of 24 Hr Samples	Minimum 24 Hr	Maximum 24 Hr	Annual Mean	Percent Valid Data
		$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	
STN29102	30	0.2	5.5	2.1	100.0
STN29113	27	0.2	9.5	2.0	90.0
STN29567	30	0.4	4.2	1.3	100.0

## Appendix 1

### Wind Frequency Distribution – 2009 Wind Rose

To show the information about the distributions of wind directions and wind speeds, one may draw a radial plot of the data as a so-called “wind rose,” based on meteorological observations of wind speeds and wind directions. Wind roses are a form of meteorological fingerprint. It is important to be able to “read” the wind rose correctly. The “arms” of a wind rose point to where the wind was **coming from**, not the direction the wind was blowing.

Wind roses summarize the relative occurrence (or frequency) of winds blowing from different directions as narrow wedges or spokes about a central point; the longer the wedge or spoke, the more frequent the winds blew in from that direction, with North at the top of the diagram. Each wedge is divided into segments of different colours, representing wind speed ranges.

Examination of a wind rose is extremely useful for siting air monitoring stations. If a large share of the energy in the wind comes from a particular direction, then you will want to site an air monitoring location in that predominant downwind vector. Examples of wind rose graphics from two of the network Meteorological Stations are provided below. For example, the longest spokes in the wind rose for STN29026 point toward the southwest, which means these spokes represent data for winds which were blowing from the southwest about 225 degrees on the compass. In other words the predominant winds for 2009 at STN29026 were from the southwest. Conversely, the predominant winds at STN29567 came from a direction that is about 270 degrees on the compass. This difference in wind directions highlights the fact that winds in Hamilton are affected a great deal by the both the harbour and the escarpment.

