Annual | 2024

Hamilton Air Monitoring Network
2024 Annual

Air Quality Monitoring Report

Report prepared by Rotek Environmental Inc., 15 Keefer Court, Hamilton Ontario, L8E 4V4, 905 573 9533

Table of Contents

Figures

Tables

SECTION 1 - OVERVIEW

Executive Summary

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

HAMN has successfully completed its 21st year of operation and has consecutively collected >97% valid data. HAMN has contributed approximately $855,255 in upgrading the network with new stations and state-of-the-art air monitoring equipment.

Individual companies participating in the MECP SEM program are required to submit an annual summary report of their air quality monitoring results obtained during the previous calendar year. This annual report is submitted by HAMN on behalf of the members.

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 the MECP in the SEM program. The complete 2024 monitoring results are provided in a separate appendix to this report.

Some of the highlights of this report include:

- There were 603 exceedances of the 10 minute Sulphur Dioxide (SO_2) AAQC, 357 exceedances at STN29102 and 246 at STN29667.
- There were 408 exceedances of the 1 hour Sulphur Dioxide (SO_2) AAQC, 234 exceedances at STN29102 and 174 at STN29667.
- STN29102 exceeded the SO_2 AAQC annual average of 0.004 ppm.
- There were 31 exceedances of the Total Reduced Sulphur (TRS) 1 hour clock odour threshold of 10 ppb, 25 at STN29102, 4 at STN29667, and 2 at STN29168. There were 7 exceedances of the 24 hour TRS standard of 4 ppb, 6 at STN29102 and 1 at STN29667.
- There were no exceedances of Nitrogen Dioxide (NO_2) AAQC or Oxides of Nitrogen (NOx) Standards.
- Based on the location of the air monitoring stations and their proximity to local sources, it is evident that road dust and fugitive emissions continue to be major contributors which elevate ambient particulate levels.
- Annual concentrations of Inhalable Particulate (PM_{10}) have remained consistent over the past several years. PM_{10} levels continue to exceed the 24 hour interim Ambient Air Quality Criterion (AAQC) of 50 µg/m^3.
- There were 2 exceedances of Respirable Particulate ($PM_{2.5}$) reference level of 27 µg/m^3, 1 at STN29153 and 1 at STN29667.
- The annual Total Suspended Particulate (TSP) criterion of 60 µg/m^3 was not exceeded at any station. The average of the 3 industry sites used for trend graphing was 46.0 µg/m^3.
- None of the Benzo[a]Pyrene (BaP) sampling sites met the annual standard of 0.01 ng/m^3. There were 83 exceedances of the 24 hour AAQC of 0.05 ng/m^3. There were 2 exceedances of the 24 hour Upper Risk Threshold (URT) limit of 5.00 ng/m^3 at STN29547.
- None of the Benzene sampling sites met the annual standard of 0.45 µg/m^3. There were 15 exceedances of the 24 hour AAQC limit of 2.3 µg/m^3 , 6 at STN29102, 5 at STN29180 and 4 at STN29667. There were no exceedances of the 24 hour URT limit of 100 µg/m^3.
- There were 14 exceedances of the 24 hour AAQC for Manganese of 0.4 µg/m^3, 1 at STN29102, 8 at STN29160 and 5 at STN29667. There were no exceedances of the 24 hour URT limit of 4 µg/m^3.

Hamilton Air Monitoring Network Overview

Since May 1st, 2003, the point source air monitoring network in the City of Hamilton has been funded, 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, assessing sources of industrial emissions has always been a difficult task.

HAMN represents participating industries that are committed to conducting air quality monitoring as part of the MECP's SEM program. The SEM program is designed to identify, monitor and report the levels of target pollutants near industrial facilities.

Table 1 – HAMN Participating Industries

ArcelorMittal Dofasco G.P.	HARSCO (at ArcelorMittal Dofasco)	GFL Environmental Inc.
ArcelorMittal Long Products	Lafarge Canada - Jones Road	Triple M Metal LP
Bartek Ingredients	Lafarge Hamilton Slag	World Energy
Baycoat Ltd.	Rain Carbon Canada	
Birla Carbon	Shell Canada Ltd	
Bunge Canada	Stelco - Hamilton Works	

Annual Report Overview

Companies participating in the MECP's SEM program are required to submit an annual summary report of their air quality monitoring results obtained during the previous calendar year. This annual report is submitted by HAMN on behalf of the members. This report summarizes HAMN's 2024 air quality data as per the MECP's reporting requirements and includes an overview of the network, historical trends, data statistics, and an explanation of the roles and responsibilities of HAMN and the MECP in the SEM program.

The MECP performs regular audits of HAMN activities and processes related to the collection of air quality data under the MECP SEM program. The audits provide an indication of the effectiveness of quality control activities used by station operators and data management staff. The overall valid data recovery and audit success rates continue to surpass ministry criteria.

Public Web Based Data Access

Since June 1st, 2009, the HAMN website has been available to the general public. Current and historical hourly data from all real time continuous analyzers can be accessed at www.hamnair.ca. In addition, non-continuous air quality data such as Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAH) and Total Suspended Particulate (TSP) are available. The website provides general information on network operations, HAMN structure, funding, and the MECP's role in HAMN. The website also provides a detailed description of contaminants measured and sampling methodologies. HAMN annual reports are posted online.

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 useful approach to examine how a pollutant behaves over time. Some data trend categories include the following:

- **Hourly Data** How a given pollutant behaves during an average day.
- **Monthly Data** How a given pollutant behaves during an average month.
- **Seasonal Data** How a given pollutant behaves during a specific season.
- **Annual Data** How a given pollutant behaves during the course of the year.
- **Historical Data** How data behaves over several years.

These analyses help in assessing the impacts of emission reduction 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 29 in Appendix 4 provides the locations of the individual monitoring stations.

A summary table for each pollutant (if applicable) is provided indicating:

- Maximum 1 Hr Average Value
- Maximum 24 Hr Average Value
- Number of Events over the 10 Minute Standard
- Number of Events over the ½ Hr Standards and Upper Risk Thresholds (URTs)
- Number of Events over the 1 Hr AAQCs and Standards
- Number of Days over the 24 Hr AAQCs, Standards and URTs
- Annual Mean
- Percent Valid Data

Data for 2024 are available in Appendix 7 "2024 Summary Statistics and Data Set".

Air Quality Monitoring – Sulphur Dioxide

Characteristics

Sulphur Dioxide (SO_2) belongs to the family of Sulphur Oxide gases (SOx). 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. SOx gases are formed when fuels containing sulphur, such as coal or oil, are burned, when gasoline is extracted from oil or when metals are processed from sulfide ores. SO_2 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.

Sources of SO_2 include industrial facilities that derive their products from raw materials like metallic ore, coal, and crude oil, or that utilize coal or oil to produce or process heat. Examples include steel industries, electric utilities, petroleum refineries, cement manufacturing and metal processing facilities.

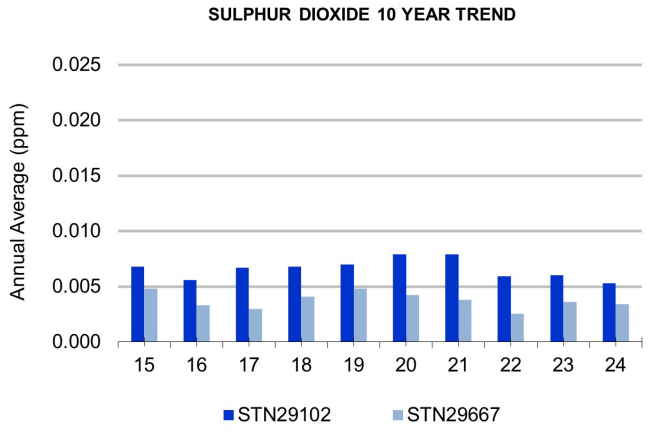
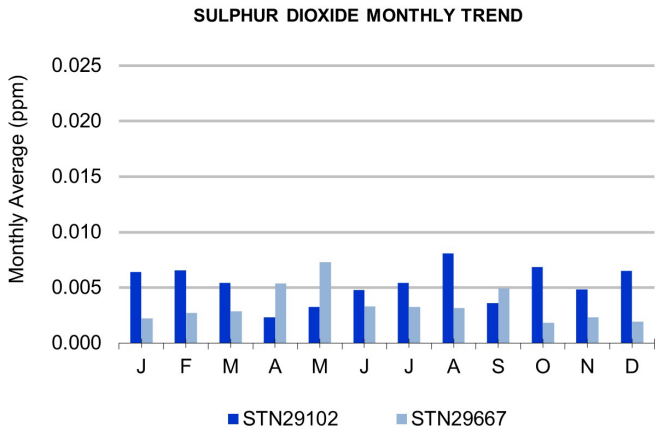


Figure 1 Annual average SO_2 trend over the past 10 years from STN29102 and STN29667.

Figure 2 Monthly SO_2 trends for 2024.



Ontario Criteria for SO_2 are:

10 min running average (AAQC)	0.067 ppm
½ hour running average (URT)	0.300 ppm
1 hour running average (AAQC & Standard)	0.040 ppm
1 hour running average (URT)	0.250 ppm
annual average (AAQC & Standard)	0.004 ppm

There were multiple exceedances of both the 10 minute and 1 hour AAQC and Standards at both stations.

There were no exceedances of the ½ hour URT or 1 hour URT (Upper Risk Threshold).

In 2024, the annual mean for STN29102 was 0.005 ppm compared to 0.003 ppm at STN29667.

STN29102 exceeded the annual average criteria.

Table 2 Sulphur Dioxide Statistics

Station	Maximum 10 Min Running Average	Maximum 1 Hr Running Average	Events > 10 Min AAQC	Events > 1 Hr AAQC & Standard	Events > ½ Hr URT	Events > 1 Hr URT	Annual Mean	Percent Valid Data
	ppm	ppm					ppm	
STN29102	0.142	0.110	357	234	0	0	0.005	96.6
STN29667	0.198	0.150	246	174	0	0	0.003	99.3

Figure 3 represents the number of 10 Minute SO_2 AAQC exceedances over a 3 year trend. Figure 4 represents the number of 1 Hour SO_2 AAQC exceedances over a 3 year trend.

