



Ministry of
Environment

**Guidance on Application of
Provincial Air Quality Objectives for SO₂**

B.C. Ministry of Environment

February 7, 2017

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1. Purpose

To provide guidance on the application of the interim provincial ambient SO₂ air quality objectives for stakeholders, and staff and statutory decision-makers of the Ministry of Environment. Other statutory decision-makers, such as the BC Oil and Gas Commission, are encouraged to consider this guidance when making statutory decisions under the *Environmental Management Act*.

2. Background

Ambient air quality objectives (AQOs) are non-statutory limits used to assess air quality and guide air management decisions, including those related to environmental assessments and authorizations. They are not legal requirements unless referenced directly in a regulation or authorization. Ambient air quality objectives applied in B.C. include provincial and national objectives and standards developed for a number of contaminants over various averaging periods.

A provincial interim ambient air quality objective (IAAQO) of 75 ppb (1 hour) was adopted in 2014 to provide a health-based tool to help inform decisions regarding new or significantly modified emissions of SO₂ in B.C. In October 2016, the Canadian Council of Ministers of the Environment endorsed new Canadian Ambient Air Quality Standards (CAAQS) for 2020 and 2025 as summarized in Table 1.

Table 1. CAAQS for SO₂ for 2020 and 2025.

Averaging Period	2020	2025	Metric
1-hour	70 ppb	65 ppb	Annual 99 th percentile of daily 1-hour maximum, averaged over three consecutive years
Annual	5 ppb	4 ppb	Annual mean concentration

To facilitate the transition to the new CAAQS for 2020, the province replaced the 2014 IAAQO with new IAAQOs in December 2016 to provide a pathway to meeting the CAAQS in 2020. The new IAAQO for SO₂ are summarized in Table 2.

Table 2. Summary of new provincial IAAQOs to support CAAQS implementation.

Averaging Period	2017	2018	2019	2020 onwards CAAQS
1-hour	75 ppb	75 ppb	75 ppb	70 ppb
Metric ¹	Annual 97 th percentile, averaged over 2015-2017	Annual 97.5 th percentile, averaged over 2016-2018	Annual 98 th percentile, averaged over 2017-2019	Annual 99 th percentile, averaged over preceding three years

Methodologies for comparing ambient data to the IAAQOs are provided in Appendix I.

3. Guiding Principles

The following principles were used to guide development of this implementation guide:

- Continuous improvement and keeping clean areas clean, to ensure ambient objectives are not “pollute up to” levels;
- Flexibility, recognizing that regulators require some latitude to manage the cumulative impacts of multiple emission sources, for the protection of human health and the environment;
- Science-based decision-making, using the most appropriate level of science to support decisions; and
- Airshed protection, striving to identify, understand and reduce cumulative environmental risk and impacts.

4. Application of Ambient Air Quality Criteria

4.1 Definition of Interim Ambient Air Quality Objectives

The “interim” status reflects the fact that the IAAQOs for SO₂ will be in place to the end of 2019, at which point the IAAQOs will be superseded by the CAAQS level and metric.

4.2 Scope of Application and Timing

Provincial air quality objectives apply to areas where there is public access, i.e. areas beyond plant boundaries. As described in “Guidelines for Air Quality Dispersion Modelling in British Columbia², “plant boundaries” are defined as:

- the facility fenceline or the perimeter of disturbed area that defines where public access is restricted;

¹ One excursion above 75 ppb but no greater than 85 ppb is allowed over the three reporting years 2017 (based on 2015-2017 data), 2018 (based on 2016-2018 data) and 2019 (based on 2017-2019 data).

² *Ibid*

- if a facility is located within another larger facility boundary, the plant boundary is the boundary of the encompassing facility; or
- if a public access road passes through the plant, the plant boundary is the perimeter along the road allowance.

The reporting of CAAQS achievement is focused on those monitoring sites that are located beyond the industrial fenceline and in proximity to populated areas or other sensitive receptors such as sensitive ecosystems.

IAAQOs for SO₂ should be used to inform air management decisions prior to 2020, and the CAAQS for SO₂ from January 1, 2020 onwards. However, for new decisions on authorizations made prior to January 1, 2020 and involving facilities that will be operational beyond this date, the CAAQS should be applied.

