

Title:	Alberta Ambient Air Quality Objectives and Guidelines – Fine Particulate Matter (PM_{2.5})
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Alberta ambient air quality objectives are issued by Alberta Environment and Parks, under Section 14 (1), the *Environmental Protection and Enhancement Act*, 1992.

- The 24-hour average Alberta ambient air quality objective for fine particulate matter (PM_{2.5}) is 29 µg m⁻³ based on health effects.

Alberta ambient air quality guidelines are issued by Alberta Environment and Parks, under Section 14 (4), the *Environmental Protection and Enhancement Act*, 1992.

- The current 1-hour average Alberta ambient air quality guideline for fine particulate matter (PM_{2.5}) will remain at 80 µg m⁻³ to be used for monitoring and reporting of the Air Quality Health Index.

Characteristics

Fine particulate matter (PM_{2.5}) refers to airborne solid or liquid particles that are 2.5 microns or less in diameter. It is either emitted directly (primary PM) or formed in the atmosphere from precursor emissions (secondary PM). Important precursors of secondary PM are nitrogen oxides (NO_x), sulphur dioxide (SO₂), ammonia (NH₃), and volatile organic compounds (VOCs). The chemical composition of PM_{2.5} can vary widely and depends on location, time of year, and weather.

Primary fine particulate matter is formed by combustion processes including: forest fires or residential wood burning; burning of solid or liquid fossil fuels in motor vehicles, furnaces, boilers, and heaters; and certain industrial processes. Secondary fine particles are created when chemicals react in the atmosphere and grow through particle-particle or gas-particle interactions.

Fine particulates undergo removal from the atmosphere by interaction with rainfall or by dry deposition. Particulate matter is measured in real time in Alberta at a number of monitoring stations across the province.

Effects

Extensive scientific studies indicate that there can be significant health and environmental effects associated with PM_{2.5}. Due to its small particle size, PM_{2.5} can travel deeper into the lungs and accumulate in the respiratory system. Fine particulate matter may be associated with

respiratory health effects such as; reduced lung function, asthma, emphysema and bronchitis or cardiovascular effects such as; angina, heart attacks and hypertension. Exposure is also linked to increased emergency room visits and hospitalization; as well as increased risk of premature mortality. Sensitive groups that appear to be at greatest risk to such effects include; children, the elderly, and individuals with cardiovascular or pulmonary disease.

Newer studies indicate that there is an approximately linear relationship between the concentration of PM_{2.5} and the health response, with no clear evidence of a threshold for effects (Health Canada, 2011).

PM_{2.5} can cause reduced visibility as the fine fraction particles scatter light effectively, reducing the distance for which the atmosphere has a clear appearance. The photochemical haze results when light scattering particles are formed through the reaction of chemical substances in the atmosphere. This ultimately causes the view of distant objects to be obscured by the haze, which can be an issue in scenic tourist destinations, as this may reduce the area's desirability as a tourist destination.

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 PM_{2.5}

Agency	Objective Title	Objective Value ($\mu\text{g m}^{-3}$) Averaging Time	
		24-hr	Annual
Canada	Ambient Air Quality Standard	28‡	10.0‡‡
Ontario MOE	Ambient air quality criterion	30	
US EPA	Ambient air quality standard	35*	12**/15†
European Union	Air quality standard		25 (by 2015) 20 (by 2020)
WHO	Air quality guideline	25††	10

‡ the 3-year average of the annual 98th percentile of the daily 24-hour average concentrations

‡‡ the 3-year average of the annual average concentrations

* 98th percentile, averaged over 3 years

** annual mean averaged over 3 years. Primary standard: provides public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly

† annual mean averaged over 3 years. Secondary standard: provides public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings

†† 99th percentile

References

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

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