Figure 3 Sulphur Dioxide 3 Year Trend of 10 Minute AAQC Exceedances (AAQC is 0.067 ppm)

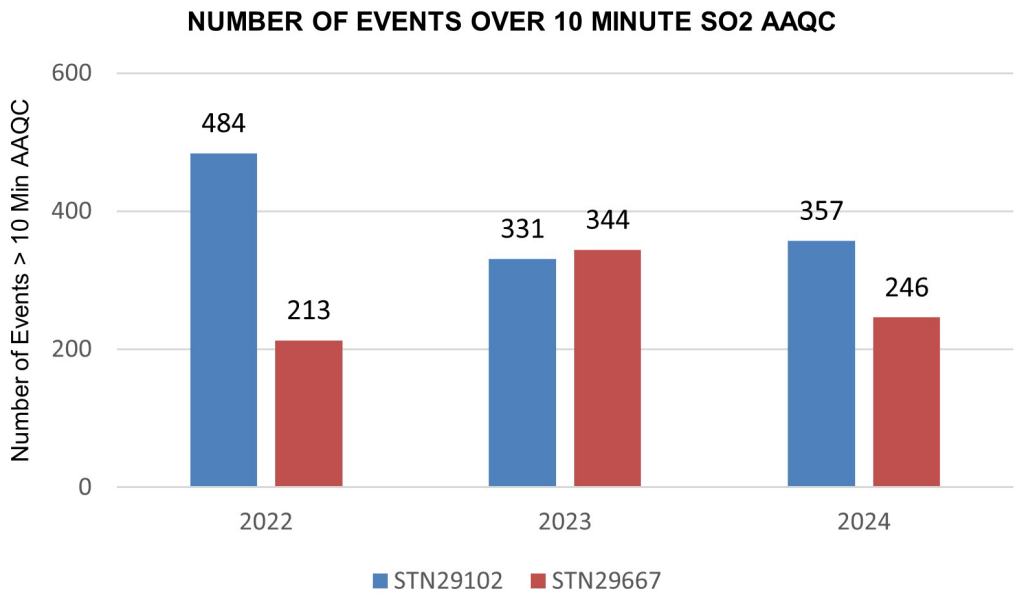
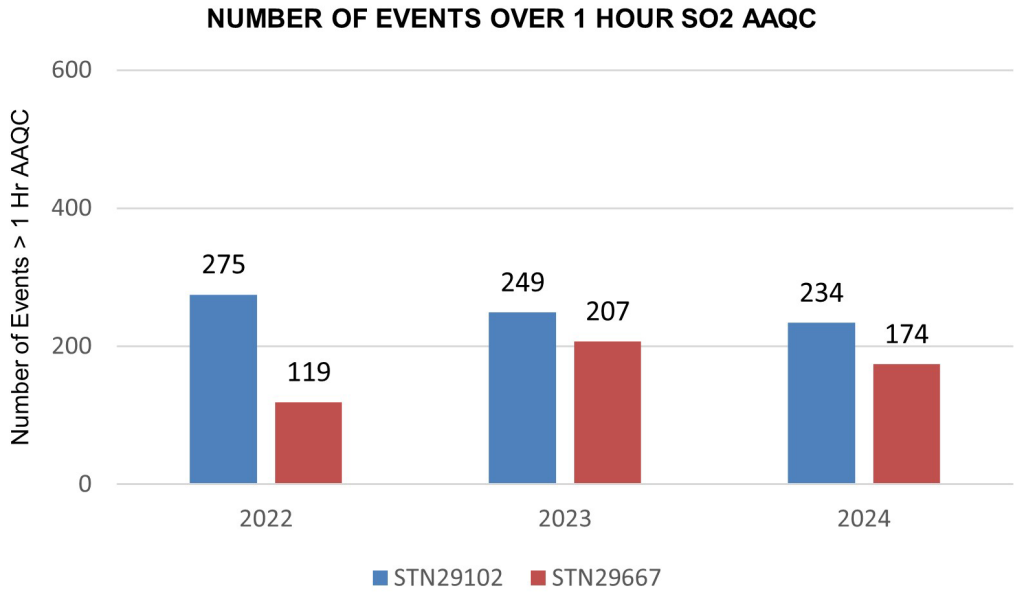


Figure 4 Sulphur Dioxide 3 Year Trend in 1 Hour AAQC Exceedances (AAQC is 0.040 ppm)



Air Quality Monitoring – Total Reduced Sulphur (TRS)

Characteristics

Total Reduced Sulphur (TRS) is a term used for a class of compounds that have offensive odours similar to rotten eggs; these compounds are a common basis for odour complaints. Common sources of TRS compounds are the steel industry (coke ovens and blast furnace releases), and pulp and paper mills. TRS compounds are not normally considered a health hazard except at very high concentrations.

There are currently no annual standards or criteria for TRS. Interpreting long term trends can be challenging or misleading because the majority of measurements are recorded at or below detection limits. The significance of TRS trends and impacts are best assessed at shorter averaging periods (i.e. 10 min for odour and 24 hrs for health).

The reportable odour threshold (RT) for TRS is 10 parts per billion (ppb).

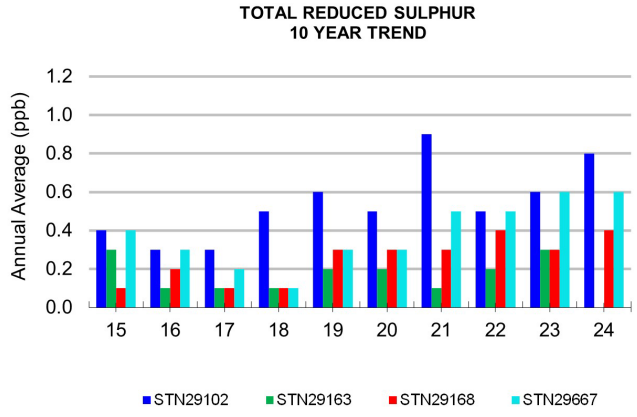
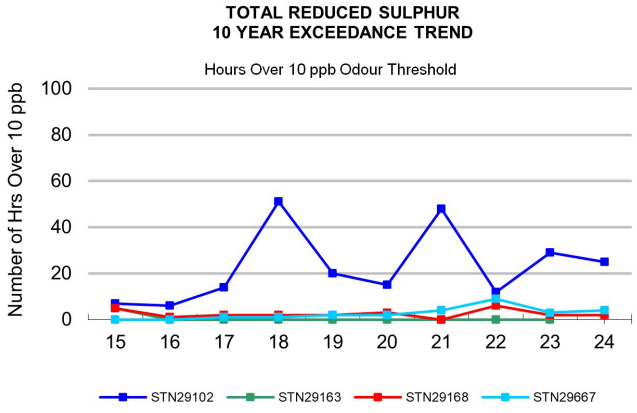


Figure 5 Annual average TRS trend over the past 10 years.

Figure 6 Annual number of hours over the odour threshold of 10 ppb for the past 10 years.



Ontario Criteria for TRS are:

10 min running average (Standard)	9 ppb
1 hour clock odour threshold (RT)	10 ppb
24 hour running average (Standard)	4 ppb
½ hour running average (URT)	143 ppb
24 hour running average (URT)	48 ppb

In 2024, there were 25 hours over the 10 ppb odour threshold at STN29102, 2 at STN29168 and 4 at STN29667. There were 6 events over the 24 hour standard of 4 ppb at STN29102.

There were no exceedances of the ½ hour or 24 hour URT (Upper Risk Threshold).

The TRS annual averages were 0.8 ppb at STN29102, 0.4 ppb at STN29168 and 0.6 ppb at STN29667.

STN29163 was decommissioned December 31, 2023.

Table 3 Total Reduced Sulphur Statistics

Station	Maximum 10 Min Running Average	Maximum ½ Hr Running Average	Maximum 1 Hr Clock Average	Maximum 24 Hr Running Average	Events > 10 Min Standard	Events > 1 Hr RT	Events > 24 Hr Standard	Events > ½ Hr URT	Events > 24 Hr URT	Annual Mean	Percent Valid Data
	ppb	ppb	ppb	ppb						ppb	
STN29102	42.3	39.1	31.6	5.4	383	25	6	0	0	0.8	95.4
STN29168	117.6	55.8	22.1	1.9	21	2	0	0	0	0.4	96.3
STN29667	53.8	45.6	27.9	4.8	100	4	1	0	0	0.6	99.6

Air Quality Monitoring – Oxides of Nitrogen (NO_X)

Characteristics

Oxides of Nitrogen (NO_X) is the generic term used for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. The MECP lists criteria for NO_X as Oxides of Nitrogen which is defined as the sum of Nitrogen Oxide and Nitric Dioxide ($NO + NO_2$). Nitric Oxide (NO) is a colorless and odourless gas which is emitted from combustion sources. Nitrogen Dioxide (NO_2) 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, usually during combustion processes. The primary man-made sources of NO_X are motor vehicles, and industrial, commercial, and residential sources that burn fuels. NO_X can also be formed naturally by lightning. Emissions of NO_X consist mainly of NO and to a lesser extent NO_2. In the atmosphere NO is converted to NO_2 by oxidation. NO_X causes a wide variety of health and environmental impacts.

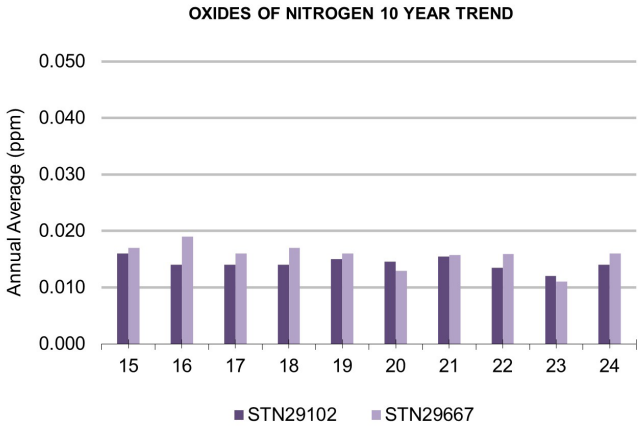
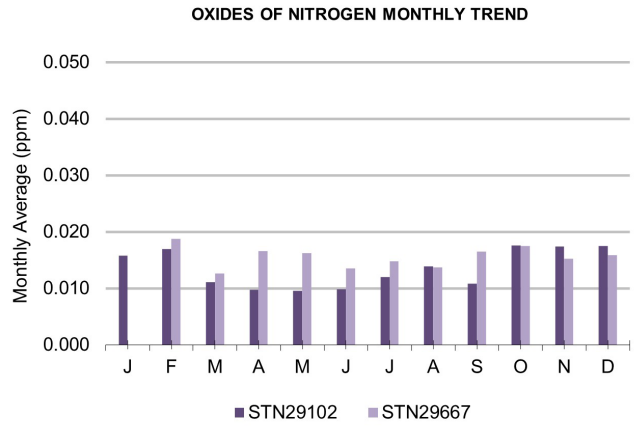


Figure 7 Annual average NO_x trend over the past 10 years.

Figure 8 Monthly NO_x trends for 2024.



Ontario Criteria for NO_X are:

1 hour running average (Standard)	0.261 ppm
24 hour running average (Standard)	0.131 ppm

There were no exceedances of the NO_X Standards.

