REVIEW OF PROVINCIAL AIR QUALITY OBJECTIVES

DISCUSSION PAPER

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BRITISH COLUMBIA

Ministry of Environment and Climate Change Strategy

CLEAN AIR SECTION

ENVIRONMENTAL STANDARDS BRANCH

REVIEW OF PROVINCIAL AIR QUALITY OBJECTIVES
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TABLE OF CONTENTS

1. INTRODUCTION

The British Columbia (B.C.) Ministry of Environment and Climate Change Strategy (the ministry) is considering approaches for the review and establishment of new provincial air quality objectives (AQOs) and reviewing provincial air quality objectives for nitrogen dioxide (NO_2).

1.1 PURPOSE OF THIS DISCUSSION PAPER

The purpose of this discussion paper is to:

- Provide background and current information on the role of AQOs in air quality management and process for establishing provincial AQOs;
- Seek comment from stakeholders on considerations and approaches to reviewing or establishing provincial AQOs where Canadian ambient air quality standards (CAAQS) have or have not been established; and
- Signal the ministry's intent to review provincial interim AQOs for NO_2 and seek comment from stakeholders on considerations and approaches.

The discussion paper includes: background information on CAAQS and provincial AQOs (section 2); background information and questions for stakeholders on the ministry's proposed approach to reviewing or setting provincial AQOs (section 3); background information on NO_2 and current interim provincial NO_2 AQOs, the ministry's proposed approach for reviewing and updating provincial NO_2 AQOs, and questions for stakeholders (section 4); confirmation of the Province's relationship and commitment to reconciliation with Indigenous peoples (section 5); description of the next steps in the provincial AQO review and development process (section 6); and annexes that provide a table of acronyms and links to additional information.

The B.C. Air Quality website provides further information, including links to air quality management in the province and the associated regulatory framework.

2. BACKGROUND

2.1 CANADIAN AMBIENT AIR QUALITY STANDARDS (CAAQS)

CAAQS are a key element under the national air quality management system, adopted by Canadian Council of Ministers of the Environment (CCME) in 2012.[a] CAAQS are established as objectives under the federal *Canadian Environmental Protection Act* (CEPA) and are intended to drive action to protect human health and the environment.

CAAQS are developed through a process that involves: federal review of the health and environmental impacts, ambient trends, emissions and modelling forecasts; a scan of criteria used in other jurisdictions; and estimation of population exposure to ambient levels of specific pollutants. This information is used to inform a multi-stakeholder working group that is tasked with providing recommendations on future CAAQS. The process includes periodic reviews as needed (approximately every five years) to maintain currency of each CAAQS and to drive continued action on air quality.

[a] https://www.ccme.ca/en/resources/air/aqms.html

CAAQS for ground-level ozone (O_3) and fine particulate matter ($PM_{2.5}$) were established in 2013 as national objectives for 2015 and 2020 achievement. CAAQS for SO_2 and NO_2 were established in 2017 for 2020 and 2025 achievement.[b] A review of the 2020 ozone CAAQS is being finalized, and this will be followed by a review of the $PM_{2.5}$ CAAQS.

Current CAAQS are summarized in Table 1. All CAAQS consist of three interrelated elements:

- An averaging time period;
- A numerical value; and
- The statistical form of the numerical standard.

Table 1. National CAAQS. Source: CCME State of the Air Report[b]

Pollutant	Averaging Time	Numerical Value			Statistical Form
		2015	2020	2025	
Fine Particulate Matter ($PM_{2.5}$)	24-hour	28 $\mu g/m^3$	27 $\mu g/m^3$		The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
	Annual	10.0 $\mu g/m^3$	8.8 $\mu g/m^3$		The 3-year average of the annual average of all 1-hour concentrations
Ozone (O_3)	8-hour	63 ppb	62 ppb		The 3-year average of the annual 4th highest daily 8-hour average concentrations
Sulphur Dioxide (SO_2)	1-hour	-	70 ppb	65 ppb	The 3-year average of the annual 99th percentile of the SO_2 daily maximum 1-hour average concentrations
	Annual	-	5.0 ppb	4.0 ppb	The average over a single calendar year of all 1-hour average SO_2 concentrations
Nitrogen Dioxide (NO_2)	1-hour	-	60 ppb	42 ppb	The 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations
	Annual	-	17.0 ppb	12.0 ppb	The average over a single calendar year of all 1-hour average concentrations

[b] Additional information available and table retrieved from: http://airquality-qualitedelair.ccme.ca/en/

2.2 PROVINCIAL AIR QUALITY OBJECTIVES (AQOs)

The British Columbia *Environmental Management Act* (EMA)[c] provides the Minister responsible with the authority to develop objectives to manage air quality in B.C.