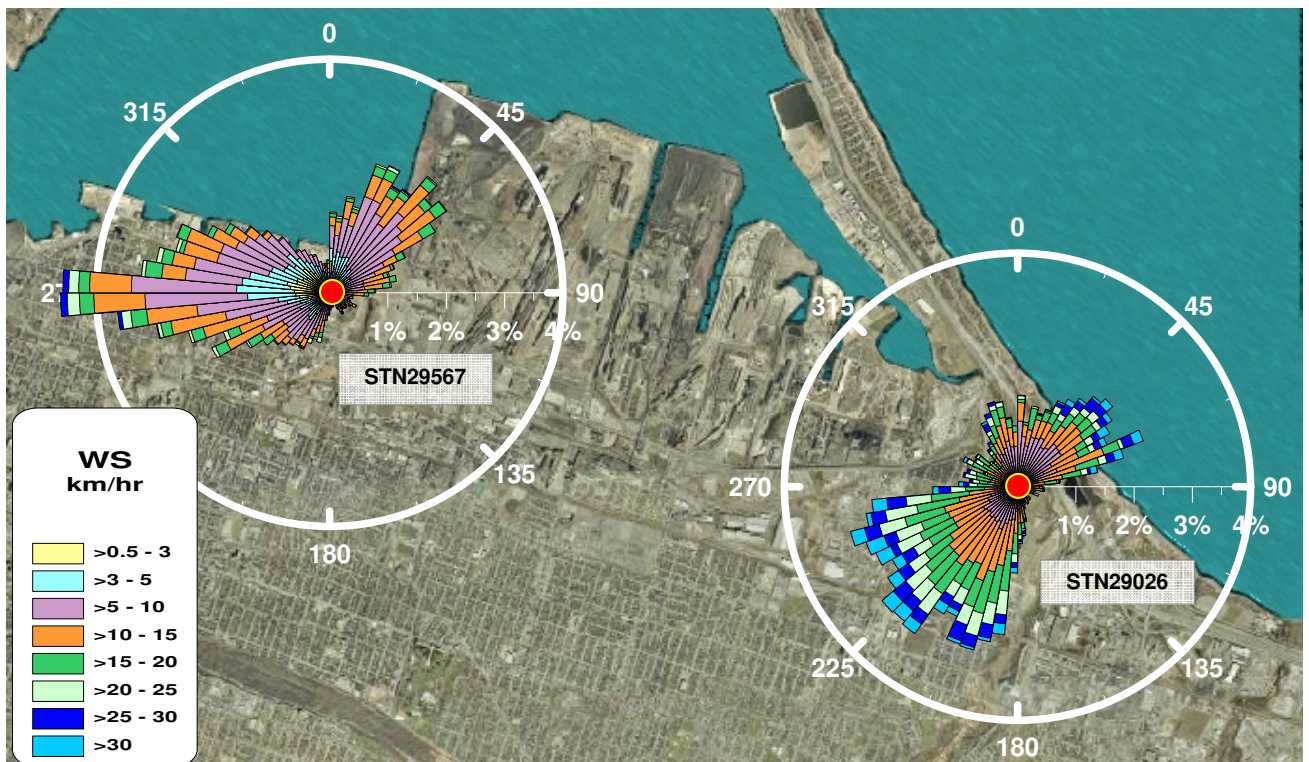


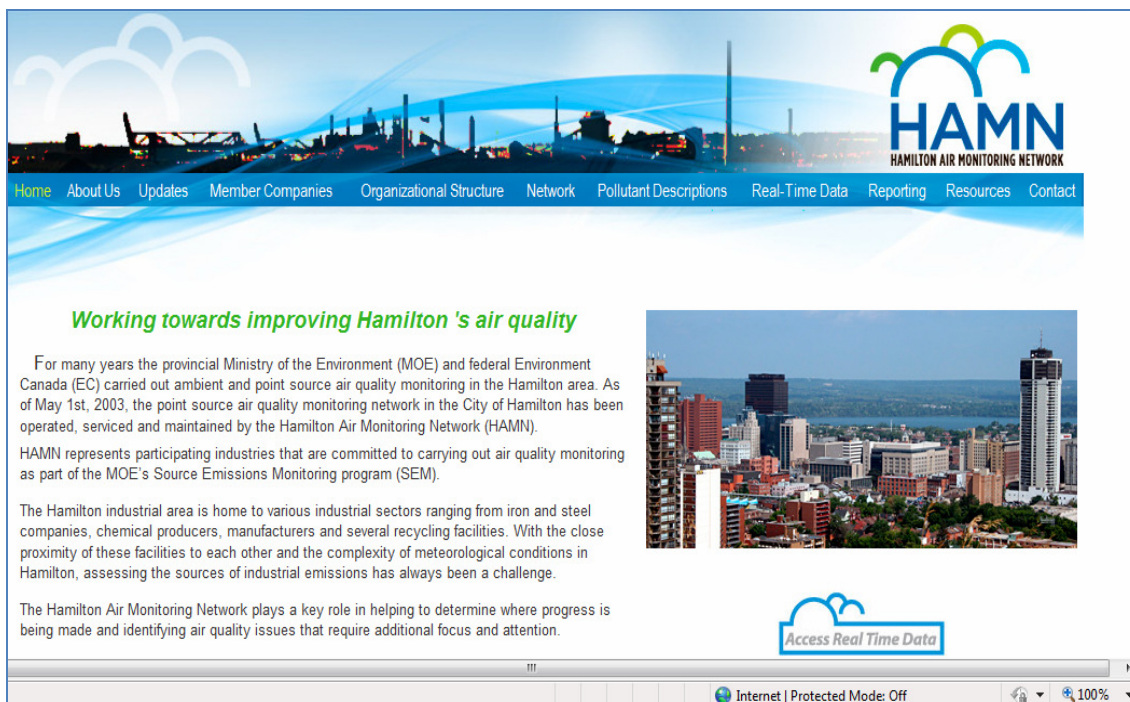
Figure 14

## Appendix 2

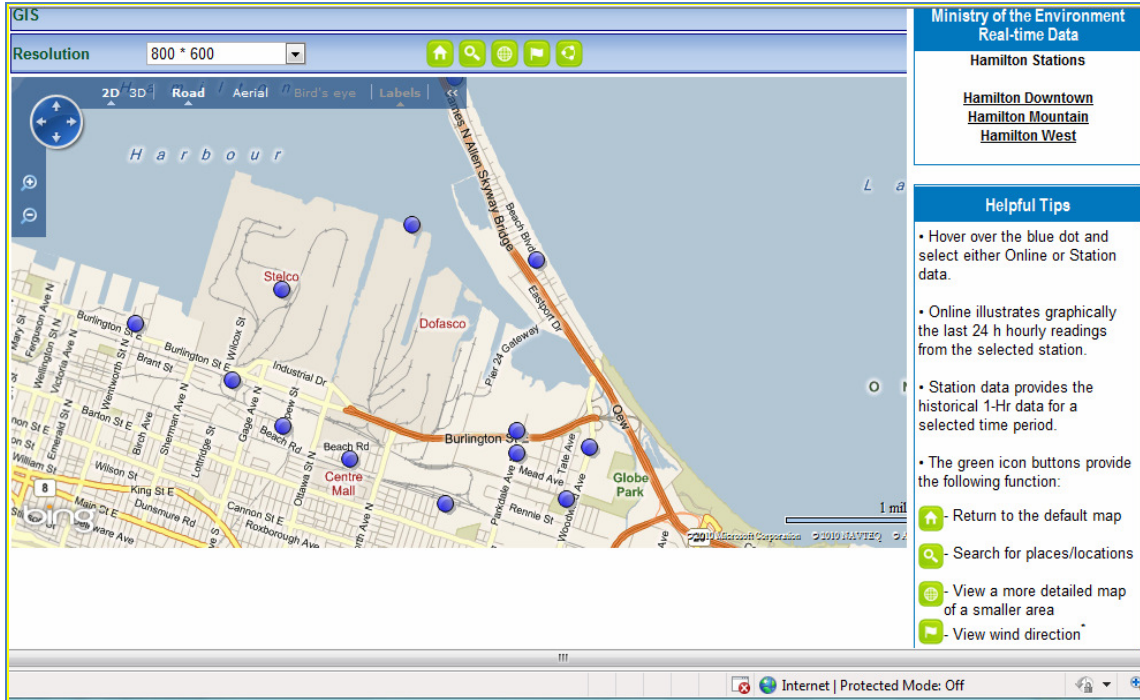
### Activities and Progress

#### Hamilton Air Monitoring Network (HAMN) Website

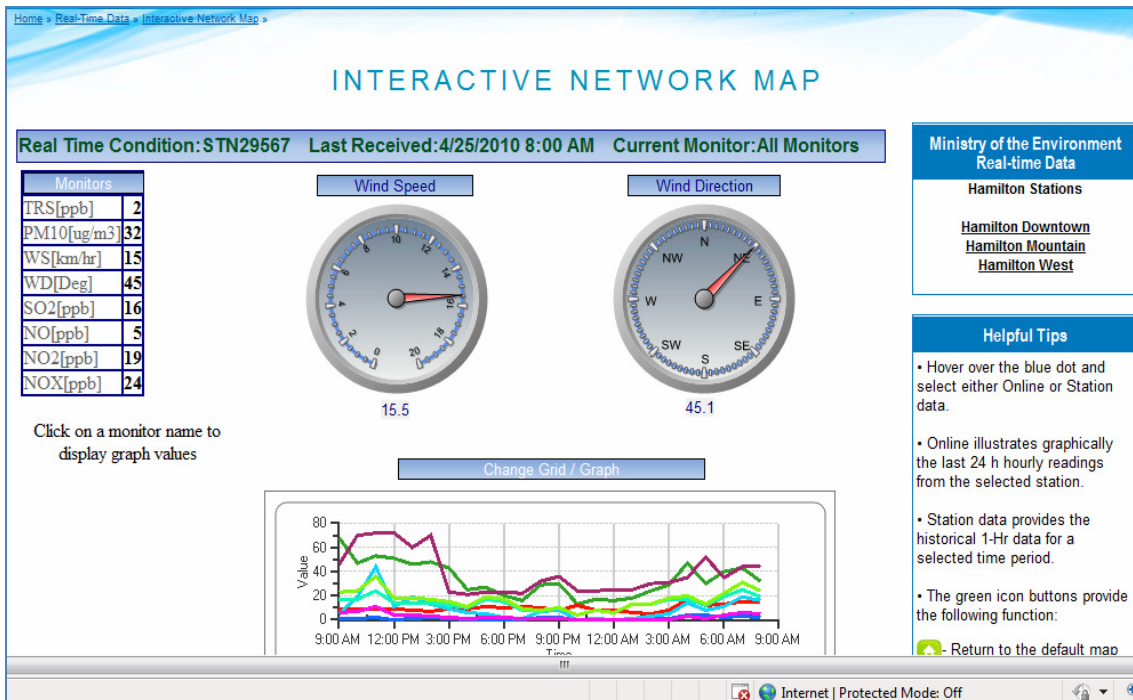
On June 1<sup>st</sup>, 2009, the HAMN website was launched and made available to the general public. Current and historical hourly data from all real-time continuous analysers can be accessed through the HAMN website at ([www.hamnair.ca](http://www.hamnair.ca)). The website provides general information on network operations such as HAMN structure, funding and the Ministry of Environment's role in HAMN. The website also provides a detailed description of contaminants measured and sampling methods. HAMN annual reports are posted and made available. In 2009, HAMN was supported by 22 companies that provided funding to support and operate the network.



The main focus of the website is to provide access to real-time data for HAMN members, Ministry of the Environment and the public. Data is available from all continuous analysers such as Sulphur Dioxide (SO<sub>2</sub>), Total Reduced Sulphur (TRS), Oxides of Nitrogen (NO, NO<sub>2</sub>, NO<sub>x</sub>) and Inhalable Particulates (PM<sub>10</sub>). Data is also available for a number of meteorological stations that provide real-time wind speed, wind direction and temperature.



A series of simplified graphical and tabular displays make near real time and historical data easily accessible. A number of report formats are also available for data viewing and assessments.



### Enhancements to the Particulate Monitoring Program

HAMN has been investing in new sampling methods for particulate monitoring. HAMN is moving away from the traditional non-continuous filter based sampling methods to real-time continuous particulate monitors. A jointly funded enhancement program of \$200,000 by the Ministry of the Environment and HAMN has added an additional 4 samplers in 2009 (shown below) bringing the network to a total of 8 real-time continuous samplers.