The NO_X annual average at STN29102 was 0.014 ppm and 0.016 ppm at STN29667.

There was insufficient data to produce a monthly mean for STN29667 in January.

Table 4 Oxides of Nitrogen Statistics

Station	Maximum 1 Hr Running Average	Maximum 24 Hr Running Average	Events > 1 Hr Standard	Events > 24 Hr Standard	Annual Mean	Percent Valid Data
	ppm	ppm			ppm	
STN29102	0.126	0.043	0	0	0.014	96.5
STN29667	0.202	0.057	0	0	0.016	89.8

Air Quality Monitoring – Nitrogen Dioxide (NO_2)

Characteristics

Nitrogen Dioxide (NO_2) is a reddish-brown gas with a pungent and irritating odour. It transforms in the air to form gaseous nitric acid and toxic organic nitrates. NO_2 also plays a major role in atmospheric reactions that produce ground-level ozone, a major component of smog. It is a precursor to nitrates, which contribute to increased respirable particle levels in the atmosphere. The MECP lists criteria for NO_2 because it causes a wide variety of health and environmental impacts.

All combustion in air produces Oxides of Nitrogen (NO_x), of which NO_2 is a component.

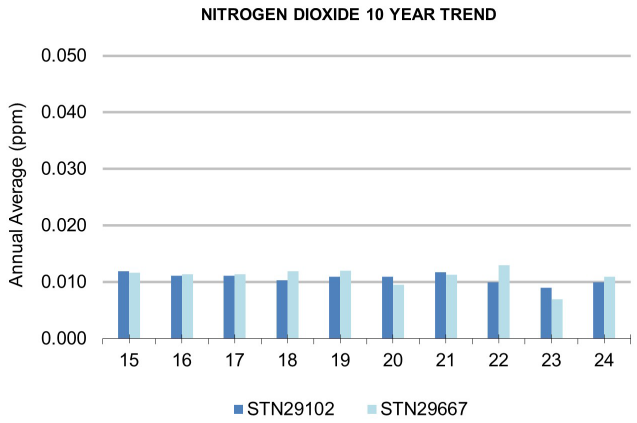
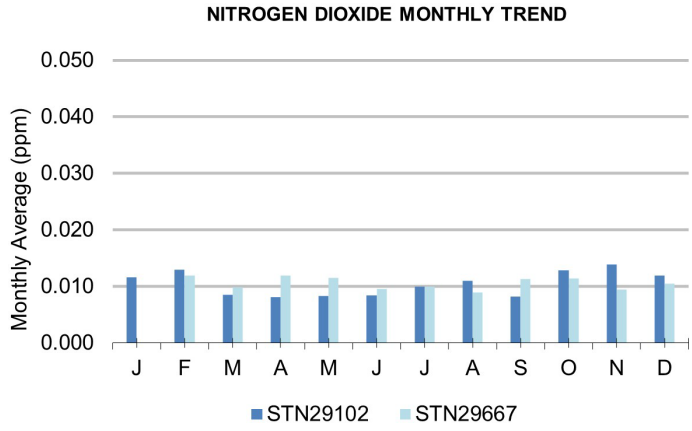


Figure 9 Annual average NO_2 trend over the past 10 years.

Figure 10 Monthly NO_2 trends for 2024.



Ontario Criteria for NO_2 are:

1 hour running average (AAQC)	0.200 ppm
24 hour running average (AAQC)	0.100 ppm

There were no exceedances of the NO_2 AAQCs.

The NO_2 annual average at STN29102 was 0.010 ppm and 0.011 ppm at STN29667.

There was insufficient data to produce a monthly mean for STN29667 in January.

Table 5 Nitrogen Dioxide Statistics

Station	Maximum 1 Hr Running Average	Maximum 24 Hr Running Average	Events > 1 Hr AAQC	Events > 24 Hr AAQC	Annual Mean	Percent Valid Data
	ppm	ppm			ppm	
STN29102	0.048	0.031	0	0	0.010	96.5
STN29667	0.053	0.028	0	0	0.011	89.6

Air Quality Monitoring – Total Suspended Particulate (TSP)

Characteristics

Total Suspended Particulate (TSP) includes all particulate material smaller than 44 µm (44 micrometres or 44 microns) in diameter. Some particles such as dust, dirt, soot, or smoke are large or dark enough to be seen with the naked eye. 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.

A substantial portion of TSP is related to industrial activities, road dusts, agricultural dusts and other sources of airborne soils.

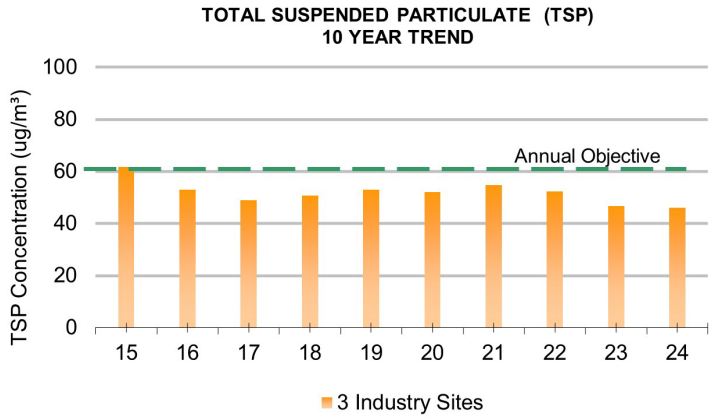
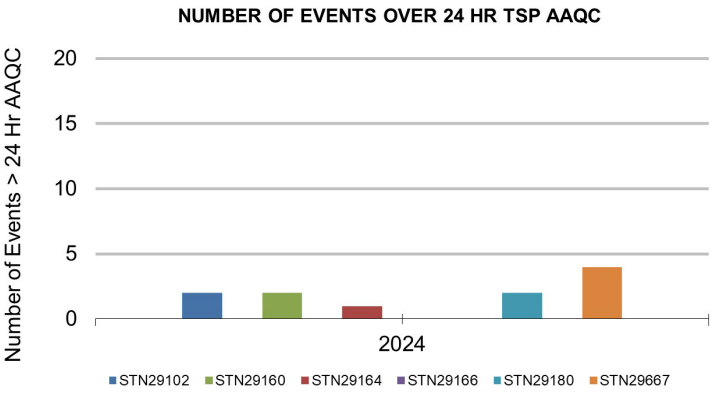


Figure 11 Network annual geometric average TSP trend over the past 10 years.

Figure 12 Number of events over 24 hour TSP AAQC per station.



Ontario Criteria for TSP are:

24 hour clock average (AAQC)	120 µg/m³
annual geometric mean (AAQC)	60 µg/m³

The TSP values in Figure 11 illustrate the geometric means from 3 industrial monitoring sites and are representative of the impacts experienced by those communities bordering on the industrial area. In 2024, the average of the 3 industry sites (STN29102, STN29180 and STN29667) was 46.0 µg/m^3.

Table 6 summarizes statistics for 6 TSP monitoring sites. No station exceeded the annual objective of 60 µg/m^3.

Table 6 Total Suspended Particulate Statistics

Station	Number of Valid Samples	Maximum 24 Hr Clock Average	Events > 24 Hr AAQC	Annual Geometric Mean	Percent Valid Data
		µg/m^3		µg/m^3	
STN29102	61	151	2	34	100.0
STN29160	58	193	2	44	95.1
STN29164	56	123	1	45	91.8
STN29166	61	116	0	41	100.0
STN29180	61	146	2	56	100.0
STN29667	60	149	4	48	98.4

Air Quality Monitoring – Metals in Total Suspended Particulate (TSP)

Characteristics

Airborne particulate matter has a mixture of components, including metals, sulphates and nitrates. Exposure to metals in the air is capable of causing human health effects but the degree of concern about human and environmental health varies with each metal. Some metals are toxic. Others are known to be essential micronutrients for humans and animals. Cadmium, Chromium, Iron, Copper, Lead, Manganese, Nickel and Vanadium are routinely analyzed in TSP. Manganese and Lead are common air pollutants, emitted mainly as a result of industrial activity and vehicle emissions.

Ontario Criteria for Lead (Pb) are:

24 hour clock average (AAQC)	0.5 µg/m³
24 hour clock average (URT)	2.0 µg/m³

Ontario Criteria for Manganese (Mn) are:

24 hour clock average (AAQC)	0.4 µg/m³
24 hour clock average (URT)	4.0 µg/m³

Ontario Criteria for Nickel (Ni) are:

24 hour clock average (AAQC)	0.2 µg/m³
24 hour clock average (URT)	2.0 µg/m³

Figure 13 illustrates the average Manganese concentrations from 5 industry sites.

There were 14 exceedances of the 24 hour AAQC for Manganese, 1 at STN29102, 8 at STN29160 and 5 at STN29667. There were no exceedances of the 24 hour URT limit for Manganese.

There were no exceedances of the 24 hour AAQC for Lead or Nickel.

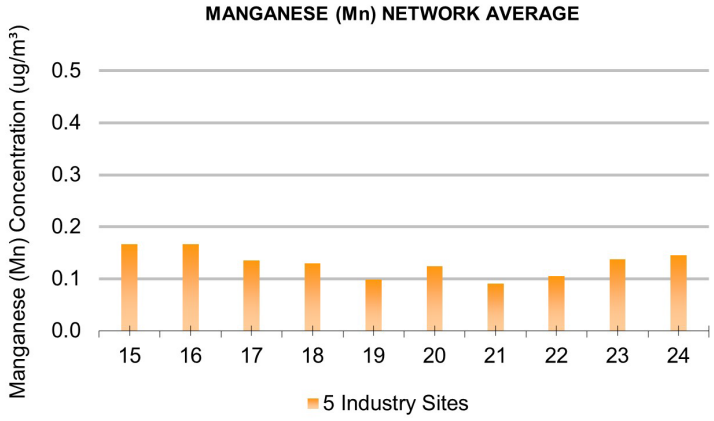


Figure 13 Network annual average Mn trend over the past 10 years.

Figure 14 Number of Mn events over the 24 hour AAQC per station.

