

Title:	Alberta Ambient Air Quality Objectives and Guidelines - Ozone
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Alberta ambient air quality objectives are issued by Alberta Environment and Parks, under Section 14 (1), of the *Environmental Protection and Enhancement Act, 2017*.

- The 1-hour daily maximum Alberta ambient air quality objective for ozone (O₃) is 150 µg m⁻³ (76 ppb) based on pulmonary effects.

Note: Underscore indicates this digit is the last significant figure in the number e.g. 150 has two significant figures.
 Note: The least significant figure is underlined to indicate calculation accuracy when converting from one unit to the other (e.g. µg m⁻³ to ppbv). These numbers do not indicate reporting accuracy or precision. Refer to the Air Monitoring Directive for the Reporting Policy on significant figures for comparison to the ambient air quality objectives.

Characteristics

Ozone is a chemical whose effect on the environment is either beneficial or detrimental depending on where it occurs. Stratospheric ozone protects us from the sun's UV light, but can be toxic in the troposphere. Ozone is a highly reactive, colourless gas that is normally present in the troposphere resulting from naturally occurring photochemical and meteorological processes. It has a sharp, clean odour which is often detected around running electric motors, after lightning storms, and around new mown hay.

Ground level ozone is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOCs) like hydrocarbons and nitrogen oxides in the presence of heat and sunlight. Sources of precursor substances include car exhaust, oil and gas industry and VOC emissions from trees and other vegetation. Changing weather patterns contribute to yearly differences in ozone concentrations from city to city. Ozone and the precursor substances can be transported into an area from pollution sources hundreds of kilometers upwind.

Effects

Extensive scientific studies indicate that there can be substantial health and environmental effects associated with exposure to ground-level ozone. Potential short-term effects include pulmonary function reductions, increased airway sensitivities, and airway inflammation. The primary site of short-term exposure injury is the lungs, which are characterized by lung congestion, fluid build-up, and bleeding. Inhalation may initiate, accelerate, or exacerbate respiratory tract disease of bacterial or viral origin. Discomfort to individuals may involve coughing, dryness of throat and mucous membranes and of nose and eyes following exposures of high concentrations and short duration. Other potential ecological effects of ozone include crop damage and greater vulnerability to disease in some tree species.

Epidemiological evidence shows a positive association between exposures to ambient ozone and respiratory symptoms in children with asthma. Generally, symptoms occurred at average 8-hr maximum concentrations of less than 69 ppb. Genetic predisposition combined with long-term ozone exposure is also associated with new onset asthma, for people in areas where the annual average of the 8-hr maximum ozone concentrations was 55.2 ppb.

Controlled human exposure studies have demonstrated heightened allergic and asthmatic responses with short term exposures in the range of 80-400 ppb. In addition, studies have shown that ozone induced inflammatory responses occur at concentrations of 60 ppb, while altered immune responses are observed with short-term exposures of 80 ppb.

Ambient 8-hour ozone exposures of less than 60-63 ppb are also associated with respiratory hospital admissions and emergency department visits.

Objectives in Other Jurisdictions

Table 1 lists ambient objectives currently in place for several jurisdictions. The metric calculation applied to each objective is noted below the table.

Table 1 Summary of Selected Air Quality Objectives and Guidelines for Ozone

Agency	Objective Title	Objective Value $\mu\text{g m}^{-3}$ (ppb) Averaging Time	
		1-hr	8-hr
Canada	Ambient Air Quality Standard	-	2015: (63)* 2020: (62)*
Ontario	Ambient Air Quality Criteria	165 (80)	-
British Columbia	Ambient Air Quality Objective	160 (82)	123 (63)
US EPA	Ambient Air Quality Standard	-	(70)†
WHO	Air Quality Guideline		100††

* 3-year average of the annual 4th highest daily maximum 8-hr average concentrations

† annual 4th highest daily maximum 8-hr concentration, averaged over 3 years, primary and secondary standards

†† daily maximum 8-hr average

References

Health Canada, 2011. Canadian Smog Science Assessment of Fine Particulate Matter and Ground-Level Ozone. Volume 2: Health-Related Chapters.

U.S. Environmental Protection Agency. 2013. Integrated Science Assessment for Ozone and Related Photochemical Oxidants. EPA 600/R-10/076F

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