STN29170



STN29113



STN29153



STN29154



## Appendix 3

### Legend

<b>QA/QC</b>	-	Quality Assurance/Quality Control
<b>SEM</b>	-	Source Emissions Monitoring
<b>HAMN</b>	-	Hamilton Air Monitoring Network
<b>AAQC</b>	-	Ambient Air Quality Criteria (Ontario)
<b>EST</b>	-	Eastern Standard Time
<b>MOE</b>	-	Ministry of the Environment
<b>NO</b>	-	Nitric Oxide
<b>NO<sub>2</sub></b>	-	Nitrogen Dioxide
<b>NO<sub>x</sub></b>	-	Oxides of Nitrogen
<b>PM<sub>10</sub></b>	-	Inhalable Particulates less than 10 microns in diameter
<b>SO<sub>2</sub></b>	-	Sulphur Dioxide
<b>TSP</b>	-	Total Suspended Particles
<b>TRS</b>	-	Total Reduced Sulphur
<b>VOC</b>	-	Volatile Organic Compounds
<b>PAH</b>	-	Polycyclic Aromatic Hydrocarbons
<b>B[a]P</b>	-	Benzo[a]Pyrene
<b>MDL</b>	-	Minimum Detection Limit
<b>ng/m<sup>3</sup></b>	-	Nanograms (of contaminant) Per Cubic Metre (of air)
<b>µg/m<sup>3</sup></b>	-	Micrograms (of contaminant) Per Cubic Metre (of air)
<b>ppb</b>	-	Parts (of contaminant) Per Billion (parts of air)
<b>ppm</b>	-	Parts (of contaminant) Per Million (parts of air)
<b>TEOM</b>	-	Tapered Element Oscillating Microbalance
<b>SSI</b>	-	Size Selective Inlet (Manual)
<b>Mn</b>	-	Manganese
<b>Fe</b>	-	Iron
<b>Continuous</b>	-	Continuous 'Real Time' Monitoring
<b>Non Continuous</b>	-	24 Hr Samples – 6 or 12 Day Rotating Schedule

## Appendix 4

### Where do we Measure Air Quality in Hamilton?

For many years the MOE and Environment Canada (EC) carried out routine ambient monitoring in the Hamilton area. Since May, 2003 HAMN's industrial air quality monitoring program has been responsible for collecting and reporting accurate, real-time continuous measurements of ambient pollutants at five sites located around the industrial area (Figure 15). These pollutants include Sulphur Dioxide (SO<sub>2</sub>), Total Reduced Sulphur (TRS), Oxides of Nitrogen (NO<sub>x</sub>), and Inhalable Particulate Matter (PM<sub>10</sub>). As well, there are 13 non-continuous air monitoring samplers in the HAMN network that collect data every sixth or twelfth day in a rotating schedule.

These samplers monitor such pollutants as Total Suspended Particulates (TSP), Volatile Organic Compounds (VOC's), Polycyclic Aromatic Hydrocarbons (PAH) and Metals (Table 9).