AQOs are non-statutory (i.e., not legally binding) limits and are used to:

- Gauge current and historical air quality;
- Guide decisions on environmental impact assessments and authorizations;
- Guide airshed planning efforts;
- Inform regulatory development; and
- Develop and apply management actions, such as air quality advisories.

Air quality objectives and associated criteria used in B.C. are based on national or provincial standards and guidance. The B.C. Air Quality website includes a link to an information sheet (last updated in May 2018) with tables summarizing the status of air quality criteria in the province. Contaminants listed in the table include particulate matter ($PM_{2.5}$, PM_{10} and Total Suspended Particulate – TSP), ground-level ozone, NO_2, sulphur dioxide (SO_2), carbon monoxide (CO), Total Reduced Sulphur (TRS) compounds and formaldehyde.

To provide greater transparency and consistency in the AQO-setting process, the ministry adopted a provincial framework for developing provincial AQOs in 2011 (see the associated information sheet on the B.C. Air Quality website). As well as goals and principles, the framework lays out a three-phase approach to the development of provincial AQOs: priority-setting; risk assessment; and risk management. The framework also flags the need for stakeholder input on priority substances for objectives development or review and the risk assessment and evaluation of risk management options.

The ministry has subsequently established interim provincial AQOs for SO_2 and NO_2, relying heavily on standards established in Canada and the United States. Provincial efforts have focussed on how to tailor these standards to B.C. application, rather than conducting a separate fundamental risk assessment and evaluation of risk management options using the provincial framework. This discussion paper and the ministry's consideration of approaches to setting AQOs reflect this direction.

[c] See the B.C. Laws website: http://www.bclaws.ca/civix/document/id/lc/statreg/03053_00 for full text of the Act.

Table 2. Summary of provincial and national air quality objectives and standards

Pollutant	Averaging Period	B.C. AQO	2015 CAAQS	2020 CAAQS	2025 CAAQS
CO	1 hour	13 ppm	-	-	-
CO	8 hour	5 ppm	-	-	-
Formaldehyde	1 hour	50 ppb	-	-	-
NO_2	1 hour	100 ppb[d]	-	60 ppb[e]	42 ppb[e]
NO_2	Annual	32 ppb	-	17 ppb	12 ppb
Ozone	8 hour	-	63 ppb[f]	62 ppb[f]	-
$PM_{2.5}$	24 hour	25 µg/m^3 [g]	28 µg/m^3 [h]	27 µg/m^3 [h]	-
$PM_{2.5}$	Annual	8 µg/m^3 [i]	10 µg/m^3 [j]	8.8 µg/m^3 [j]	-
PM_{10}	24 hour	50 µg/m^3	-	-	-
SO_2	1 hour	75 ppb[k]	-	70 ppb[l]	65 ppb[l]
SO_2	Annual			5 ppb[i]	4 ppb[i]
TRS	1 hour	5 ppb	-	-	-
TRS	24 hour	2 ppb	-	-	-
TSP	24 hour		120 µg/m^3	-	-
TSP	Annual		60 µg/m^3	-	-

Note: i) provincial AQOs for carbon monoxide (CO) and Total Reduced Sulphur (TRS) compounds are based on pollution control objectives for source sectors established in the 1970s; and ii) Total Suspended Particulate (TSP) criteria were adopted as national ambient AQOs in 1974, prior to the CAAQS process. Also, the interim provincial AQOs for NO_2 are currently under review (as discussed in this paper).

[d] Daily 1-hour maximum, annual 98th percentile over one year

[e] Daily 1-hour maximum, annual 98th percentile, averaged over three consecutive years

[f] Daily 8-hour maximum, annual 4th highest, averaged over three years

[g] Daily 24-hour average, annual 98th percentile over one year

[h] Daily 24-hour average, annual 98th percentile, averaged over three consecutive years

[i] Annual average over one year

[j] Annual average, averaged over three consecutive years

[k] Daily 1-hour maximum, annual 97th percentile averaged over 2015-2017, annual 97.5th percentile averaged over 2016-2018 and annual 98th percentile averaged over 2017-2019. One allowable exceedance above 75 ppb to a maximum of 85 ppb over a three-year period prior to 2020. To be superseded by CAAQS level and metric Jan. 1, 2020.