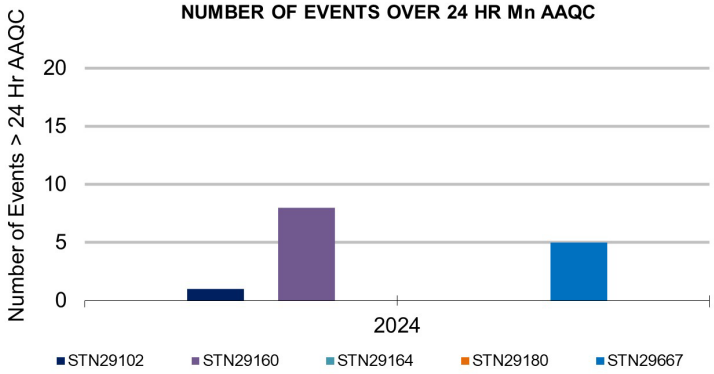


Table 7 Metals Statistics

Station	Maximum 24 Hr Clock Average Pb	Maximum 24 Hr Clock Average Mn	Maximum 24 Hr Clock Average Ni	Events > 24 Hr AAQC Pb	Events > 24 Hr AAQC Mn	Events > 24 Hr AAQC Ni	Events > 24 Hr URT Pb	Events > 24 Hr URT Mn	Events > 24 Hr URT Ni	Percent Valid Data
	µg/m³									
STN29102	0.02	0.428	0.01	0	1	0	0	0	0	100.0
STN29160	0.02	2.504	0.01	0	8	0	0	0	0	95.1
STN29164	0.02	0.325	0.01	0	0	0	0	0	0	91.8
STN29180	0.02	0.359	0.04	0	0	0	0	0	0	100.0
STN29667	0.02	0.740	0.02	0	5	0	0	0	0	98.4

Air Quality Monitoring – Inhalable Particulate Matter (PM_{10})

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_{10}) because they can enter the lungs. Once inhaled, these particles can affect the heart and lungs causing serious health effects.

Primary particles are emitted directly from sources 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_2 and NO_X that are emitted from power plants, industries and automobiles.

Ontario Criterion for PM_{10} is:

24 hour running average (AAQC)	50 µg/m³

Figure 15 represents the network annual average PM_{10} trend over the past 10 years.

Figure 16 represents the 2024 annual PM_{10} means from each station. Annual means ranged from 18 to 26 µg/m³.

Figure 17 represents the annual trend for each station over the past 7 years.

STN29170 was decommissioned in 2021, therefore no annual statistics are available.

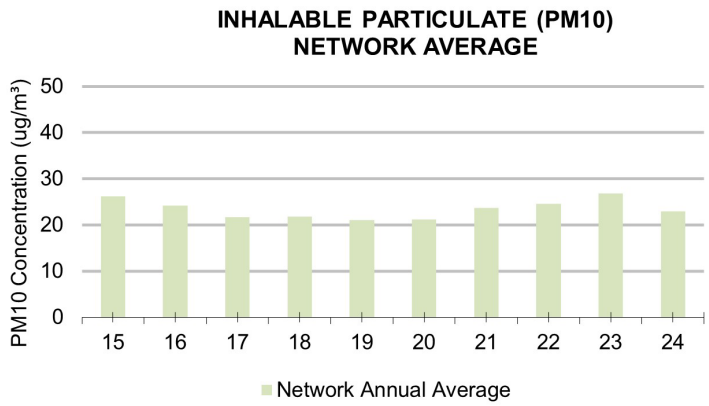


Figure 15 Network annual average PM_{10} trend.

Figure 16 2024 PM_{10} annual station means.

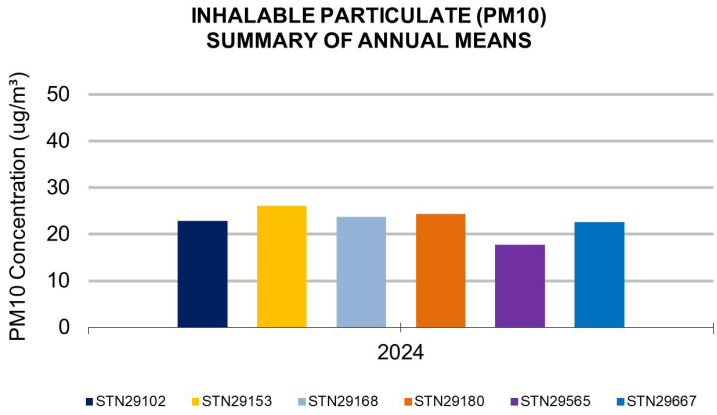


Figure 17 Annual average PM_{10} trends by station.

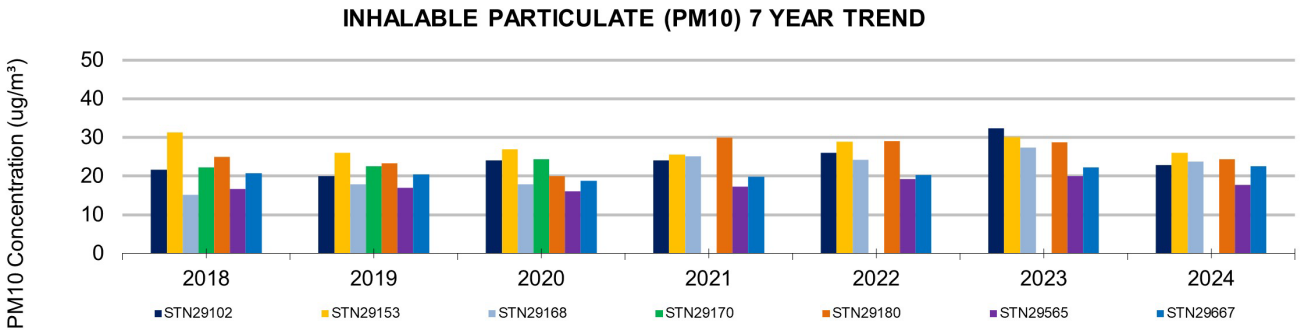


Figure 18 shows the number of 24 hour PM_{10} AAQC exceedances in each month of 2024. STN29102 recorded the highest number of events (26) over the year. Data from STN29102 were invalidated from January 1 to February 21 due to a flow issue, exceedances during this period could not be assessed.

Table 8 provides statistics on data collected from the continuous PM_{10} monitors in the network.

Figure 18 Monthly PM_{10} exceedance trends.

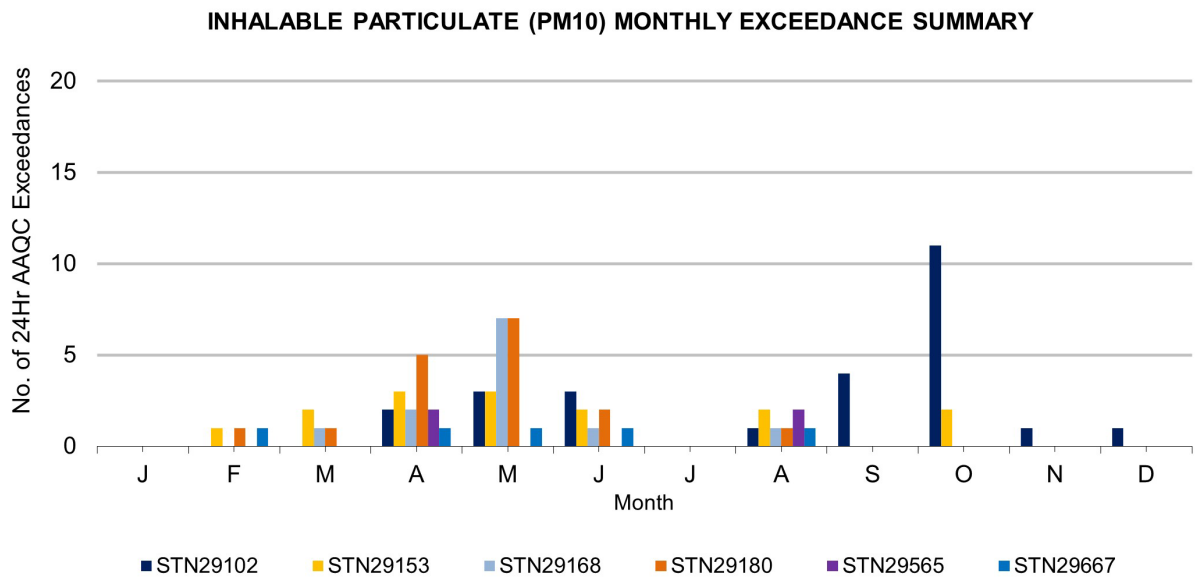


Table 8 Inhalable Particulate Matter Statistics

Station	Maximum 1 Hr Clock Average	Maximum 24 Hr Running Average	Events > 24 Hr AAQC	Annual Mean	Percent Valid Data
	µg/m³	µg/m³		µg/m³	
STN29102	812	107	22	23	81.0
STN29153	213	77	15	26	99.9
STN29168	183	69	12	24	96.3
STN29180	205	96	17	24	99.2
STN29565	212	73	4	18	99.9
STN29667	298	67	5	23	98.3

Air Quality Monitoring – Respirable Particulate Matter ($PM_{2.5}$)

Characteristics

Particulate matter is characterized according to size, mainly because of the different health effects associated with particles of different diameters. Particulate matter is the general term used for a mixture of solid particles and liquid droplets in the air. It includes aerosols, smoke, fumes, dust, ash and pollen. The composition of particulate matter varies with place, season and weather conditions. Fine particulate matter is 2.5 microns in diameter and less. It is also known as $PM_{2.5}$ or respirable particulate because it penetrates further into the respiratory system than larger particles.

$PM_{2.5}$ is primarily formed from chemical reactions in the atmosphere and through fuel combustion, e.g. motor vehicles, power generation, industrial facilities, residential fire places, wood stoves and agricultural burning.

Some studies suggest that approximately 75% of $PM_{2.5}$ emissions in Hamilton can be attributed to transboundary sources.

Ontario Criterion for $PM_{2.5}$ is:

24 hour clock average (Ref Level) 27 µg/m^3

The MECP Reference Level (Ref Level) of 27 µg/m^3 is based on the Canadian Ambient Air Quality Standard (CAAQS).

There were 2 exceedances of the 24 hour Reference Level, 1 at STN29153 and 1 at STN29667.

There was insufficient data to calculate the monthly mean at STN29102 for January, February and December.

Figure 19 shows monthly $PM_{2.5}$ trends.

Figure 20 shows the Annual Means at all five stations.

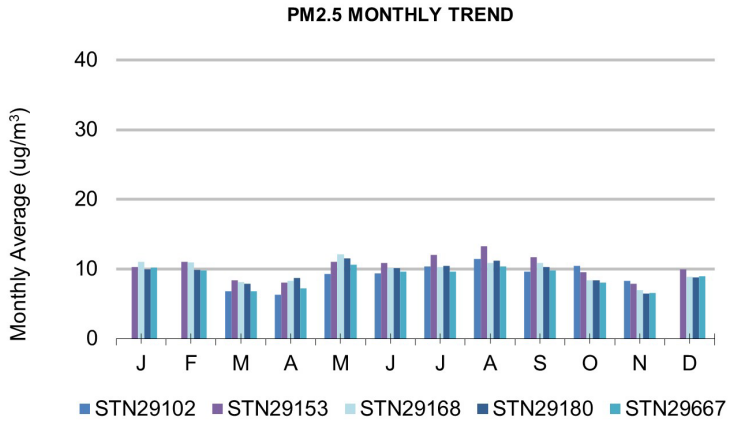


Figure 19 Monthly $PM_{2.5}$ trends for 2024.

