Grey-Bruce Air Quality Study
2015

Ontario Ministry of the Environment and Climate Change

Report prepared by:

Air Monitoring and Transboundary Air Sciences Section
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Report Completion Date: December 2015

Ontario

Executive Summary

In 2015, the Ontario Ministry of the Environment and Climate Change (Ministry or MOECC) conducted an air quality study in the Grey-Bruce Region to measure ambient concentrations of Air Quality Health Index (AQHI) criteria pollutants. The purpose of the study was to determine whether the Ministry's existing AQHI air monitoring station located at Tiverton, Ontario is representative of air quality in Owen Sound and the greater Grey-Bruce Region. The Ministry deployed a mobile air quality monitoring system configured to measure ambient concentrations of ozone (O_3), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) at three sites across the region in the summer of 2015 and the data collected were compared to concurrent data collected at the Ministry's Tiverton AQHI air monitoring station. No high risk or very high risk AQHI events were recorded at any location during the study. Furthermore, concentrations of O_3, $PM_{2.5}$ and NO_2 measured by the mobile air quality monitoring system tracked the Tiverton data well. These findings indicate that the existing Tiverton AQHI station provides adequately representative measurements of common air pollutants and AQHI values for the Grey-Bruce Region.

1. Introduction

In 2015, the Air Monitoring and Transboundary Air Sciences Section of the Ontario Ministry of the Environment and Climate Change (Ministry or MOECC) conducted an air quality study in the Grey-Bruce Region at the request of the Ministry's Owen Sound District Office to measure ambient concentrations of Air Quality Health Index (AQHI) criteria pollutants. The purpose of the study was to assess whether the existing MOECC AQHI air monitoring station located at Tiverton, ON, is representative of air quality in Grey and Bruce Counties.

The Ministry deployed a mobile air quality monitoring system (Airpointer) configured to measure ambient concentrations of ozone (O_3), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) to the region from June through September 2015. Over this period the mobile unit was located at three different sites to assess the homogeneity of air quality across the Grey-Bruce Region. Data were also collected simultaneously at the Ministry's Tiverton AQHI air monitoring station. The Airpointer site locations and the Tiverton AQHI station location are shown in Figure 1. Site 1 was located in the Municipality of Northern Bruce Peninsula, Site 2 was located in Owen Sound adjacent to the Grey-Bruce Health Unit Building, and Site 3 was located on the outskirts of Hanover in the Municipality of West Grey. The Airpointer was deployed at Site 1 from June 4th to July 8th, Site 2 from July 9th to August 13th and Site 3 from August 14th to September 18th.