### Hamilton Air Monitoring Network Map

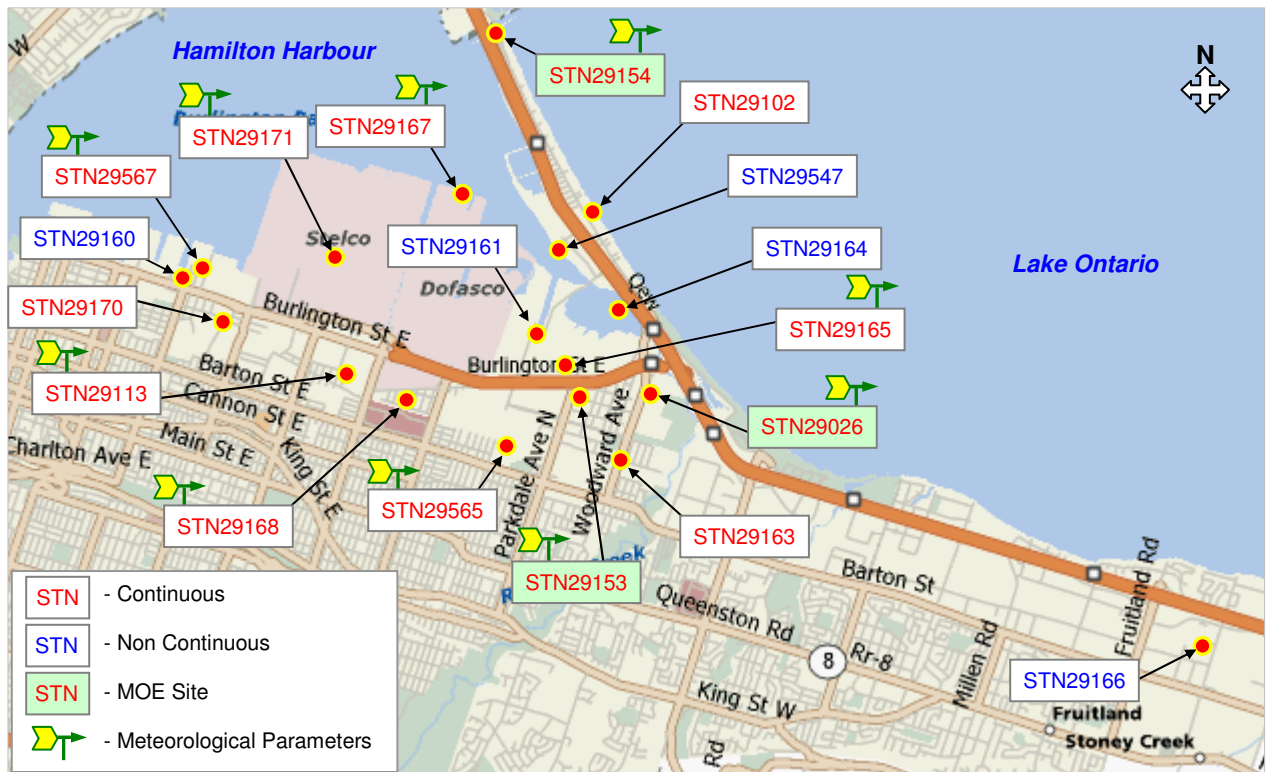


Figure 15

The data generated are used to monitor air quality in and around the industrial area, determine which areas meet and/or exceed Ontario Ambient Air Quality Criteria (AAQC) and develop pollution trends. The HAMN program encompasses operation of the sampling and monitoring network, laboratory analysis of air samples, and quality assurance activities to ensure the quality of the data collected.

HAMN provides the MOE with real-time access to continuous air monitoring data and submits quarterly and annual data summary reports of all continuous and non-continuous air monitoring data. Also, HAMN provides immediate notification of all exceedances of the AAQC. The MOE has real-time data access to the air quality information to assist them with abatement programs and complaint investigations.

## HAMN Network Configuration

### Network Configuration

Parameter	SO2	TRS	NOX	PM10	PM10	TSP	VOC	PAH	MET
				Real Time	SSI	Metals			
STN29102	◆	◆	◆	◆		○	○		
STN29547								○	
STN29565				◆					◆
STN29567	◆	◆	◆	◆		○	○	○	◆
STN29113				◆		○	○	○	
STN29160						○			
STN29161						○			
STN29163		◆							
STN29164						○			
STN29166						○			
STN29167									◆
STN29168		◆		◆					◆
STN29170				◆					
STN29171									◆
STN29153				◆					
STN29154				◆					◆
STN29165									◆
STN29026									◆

◆ Continuous      ○ Non-Continuous

Table 9

### How do we Measure Air Quality?

The network data is used to provide HAMN members and the MOE with accurate air quality information. The continuous monitoring sites in the network include instruments that measure ambient levels of gaseous and particulate air pollutants, and in some cases, meteorological parameters. The data signals from these analyzers and sensors must be averaged, digitized and processed according to detailed MOE guidelines for collecting air quality monitoring data. Figure 16 illustrates the real-time movement of data to both industry members and MOE servers.

### Telemetry System

Data that is received by the HAMN operated servers is utilized for troubleshooting and rectifying network anomalies, generating reports, implementing QA/QC protocols and notifying MOE and industry personnel of AAQC exceedances and/or unusual air quality events. The MOE database provides for real-time oversight of network operations to ensure compliance with defined protocols and provides immediate access to daily pollutant trends for tracking of abatement program initiatives (Figure 16).

