

Introduction

This is the sixth annual air quality report for the Coastal Air Zone. Annual air zone reporting is a commitment under the national Air Quality Management System (AQMS). This report describes achievement of the Canadian Ambient Air Quality Standards (CAAQS) for ground-level ozone (O₃) and fine particulates (PM_{2.5}), the associated management levels and recent actions to improve air quality. A province-wide summary can be found at: <http://www.env.gov.bc.ca/soe/indicators/air/>.

Background

The AQMS is the national approach to managing air quality in Canada. Under the AQMS, the CAAQS are developed to drive action to protect human health and the environment. Air zones are areas that exhibit similar air quality characteristics, issues and trends, and that form the basis for monitoring, reporting and taking action on air quality. The Coastal Air Zone (see Figure 1) is one of seven broad air zones across the province. Under the AQMS progressively more rigorous actions are expected as air quality approaches or exceeds the CAAQS. The level of action is guided by the Air Zone Management Framework outlined in Table 1.



Figure 1. Coastal Air Zone.

Table 1. Air zone management framework for ground-level ozone and PM_{2.5} defined based on 2015 CAAQS criteria.

Management Level	Objectives	Ozone	PM _{2.5}	
		8-hour (ppb)	Annual (µg/m ³)	24-hour (µg/m ³)
Red	Achieve CAAQS	>63	>10.0	>28
Orange	Prevent CAAQS Exceedance	>56 and ≤63	>6.4 and ≤10.0	>19 and ≤28
Yellow	Prevent Air Quality Deterioration	>50 and ≤56	>4.0 and ≤6.4	>10 and ≤19
Green	Keep Clean Areas Clean	≤50	≤4.0	≤10

Ozone Levels

Ozone monitoring was initiated at the Terrace Skeena Middle School site in 2015. Based on data collected between 2016 and 2018, ozone concentrations at this site reached 46 ppb. This level was well below the national standard of 63 ppb.¹

Trends in annual ozone levels are shown in Figure 3.² Concentrations have remained well below the level of the national standard over the period of record.

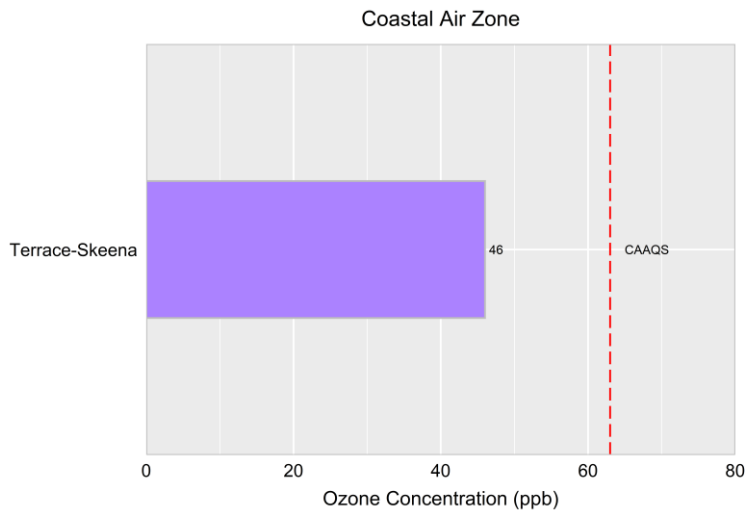


Figure 2. Ozone concentrations in the Coastal Air Zone, based on annual 4th highest daily 8-hour maxima, averaged over 2016-2018. Red dashed line identifies the CAAQS of 63 ppb.