[l] Daily 1-hour maximum, annual 99th percentile averaged over three consecutive years

2.3 ROLE OF CAAQS IN SETTING PROVINCIAL AQOs

Application of the CAAQS to provincial AQOs has varied from pollutant to pollutant. $PM_{2.5}$ AQOs preceded CAAQS development and are more stringent than the CAAQS, although the gaps will be 10% or less in 2025. The province relies on the ozone CAAQS, in addition to the former 1-hour national objective of 82 ppb to inform the issuance of air quality advisories. Provincial SO_2 AQOs are intended to transition to the CAAQS for 2020. Finally, current interim AQOs for NO_2 were developed in anticipation of the CAAQS, but are significantly less stringent.

In summary, the CAAQS are a growing influence in the setting of provincial objectives – as they are supported by the significant effort at the federal/provincial/territorial and stakeholder level to assemble and/or assess the supporting information, and the associated multi-stakeholder process to reach consensus on new standards.

3. PROPOSED APPROACH TO REVIEWING OR SETTING PROVINCIAL AQOs

3.1 BACKGROUND

In 2015-2016, the ministry conducted a scan of stakeholder views on provincial interim ambient air quality objectives (IAAQOs) and proposed CAAQS for SO_2. As well as specific comments pertaining to SO_2, stakeholders provided many comments or suggestions regarding the overall process of developing and reviewing provincial AQOs in relation to CAAQS that are relevant to the current review. These included:

- A need for a transparent, consistent and science-based development process;
- Recognition of the need for advance notice and realistic timelines for implementation of AQOs;
- "Achievability" of standards and a need for flexibility and recognition of local factors in determining cost-effective, as well as effective, actions to improve local air quality;
- Differences across jurisdictions in applying CAAQS, such as aspirational versus statutory limits, use of "fenceline" versus community-based monitoring for reporting of CAAQS achievement, and dispersion modelling requirements;
- Questions about the consequences of exceedance of CAAQS and the role of authorizations in areas that exceed CAAQS; and
- Public understanding of provincial AQOs and CAAQS, and interpretation of monitoring and reporting (e.g., averaging times, numerical values, statistical forms, and consequences of exceedances).

3.2 PROPOSED APPROACH TO REVIEWING OR SETTING PROVINCIAL AQOs

The ministry is considering a streamlined approach for reviewing or setting provincial AQOs that reflects the growing importance of the CAAQS:

1. ***Where CAAQS exist***, CAAQS and their supporting documents would form the basis of the review. Additional criteria would be considered to clarify specific B.C. needs or conditions, including timelines and pathways to achievement of CAAQS, sensitive receptors, baseline levels, monitoring and modelling needs, emission sources, achievability and multi-pollutant management issues.
2. ***Where CAAQS do not exist*** (e.g., specific VOCs), criteria established by leading Canadian or U.S. jurisdictions (identified through a jurisdictional scan) would provide the starting point for review. This would be followed by consideration of specific B.C. needs and conditions,

including sensitive receptors, baseline levels, monitoring and modelling needs, emission sources, achievability, and multi-pollutant management issues.

For any new or revised provincial AQOs, further guidance would be developed to clarify how the AQOs are to be applied. The guidance would include information applicable to: decisions on new and existing sources; local airshed management; and air quality advisories.

3.3 QUESTIONS FOR STAKEHOLDERS: REVIEWING OR SETTING PROVINCIAL AQOs

1. Do you have any comments regarding the use of CAAQS as a starting point for the development of new or updated provincial AQOs?
2. If you are supportive of this approach, what additional considerations specific to B.C. do you feel should be assessed and/or addressed in the process of reviewing or setting provincial AQOs?
3. Do you have any suggestions regarding the process to establish or update provincial AQOs for air pollutants that are not encompassed in CAAQS?
4. Do you have any additional comments or suggestions regarding the review or setting of provincial AQOs?
5. Do you feel that there is a need for the development of new or updated provincial AQOs for other air pollutants? If so, what would be the highest priority pollutant to review?

4. IMPLICATIONS FOR REVIEW OF PROVINCIAL AQOs FOR NITROGEN DIOXIDE (NO_2 AQOs)

4.1 BACKGROUND

NO_2 is a reddish-brown gas associated with high-temperature fuel combustion. As well as contributing to $PM_{2.5}$ and ground level ozone formation, NO_2 has direct and indirect effects on human health and the environment. The young, elderly and those with pre-existing respiratory conditions are particularly sensitive to contaminants such as NO_2. There is strong evidence that NO_2 causes respiratory effects and contributes to early mortality at ambient concentrations commonly found in Canada. There is no clear scientific evidence of an effects threshold for NO_2.