Figure 20 Annual means trends.

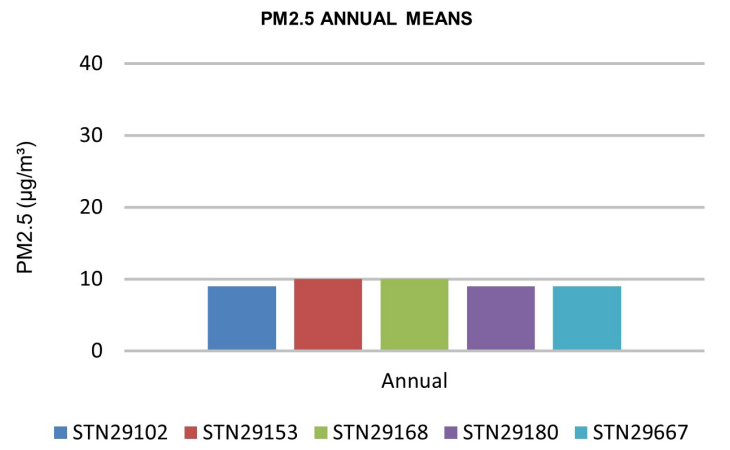


Table 9 Respirable Particulate Matter Statistics

Station	Maximum 1 Hr Clock Average	Maximum 24 Hr Clock Average	Events > 24 Hr Ref Level	Annual Mean	Percent Valid Data
	µg/m^3	µg/m^3		µg/m^3	
STN29102	58	27	0	9	81.0
STN29153	67	29	1	10	99.9
STN29168	60	27	0	10	96.3
STN29180	91	27	0	9	99.2
STN29667	71	29	1	9	98.7

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). PAH are 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. BaP is a known carcinogen and is produced by the combustion of carbonaceous fuels (gasoline, diesel fuel, wood, coal, etc.) and tobacco.

The principal source of BaP in Hamilton is 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 industry.

A scan of 8 PAH compounds are routinely analyzed, however, only BaP has Ontario criteria.

Ontario Criteria for Benzo[a]Pyrene are:

24 hour clock average (AAQC)	0.05 ng/m^3
24 hour clock average (URT)	5.00 ng/m^3
24 hour reference level	1.10 ng/m^3
annual average (AAQC)	0.01 ng/m^3

The 24 hour AAQC of 0.05 ng/m^3 is below the current analytical method detection limit. The previous AAQC of 1.10 ng/m^3 is used for historical comparison purposes.

There were 19 exceedances of the 24 hour Reference Level of 1.10 ng/m^3. 1 at STN29180, 11 at STN29547 and 7 at STN29667.

There were 2 exceedances of the 5.00 ng/m^3 URT at STN29547.

None of the stations met the annual average BaP AAQC of 0.01 ng/m^3.

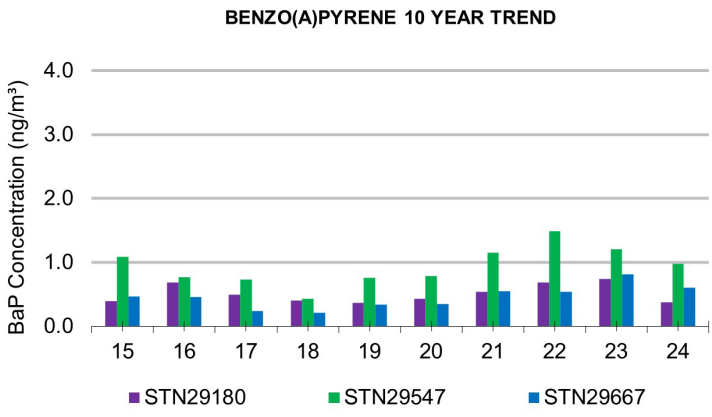


Figure 21 Annual average BaP trends over the past 10 years for STN29180, STN29547 and STN29667.

Figure 22 Number of events exceeding the BaP 24 hour Reference Level of 1.10 ng/m^3.

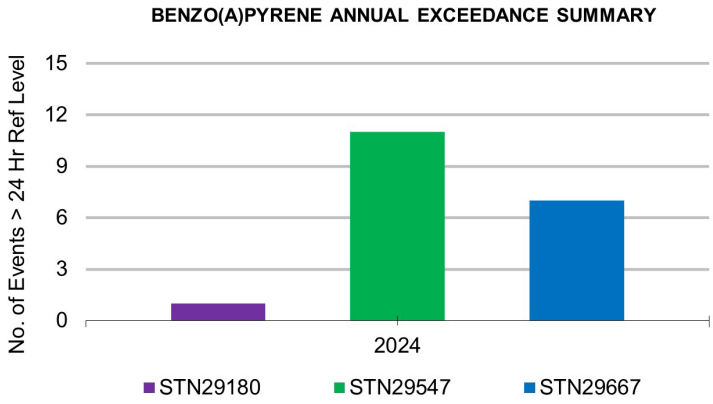


Table 10 Benzo[a]Pyrene (BaP) Statistics

Station	Number of Valid Samples	Maximum 24 Hr Clock Average ng/m^3	Events > 24 Hr AAQC	Events > 1.10 ng/m^3 24 Hr Ref Level	Events > 24 Hr URT	Annual Mean ng/m^3	Percent Valid Data
STN29180	30	1.71	30	1	0	0.38	100.0
STN29547	30	5.43	24	11	2	0.98	100.0
STN29667	30	3.12	29	7	0	0.60	100.0

Air Quality Monitoring – Volatile Organic Compounds (VOC)

Characteristics

Volatile Organic Compounds (VOCs) consist of various compounds including Benzene. Benzene is a volatile organic compound that has been classified as a human carcinogen. The main sources of Benzene are transportation, steel industry, petroleum distribution and refining, forest fires and wood combustion.

Industrial Benzene emissions arise primarily from the coke ovens and the associated by-products in the steel industry.

Ontario Criteria for Benzene are:

24 hour clock average (AAQC)	2.3 µg/m³
24 hour clock average (URT)	100 µg/m³
annual average (AAQC)	0.45 µg/m³

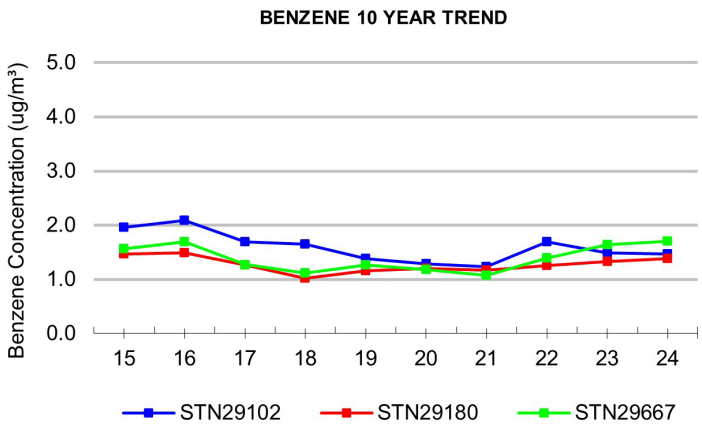


Figure 23 Annual average Benzene trends for 10 years at STN29102, STN29180 and STN29667.

Figure 23 represents annual averages for Benzene over the past 10 years.

Figure 24 illustrates annual exceedance summary of the Benzene 24 hour (AAQC).

There were 6 exceedances of the 24 hour AAQC of 2.3 µg /m³ at STN29102, 5 at STN29180 and 4 at STN29667.

There were no exceedances of the URT.

None of the stations met the annual AAQC of 0.45 µg/m³.

Figure 24 Number of days which exceeded the Benzene 24 hour AAQC.

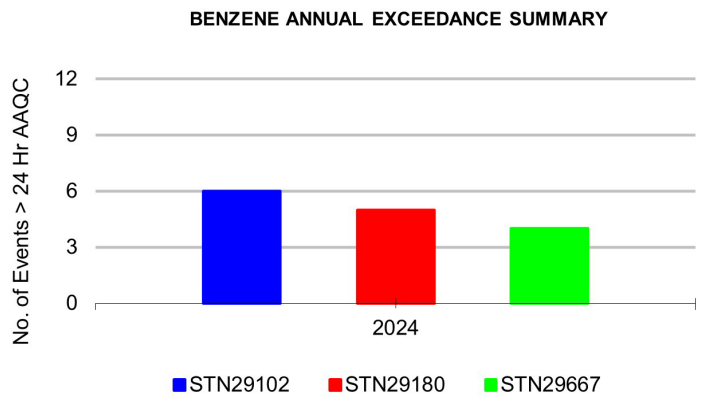


Table 11 Volatile Organic Compounds Benzene Statistics

Station	Number of Valid Samples	Maximum 24 Hr Clock Average µg/m³	Events > 24 Hr AAQC	Events > 24 Hr URT	Annual Mean µg/m³	Percent Valid Data
STN29102	30	4.41	6	0	1.47	100.0
STN29180	30	4.77	5	0	1.38	100.0
STN29667	28	6.95	4	0	1.70	93.3

