

## Air Quality Health Index in Windsor, Canada, and the Impact of Regional Scale Transport

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**Abstract :** In Canada, Air Quality Health Index (AQHI) is a scale designed to help residences understand the impact of air quality on human health. In Ontario, Canada, AQHI was implemented in June 2015. This study investigated temporal variability of daily AQHI and impact of regional transport on AQHI in Windsor, Ontario, Canada from 2016 to 2019. During 2016–2019, 1428 daily AQHIs were recorded in Windsor Downtown Station. Among those, the AQHIs were at the low health risk level (AQHI = 1, 2 or 3) in 82% of days, only a few days at high risk level (AQHI = 7), the rest were at moderate health risk level (AQHI = 4, 5, 6), indicating air quality in Windsor was fairly good with relatively low health risk. The annual mean AQHI value decreased from 2.95 in 2016 to 2.81 in 2019, demonstrating the improvement of air quality. Half of the days, AQHI were 3 regardless of season. AQHI was higher in the warm season (3.1) than in the cold season (2.6) due to more frequent moderate risk days (27%, AQHI = 4) in warm season and more frequent low risk days (42%, AQHI = 2) in the cold season. Among the three pollutants considered in AQHI calculation, O<sub>3</sub> was the most frequently reported dominant contributor to daily AQHI (88% of days), followed by NO<sub>2</sub> (12%), especially in the cold season, with small contribution from PM<sub>2.5</sub> (<1%). In the past two decades, NO<sub>2</sub> concentrations had decreased significantly and O<sub>3</sub> concentrations had increased, resulting in daily AQHI being less reliance on NO<sub>2</sub> (from 51% of days being the primary contributor during 2003–2010 to 12% during 2016–2019) and more on O<sub>3</sub> concentrations (49% to 88%). Trajectory analysis found that AQHI ≤ 3 days were closely associated with air masses from the north and northwest, whereas AQHI > 3 days were closely associated with air masses from the west and southwest. This is because northerly flows brought in clear air mass owing to less industrial facilities, while polluted air masses were transported from the south of Windsor, where several industrial states of the US were located. Overall, O<sub>3</sub> concentrations dictate the daily AQHI values, the seasonal variability of AQHI, and the impact of regional transport on AQHI in Windsor. This makes further reductions of AQHI challenging because O<sub>3</sub> concentrations are likely to continue increasing due to weakened consumption of O<sub>3</sub> by NO owing to decreasing NO emissions and more hot days because of climate change. The predominant and increasing contribution of O<sub>3</sub> to AQHI calls for more effective control measures to mitigate O<sub>3</sub> pollution and its impact on human health and the environment.

**Keywords :** air quality, Air Quality Health Index (AQHI), hysplit, regional transport, windsor

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