



Ministry of
Environment and
Climate Change Strategy

**Guidance on Application of
Provincial Air Quality Objectives for NO₂**

B.C. Ministry of Environment and Climate Change Strategy

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1. Purpose

To provide guidance on the application of the provincial air quality objectives for nitrogen dioxide (NO₂) to stakeholders, and staff and statutory decision-makers of the Ministry of Environment and Climate Change Strategy (ENV). 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* (EMA). Under the EMA, Metro Vancouver Regional District (MVRD) has the delegated authority over air quality management in the Greater Vancouver area, and are not subject to this guidance.

2. Background

Ambient air quality objectives define non-statutory limits 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.

Updated provincial air quality objectives (AQOs) were adopted in November 2021 following the 2020 Provincial Framework for AQO Adoption and based on the 2020 Canadian Ambient Air Quality Standards (CAAQS) for NO₂. The AQOs are a 1-hour metric of 60 parts per billion (ppb) and an annual metric of 17 ppb. Appendix I explains the methods for calculating the 1-hour and annual metrics.

Table 1. Summary of the Provincial Ambient Air Quality Objectives for NO₂.

NO ₂ Metric	Air Quality Objective	Calculation method
1-hour	60 ppb	Annual 98 th percentile of daily 1-hour maximum, over three consecutive years
Annual	17 ppb	Annual average of 1-hour concentrations over one year

3. Guiding Principles

The following principles were used to develop this implementation guide:

- Continuous improvement and keeping clean areas clean, to ensure ambient air quality objectives are not “pollute up to” levels in recognition of NO₂ as a non-threshold pollutant, i.e., it does not have a safe lower limit;
- 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 Objectives

4.1 Definition of Provincial Air Quality Objectives for Nitrogen Dioxide

The Provincial Air Quality Objectives (AQOs) for nitrogen dioxide (NO₂) specifies the 1-hour and the annual concentration limits of NO₂ based on studies during CAAQS development and applying B.C.-specific factors of achievability and consideration for sensitive receptors.

4.2 Scope of Application

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 Columbia¹, “plant boundaries” are defined as:

- the facility fenceline or the perimeter of disturbed area that defines where public access is restricted;
- 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 AQOs for NO₂ apply to decisions on new or significantly modified² discharges of NO₂. Specifically, the air quality objectives:

- Are intended to apply to all applications for authorizations under the *EMA* made after November 1st, 2021;

¹ See: <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/bc-dispersion-modelling-guideline-2015.pdf>

² “Significantly modified” refers to an increase in authorized quantity of emission of greater than 10%. Under *EMA* 14(4)(b)(iv), a director may amend a permit authorizing an introduction of waste described in subsection (3) (a), (b) or (c), if for a purpose that includes “(iv) an increase of not more than 10% in the authorized quantity of the discharge, emission or stored material.

- Are not intended to apply to existing facilities and applications for *EMA* authorizations made as of November 1st, 2021.

4.3 Application to Authorized Emissions

The *EMA* sets out the duties, powers and functions of the minister relating to the management, protection and enhancement of the 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 Regional District (MVRD) with delegated authority to manage air discharges within the Greater Vancouver area. The B.C. 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 ENV.

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 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.

³ Exceptions include oil and gas activities falling under the jurisdiction of the Canada Energy Regulator, which ENV has responsibility for administering.

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 Authorization Process".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., ENV, OGC) to describe the source and its potential impacts on the environment and human health. 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 low 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 can assist permit applicants in the early stages to clarify regulatory expectations with respect to:

- ambient air quality objectives, including provincial AQOs and CAAQS,
- 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

Close collaboration with regulatory staff involved in source management, ambient monitoring and environmental protection ensures that approach is comprehensive, consistent and coordinated. Once completed, regulatory staff conducts 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.