Appendix 1

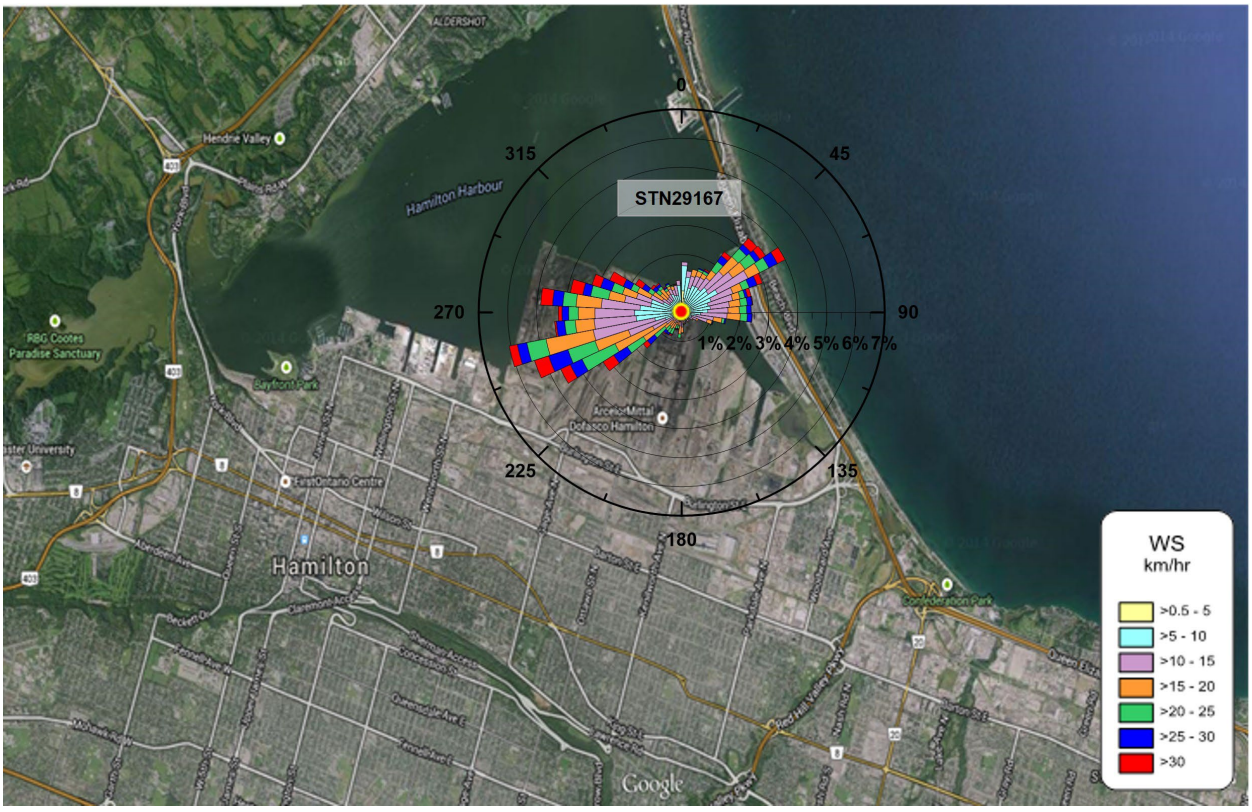
Wind Frequency Distribution 2024 Wind Rose

A wind rose, which is developed from meteorological observations, is used to show predominant wind speed and direction. Wind roses vary from one location to the next, and are a form of meteorological fingerprint. Figure 25 overlays an annual wind rose from meteorological station STN29167 superimposed on an aerial view of the Hamilton area.

Wind roses summarize the occurrence of winds at a specific location, showing their strength, direction and frequency. Each branch of the rose represents wind coming from that direction, with north to the top of the graphic. The branches are divided into segments of different colours, which represent wind speed ranges from that direction. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction. Wind directions are always characterized by the direction from which the wind blew.

The annual wind rose illustration for STN29167 indicates a predominant wind direction vector of southwest to northwest winds with contribution from the northeast.

2024 Annual Wind Rose – Figure 25



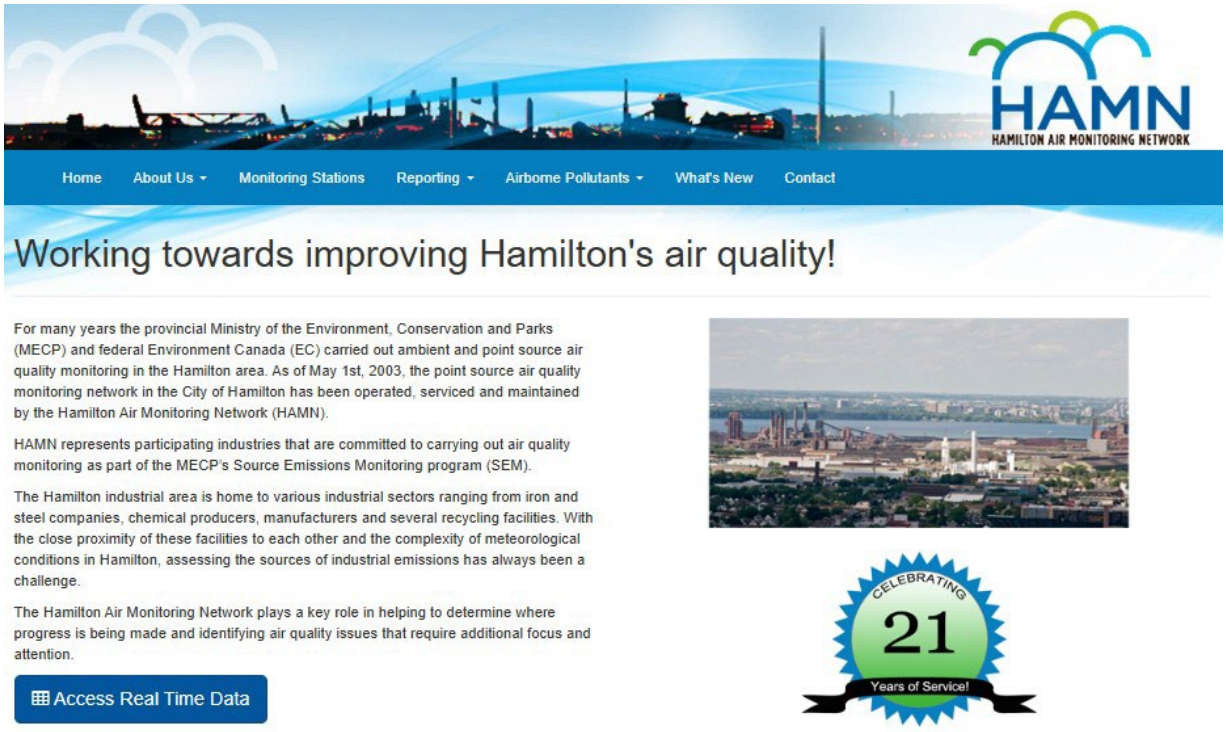
Appendix 2

Activities and Progress

Hamilton Air Monitoring Network (HAMN) Website

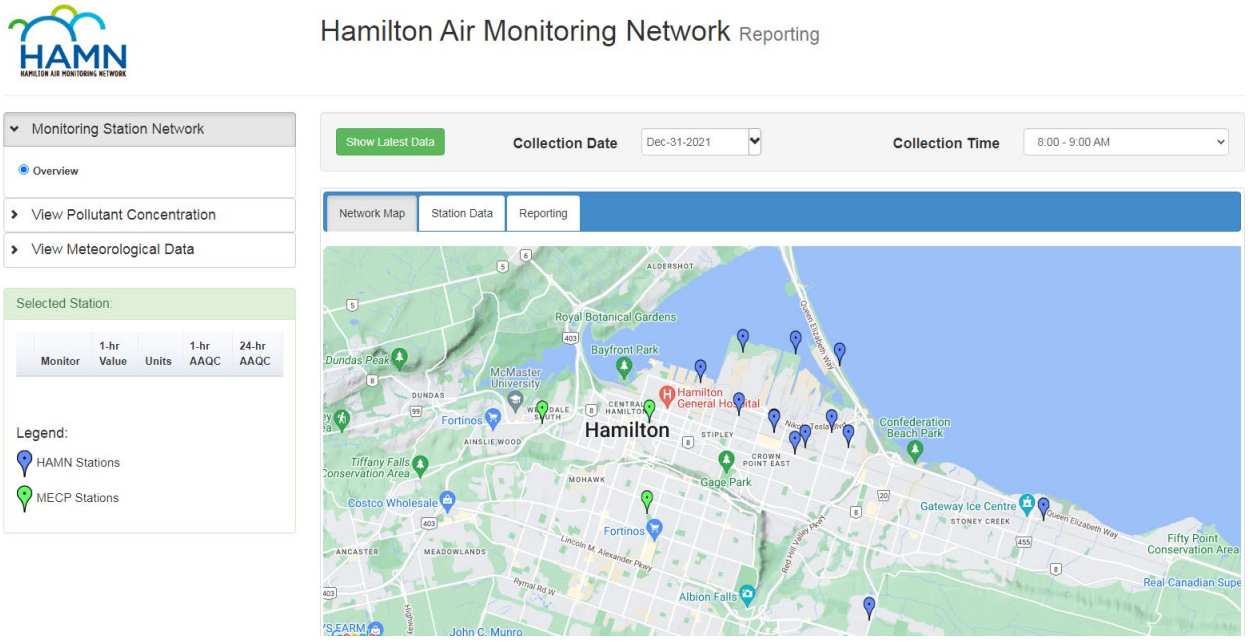
On June 1st, 2009, the HAMN website was made available to the general public. An upgraded website was launched on January 1st, 2017. Current and historical data from real time continuous analyzers and non-continuous data can be accessed through the website at www.hamnair.ca. The website provides general information on network operations such as HAMN structure, contaminants measured, sampling methods, funding, and the MECP's role in HAMN. The website also provides public access to annual reports. In 2024, HAMN was supported by 18 companies that provided funding to support and operate the network.

HAMN Website Home Page - Figure 26



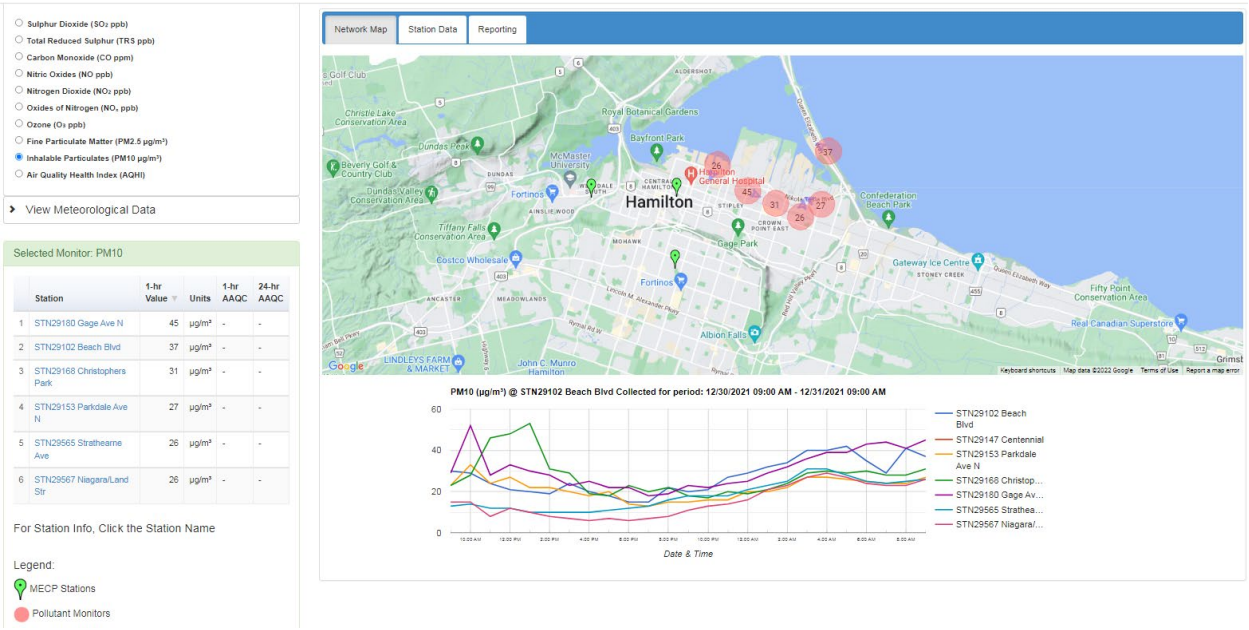
The main focus of the website is to provide access to real time data for HAMN members, MECP staff and the general public. Data is available from all continuous analyzers such as Sulphur Dioxide (SO_2), Total Reduced Sulphur (TRS), Oxides of Nitrogen (NO, NO_2, NOx), Inhalable Particulates (PM_{10}) and Respirable Particulates ($PM_{2.5}$). There is also a compilation of non-continuous sampler measurements (e.g., VOC, PAH, TSP and metal data). Data is available for a number of meteorological stations that provide wind speed, wind direction and temperature.

