

Ministry of the Environment,
Conservation and Parks

Ministère de l'Environnement, de la Protection de la
nature et des Parcs

Southwest Region

Région du Sud-Ouest

733 Exeter Road
London ON N6E 1L3
Tel.: 519 873-5000
Fax.: 519 873-5020

733, rue Exeter
London ON N6E 1L3
Tél. : 519 873-5000
Télééc. : 519 873-5020

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Ministry of the Environment, Conservation and Parks Sarnia Airpointer Project – Results Summary

Background

In consultation with the Clean Air Sarnia and Area (CASA) advisory panel, the ministry completed a review of the Sarnia air monitoring network. The goal was to determine if Sarnia's air monitoring network adequately represented air quality in the area, or whether one or more long-term air monitors should be added to the network. Two additional temporary air monitoring locations were selected for a one-year air monitoring study. After one year of data collection, the results would be compared with other values in the network to determine if changes or additions to the monitoring network were warranted. 24-hour canister samples of volatile organic compounds (VOCs) were collected at each location, and airpointers (APs) were used to measure concentrations of other pollutants including sulphur dioxide (SO₂), nitrogen oxides (NO_x), ozone (O₃), and particulate matter less than 2.5 µm in diameter (PM_{2.5}). The two temporary air monitoring locations are shown in Figure 1 below (AP1 and AP2), along with the Aamjiwnaang Station and the Sarnia Air Quality Health Index (AQHI) Christina Street Station for reference.

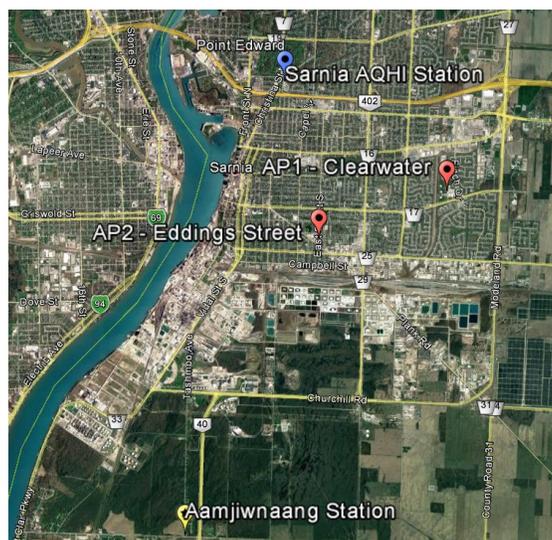


Figure 1: Temporary air monitoring stations, Aamjiwnaang Station, and Sarnia AQHI Station

The full list of pollutants measured at the two temporary stations along with the sample schedule is shown in Table 1 below.

Table 1: Pollutants measured and sampling schedule at the two temporary stations

Pollutant / Parameter	AP1 - Clearwater	AP2 – Eddings Street
Sulphur dioxide (SO ₂)	Measured continuously from July 1, 2017 to May 31, 2018	Measured continuously from July 1, 2017 to March 6, 2019
Particulate matter less than 2.5 micrometres in diameter (PM _{2.5})	Measured continuously from July 1, 2017 to May 31, 2018	Measured continuously from July 1, 2017 to March 6, 2019
Ozone (O ₃)	Measured continuously from July 1, 2017 to May 31, 2018	Not measured
Oxides of nitrogen (NO _x) including nitrogen oxide (NO) and nitrogen dioxide (NO ₂)	Not measured	Measured continuously from July 1, 2017 to March 6, 2019
Volatile organic compounds (VOCs)	24-hour sample collected every six days from February, 2017, through March, 2018	24-hour sample collected every six days from February, 2017, through March, 2018
Wind Direction	Measured continuously from July 1, 2017 to May 31, 2018	Measured continuously from July 1, 2017 to March 6, 2019
Wind Speed	Measured continuously from July 1, 2017 to May 31, 2018	Measured continuously from July 1, 2017 to March 6, 2019

Results

From a review of the data, it was found that SO₂ and benzene were the main pollutants of concern and these two pollutants are the main focus of this memorandum. Measured concentrations of benzene and SO₂ have been found to exceed their AAQC and updated AAQC, respectively. All other pollutants were found to remain below their AAQC, or were pollutants of regional concern (such as O₃ and PM_{2.5}) and were generally correlated with data from the permanent monitoring network (not shown).

Sulphur Dioxide:

Pollution roses from each of the two temporary monitoring locations (AP1 and AP2) are shown in Figure 2. The wind directions in the pollution roses are noticeably different suggesting there are likely local influences, such as nearby buildings, that are impacting the wind directions. For this reason, relation between elevated concentrations and specific wind direction may be less reliable, but the general trends observed should still be reasonably accurate. At both stations, the highest concentrations appear to occur when winds are blowing generally from the southwest, which is in the approximate direction of the main industrial sources.