Nitrogen oxide (NO) and NO_2 are collectively referred to as "NOx". NOx emissions are comprised of approximately 10% NO_2 and 90% NO, which reacts with other gases to form NO_2. Sources of NO_2 in B.C. include on-road vehicles, the marine sector, cement plants, pulp and paper plants, and natural gas facilities Historically, the highest ambient levels of NO_2 in B.C. have been observed in areas close to major transportation corridors or hubs (i.e., highways and arterial streets, ports, airports) in the western portions of Metro Vancouver.

Interim Ambient Air Quality Objectives (IAAQOs) for NO_2, based on a review of leading jurisdictions, were adopted by the province in 2014, with guidance updated in February 2017. Use of the national annual objective of 32 ppb was retained, but the 1-hour objective of 100 ppb was updated to reflect the U.S. EPA standard that was adopted by the U.S. in 2010. Prior to adoption of the IAAQOs, the province relied upon national objectives that had been developed in the 1970s. The IAAQOs were adopted with the intent to revisit them on establishment of CAAQS for NO_2.

CAAQS for NO_2 were endorsed by the CCME and established as national objectives under CEPA in 2017 for 2020 and 2025 achievement. While more stringent than B.C. IAAQOs for NO_2 (see table 2), monitoring data indicate that the CAAQS are generally achievable in B.C., with the exception of parts of the western LFV, especially downtown Vancouver.

NOx emissions in the LFV have fallen significantly over the past 20 years, as shown in Figure 1.[m] Improved motor vehicle emissions and the AirCare vehicle inspection and maintenance program were large contributors to these improvements. On-road mobile emissions are still a significant source of NOx emissions in the LFV. However, projections to 2035 indicate that marine and industrial emissions will comprise a larger percentage of NOx emissions in the future.

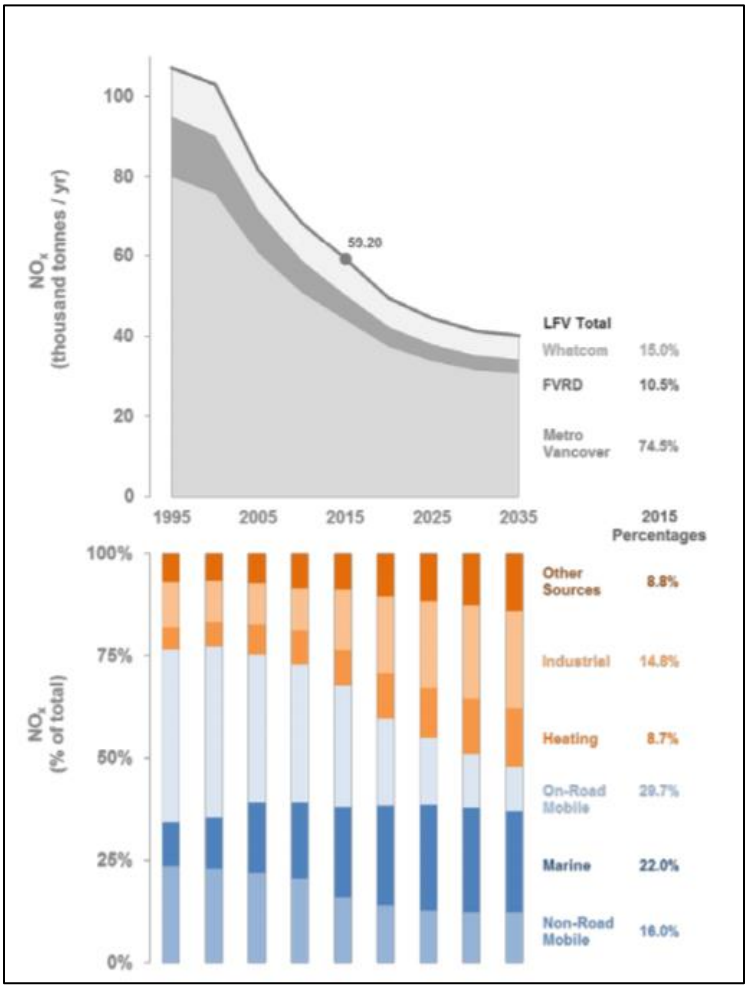

Figure 1. LFV NOx emission trends and percentage distribution across sectors[m]

Elsewhere in the province, based on current modelling practices – such as the use of conservative baseline concentrations described in the B.C. Dispersion Modelling Guideline – there is some indication that achievement of the CAAQS (particularly the 2025 CAAQS) may be challenging in some instances.