Monitoring Station Network Overview - Figure 27



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

Real Time Data Overview - Figure 28



Enhancements to the Network Monitoring Program

In 2024 a new meteorological station was commissioned at STN29175 (Stoney Creek) at a cost of $15k.

Appendix 3 Legend

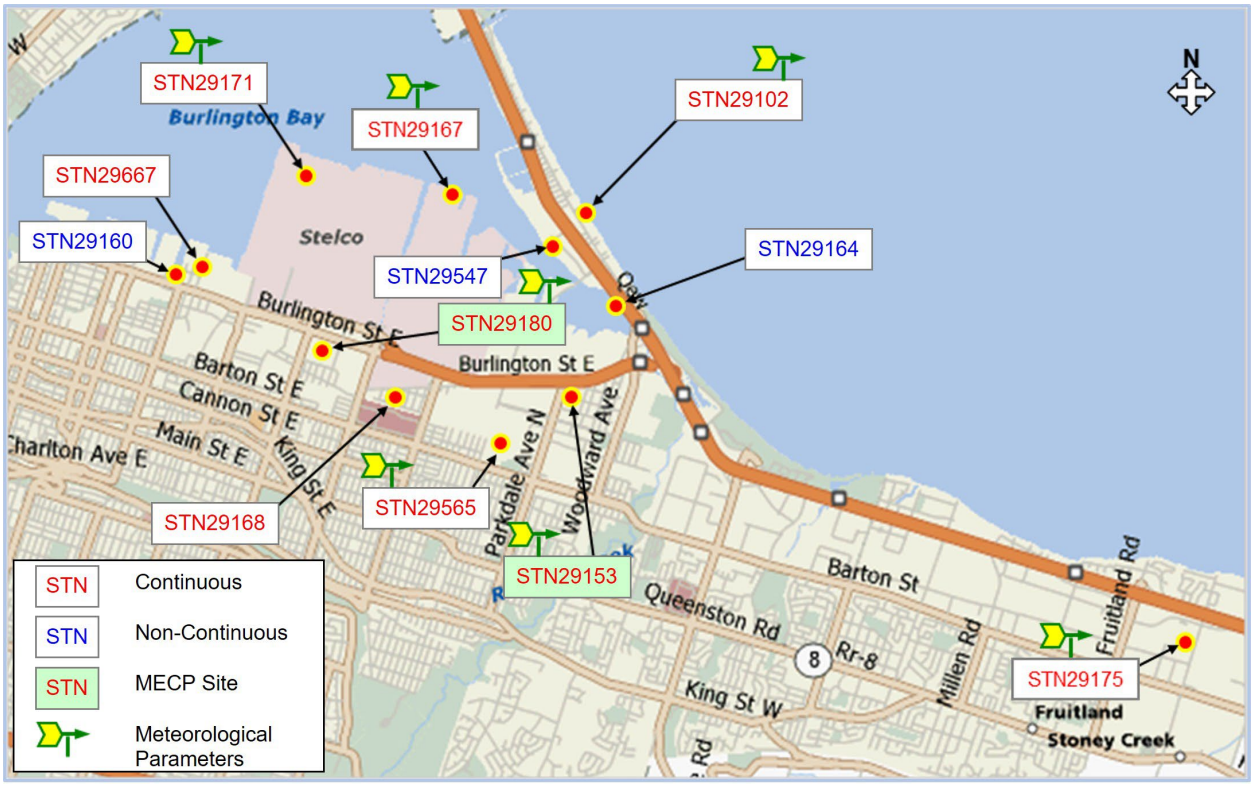
QA/QC	-	Quality Assurance/Quality Control
SEM	-	Source Emissions Monitoring
HAMN	-	Hamilton Air Monitoring Network
AAQC	-	Ambient Air Quality Criteria (Ontario)
EST	-	Eastern Standard Time
MECP	-	Ministry of the Environment, Conservation and Parks
NO	-	Nitric Oxide
NO_2	-	Nitrogen Dioxide
NO_x	-	Oxides of Nitrogen
PM_{10}	-	Inhalable Particulates less than 10 microns in diameter
$PM_{2.5}$	-	Respirable Particulates less than 2.5 microns in diameter
SO_2	-	Sulphur Dioxide
TSP	-	Total Suspended Particulate
TRS	-	Total Reduced Sulphur
VOCs	-	Volatile Organic Compounds
PAH	-	Polycyclic Aromatic Hydrocarbons
BaP	-	Benzo[a]Pyrene
MDL	-	Minimum Detection Limit
ng/m^3	-	Nanograms (of contaminant) Per Cubic Meter (of air)
$\mu g/m^3$	-	Micrograms (of contaminant) Per Cubic Meter (of air)
ppb	-	Parts (of contaminant) Per Billion (parts of air)
ppm	-	Parts (of contaminant) Per Million (parts of air)
Mn	-	Manganese
Fe	-	Iron
Continuous	-	Continuous ‘Real Time’ Monitoring
Non-Continuous	-	24 Hr samples collected on a 6 or 12 day schedule
URT	-	Upper Risk Threshold
RT	-	Reportable Threshold

Appendix 4

Where We Measure Air Quality Data in Hamilton

For many years the MECP and Environment and Climate Change Canada (ECCC) 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 several sites located around the industrial area (Figure 29). These pollutants include Sulphur Dioxide (SO_2), Total Reduced Sulphur (TRS), Oxides of Nitrogen (NO_x), Inhalable Particulate Matter (PM_{10}) and Respirable Particulate Matter ($PM_{2.5}$). Sampling site labels with a weather vane icon are sites equipped with meteorological sensors. As well, there are 12 non-continuous air monitoring samplers in the HAMN network that collect data every 6th or 12th day on a rotating schedule. These samplers monitor such pollutants as Total Suspended Particulates (TSP), Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAH) and Metals. Table 12 identifies the parameters monitored at each site.

Hamilton Air Monitoring Network Map - Figure 29



Data generated are used to monitor air quality in and around the industrial area and determine which areas meet and/or exceed applicable O. Reg 419/05 standards, AAQCs, URTs, and ministry guidelines in order to 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 MECP 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. HAMN provides immediate notification of AAQC, Standards and URT exceedances. The MECP has real time data access to the air quality information to assist them with abatement programs and complaint investigations.

HAMN Air Monitoring Network Configuration

Network Configuration – Table 12

Parameter	SO2	TRS	NOX	PM10	PM2.5	TSP / Metals	VOCs	PAH	MET
STN29102	♦	♦	♦	♦	♦	o	o		♦
STN29153				♦	♦				♦
STN29160						o			
STN29164						o			
STN29166						o			
STN29167									♦
STN29168		♦		♦	♦				
STN29171									♦
STN29175									♦
STN29180				♦	♦	o	o	o	♦
STN29547								o	
STN29565				♦					♦
STN29667	♦	♦	♦	♦	♦	o	o	o	

♦ Continuous o Non-Continuous

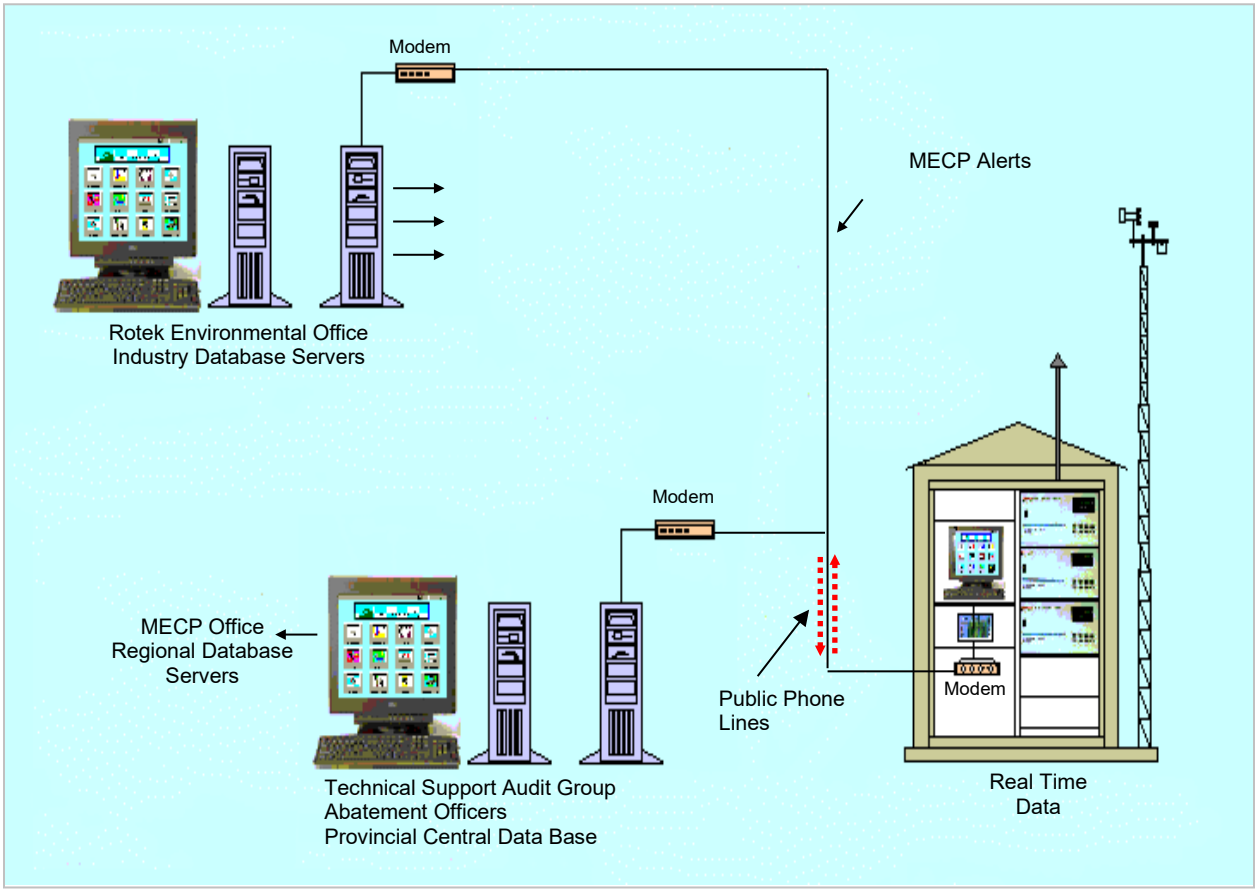
How We Measure Air Quality Data

Network data is used to provide HAMN members and the MECP 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 MECP guidelines for collecting air quality monitoring data.
Figure 31 illustrates the real time movement of data to both industry and MECP servers.