4.3 Application to Authorized Emissions

The *Environmental Management Act (EMA)* sets out the responsibilities of the Minister of Environment. It provides the ministry with overall responsibility for waste management in the province and the underlying legislation to air-quality-related regulations in B.C. It provides Metro Vancouver with delegated authority to manage air discharges within the Greater Vancouver area. The Oil and Gas Commission (OGC), under the *Oil and Gas Activities Act (OGAA)*, makes permitting decisions for oil and gas activities under *EMA*.³ OGC also administers the BC Oil and Gas Waste Regulation. The authorization process used by OGC is similar to that used by the Ministry.

Under sections 6(2) and 6(3) of the *EMA*, waste must not be introduced into the environment in the course of conducting a prescribed industry, trade or business unless in accordance with:

- the Act,
- a site-specific authorization (e.g. permit, approval or order),
- a regulation (including code of practice), and
- a waste management plan approved by the Minister.

Schedules 1 and 2 of the *Waste Discharge Regulation* prescribe those industries, trades, businesses operations and activities that must obtain ministry authorization to discharge waste into the environment.

Prescribed industries, trades, businesses, operations and activities listed in Schedule 1 include those that will generally continue to be authorized through the use of site-specific authorizations or regulations due to the complexity of their discharges, the potential for significant environmental impacts, or the limited number of similar

³ Exceptions include oil and gas activities falling under the jurisdiction of the National Energy Board, which the Ministry of Environment has responsibility for administering.

operations in the province. Schedule 1 also includes some industries, trades, businesses, operations and activities that are not authorized by existing regulations.

Prescribed industries, trades, businesses, operations and activities listed in Schedule 2 are those that may be authorized by a minister's code of practice or a regulation. Codes of practice are legally enforceable standards. An authorization to discharge may be obtained by registering under the code and complying with the requirements of the code.

Those industries, trades, businesses, operations and activities not listed in either Schedules 1 or 2 do not require a formal authorization to discharge waste. However, the discharges must not cause pollution or present a risk to public health.

4.3.1 Application to Permits and Approvals

The issuance of a permit or approval under the *EMA* is based upon a multi-step process described more fully in the ministry's guidance document "Waste Discharge Regulation Implementation Guide."⁴ Guidance specific to oil and gas activities can be found in "Guidance For Applications to Discharge Air Contaminants From Oil and Gas Facilities in British Columbia."⁵

As part of the process to apply for a permit or approval, technical information must be provided to the applicable regulatory body (e.g. ministry, OGC) that describes the source and its potential impacts on the environment. For high risk or complex authorizations, the applicant is required to prepare a detailed technical assessment report. The director clarifies this requirement during a pre-application meeting. For lower risk or less complex discharges, an environmental impact technical assessment report may not be required. Instead, supporting technical information is provided directly in the application form package.

Where a technical assessment is required, regulatory staff work with applicants in the early stages to clarify regulatory expectations with respect to:

- ambient air quality objectives, including interim,
- ambient monitoring requirements,
- emission control technology requirements, and
- recommended approach to dispersion modelling, as appropriate and described in "Guidelines for Air Quality Dispersion Modelling in British Columbia" and related technical guidance by the Ministry.⁶

This involves close collaboration between regulatory staff involved in source management and ambient monitoring and protection to ensure a consistent and coordinated approach.

⁴ See: <http://www.env.gov.bc.ca/epd/main/ema.htm#2>

⁵ See: <https://www.bcogc.ca/node/5944/download>

⁶ See: <http://www.bcairquality.ca/assessment/dispersion-modelling.html>

Once complete, regulatory staff conduct a review of the submitted impact assessment and technical report. The director may then issue a permit subject to conditions considered advisable for the protection of the environment. In determining what is advisable, the director considers information provided by regulatory staff, the applicant, concerned persons and other agencies.

The director may consider current or future economic growth and the associated cumulative impacts of multiple emission sources in an airshed when determining an applicant's maximum allowable impact on that airshed. This extends to undeveloped areas, to ensure that no single source "uses up" the entire capacity of an airshed, as reflected in predicted concentrations approaching or exceeding the ambient air quality objectives. The director may also require the application of additional ambient air quality criteria beyond established provincial or national ambient air quality objectives or standards, to assess site-specific concerns regarding potential health and environmental impacts. This may include more stringent criteria than the current IAAQOs.

