



Alberta ambient air quality objectives and guidelines

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Ministry of Environment and Protected Areas, Government of Alberta

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Alberta ambient air quality objectives and guidelines

Alberta Ambient Air Quality Objectives (AAAQOs) and Alberta Ambient Air Quality Guidelines (AAAQGs)¹ are developed under Section 14 of the *Environmental Protection and Enhancement Act* (EPEA). Objectives and guidelines may be developed under EPEA for all or part of Alberta and are a component of Alberta's Air Quality Management System.

Alberta ambient air quality objectives

AAAQOs are developed to provide protection of human health and the environment to an extent technically and economically feasible, and reflective of Albertans' social concerns. The current process for the development and review of AAAQOs involves a multi-stakeholder process that considers input from the public and key stakeholders. The Minister of Alberta Environment and Protected Areas (the department) is ultimately responsible for developing AAAQOs. The department puts policies and programs in place such that emissions from anthropogenic activities are minimized with the goal of managing air quality so ambient concentrations are below the AAAQOs.

AAAQOs provided in Appendix: Table 1 are used in a variety of contexts to:

- evaluate the adequacy of facility design in regulatory applications
- establish approval conditions for regulated air emission sources
- assess beyond project boundary impacts of air pollutant sources and evaluate facility performance
- compare to ambient air quality monitoring data to inform Albertans and guide air quality surveys and focused studies
- augment reporting of the national Air Quality Health Index to respond to real-time air quality events
- report on the condition of the environment in Alberta, including trending and the use of triggers and limits in regional Air Quality Management Frameworks

Alberta ambient air quality guidelines

AAAQGs differ from AAAQOs. AAAQGs are established to meet more specific environmental protection goals than AAAQOs, including to act as an indicator for the need to manage of some types of odour. AAAQGs are generally not used in the same manner as AAAQOs, as in some circumstances the AAAQG represents a suite of compounds whereby the individual impact of each cannot fully be characterized. AAAQGs may function as indicators of air quality management issues that may warrant further investigation. AAAQGs may also differ from AAAQOs in instances where measurements for the same parameter are made across shorter timeframes (e.g., one hour) that are a derivative of a longer term threshold (e.g., 24 hour) that is typically used for air quality management.

AAAQGs provided in Appendix: Table 2 are used:

- for planning and air quality management
- as a general performance indicator of ambient air quality in an air zone
- as a performance indicator of local air quality impacts associated with industrial emissions (e.g., through regulatory air quality modelling)
- to assess air quality trends over time
- to assess local air quality concerns (e.g., nuisance dust, etc.)

Alberta ambient air quality guidelines for odour management

AAAQGs for odour management (odour guidelines) are a subset of AAAQGs and are established as an indicator for the need to manage of some types of odour. Odour guidelines are used as a tool for managing odour issues at a local or regional level. Odour guidelines are used during investigation of odour issues/complaints to characterize the frequency, concentration and duration of exposure to known odorous compounds. This information may be used to direct management actions in areas where measured ambient air quality concentrations are above an AAAQG and/or there is a record of odour complaints.

¹ The acronym for Alberta Ambient Air Quality Guidelines is frequently and historically referenced as: AAAQG. Other acronyms such as AAAQGL are in use, and should be considered synonymous to AAAQG.

Appropriate actions for the management of odour are determined by the circumstances. For example, for odour issues/complaints associated with industrial emitters, odour guidelines may be utilized to develop management actions for sources that impact local ambient air quality.

Odour guidelines provided in Appendix: Table 3 may be used for:

- Identifying and characterizing an odour issue (e.g., by establishing the frequency, intensity, and duration of measured concentrations associated with some types of odourous compounds).
- Identifying the source(s) of an odour (e.g., by correlating measured concentrations with wind direction and wind speed).
- Providing a quantitative, evidence-based validation of odour-based complaints (i.e., identify compounds associated with the odour and which may be causing the odour).
- Where applicable, to manage emissions from sources that impact local ambient air quality, through tools such as regulatory air quality modelling and management plans to address odours².