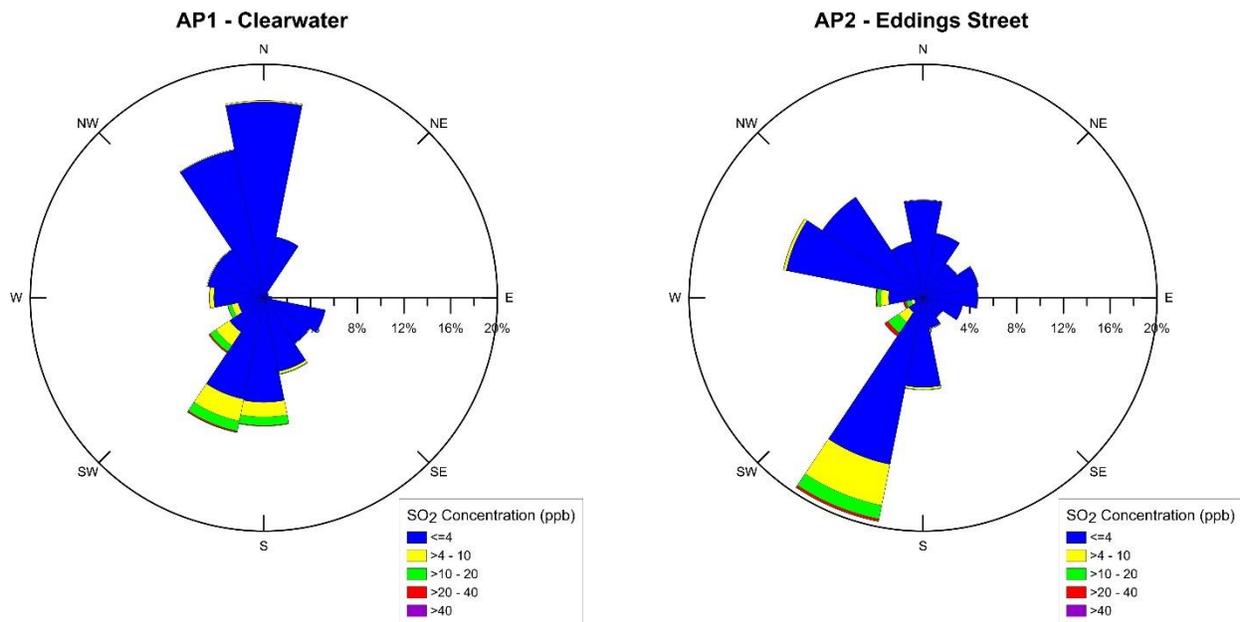


Figure 2: SO₂ pollution roses for the two temporary monitoring stations

Table 2 provides a summary of the concentrations measured at the two temporary locations for the entire period that each monitor was deployed. Note that as of March 20, 2018, the updated 10-minute SO₂ AAQC of 67 ppb, the updated 1-hour SO₂ AAQC of 40 ppb, and the updated annual SO₂ AAQC of 4 ppb took effect. For informational purposes, the 10-minute, 1-hour, and annual SO₂ concentrations are compared against the levels of 67 ppb, 40 ppb, and 4 ppb respectively. These are referred to as “exceedances” throughout this memorandum even though the updated AAQC were not in effect for much of the monitoring period.

Table 2: Summary of SO₂ data measured at the temporary monitoring stations

Station:	AP1 - Clearwater	AP2 – Eddings Street
Valid Hours:	7,147	14,291
10-minute data (updated 10-minute AAQC = 67 ppb)		
Maximum (ppb):	63	133
# of Exceedances:	0	6
1-hour data (updated 1-hour AAQC = 40 ppb)		
Maximum (ppb):	55	68
# of Exceedances:	2	14
Annual data (updated annual AAQC = 4 ppb) [1]		
Average (ppb):	1.9	2.2
# of Exceedances:	0	0

Notes:

[1] The annual average concentration at AP1 was calculated for the period of July 1, 2017, through May 31, 2018, and does not quite represent a full year. The annual average concentration at AP2 is the maximum rolling annual average over the period of July 1, 2017, through March 6, 2019.

During the period assessed, both stations remained below the updated annual AAQC for SO₂, however there were a few exceedances of the updated 10-minute and 1-hour AAQCs. In general, AP2 measured higher concentrations than AP1.

Benzene:

Table 3 below provides a summary of the concentrations measured at the two temporary locations.