Where exceedances of ambient air quality objectives are predicted, additional consideration is typically given to the conditions related to the exceedances (e.g. location of maxima relative to populated areas, timing, duration and magnitude of exceedances), and the relative contribution and spatial variation of background levels. The proponent may be asked to demonstrate that its project would not significantly impact or increase the risk to human health or the environment. Following these assessments, the director may require the proponent to develop strategies or options to further mitigate emissions at the facility or within the affected airshed. For more information on airshed management in B.C., see Section 4.4.

4.3.2 Application to Regulated Facilities

Regulations, including codes of practice, set enforceable standards that apply to prescribed industries, trades, businesses, activities or operations. Section 138(2)(l) of *EMA* gives the minister or director the authority to substitute a different requirement than that contained in the regulations, including codes of practice, where deemed necessary to protect the public or the environment, or where the intent of a code of practice will be met by a substitution.

4.4 Application to Airshed Management

Airshed management is a process to coordinate activities affecting air quality in a defined area or airshed. This approach recognizes that local air quality is influenced by a number of activities and emission sources, stakeholders and overlapping jurisdictions. Active airshed management plans are in place in a number of areas of the province, including: Metro Vancouver, Fraser Valley Regional District, Sea-to-Sky Airshed, Merritt, the Boundary Airshed, Central Okanagan Regional District, Williams Lake, Quesnel, Prince George and Bulkley Valley-Lakes District.

Under an airshed approach, the ministry manages authorized and regulated sources under its jurisdiction, as described in Section 4.3, and coordinates monitoring across the airshed. Where air quality levels approach or exceed ambient air quality objectives or standards, the ministry considers a range of actions to improve air quality for the affected communities, including: programs to reduce emissions from non-point sources; more frequent permit reviews and compliance inspections; best achievable technology; more stringent requirements for regulated sources; and detailed scientific studies to better characterize and quantify the impacts of sources and other influences on air quality. More information on these approaches can be found in “Provincial Framework for Airshed Planning.”⁷

Expectations for affected industries under an airshed management approach may include:

- Contributing to a robust monitoring network to ensure protection for the environment and human health;
- Considering the potential for future requirements in facility design; and
- Taking mitigative actions to reduce emissions if air quality approaches ambient air quality objectives, as indicated by air quality monitoring.

4.4.1 Air Zone Management

Jurisdictions across Canada are currently implementing the CCME-endorsed Air Quality Management System (AQMS). Key components of this system include new CAAQS for PM_{2.5}, ozone and SO₂; Base-Level Industrial Emission Requirements (BLIERS) for major industry; a process to address emissions from mobile sources; and place-based management in the form of air zones to encourage progressively more rigorous actions in areas where air quality approaches or exceeds the CAAQS.⁸

B.C. is currently implementing the requirements for air zone management, and has identified seven broad air zones to facilitate public reporting on CAAQS achievement.⁹ Existing airshed plans will be a fundamental part of broader air zone management. As industrial facilities are the major sources of SO₂ in B.C., the province has committed to working with affected facilities and local government where the CAAQS level is approached or exceeded.

4.5 Air Quality Advisories

Air quality advisories are issued by regional offices of the Ministry of Environment and Metro Vancouver to inform the public of degraded air quality, and to trigger actions to

⁷ http://www.bcairquality.ca/reports/pdfs/airshedplan_provframework.pdf . Note Canada-wide Standards (CWS) referenced in framework have been replaced by CAAQS for PM_{2.5} and ozone.

⁸ For more information, see: http://www.ccme.ca/files/Resources/air/aqms/pn_1481_gdazm_e.pdf

⁹ See: http://www.bcairquality.ca/plans/pdf/air_quality_man_system_fs.pdf

reduce or avoid emissions. This may occur when measured air quality levels approach or exceed “acceptable” levels, as defined by ambient air quality objectives or other established criteria.

Historically, air quality advisories in the province have been triggered by elevated levels of PM_{2.5}, fugitive dust (PM₁₀) or ground-level ozone. The spatial scale of these advisories has ranged from community-specific to regional, depending on the contaminant, the sources involved and the atmospheric dispersion conditions. To date, no advisories have been issued for SO₂. The ministry is working on a pilot project to establish an SO₂ public notification system in the Kitimat airshed that may form the basis for future provincial application.