Regulatory application of AAAQOs and AAAQGs

AAAQOs and AAAQGs are the principal regulatory tool for the management of ambient air quality in the province. However, air quality triggers, limits and standards may also be applied for various pollutants across regions of Alberta that may result in place-based management. Place-based management may result in the need to take actions to achieve lower ambient concentrations of pollutants than expressed by individual AAAQOs or AAAQGs.

Substance release and ambient air quality monitoring

EPEA enables the department to establish and apply ambient air objectives and guidelines. In general, AAAQOs and AAAQGs apply to anyone who releases a substance into the atmosphere, including those specified in Chapter 1 of Alberta's Air Monitoring Directive.

Substance releases from activities not requiring an authorization under EPEA (e.g., instead regulated by an energy statute or general provision under EPEA) may also be assessed by a regulatory agency using the objectives, guidelines and guidelines for odour management should odour issues arise. Guidelines for odour management do not apply to some activities carried out by the agricultural sector as odour emissions from agricultural activities carried out under generally accepted practices are addressed under the *Agricultural Operations Practices Act* (as referred to in EPEA Section 116). Ambient air concentrations in excess of AAAQOs and AAAQGs must be reported as outlined in the Air Monitoring Directive. There may be specific reporting protocols for AAAQGs.

Regulatory air quality modelling

AAAQOs and AAAQGs are used as part of the regulatory application process to assess the impacts of emissions sources on ambient air quality. Person(s) responsible for activities that emit substances into the atmosphere that require an EPEA approval that operate under a code of practice for emissions to the atmosphere, or as required by other regulatory agencies within Alberta are required to undertake appropriate air quality modelling to demonstrate their impact on ambient air quality for the substances released by their project:

- relative to the AAAQOs listed in the Appendix: Table 1
- relative to the AAAQGs listed in the Appendix: Tables 2 and 3, where it is reasonable to expect a local concern about these substances³

If maximum predicted concentrations are in excess of an AAAQO, or where applicable an AAAQG, the industrial applicant must contact the director to discuss next steps to address the predicted exceedances. All equipment that emits substances to the atmosphere should be designed and operated in such a way that the ambient air quality remains below AAAQOs and AAAQGs. [Using Ambient Air Quality Objectives in Industrial Dispersion Modelling and Individual Industrial Site Monitoring](#), as

² Management plans may aim to characterize frequency, intensity, and duration of measured concentrations observed above a guideline for odour management, improve source attribution, indicate the need for additional data analysis, or set out steps for implementing actions and resolving the identified odour management issue.

³ See the Alberta Air Quality Model Guideline, Section 2.1 – Modelling Decisions

amended or replaced, provides guidance on how AAAQOs and AAAQGs are used in air quality modelling and ambient air quality monitoring for industrial facilities.

Development of AAAQOs and AAAQGs

EPEA requires public consultation as part of the development of ambient environmental quality objectives.⁴ The department has reviewed AAAQOs and AAAQGs through multi-stakeholder engagement since 2000. AAAQOs and AAAQGs are based on a review of scientific information about the impacts of substances released to the atmosphere on human health and the environment. AAAQOs and AAAQGs are developed or updated as needed based on new or relevant scientific information. Additionally, AAAQOs and AAAQGs may be developed for various averaging periods to account for short-term and long-term effects. A range of considerations are considered during the development of AAAQOs and AAAQGs. These considerations may include:

- Monitoring – Can the substance be routinely monitored in the atmosphere?
- Natural ranges and fluctuations in concentrations – Do substances fluctuate as they enter the atmosphere from natural but uncontrollable sources (e.g., forest fires)?
- Sensitive receptors – Is one component of the environment or one stage in an organism's development more sensitive than another?
- Substance behaviour in the atmosphere – What reactions do substances undergo and how long is the substance in the air?
- Substance behaviour in the environment – Can the substance bioaccumulate or biodegrade after entering the environment?
- Technological and economic feasibility – What is the cost and availability of technology to control or avoid emissions of a substance? Are there available ambient air quality monitoring methods that can feasibly and economically measure the substance at a frequency sufficient to compare to the objective or guideline for the substance?
- Comparison to other jurisdictions – Do other jurisdictions have objectives or guidelines for a substance? If so, what averaging periods, concentrations, and other basis are used in other jurisdictions to define the objective or guideline?