⁴ See: <https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization/process>

⁵ See: <https://www.bcogc.ca/files/operations-documentation/Oil-and-Gas-Operations-Manual/Supporting-Documents/application-discharge-guidancedo-not-deletelinked-web.pdf>

⁶ *Ibid*

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 a currently proposed source does not preclude future development, 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 AQOs.

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.

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

⁷ See: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/airshedplan_provframework.pdf. Note: Canada-wide Standards (CWS) referenced in framework have been replaced by CAAQS for PM_{2.5} and ozone.

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, NO₂, 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. Reporting of NO₂ CAAQS achievement will be included in the 2018-2020 and subsequent air zone reports.

4.5 Air Quality Advisories

Air quality advisories are issued by regional offices of ENV and MVRD to inform the public of degraded air quality, and to trigger actions to 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, NO₂-related air quality advisories have not been issued in B.C. NO₂ is incorporated within the Air Quality Health Index (AQHI) – a scale to help the public understand the health risks posed by air quality. Current and forecast AQHI values are available on gov.bc.ca/airquality and https://weather.gc.ca/airquality/pages/provincial_summary/bc_e.html.

5. Monitoring and Reporting

Monitoring sites are required to meet the requirements outlined in Part B of the B.C. Field Sampling Manual¹⁰. These include station start-up and siting requirements, continuous monitoring and sampling methods, and operational requirements such as calibration, verification and maintenance. The manual also details ENV’s data collection,

⁸ For more information, see: <https://www.ccme.ca/en/air-quality-report>

⁹ See: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality/current-air-quality-data/air-zone-map>

¹⁰ See: <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>

validation, and auditing processes that are required to have official, ENV-validated data for the purposes of reporting the 1-hour and annual NO₂ metrics. Appendix I outlines the steps for calculating the 1-hour and annual metrics using officially valid data that can be compared against the ambient air quality objectives.

6. Summary

This guidance has been developed to assist stakeholders, ENV staff and statutory decision-makers in the application of these criteria to various air management decisions, including those related to authorizations and monitoring and reporting.

Appendix I. Data Reporting and Calculations

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

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 AQO (i.e., 60 ppb for NO₂).

2. Calculating the Daily 1-hour Maximum Concentration

The daily 1-hour maximum concentration refers to the highest 1-hour value reported over a 24-hour period (midnight to midnight, Pacific Standard Time). The value is to be reported to the nearest 0.1 ppb.

3. Calculating the Annual 98th 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 98th percentile corresponds to the Kth highest value, which is obtained as follows:

- Sort all the daily 1-hour maximum concentration values for the given year in a numerical array of descending order.
- Repeating values are considered separate, individual measurements in the array.
- Determine number of valid days “N” of data for each year.
- Calculate Kth highest value, where
$$K^{\text{th}} \text{ highest value} = N - \text{truncated}(N \times p)$$
$$p = 0.98 \text{ for the } 98^{\text{th}} \text{ percentile}$$
- Data are reported to the nearest 1 ppb.

Table I-1 describes the rank of the 98th percentile values for a given number of days.

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

No. of Valid Days	Rank Equivalent to Annual 98 th Percentile
10-50	1
51-100	2
101-150	3
151-200	4
201-250	5
251-300	6
301-350	7
351-366	8

4. Calculating the Annual Average

An annual average value reflects the average of all hourly values. The annual average concentrations should be reported to the nearest 0.1 ppb.

Intermediate calculations should retain all available digits and decimal places.

5. Annual Data Completeness

5.1 1-Hour Metric for NO₂

The data completeness requirement for the 1-hour metric is satisfied if at least 60% of all daily 1-hour maximum measurements for 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 are valid. Years that do not meet data completeness criteria, but which exceed the AQO should be flagged and retained for reporting. At least two of three annual 98th percentiles are required for the 1-hour metric.

5.2 Annual Metric for NO₂

The data completeness requirement for the annual metric is satisfied if there are at least 60% of all hourly measurements in each quarter and 75% of all hourly measurements in each year.