Table 3: Summary of Benzene data measured at the temporary monitoring stations

Station:	AP1	AP2
Time Period	Feb. 6, 2017 – Mar. 21, 2018	Feb. 6, 2017 – Mar. 21, 2018
Valid Samples:	32	34
24-hour data (24-hour AAQC = 2.3 µg/m ³)		
Maximum (µg/m ³):	1.6	2.8
# of Exceedances:	0	2
Annual data (Annual AAQC = 0.45 µg/m ³) [1]		
Average (µg/m ³):	0.50	0.91
# of Exceedances:	1	1

[1] The annual average concentrations have been calculated for the entire period of data available for illustrative purposes. There were several missing samples throughout this monitoring period and the 75% valid data threshold to calculate an annual average was not met.

Average concentrations were above the annual AAQC at both locations however there were only two measured exceedances of the 24-hour AAQC, which occurred at AP2. AP2 also recorded the higher average concentration.

Figure 3 below shows the 24-hour benzene concentrations measured at both AP1 and AP2 locations.

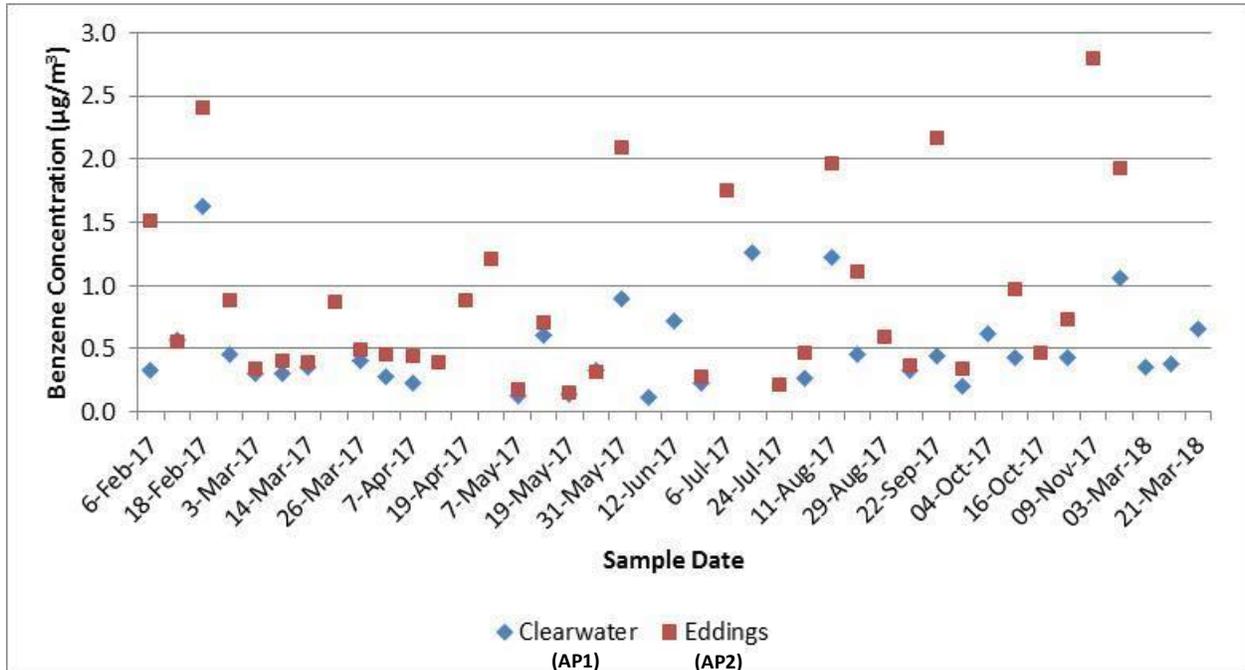


Figure 3: 24-hour benzene concentrations measured at the temporary monitoring stations

This graph shows that benzene concentrations measured at AP2 were often higher than those measured at AP1, and this trend was statistically significant.

Changes to Air Monitoring Network

The one-year study successfully showed how the concentrations of the measured air pollutants compare and helped to assess potential modifications that could be made to the air monitoring network. Based on the review of data from these two temporary air monitoring stations (AP1 and AP2), as well as a separate review of facility emissions, permanent monitoring stations and modelling, the following changes were made to the network:

- Both APs have been equipped with a gas chromatograph (miniGC) in order to measure hourly concentrations of benzene as well toluene, ethylbenzene, and xylene. The miniGC measures concentrations continuously and the 1-hour time resolution allows for a comparison between benzene concentrations and wind directions.

- Community exposure to SO₂ and benzene was anticipated to be more elevated at the north side of Aamjiwnaang First Nation compared to areas around the other existing monitoring locations. AP1 has been relocated to this area near the corner of Tashmoo Ave. and Churchill Rd. in order to assess concentrations of SO₂ and benzene. AP1 has been operating at this location since March 8, 2019.
- Community exposure to SO₂ and benzene was anticipated to be more elevated in the residential area further to the west of the AP2 Eddings Street location. AP2 has been relocated to this area near Vidal St. and Confederation St. in order to assess concentrations of SO₂ and benzene. AP2 has been operating at this location since November 20, 2019.