Substance descriptions, effects and information on the AAAQO or AAAQG concentration levels are provided in supporting documents found at: <https://www.alberta.ca/ambient-air-quality-objectives.aspx>.

The department works with a variety of stakeholders, including other government departments, the scientific community, environmental non-governmental organizations, industry and the general public to identify and prioritize substances for which AAAQOs and AAAQGs should be developed or reviewed. The department used multi-stakeholder forums to bring stakeholders together for AAAQO and AAAQG review and development. This work considers a variety of information, such as jurisdictional reviews, health effects reviews, historical air quality monitoring data and stakeholder perspectives to help inform proposed AAAQO or AAAQG concentration levels and averaging periods.

Implementation of an AAAQO or AAAQG typically includes the following steps:

- After review and consideration of the collected information, the department decides on AAAQO or AAAQG concentration levels and averaging periods to proceed with and develops materials for public review.
- Proposed AAAQOs or AAAQGs are posted for broad stakeholder review for at least 60 days. Stakeholders who have subscribed to the mailing list (see below) will be notified at the commencement of this review period.
- The department consolidates and analyzes any feedback received from the review period, working to make revisions where warranted. The Minister, or other delegated authority where applicable, is responsible for the final decision on the new or amended AAAQOs or AAAQGs to be implemented.
- Finalized documents are prepared and posted online with an effective date of at least 60 days following the date of posting. Stakeholders who have subscribed to the mailing list will be notified of the posting date.
- Stakeholders, including Alberta airsheds and EPEA approval holders, involved in monitoring ambient air quality have 90 days from the effective date of the AAAQO or AAAQG to update or implement monitoring protocols and report against the new or amended AAAQO or AAAQG.

⁴ See the Environmental Protection and Enhancement Act, Section 14(1) - Development of guidelines and objectives

Further Information

The department has an email distribution list to circulate information related to AAAQOs and AAAQGs, such as notifications on engagement or review periods, the posting of new or revised AAAQOs or AAAQGs and responses to common questions received regarding AAAQOs or AAAQGs. Subscription to receive these emails is open. To subscribe to the mailing list, please follow the directions at: <https://www.alberta.ca/ambient-air-quality-objectives.aspx>.

Supporting Information

Supporting information, including links to documents referenced within this document, can be found at: <https://www.alberta.ca/ambient-air-quality-objectives.aspx>.

Appendix

For additional information about AAAQOs, see the “Alberta Ambient Air Quality Objectives” section above.