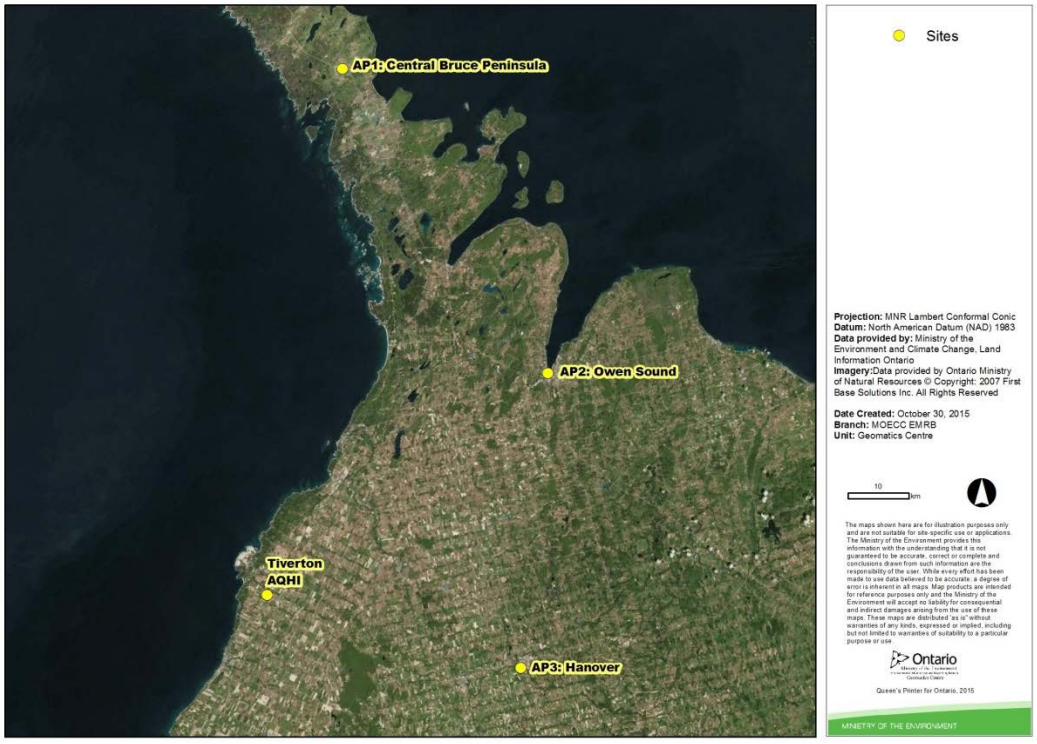

Figure 1: Map of the Grey-Bruce Region indicating locations of the Tiverton AQHI station and the three sites used for deployment of the Airpointer mobile air monitoring unit.

2. Data Analysis and Results

Meteorology

Meteorological data collected by Environment Canada at Wiarton Airport for the entire study period (June 4th-September 18th 2015) was used to provide context to the air quality measurements. Temperature was in the range 5-32 ºC, with a mean value of 18 ºC. Wind speed and direction data are shown in Figure 2. Wind was predominantly from the west and calm winds (<5 km/h) were observed for 12% of the study period.

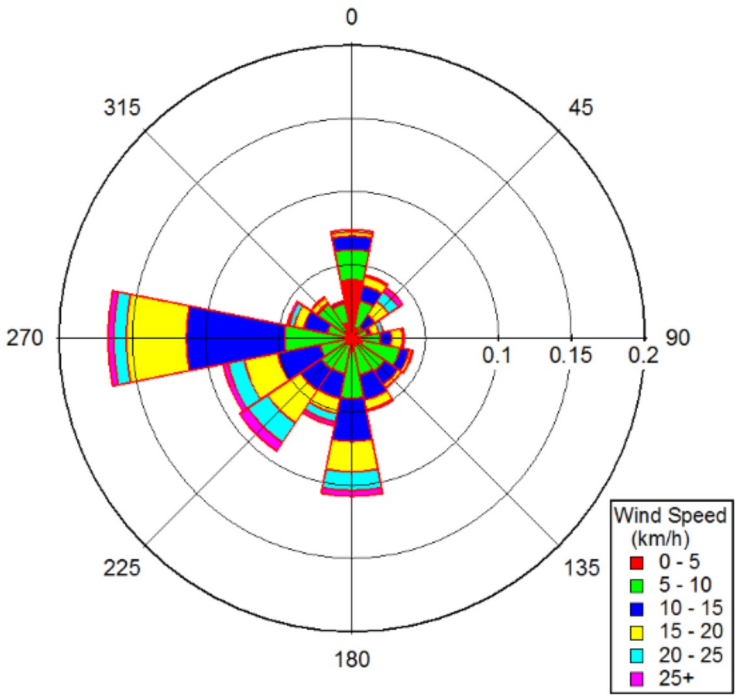

Figure 2: Wind Rose for Wiarton Airport June 4th-September 18th 2015

Criteria Pollutants

The Airpointer mobile unit measured ambient concentrations of the three common air pollutants in air; ozone (O_3), nitrogen dioxide (NO_2) and fine particulate matter ($PM_{2.5}$). A comparison of daily maximum 1 hour concentrations of O_3 for Tiverton and the Airpointer is shown in Figure 3. The Ontario Ambient Air Quality Criterion (AAQC) value for 1 hour concentrations of ozone is included for reference. Close agreement is observed between Tiverton and the Airpointer at all three locations. The mean concentrations of ozone for the entire study duration are 32.6 and 30.5 ppb for Tiverton and the Airpointer, respectively. Although the AAQC was exceeded for a single hour in Tiverton on July 17th, no exceedances were observed for the Airpointer. The single exceedance at Tiverton did not lead to a high risk AQHI category value for that hour, however, as discussed in the next section.

