Alberta Ambient Air Quality Objectives and Guidelines – Sulphur Dioxide - DRAFT

Title of publication Alberta Ambient Air Quality Objectives and Guidelines – Sulphur Dioxide - Draft
Issuing department, agency, board or other entity Air Policy
Date of publication TBD
ISBN, ISSN, or other unique identifiers TBD

Title:	**Alberta Ambient Air Quality Objectives and Guidelines – Sulphur Dioxide - Draft**
Number:	**AEP, Air Policy, TBD, No. TBD**
Program Name:	**Air Policy**
Effective Date:	**1975, this update effective TBD**
ISBN No:	**ISBN (PDF)**

Alberta ambient air quality objectives are issued by Alberta Environment and Parks, under Section 14 (1), the *Environmental Protection and Enhancement Act,* 1992.

- The 1-hour average Alberta Ambient Air Quality Objective for Sulphur dioxide is 246 µg m^{-3} (94 ppb), based on human health effects.
- The 24-hour average Alberta Ambient Air Quality Objective for Sulphur dioxide is 79 µg m^{-3} (30 ppb), based on human health effects.
- The 30-day average Alberta Ambient Air Quality Objective for Sulphur dioxide is 26 µg m^{-3} (10 ppb).
- The annual average Alberta Ambient Air Quality Objective for Sulphur dioxide is 13 µg m^{-3} (5 ppb), based on ecosystem effects.
- **Effective January 1, 2025**, the annual average Alberta Ambient Air Quality Objective for Sulphur dioxide is 10.5 µg m^{-3} (4 ppb), based on ecosystem effects.

Characteristics

Sulphur dioxide (SO_2) is a colourless, non-flammable gas with a sharp, pungent odour. Natural sources include volcanoes, decaying organic matter and solar action on seawater. Human activities that lead to the release of SO_2 are fossil fuel combustion, petroleum refining, and smelting sulphide ores. Sulphur dioxide is used: in the production of sulphuric acid; in the pulp and paper industry; as a food preservation agent; as a disinfectant; and as a solvent.

Effects

Human Health

Short-term exposure to SO_2 affects respiratory health and may contribute to premature mortality. Healthy subjects exhibit increased airway resistance and bronchoconstriction, decreased maximum expiratory flow and decreased pulmonary function. Asthmatic subjects exhibit similar symptoms but also report increases in asthma symptoms, wheezing, chest tightness, and difficulty breathing. There is also some suggestive evidence for reproductive/developmental effects such as preterm birth and congenital heart malformations in babies exposed to SO_2 in utero.

Vegetation

Sulphur dioxide injury to vegetation is characterized as being a result of either acute (exposures of a few minutes to hours to a concentration that results in visible injury within a few hours or days) or chronic (long-term, weeks to years, to low concentrations that result in metabolic injury). Long-term exposures (growing season or longer) to low SO_2 levels have been shown to increase foliar sulphur levels and affect metabolic activity. In addition, emissions of SO_2 can result in the formation of acidic compounds and acid deposition, which can have long-term effects on ecosystems.

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 Standards and Guidelines for Sulphur Dioxide in Other Jurisdictions

Agency	Objective Title	Objective Value µg m^{-3} (ppb) Averaging Time				
		10 min	1 hour	3 hour	24 hour	Annual
Canada	Ambient Air Quality Standard		(70)* 2025: (65)*			(5)** 2025: (4)**
Ontario	Ambient Air Quality Criteria	(67)	(40)†			(4)
British Columbia	Ambient Air Quality Objective		183 (70)*			13 (5)**
US EPA	Ambient Air Quality Standard		(75)* (Primary)	(500)‡ (Secondary)		
WHO	Air Quality Guideline	500			20	

* Three-year average of the annual 99th percentile of the daily-maximum 1-hour average concentrations
** Average over a single calendar year of all the 1-hour average concentrations
† Converted from the 10-minute AAQC to allow assessment of 1-hour air quality data for implementation
‡ Averaged over 3-hours, not to be exceeded more than once per year

References

Alberta Environment, 2004. Assessment Report on Sulphur Dioxide for Developing Ambient Air Quality Objectives: Effects on Vegetation.

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