TABLE 1: ALBERTA AMBIENT AIR QUALITY OBJECTIVES

Substance (CAS Number)	Averaging Period	$\mu\text{g m}^{-3}$ †	ppbv *	Basis	Original Effective Date**	Latest Revision/ (Review)**
Acetaldehyde (75-07-0)	1-hour	90	50	Adopted from Texas	1999	
Acetic acid (64-19-7)	1-hour	250	102	Adopted from Texas	1999	
Acetone (67-64-1)	1-hour	5,900	2,400	Adopted from Texas	1999	May 1, 2005
Acrolein (107-02-8)	1-hour	4.5	1.9	Adopted from Ontario (development of irritation)	Oct 1, 2013	
	24-hour	0.40	0.17	Adopted from Ontario (development of lesions in upper airways)		
Acrylic acid (79-10-7)	1-hour	60	20	Adopted from Texas	Jan 1, 2004	
	Annual	1.0	0.34	Adopted from California		
Acrylonitrile (107-13-1)	1-hour	43	19	Adopted from Texas	Jan 1, 2004	
	Annual	2	0.9	Adopted from California		
Ammonia (7664-41-7)	1-hour	1,400	2,000	Odour perception	1976	(2005)
Arsenic (7440-38-2)	1-hour	0.1	-	Respiratory effects	May 1, 2005	(2013)
	Annual	0.01	-	Carcinogenic effects		
Benzene (71-43-2)	1-hour	30	9.0	Hematological effects	1999	(2012)
	Annual	3	0.9	Carcinogenic effects		
Benzo[a]pyrene (50-32-8)	Annual	3.0×10^{-4}	2.9×10^{-5}	Chronic and carcinogenic human health effects	June 1, 2009	
Carbon disulphide (75-15-0)	1-hour	30	10	Odour threshold	1999	(2005)
Carbon monoxide (630-08-0)	1-hour	15,000	13,000	Oxygen carrying capacity of blood	1975	
	8-hour	6,000	5,000	--		
Chlorine (7782-50-5)	1-hour	15	5.0	Adopted from Texas	1999	
Chlorine dioxide (10049-04-4)	1-hour	2.8	1.0	Adopted from Texas	1999	
Chromium (7440-47-3)	1-hour	1	-	Adopted from Texas	1999	
Cumene (98-82-8)	1-hour	500	100	Adopted from Texas	May 1, 2005	
Dimethyl ether (115-10-6)	1-hour	19,100	10,100	Adopted from Texas	1999	
2-Ethylhexanol (104-76-7)	1-hour	600	110	Adopted from Ontario	May 1, 2005	
Ethylbenzene (100-41-4)	1-hour	2000	460	Adopted from Texas	May 1, 2005	
Ethyl chloroformate (541-41-3)	1-hour	0.57	0.13	Stack emission limits	1999	
Ethylene (74-85-1)	1-hour	1,200	1,050	Crop yield	Jan 1, 2004	
	3-day	45	40	Crop yield		
	Annual mean	30	26	Conifers and perennials		
Ethylene oxide (75-21-8)	1-hour	15	8.0	Adopted from Ontario	1999	
Formaldehyde (50-00-0)	1-hour	65	53	Adopted from Texas	1999	(2007)
n-Hexane (110-54-3)	1-hour	21,000	5,960	Derived from 24-hr California objective	Aug 1, 2008	
	24-hour	7,000	1,990	Adopted from California		
Hydrogen chloride (7647-01-0)	1-hour	75	50	Adopted from Texas	1999	

Substance (CAS Number)	Averaging Period	$\mu\text{g m}^{-3}$ †	ppbv *	Basis	Original Effective Date**	Latest Revision/ (Review)**
Hydrogen fluoride (7664-39-3)	1-hour	4.9	6.0	Adopted from Texas	1999	(2009)
Fluoride content in forage – dry weight basis				Adopted from Ontario	May 1, 2009	
	30-day avg.	35 $\mu\text{g g}^{-1}$	-	April 1 to October 31		
	Avg. for any single 30-day period	80 $\mu\text{g g}^{-1}$	-	April 1 to October 31		
	Avg. for 2 consecutive months	60 $\mu\text{g g}^{-1}$	-	April 1 to October 31		
Hydrogen sulphide (7783-06-4)	1-hour	14	10	Odour perception	1975	(2018)
	24-hour	4	3	Health effects		
Isopropanol (67-63-0)	1-hour	7,850	3,190	Adopted from Texas	Aug 1, 2005	
Lead (7439-92-1)	1-hour	1.5	-	Adopted from Texas	1999	
Manganese (7439-96-5)	1-hour	2	-	Adopted from Texas	May 1, 2005	
	Annual	0.2	-	Adopted from Texas and California		
Methanol (67-56-1)	1-hour	2,600	2,000	Adopted from Texas	1999	
Methylene bisphenyl diisocyanate (101-68-8)	1-hour	0.51	0.050	Adopted from Texas	1999	
Monoethylamine (75-04-7)	1-hour	1.19	0.645	Stack emission limits	1999	
Naphthalene (91-20-3)	Annual	3	-	Health effects	Sept 1, 2016	
Nickel (7440-02-0)	1-hour	6	-	Adopted from California	May 1, 2005	
	Annual	0.05	-	Adopted from California		
Nitrogen dioxide (10102-44-0)	1-hour	300	159	Respiratory effects	1975	June 15, 2011
	Annual	45	24	Vegetation		
Ozone – ground level (10028-15-6)	Daily 1-hour maximum	150	76	Pulmonary function	1975	April 1, 2019
Particulate Matter Fine – 2.5 microns or less (PM _{2.5})	24-hour	29	-	Health effects	2007	January 1, 2019
Total suspended particulate matter (TSP)	24-hour	100	-	Pulmonary effects	1975	
	Annual geometric mean	60	-			
Pentachlorophenol (87-86-5)	1-hour	5.0	0.44	Adopted from Texas	Nov 1, 2004	
	Annual	0.5	0.04	Adopted from Texas		
Phenol (108-95-2)	1-hour	100	26.0	Adopted from Ontario	1999	
Phosgene (75-44-5)	1-hour	4	1	Adopted from Texas	1999	
Propylene oxide (75-56-9)	1-hour	480	200	Adopted from Oklahoma	Jan 1, 2004	
	Annual	30	13	Adopted from California		
Styrene (100-42-5)	1-hour	215	52.0	Adopted from Texas	1999	
Sulphur dioxide (7446-09-5)	1-hour	450	172	Pulmonary function	1975	Feb 15, 2011
	24-hour	125	48.0	Adopted from European Union – human health		
	30-day	30	11			
	Annual	20	8.0	Adopted from European Union - ecosystems		