Telemetry System

Data that is received by HAMN operated servers is utilized for troubleshooting and rectifying network anomalies, generating reports, implementing QA/QC protocols and notifying both MECP and industry personnel of exceedances and/or unusual air quality events. The MECP 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.

Telemetry System - Figure 30



Appendix 5

Ministry of the Environment, Conservation and Parks (MECP) Role in HAMN

In April of 2003 the MECP launched a new program called Source Emissions Monitoring (SEM). This initiative 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:

- Assist in the prevention of possible adverse effects due to air emissions from an industrial facility.
- 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 Environmental Compliance Approvals.
- 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 MECP as a component of the MECP standard setting process. These lists are updated periodically.
- Provide accurate and reliable data in support of air quality modeling calculations.
- Determine the impact of industrial air emissions on local air quality in adjacent communities and in the regional air shed.
- Provide accurate and reliable data as part of an integrated air quality management control system.
- Determine air quality improvements and trends in conjunction with industrial air emissions abatement programs.
- Provide data to assess local population and ecosystem exposure to air pollutants.

Links to the Ministry of the Environment, Conservation and Parks

The HAMN air monitoring network is funded and operated by 15 industrial members. HAMN has hired two consultants 1) Administrator - to oversee the network operations as per MECP requirements, and a second 2) Service Contractor - to provide the service, repair and maintenance of the monitoring network.

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

A) **Data Access**

- The MECP has access to all continuous monitoring stations.
- MECP 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 MECP for review. Data is reviewed by the MECP Air Quality Analyst and forwarded to District abatement staff should further investigation be required.
- The MECP has access to all performance and calibration records.

B) **Notification**

- HAMN to notify the MECP immediately of any URT exceedances.

C) **Reporting**

- HAMN to provide a monthly episode summary report.
- HAMN to provide a quarterly data summary report.
- HAMN to provide an annual data summary report.

D) **Auditing**

- MECP staff will conduct routine auditing of all HAMN air monitoring samplers.
- MECP audits conducted on continuous analyzers are performed with certified test gases.
- MECP staff will conduct a performance check on all non-continuous samplers.
- Duplicate monitoring of HAMN samplers is conducted to verify system audits and laboratory analyses.

E) **Communication**

- 2 HAMN committees have been established to provide communication between HAMN members and the MECP.

    i. HAMN Steering Committee
    The HAMN steering committee members include 6 HAMN members, HAMN Administrator, MECP District abatement and MECP Technical support staff.

    ii. HAMN Technical Sub-Working Group.
    This working group deals with the operation of the network. The group is comprised of MECP technical support staff, the HAMN administrator and the network contractor who meet on a quarterly basis. On occasion, MECP district abatement staff may be called in to discuss specific abatement issues.

F) **Service Contractor Performance Audit Review**

- HAMN conducts a yearly review of the service contractor's performance. Performance assessment criteria are determined by the MECP 'Operations Manual for Air Quality Monitoring in Ontario' (January 2018).

Ministry of the Environment, Conservation and Parks – Audit Program

The MECP 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 verified by MECP staff and is incorporated in their audit reports.

The MECP uses a conformance/non-conformance limit of ±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 MECP staff is required to ensure that appropriate corrective actions have been taken in a timely manner. For continuously monitored parameters (such as SO_2 or TRS) acquired with a telemetry system, a systems audit starting from the analyzer through to the operator's central computer is undertaken periodically. For non-continuous monitored parameters such as TSP, PAH and VOCs, ministry staff conduct co-located duplicate sampling in addition to auditing sampler performance, sample handling, storage, and submission procedures. The MECP's Laboratory Services Branch also participates in these audit activities with respect to the use and performance of private laboratories.

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

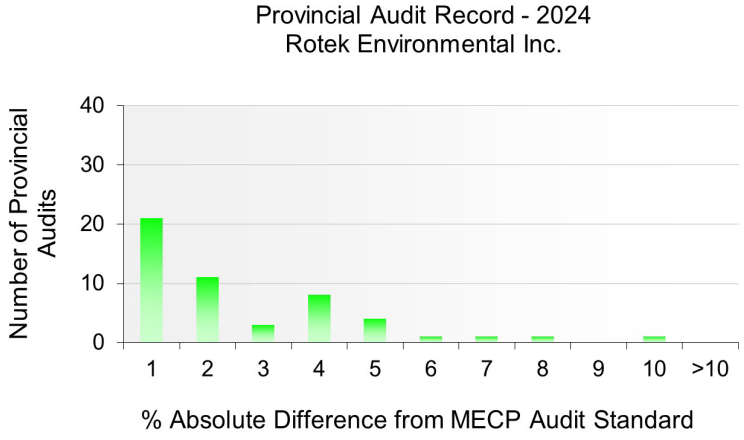
1) Auditing field samplers to ensure sampling equipment is being maintained and operated as per MECP 'Operations Manual for Air Quality Monitoring in Ontario', January 2018.

2) Auditing contract laboratories to ensure analyses are carried out as per MECP Standard Operating Procedures.

Ministry of the Environment, Conservation and Parks Provincial Audit Record

In 2024 there were a total of 51 Provincial audits of both the continuous and non-continuous air monitoring equipment operated and maintained by Rotek Environmental Inc. All of the 51 audits were certified by the MECP as being acceptable, a 100% audit success rate. Figure 31 illustrates the Provincial Audit Record for 2024.

Figure 31



Appendix 6

HAMN Structure

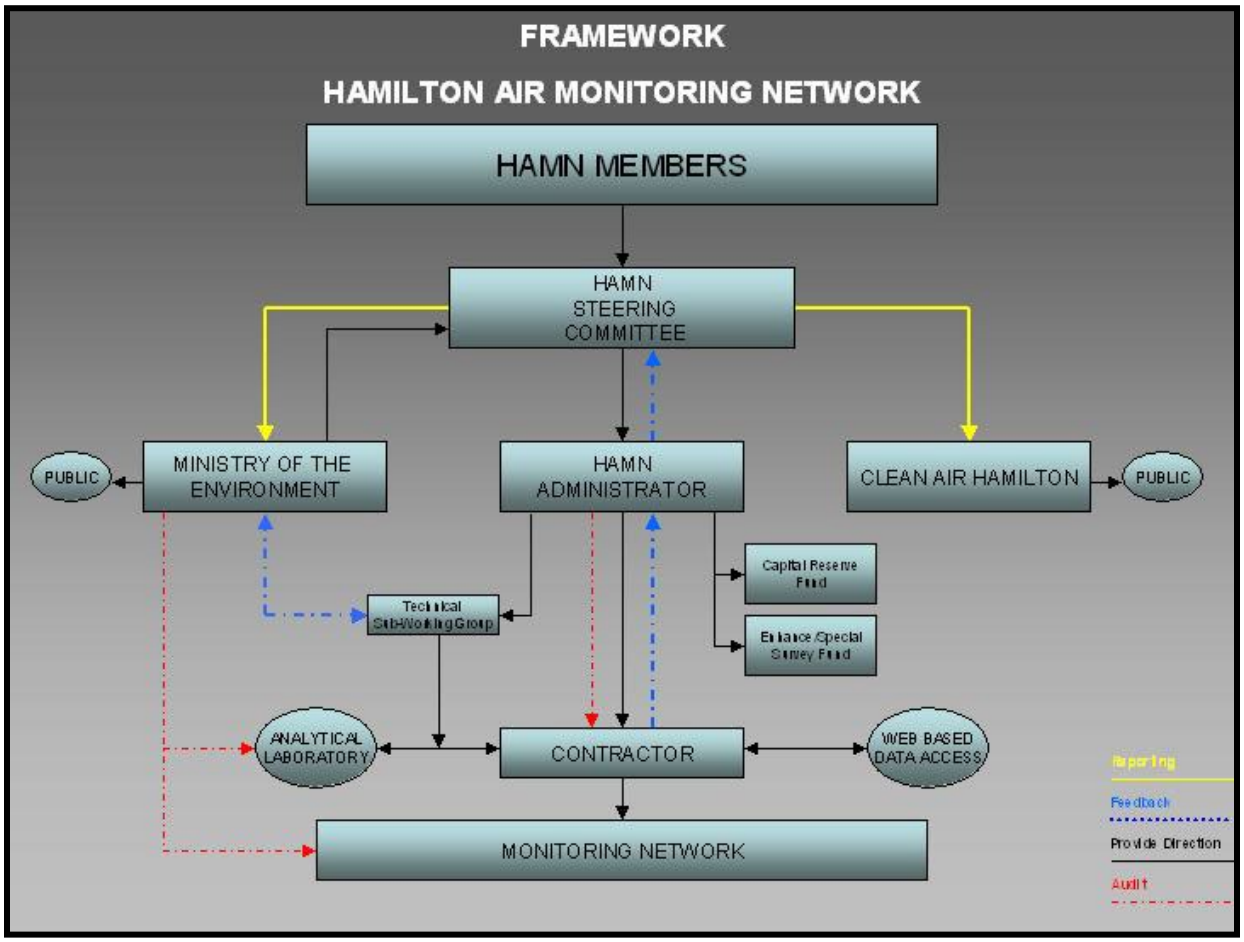
Working Committees:

1) **HAMN Steering Committee -** a management group comprising of 6 industry members, the HAMN administrator, and a representative from the MECP. The mandate of this committee is to ensure that both the MECP 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 provide a continuous line of communication among the industrial partners, air monitoring network contractor, Clean Air Hamilton, and the MECP. In February, 2003, HAMN acquired the services of an administrator to oversee the SEM project and ensure compliance with MECP requirements and protocols.

HAMN Framework – Figure 32



Contacts

HAMN Administrator

Neil Buonocore
HAMN Administrator
Hamilton Air Monitoring Network
4 – 168 Barton Street East, #321
Stoney Creek, ON
L8E 4V6
Phone - 905 541 3484
Email - HAMN@hamnair.ca

Network Monitoring and Service Contractor

Paul Daszko
Technical Manager
Rotek Environmental Inc.
15 Keefer Court
Hamilton, ON
L8E 4V4
Phone - 905 573 9533
Email - daszko@rotekinc.com
Web - www.rotekinc.com