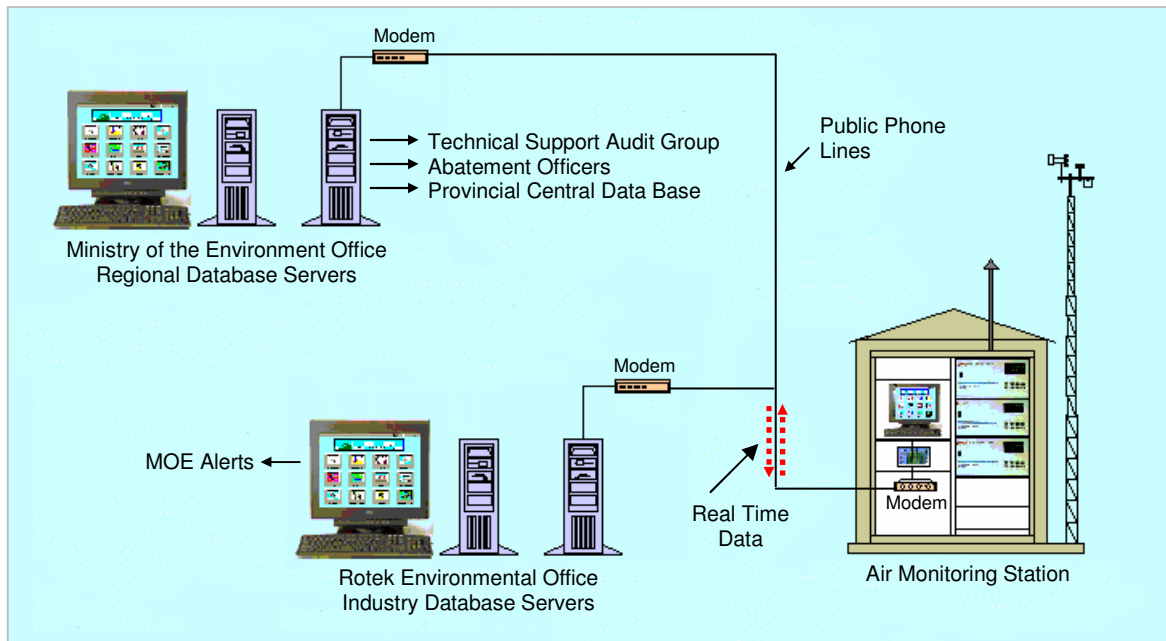


Figure 16

## Appendix 5

### Ministry of the Environment (MOE) Role in HAMN

In April of 2003 the MOE launched a new initiative called Industrial Source Emissions Monitoring (SEM). This program requires that companies in Ontario assume the responsibility for monitoring air quality near their facilities.

The objectives of the air quality monitoring program near industrial point sources include the following:

- To assist in the prevention of possible adverse effects due to air emissions from an industrial facility.
- To demonstrate compliance with provincial regulatory air quality limits as set out in Regulation 419, Regulation 337 or in other regulatory instruments such as Orders and Certificates of Approval.
- To demonstrate conformance with Schedule 1, 2 and/or 3 standards set out in Regulation 419 and listed in the document "SUMMARY of STANDARDS and GUIDELINES to support Ontario Regulation 419: Air Pollution – Local Air Quality", and Ambient Air Quality Criteria listed in the document "ONTARIO'S AMBIENT AIR QUALITY CRITERIA" which are developed by the MOE as a component of the MOE standard setting process. These lists are updated periodically.
- To provide accurate and reliable data in support of air quality modeling calculations.
- To determine the impact of industrial air emissions on local air quality in adjacent communities and in the regional air shed.
- To provide accurate and reliable data as part of an integrated air quality management-control system.
- To determine air quality improvements and trends in conjunction with industrial air emissions abatement programs.
- To provide data to assess local population and ecosystem exposure to air pollutants.

### Linkages to the Ministry of the Environment (MOE)

The HAMN air-monitoring network is solely funded and operated by 22 industrial members. HAMN has hired two consultants 1) Administrator - to oversee the network operations as per MOE requirements, and a second 2) Service Contractor - to provide the service, repair and maintenance of the monitoring network. Although the network is owned and operated by industry the MOE has made several request of HAMN to ensure credibility of Hamilton air quality data.

The following is a list of requirements specified by the MOE:

#### A) Data Access

- The MOE has full access to all continuous monitoring stations via HAMN telemetry and data acquisition system.  
MOE can review and assess all raw air quality data collected by HAMN. Data corrections and/or edits are electronically logged and made available to the MOE for review. Data is reviewed by the MOE Air Quality Analyst and forwarded to District abatement staff should further investigation be required.
- The MOE has full access to all analyser's daily calibration records.  
MOE can review and verify instrument performance through daily calibration records.  
MOE will notify HAMN staff of any anomalies.

**B) Notification**

- HAMN to notify the MOE immediately of any exceedances of the air quality guideline or standards.

**C) Reporting**

- HAMN to provide monthly exceedances summary report.  
HAMN prepares and submits to the MOE a monthly summary report of all exceedances that occur within the network.
- HAMN to prepare and provide to the MOE a quarterly summary of all collected and reviewed data.
- HAMN to prepare and provide to the MOE an annual data summary report.

**D) Auditing**

- MOE staff will carry out routine auditing of all HAMN air monitoring samplers. MOE audits carried out on continuous analysers are performed with certified calibration test gases.  
MOE carried out system audits on all non-continuous samplers. A system audit is a performance check of the instrument performance.  
Duplicate monitoring of MOE/HAMN samplers is carried out to verify system audits and laboratory analysis.

**E) Communication**

- Two HAMN committees have been established to provide communication between all HAMN members and the MOE.
  - i. HAMN steering Committee  
The HAMN steering committee members include 10 HAMN members, HAMN Administrator, MOE District abatement staff, and MOE Technical support staff.
  - ii. HAMN Technical sub-working group.  
This working group deals with day-to-day operation of the network. MOE technical support staff, service contractor and HAMN administrator meet bi-monthly. On occasion MOE district abatement staff may be called in to discuss specific abatement issues.