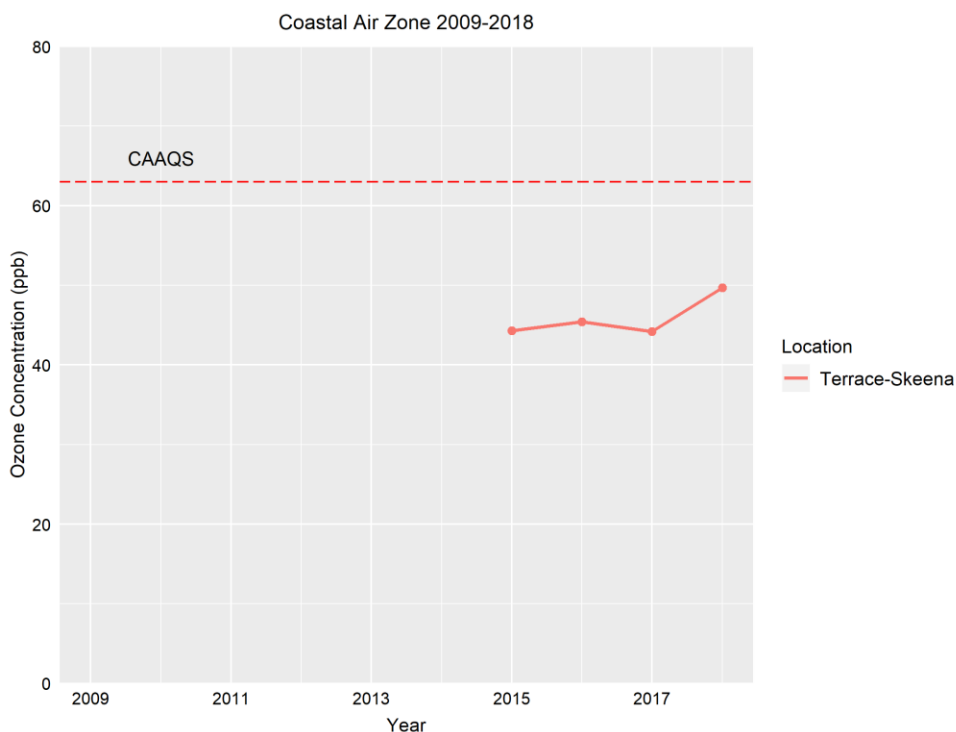


Figure 3. Annual trends in ozone concentrations (2009-2018), based on annual 4th highest daily 8-hour maxima for a single year. Red dashed line identifies CAAQS of 63 ppb.

¹ Concentrations based on the annual 4th highest daily 8-hur maximum, averaged over three years (2016-2018).

² Concentrations based on 4th highest daily 8-hour maximum, averaged over a single year.

PM_{2.5} Levels

PM_{2.5} refers to inhalable particles up to 2.5 micrometres in diameter. PM_{2.5} measurements are summarized in Figure 4. All measurements were from Federal Equivalent Method (FEM) monitors, which have largely replaced the older TEOM instruments and provide a more complete measure of PM_{2.5}.

For the period of 2016 to 2018, CAAQS achievement could be determined for only two of four available monitoring sites due to data availability issues.³ Daily concentrations (upper plot) ranged from 12 to 18 µg/m³.⁴ Both sites achieved the national standard of 28 µg/m³. Annual concentrations ranged from 4.8 to 6.2 µg/m³ and were well below the national standard of 10 µg/m³.⁵

Annual mean concentrations between 2009 and 2018 are shown in Figure 5.⁶ A shift to higher reported concentrations is seen with the change from TEOM to FEM instruments from in 2013.