Substance (CAS Number)	Averaging Period	$\mu\text{g m}^{-3}$ †	ppbv *	Basis	Original Effective Date**	Latest Revision/ (Review)**
Sulphuric acid (7664-93-9)	1-hour	1 <u>0</u>	2. <u>5</u>	Adopted from Texas	1999	
Toluene (108-88-3)	1-hour	1,8 <u>80</u>	4 <u>99</u>	Adopted from Texas	May 1, 2005	
	24-hour	40 <u>0</u>	10 <u>6</u>	Adopted from Michigan and Washington		
Vinyl Chloride (75-01-4)	1-hour	1 <u>30</u>	5 <u>1</u>	Adopted from Texas	1999	
Xylenes (1330-20-7)	1-hour	2, <u>300</u>	5 <u>30</u>	Adopted from Ontario	May 1, 2005	
	24-hour	70 <u>0</u>	16 <u>1</u>	Adopted from California		

† - $\mu\text{g m}^{-3}$ is the weight, in micrograms, of the substance in one cubic meter of air. If other units are used, they are otherwise specified in the table.

* - Standard conditions of 25°C and 101.325 kPa are used as the basis for conversion from $\mu\text{g m}^{-3}$ to ppbv (parts per billion by volume) or from mg m^{-3} to ppmv (parts per million by volume).

** - The Original Effective Date column indicates when the objective/guideline was initially effective in Alberta. A date in the Latest Revision/ (Review) column indicates that the objective/guideline was reviewed and the number was changed effective that date. If the date in the column is the year in brackets e.g. (2005), this indicates the objective/guideline was reviewed that year but not changed.

Note: Underscore indicates this digit is the last significant figure in the number e.g., 100 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. $\mu\text{g m}^{-3}$ to ppbv). These numbers **do not** indicate reporting accuracy or precision. Refer to Sections 3.1.2 and 13.1.2 of Alberta's Air Monitoring Directive for requirements for reporting significant figures for comparison to the AAQOs and AAQGs.

For additional information about AAAQGs, see the Alberta Ambient Air Quality Guidelines” section above.

TABLE 2: ALBERTA AMBIENT AIR QUALITY GUIDELINES

Substance	Averaging Period	Concentration and Units	Basis	Original Effective Date**	Latest Revision/ (Review)**
Dustfall	30-day	53 mg 100 cm ⁻² (In residential and recreation areas)		1975	
	30-day	158 mg 100 cm ⁻² (In commercial and industrial areas)			
Particulate Matter Fine - 2.5 microns or less (PM_{2.5})	1-hour	80 µg m ⁻³	Derived from the Canada Wide Standard (2000)	Feb 1, 2007	(2018)
Static fluorides	30-day	40 µg 100 cm ⁻² (Water soluble fluorides)		Pre 1976	

For additional information about AAAQGs for odour management, see the Alberta Ambient Air Quality Guidelines for Odour Management section above.

TABLE 3: ALBERTA AMBIENT AIR QUALITY GUIDELINES FOR ODOUR MANAGEMENT

Substance	Averaging Period	Concentration and Units	Basis	Original Effective Date**	Latest Revision/ (Review)**
Total Reduced Sulphur	30-minute	5 ppb	Adopted from World Health Organization (2000)	Oct 1, 2024	