Alberta Ambient Air Quality Objectives

Alberta ambient air quality objectives are issued by Alberta Environment, under Section 14 (1), the Environmental Protection and Enhancement Act, 1992 (EPEA). Based upon the available information:

- The 1-hour average Alberta Ambient Air Quality Objective for sulphur dioxide is 450 µg m\(^{-3}\) (172 ppb) based on pulmonary effects.
- The 24-hour average Alberta Ambient Air Quality Objective for sulphur dioxide is 125 µg m\(^{-3}\) (48.0 ppb) adopted from the European Union, which based its objective on human health.
- The 30-day average Alberta Ambient Air Quality Objective for sulphur dioxide is 30 µg m\(^{-3}\) (11 ppb).
- The annual average Alberta Ambient Air Quality Objective for sulphur dioxide is 20 µg m\(^{-3}\) (8.0 ppb) adopted from the European Union, which based its objective on the protection of ecosystems.

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.

According to the National Pollutant Release Inventory, SO\(_2\) emissions in Alberta have declined from 608 kilotonnes in 1995 to 453 kilotonnes in 2005. Annual average ambient levels across Alberta in 2006 were below 7.5 µg m\(^{-3}\). Sulphur dioxide is measured continuously by pulsed fluorescence (detection limits of 2 – 5 µg m\(^{-3}\)).

Effects

Exposure to SO\(_2\) results in numerous effects to the pulmonary system. 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. Exercise increases the severity of response to SO$_2$ in both healthy and asthmatic individuals. In addition, cold and/or dry air increases the asthmatic response.

**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.

**Other Jurisdictions**

In December 2009 the US EPA announced their intent to reduce their 1-hour SO$_2$ standard to between 131 to 262 µg m$^{-3}$. The short term objectives in other jurisdictions are generally designed to protect human health while annual objectives are used to protect vegetation and ecosystems. The one hour objective for sulphur dioxide ranges from 350 µg m$^{-3}$ (New Zealand and the European Union) to 1,310 µg m$^{-3}$ (Quebec). Twenty-four hour averages vary from 105 µg m$^{-3}$ (California), 120 µg m$^{-3}$ (New Zealand), 125 µg m$^{-3}$ (European Union) to 365 µg m$^{-3}$ (US EPA). Annual objectives range from 10 µg m$^{-3}$ (New Zealand), 20 µg m$^{-3}$ (European Union), 25 µg m$^{-3}$ (British Columbia) to 80 µg m$^{-3}$ (United States).

**References**

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