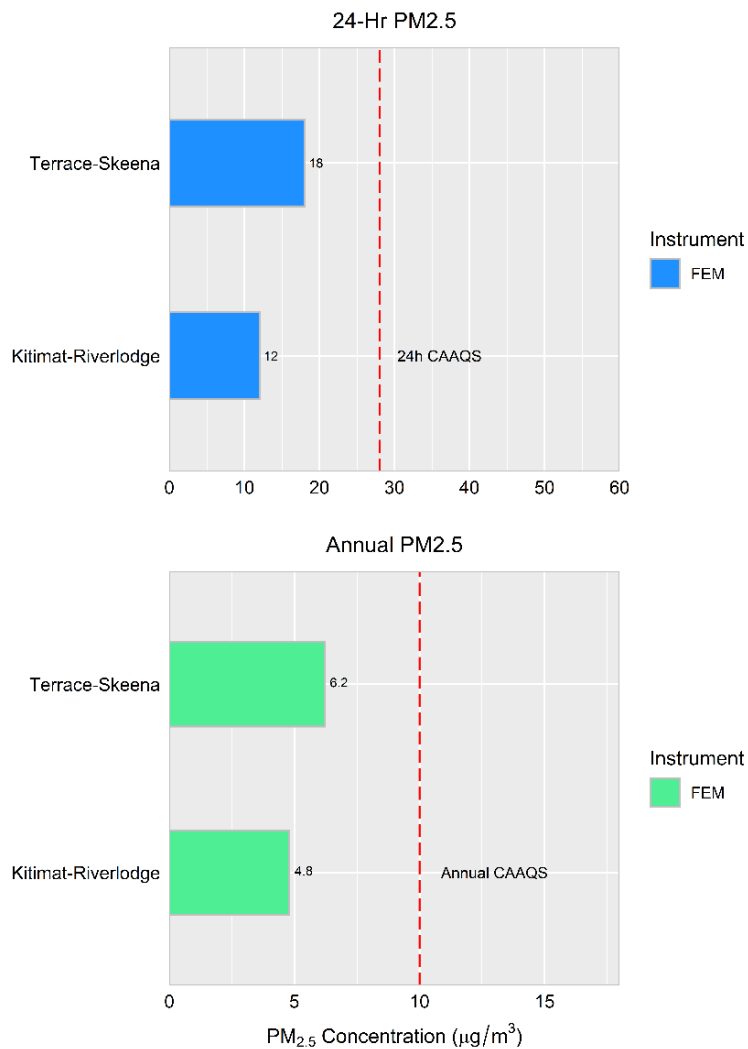


Figure 4. PM_{2.5} concentrations in the Coastal Air Zone. Upper plot based on 24-hour concentration (annual 98th percentile, averaged over 2016-2018). Lower plot based on annual mean concentration (averaged over 2016-2018). Red dashed lines identify CAAQS of 28 µg/m³ (upper plot) and 10 µg/m³ (lower plot).

³ Data completeness requirements were not met for Kitimat-Haisla and Kitimat-Whitesail stations.

⁴ Concentrations based on the annual 98th percentile of 24-hour values, averaged over three years (2016-2018).

⁵ Concentrations based on the annual average of 24-hour values, averaged over three years (2016-2018).

⁶ Concentrations based on the annual average of 24-hour values over single year.

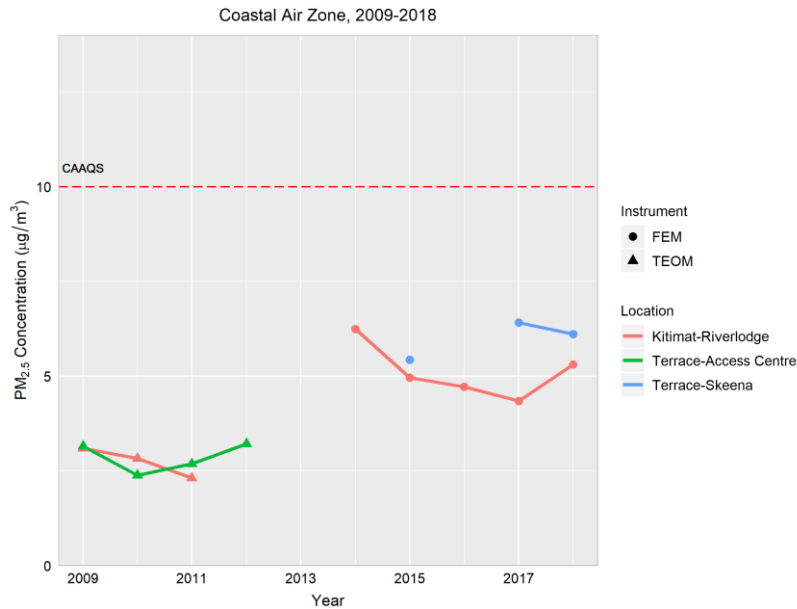


Figure 5. Trends in PM_{2.5} concentrations (2009-2018), based on annual mean concentrations from a single year. The CAAQS value of 10 µg/m³ is shown by the dashed line. PM_{2.5} measurements prior to 2011 are reported at 25°C and 1 atm. From 2011 onward, measurements are reported at local conditions.

Air Zone Management Levels

Air zone management levels are assigned on the basis of the highest concentrations within an air zone, excluding contributions from transboundary flows (TF) and exceptional events (EE) such as wildfires, and preferentially based on a site with three complete years of data. TF/EE influences are removed so that long-term management strategies are not developed on the basis of events that are beyond local or provincial control. The methodology for flagging wildfire influences is described in Appendix I.