5. Monitoring and Reporting

All monitoring sites are required to meet minimum siting standards to ensure that a representative measure of air quality is made.¹⁰ All sites are audited by the ministry every 6 months to verify that monitors are operating properly to ensure the collection of valid and complete data. Approved monitoring methods are as described in Appendix II. It is expected that future ambient air quality reports will track achievement of the IAAQOs (see Appendix I for recommended methodologies).

6. Summary

The province has adopted new interim 1-hour ambient air quality objectives for SO₂ as it transitions to the recently established CAAQS in 2020.. Guidance has been developed to assist stakeholders, ministry staff and other statutory decision-makers in the application of these criteria to various air management decisions, including those related to authorizations and monitoring and reporting.

¹⁰ “Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements Version 1.0 (Draft).” EPA-454/D-06-001, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, October 2006.

Appendix I. Data Reporting

The following calculation methodologies should be used when comparing ambient data to provincial IAAQOs for NO₂ and SO₂.

1. Daily Data Completeness

For the purpose of determining a daily 1-hour maximum concentration, a valid daily value is calculated:

- where at least 18 hourly measurements are available in a day, or
- where <18 hourly measurements are available in a day but at least one hourly measurement exceeds the numeric limit of the IAAQO (i.e. 75 ppb for SO₂).

2. Annual Data Completeness

2.1 Hourly Average IAAQO for SO₂

The data set should be considered complete if there are available at least 60% of all daily maximum 1-hour measurements in each quarter (i.e. Jan-Mar, Apr-Jun, Jul-Sep and Oct-Dec) and 75% of all daily-maximum 1-hour measurements in each year. Years that do not meet data availability criteria but which exceed the IAAQO should be flagged and retained for reporting.

3. Calculating the Daily 1-hour Maximum Concentration

The daily 1-hour maximum concentration refers to the maximum 1-hour value reported over a 24-hour period (midnight to midnight, local standard time). The value is to be reported to the nearest 0.1 ppb.

4. Calculating the Percentile Values

Use of percentiles is a means of adjusting for differences in sample size and ensuring that the values used for achievement determination are not unduly affected by extreme events. For example, the 98th percentile is the daily 1-hour maximum value out of a year of monitoring data for which 98 percent of all values at a given monitoring station are less than or equal to this level. Percentiles are to be reported to the nearest integer.

The annual percentile value corresponds to the Kth highest value, which is obtained as follows:

- Sort all the daily 1-hour maximum concentration values for the given year into an array of numbers ordered from the highest to the lowest.
- Repeat equal values as many times as they occur.
- Determine number of valid days "N" of data for each year.
- Calculate the Kth highest value, where
$$K^{\text{th}} \text{ highest value} = N - \text{truncated}(N \times p)$$

p = p=.97, .975, .98 or .99 for the 97th, 97.5th, 98th or 99th percentile, respectively
- Data are reported to the nearest 1 ppb.

Table I-1 describes the rank of the 97th, 97.5th, 98th and 99th percentile values for a given number of days.

Table I-1. Rank equivalent to 97th, 97.5th, 98th and 99th percentile values over range of valid days of reporting (data sorted in descending order).

No. of Valid Days	Rank Equivalent to Annual 97 th Percentile	No. of Valid Days	Rank Equivalent to Annual 97.5 th Percentile	No. of Valid Days	Rank Equivalent to Annual 98 th Percentile	Rank equivalent to Annual 99 th Percentile
1-33	1	1-39	1	10-50	1	1
34-66	2	40-79	2	51-100	2	1
67-99	3	80-119	3	101-150	3	2
100-133	4	120-159	4	151-200	4	2
134-166	5	160-199	5	201-250	5	3
167-199	6	200-239	6	251-300	6	3
200-233	7	240-279	7	301-350	7	4
234-266	8	280-319	8	351-366	8	4
267-299	9	320-359	9			
300-333	10	360-366	10			
334-366	11					

Appendix II. Approved Monitoring Methods for SO₂.

The Ministry of Environment does not make specific recommendations regarding monitoring methods. In general, methods approved by the U.S. Environmental Protection Agency (EPA) are considered to be acceptable in B.C. Current EPA-approved monitors may be found at: <http://www.epa.gov/ttn/amtic/files/ambient/criteria/reference-equivalent-methods-list.pdf>. Ministry staff can provide advice to stakeholders regarding appropriate methods for specific applications.