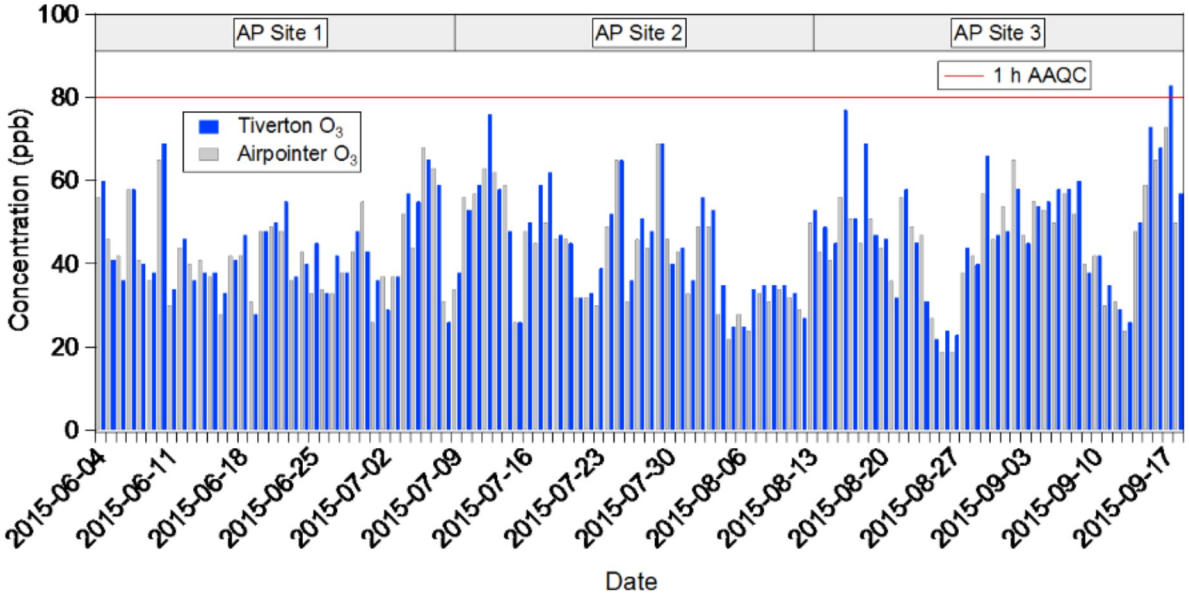

Figure 3: Daily maximum 1 hour concentrations of O_3 at the Tiverton AQHI site and the three Airpointer (AP) sites

A comparison of 24 hour mean concentrations of $PM_{2.5}$ for Tiverton and the Airpointer is shown in Figure 4. The Ontario 24 hour $PM_{2.5}$ reference level value is also included. Again, very good agreement is observed between Tiverton and the Airpointer for all three periods. The mean concentrations for $PM_{2.5}$ for the entire study are 6.6 and 6.9 µg m^{-3} for Tiverton and the Airpointer, respectively.

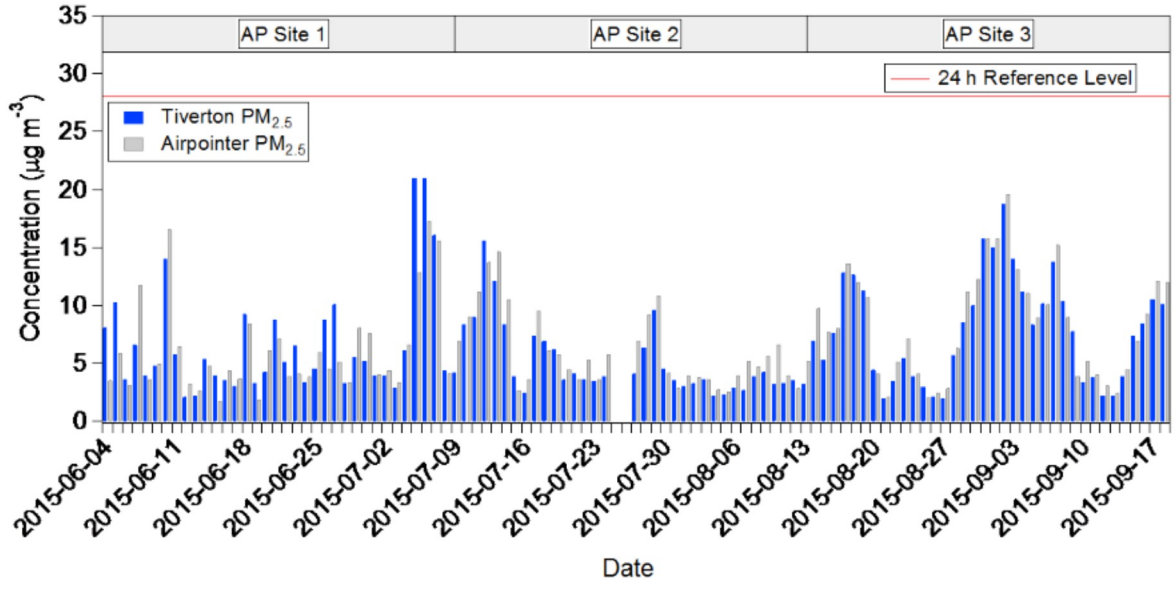

Figure 4: 24 hour mean concentrations of $PM_{2.5}$ at the Tiverton AQHI site and the three Airpointer (AP) sites