These and other considerations provide context for the review of provincial NO_2 AQOs.

[m] Metro Vancouver. 2015. See Annex B for a link to the report.

4.2 PROPOSED PROCESS TO REVIEW PROVINCIAL NO_2 AQOs

The ministry is proposing an approach for reviewing the IAAQOs for NO_2 and confirming provincial NO_2 AQOs that draws on the CAAQS process and standards.

1. **Proposed Approach:** CAAQS for NO_2, with supporting documentation, will serve as the basis or starting point from which provincial NO_2 AQOs are derived. Additional criteria may be provided to clarify conditions or needs specific to B.C., including timelines or pathway to ultimate CAAQS achievement.

   Rationale for the proposed approach includes the following:

   - CAAQS have been endorsed by the Canadian Council of Ministers of the Environment and are established as national objectives under CEPA. The CAAQS have become a driver for more stringent air quality criteria in Canada;
   - CAAQS established for 2020 and 2025 achievement are significantly more stringent than current provincial IAAQOs for NO_2;
   - CAAQS development is supported by recent and comprehensive scientific assessments, including the "Human Health Risk Assessment for Ambient Nitrogen Dioxide" prepared by Health Canada;[n]
   - CAAQS development is conducted through a multi-stakeholder collaborative process involving NGO, indigenous group, public health and industry representatives, and reflects consensus among these representatives; and
   - CAAQS may be reviewed periodically to ensure that the CAAQS continue to be supported by the most current scientific information, and that the CAAQS in turn drive action on air quality (particularly where no safe health threshold has been identified).

2. **Principles** in establishing provincial NO_2 AQOs include the following:
   - Provincial AQOs should support the transition to/achievement of the CAAQS or complement CAAQS achievement;
   - Provincial AQOs should be in a form that enables comparison with monitored levels and dispersion modelling output; and
   - Provincial AQOs should be accompanied by further guidance that describes how the AQOs may be applied in B.C. air management.

3. **Considerations specific to B.C. application** may include:
   - Averaging period and statistical form to support or complement CAAQS achievement;
   - Timelines for implementation and/or achievement;
   - Sensitive receptors;
   - Background levels and monitoring/modelling needs;
   - Achievability;
   - Major sources and opportunities to drive improvements; and
   - Multi-pollutant management needs.

[n] See Annex B for a link to the report.

4. **Development of Guidance Documents.** Guidance documents for provincial NO_2 AQOs should clarify:
    - Determination of AQO achievement;
    - Relevant reporting stations;
    - Modelling guidance (contained within the Provincial Dispersion Modelling Guideline);
    - Application of AQOs for new sources;
    - Application of AQOs for existing sources (including where AQOs are already exceeded);
    - Use of AQOs in local airshed management;
    - Use of AQOs in air quality advisories; and
    - Additional considerations for a multi-pollutant approach to air management.

4.3 QUESTIONS FOR STAKEHOLDERS: ESTABLISHING PROVINCIAL NO_2 AQOS

1. Do you have any comments regarding the use of CAAQS in reviewing and establishing provincial NO_2 AQOs?
2. Do you have any comments about the role of provincial NO_2 AQOs in air management ***relative to CAAQS*** – for example:
    a. How provincial NO_2 AQOs could complement the CAAQS (e.g., different statistical form, such as not-to-be exceeded level)?
    b. How provincial NO_2 AQOs could transition to the CAAQS within a specified timeline?
3. What B.C.-specific considerations do you feel are important in the development of NO_2 AQOs?
4. What additional clarification do you feel is needed to support implementation of NO_2 AQOs?

5. PROVINCE OF BRITISH COLUMBIA'S RELATIONSHIP WITH INDIGENOUS PEOPLES

The Province of British Columbia has adopted the United Nations Declaration on the Rights of Indigenous People (UNDRIP)[o] and the Calls to Action of the Truth and Reconciliation Commission.[p] In September 2017, each ministry in the B.C. Government received a mandate letter that includes policy direction from the Premier to implement UNDRIP. Broadly speaking, implementation includes the acknowledgement of Indigenous territories, languages, self-governance rights, resource access rights and economic development rights.