**F) Service Contractor Performance Audit Review**

- HAMN carries out a yearly review of the service contractor's performance. Performance assessment criteria are determined by the MOE 'Operations Manual for Air Quality Monitoring in Ontario' (March 2008). A copy has been provided to all HAMN members.

## Ministry of the Environment (MOE) – Audit Program / HAMN Performance

The MOE performs regular audits of activities and processes related to the collection of air quality data under the SEM program. The audit program provides an indication of the effectiveness of quality control activities used by station operators and data management staff. Performance audits are independent evaluations of data quality produced by the analyzers, and are performed in addition to the normal quality control activities. In addition to auditing analyzer and sampler performance, quality control activities of the operator, siting criteria, assessment of the complete sampling system, and completeness and quality of the site logging information is also verified by MOE staff and is incorporated in their audit reports.

The MOE uses a conformance/non-conformance limit of  $\pm 10\%$  of the test gas value or sampler air flow rate standard. Non-conformance with this criterion requires immediate and/or quick corrective action by station operators and data management individuals if data correction/editing are required. In such instances, a follow-up audit by MOE staff is required to ensure that appropriate corrective actions have been taken in a timely manner. For continuously monitored parameters (such as SO<sub>2</sub> or TRS) acquired with a telemetry system, a systems audit starting from the analyzer through to the operator's central computer is undertaken periodically. In addition to auditing sampler performance, MOE staff audit sample handling, storage and submission procedures for such parameters as TSP, PAH and VOCs. The MOE's Laboratory Services Branch also participates in these audit activities with respect to the use and performance of private laboratories.

As described above the Ministry of the Environment carries out a QA/QC function in ensuring quality of data. The QA/QC program is made-up of two parts:

- 1) Auditing field samplers to ensure sampling equipment is being maintained and operated as per MOE 'Operations Manual for Air Quality Monitoring in Ontario', March 2008.
- 2) Auditing contract laboratories to ensure analyses are carried out as per MOE Standard Operating Procedures.

### Ministry of the Environment Provincial Audit Record

In 2009 there were a total of 76 individual Provincial audits of SEM continuous and non-continuous air monitoring equipment controlled, serviced and maintained by Rotek Environmental Inc. Of the 76 audits, 71 were certified by the MOE as being acceptable, a 93.4% audit success rate.

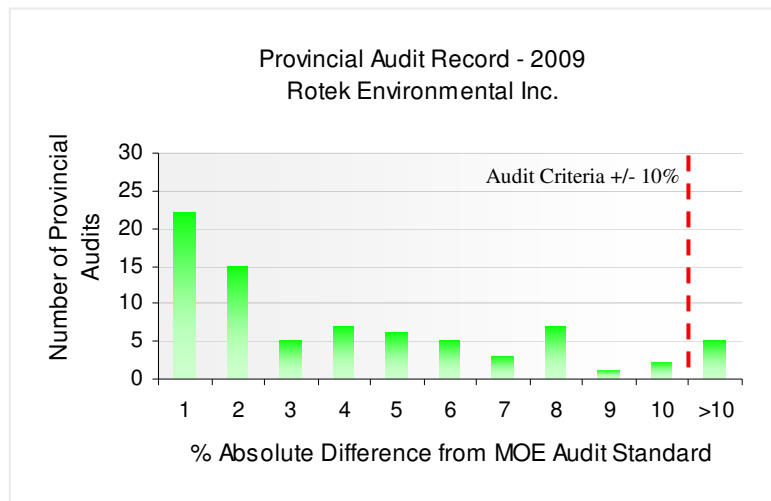


Figure 17

## Appendix 6

### HAMN Structure

#### Working Committees:

- 1) **HAMN Steering Committee** - a management group comprising of 10 industry members, the Clean Air Hamilton Chair and a representative from the MOE of the Environment. The mandate of this committee is to ensure that both the Ministry and the industrial partners' needs are met with regards to their SEM responsibilities.
- 2) **HAMN Technical Working Group** - a technical working group to deal with day-to-day issues related to the operation of the air-monitoring network.

These committees will provide a continuous line of communication among the Industrial partners, air monitoring network contractor, Clean Air Hamilton, and the MOE. In February, 2003, HAMN acquired the services of an administrator to oversee the SEM project and ensure compliance with MOE requirements and protocols.