Finally, a comparison of daily maximum 1 hour concentrations of NO_2 is shown in Figure 5. The Ontario AAQC value for 1 hour concentrations of NO_2 is included for reference. Values are consistently low and good agreement is observed between Tiverton and the Airpointer at all times. The mean values for the entire study for NO_2 are 1.2 and 1.5 ppb for Tiverton and the Airpointer, respectively.

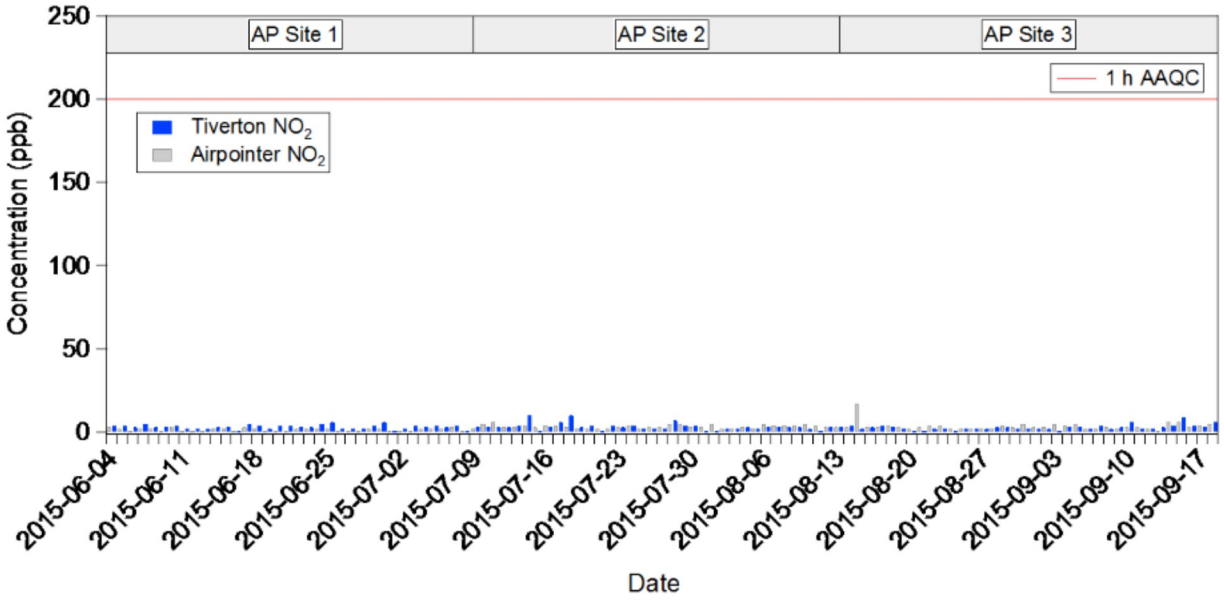

Figure 5: Daily maximum 1 hour concentrations of NO_2 at the Tiverton AQHI site and the three Airpointer (AP) sites

Air Quality Health Index (AQHI)

The AQHI is designed to measure air quality in relation to health on a scale from 1 to 10. The higher the number, the greater the health risk associated with exposure to ambient air. The index is calculated based on the relative risks of a combination of O_3, $PM_{2.5}$ and NO_2. In Ontario, exceedances of existing AAQC values are also considered when reporting AQHI risk categories. AQHI values were calculated for each hour of the study for the Tiverton and Airpointer datasets and the distributions of these values are shown in Figure 6.