In May 2018, the Province released the Draft Principles that Guide the Province of British Columbia's Relationship with Indigenous Peoples ("draft principles").[q] The draft principles will renew the Crown-Indigenous relationship and support the shift toward a government-to-government relationship with First Nations. The mandate and ministerial objectives for the ministry include commitments to UNDRIP.

[o] See Annex B for reference and a link to document.

[p] See Annex B for reference and a link to document.

[q] See Annex for links to additional information and the draft principles.

6. NEXT STEPS IN THE PROVINCIAL AQO REVIEW AND DEVELOPMENT PROCESS

The ministry will host information webinars in March 2019. The webinars will provide background information regarding provincial AQOs and outline the ministry's proposed approach to reviewing and confirming provincial NO_2 AQOs.

Parties who have expressed interest or previously submitted comments to the ministry regarding development of provincial AQOs will be notified of the proposed changes and webinars.

If you are interested in participating in an information webinar, or would like to receive updates on the review and development process, please send your contact information to Cindy Bertram at AQOreview@gov.bc.ca.

Please provide any comments that you may have on the questions in this discussion paper to the ministry at AQOreview@gov.bc.ca by March 27, 2019. A fillable Word format comment form with the questions has been posted to the ministry's Air Quality website at https://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality-management/regulatory-framework/objectives-standards. Separate comments or submissions are also welcome.

Following the webinars, the ministry will review and consider all comments received, and inform those who have indicated an interest of next steps in the provincial AQO review and development process.

Thank you for your time and interest

ANNEXES

A. ACRONYMNS

Acronym	Definition
AAQO	Ambient air quality objective
AQO	Air quality objective
B.C.	British Columbia
CAAQS	Canadian ambient air quality standards
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act* (Canada)
CO	Carbon monoxide
EMA	*Environmental Management Act* (B.C.)
IAAQO	Interim ambient air quality objectives (provincial)
LFV	Lower Fraser Valley
$\mu g/m^3$	Micrograms (millionths of a gram) per cubic metre
NAAQO	National ambient air quality objective
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxide and nitrogen dioxide (collectively)
O_3	Ozone
PM	Particulate matter
$PM_{2.5}$	Particulate matter 2.5 micrometre (millionths of a metre) or smaller in size
ppb	parts per billion
SO_2	Sulphur dioxide
TRS	Total reduced sulphur
TSP	Total suspended particulates
U.S.	United States
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile organic compounds

B. ADDITIONAL INFORMATION

Provincial information and resources:

B.C. legislation, *Environmental Management Act*:
http://www.bclaws.ca/civix/document/id/lc/statreg/03053_00

BC Air Quality website:
https://www2.gov.bc.ca/gov/content/environment/air-land-water/air

Air Quality Management in B.C.:
https://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-quality-management

Provincial Air Quality Objective Information Sheet:
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/aqotable.pdf

Provincial Framework for Developing Provincial AQOs Information Sheet:
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/air/reports-pub/aqo-framework-information-sheet.pdf

B.C. Air Quality Dispersion Modelling Guideline:
https://www.bcogc.ca/node/13339/download

Draft Principles that Guide the Province of British Columbia's Relationship with Indigenous Peoples:

https://www2.gov.bc.ca/gov/content/governments/indigenous-people/new-relationship/about-the-ten-principles

Canadian Council of Ministers of the Environment (CCME) resources:

Canada-wide Air Quality Management System:
https://www.ccme.ca/en/resources/air/aqms.html

CAAQS and Air Quality information:
http://airquality-qualitedelair.ccme.ca/en/

Additional Resources:

Metro Vancouver Lower Fraser Valley Air Emissions Inventory:
http://www.metrovancouver.org/services/air-quality/AirQualityPublications/2015LowerFraserValleyAirEmissionsInventory.pdf

Health Canada:
Human Health Risk Assessment for Ambient Nitrogen Dioxide:

http://publications.gc.ca/collections/collection_2016/sc-hc/H114-31-2016-eng.pdf

United Nations:
*United Nations Declaration on the Rights of Indigenous Peoples (*2008):

http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf

Truth and Reconciliation Commission of Canada:
Truth and Reconciliation Commission of Canada: Calls to Action (2015):
http://www.trc.ca/websites/trcinstitution/File/2015/Findings/Calls_to_Action_English2.pdf