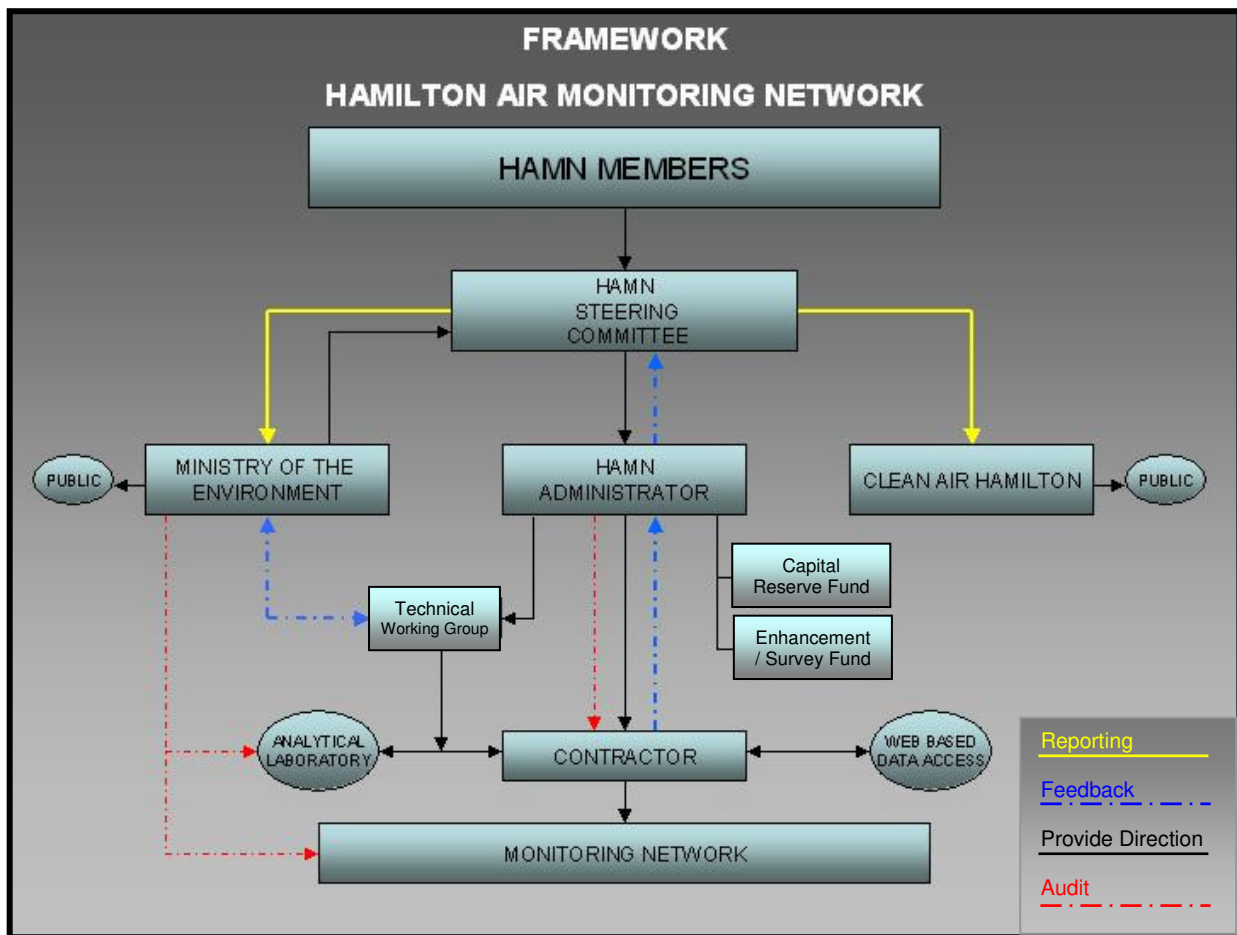


Figure 18

## Contacts

### HAMN Administrator

Neil Buonocore  
HAMN Administrator  
Hamilton Air Monitoring Network  
RPO CENTRE MALL  
P.O Box 47542  
Hamilton, ON  
L8H 7S7  
Phone - 905-541-3484  
Email - [HAMN@hamnair.ca](mailto:HAMN@hamnair.ca)

### HAMN Steering Committee, Chair

Dr. B.E. McCarry  
Department of Chemistry  
McMaster University  
Hamilton, ON, Canada  
L8S 4M1  
Phone - 905-525-9140 Extension 24504  
Fax - 905-522-2509  
Email - [mccarry@mcmaster.ca](mailto:mccarry@mcmaster.ca)

Dr. Brian McCarry, McMaster University, is the Chair of the HAMN Steering Committee. Dr. McCarry is also the Chair of Clean Air Hamilton.

Clean Air Hamilton was formed in October, 1998, to promote and support improvements to air quality in the City of Hamilton by reducing emissions that affect human and environmental health.

HAMN will continue to provide data in support of Clean Air Hamilton.

### Network Monitoring and Service Contractor

Rotek Environmental Inc.  
42 Keefer Court, Unit 2  
Hamilton, ON  
L8E 4V4  
Phone - 905-573-9533  
Fax - 905-578-5167  
Email - [rotek@rotekinc.com](mailto:rotek@rotekinc.com)  
Web - [www.rotekinc.com](http://www.rotekinc.com)