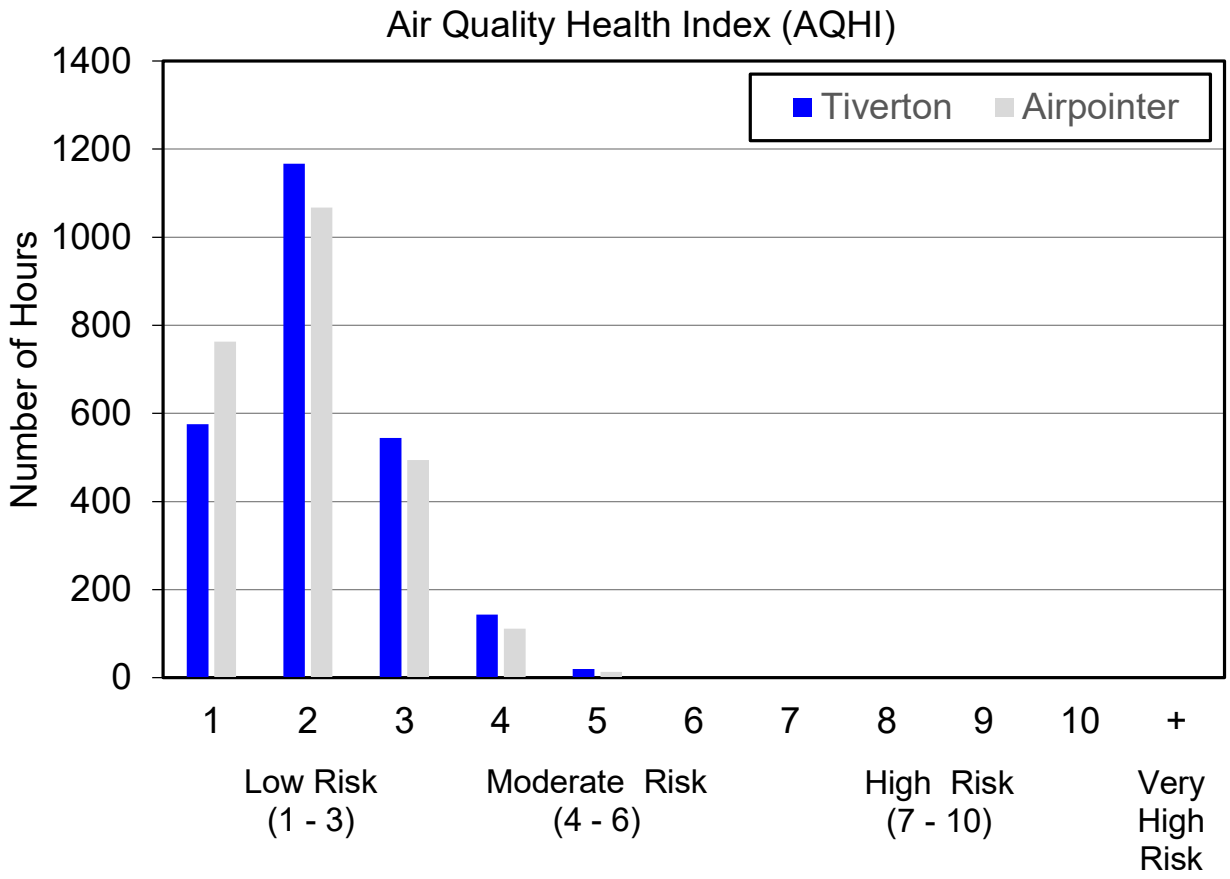

Figure 6: 1 hour AQHI values for the Tiverton and Airpointer datasets

The vast majority of AQHI values were in the low risk (1-3) category for both datasets, representing 93% and 95% of the Tiverton and Airpointer measurements, respectively. The remaining hours were in the moderate risk (4-6) category in both cases, and no high risk or very high risk hours were recorded at any location in the Grey-Bruce Region during the study.

Conclusions

In 2015, the Air Monitoring and Transboundary Air Sciences Section of the Ontario Ministry of the Environment and Climate Change conducted an air quality study in the Grey-Bruce Region to measure ambient concentrations of Air Quality Health Index (AQHI) criteria pollutants. The purpose of the study was to assess whether the existing MOECC AQHI air monitoring station located at Tiverton, ON, is representative of air quality in Grey and Bruce Counties. The Ministry deployed a mobile air quality monitoring system configured to measure ambient concentrations of ozone (O_3), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) at three sites across the region in the summer of 2015 and the data collected were compared to concurrent data collected at the Ministry's Tiverton AQHI air monitoring station. No high risk or very high risk AQHI events were recorded at any location during the study. Furthermore, concentrations of

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