

The Air Quality Health Index (AQHI) and the AQHI-Plus

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June 21, 2018

Introduction

The [Air Quality Health Index](#) (AQHI) is a tool designed to help people understand what air quality means to their health. It was developed by the federal and provincial governments and other stakeholders. Public feedback on the limitations of the AQHI has led to the BC Ministry of Environment and Climate Change Strategy (BC MoE) to develop adjustments to the AQHI to better account for health risks related to biomass smoke. These adjustments have been developed by the BC Centre for Disease Control (BCCDC).

To address the health effects of wildfire smoke, the *Wildfire Season AQHI-Plus* has been developed to operate for five months (May through September). It is designed to communicate health risks that are associated with wildfire smoke, which originates from forested regions and can impact large areas of the province. The need for a second AQHI-Plus for use during the cooler season (October through April) is currently being assessed.

The published AQHI is always the greater of the AQHI and the AQHI-Plus. Only one AQHI-Plus will be in operation at any given time.

The AQHI is based on the health impacts of three air pollutants

The AQHI was based on the observed relationship between daily mortality and concentrations of nitrogen dioxide (NO₂), ground-level ozone (O₃), and fine particulate matter (PM_{2.5}) in ten large Canadian cities, most of which are in central and eastern Canada. Each of these pollutants poses health risks, even at low levels of exposure. The three-pollutant AQHI equation developed by the federal and provincial governments is as follows, where the NO₂, O₃ and PM_{2.5} terms refer to 3-hour trailing averages of the concentrations of each pollutant.

$$AQHI = 10/10.4 * (100 * (e^{(0.000871 * NO_2)} - 1) + e^{(0.000537 * O_3)} - 1 + e^{(0.000487 * PM_{2.5})} - 1))$$

The people most at risk from degraded air quality are those with compromised health due to conditions such as asthma, chronic obstructive pulmonary disease (COPD), cardiovascular disease, and diabetes. Seniors, young children, and pregnant women are also more affected. Air pollution makes it even harder for sensitive people to breathe and can make existing lung- or heart-related symptoms worse.

Limitations of the three-pollutant AQHI and the introduction of the AQHI-Plus

The impetus for the development of the AQHI-Plus was based on public feedback, particularly from small BC communities where people perceived that the three-pollutant AQHI was failing to reflect the health risks during smoke episodes. Smoke events can be caused by wildfires, open burning, industry, and residential wood burning. Because the weighting of PM_{2.5} in the three-pollutant AQHI equation above was based on large urban centres, it was not designed to capture such smoke episodes.

However, the health impacts of smoke episodes are well-documented in BC, so it is important to ensure that reported AQHI values reflect these risks. The BC MoE and the BCCDC first introduced an AQHI-Plus adjustment in 2016, which was designed to ensure that health risks from smoke were reflected in the provincial AQHI.

The Wildfire Season AQHI-Plus

Wildfire smoke was extensive and pervasive throughout the summer of 2017 in BC. Together with public concerns about the performance of the 2016 AQHI-Plus, this led to a new version of the AQHI-Plus being developed in early 2018 by the BCCDC to focus on wildfire smoke. Wildfire smoke was considered independently in this version because the magnitude, duration, and composition of the exposure are different from smoke caused by open burning, industry, and residential wood burning in BC. The *Wildfire Season AQHI-Plus* is based on statistical analyses of the health impacts of wildfire smoke, measured as PM_{2.5} concentrations at monitoring stations from May through September in the years 2010 through 2017. The algorithm developed by the BCCDC is:

$$\text{Wildfire Season AQHI-Plus} = \text{ceiling value (the closest integer greater than or equal to a given number) of the 1-hour PM}_{2.5} \text{ concentration divided by 10}$$

The final published hourly AQHI is always the greater of the three-pollutant AQHI and the one-pollutant AQHI-Plus. The *Wildfire Season AQHI-Plus* was implemented on the [Environment and Climate Change Canada web site](#) and the [BC MoE](#) air quality websites on May 1, 2018 as a pilot study.

Conclusion

The *Wildfire Season AQHI-Plus*, developed as an adjustment to the three-pollutant AQHI, will be piloted for the period May 1 through September 30, 2018. A report on these the results of this pilot will be prepared in 2019.