Table 2 summarizes ozone concentrations as measured and after consideration of any TF/EE influences, which were not determined to be significant. The Coastal Air Zone is assigned a “green” management level based on ozone concentrations in Terrace. This indicates that ozone levels are generally low and that any actions that are undertaken should be to keep clean areas clean.

Table 2. Summary of ozone concentrations as measured and air zone management levels for the Coastal Air Zone (based on 2016-2018 data).

Location	No. Valid Years	4 th Highest Daily 8-hour Maxima (ppb)		Air Zone Management Level
		As Measured	TF/EE Removed	
Terrace-Skeena Middle School	3	46	46	Goal: Keeping Clean Areas Clean

Table 3 summarizes PM_{2.5} concentrations as measured and after TF/EE influences (e.g. wildfires) have been removed. Wildfire-influenced days are identified in Appendix II. The Coastal Air Zone is assigned a “yellow” management level for PM_{2.5}. This indicates that any PM_{2.5}-related actions should focus on preventing air quality deterioration.

Table 3. Summary of PM_{2.5} concentrations as measured and air zone management levels for the Coastal Air Zone (based on 2016-2018 data).

Location	Monitor Type	No. Valid Years	Daily Mean (98 th Percentile)		Annual Mean		Air Zone Management Level
			As Measured	TF/EE Removed	As Measured	TF/EE Removed	
Kitimat-Riverlodge	FEM	3	12	11	4.8	4.7	Goal: Preventing AQ Deterioration
Terrace-Skeena Middle School	FEM	2	18	18	6.2	6.2	

Actions to Protect Air Quality

In 2016, the Province adopted a new Solid Fuel Burning Domestic Appliance Regulation. This piece of legislation requires nearly all wood burning appliances sold in B.C. to be certified to meet particulate emissions standards set by the US Environmental Protection Agency (EPA) in 2015, or equivalent standards set by the Canadian Standards Association (CSA) in 2010. The regulation also specifies the types of fuels that can be burnt and has provisions around the sale and installation of outdoor wood boilers. For more information on the regulation, see:

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/air/air-pollution/smoke-burning/regulations/solid-fuel-burning-domestic-appliance-regulation>.

The Provincial Wood Stove Exchange Program encourages residents to change out their older, smoky wood stoves for low-emission appliances including new CSA-/EPA-certified clean-burning wood stoves. A wood stove change-out program was supported in the Strathcona Regional District in 2017.⁷ Additional programs in the Alberni-Clayoquot Regional District have provided enhanced incentives to further encourage the transition away from wood stoves to natural gas or pellet stoves and electric heat pumps. Both areas straddle the Coastal Air Zone boundaries

A description of other activities underway in B.C. air zones can be found in the “Air Zone Management Response for British Columbia” (see: www.gov.bc.ca/bcairquality).

⁷ For more information, see: <https://srd.ca/services/wood-stove-exchange-program/>

Appendix I – Approach to Identify Wildfire-influenced Data

Summertime air quality in British Columbia is periodically influenced by wildfire smoke – from local fires as well as long-range transport from outside of the province. The wildfire season in B.C. typically occurs between May and September, when warm and dry conditions prevail.

A myriad of different pollutants is emitted from wildfires. These include PM_{2.5} and gases such as nitrogen oxides and volatile organic compounds that can react in the atmosphere to form ground-level ozone and additional PM_{2.5}.

Given that smoke-affected areas may be extensive, and that smoke may linger for days before being fully dispersed from an airshed, the current analysis has focussed on those periods when wildfire smoke may have contributed to an exceedance of the CAAQS levels for ground-level ozone or PM_{2.5}. Criteria used to flag and evaluate wildfire-influenced data included the following:

- 24-hour PM_{2.5} concentrations in excess of the CAAQS level of 28 µg/m³ and/or 8-hour daily maximum ozone concentrations in excess of the CAAQS level of 63 ppb between May and September;
- Wildfires of interest identified based on data from the B.C. Wildfire Management Branch;
- Smoky Skies bulletins issued by the Ministry of Environment and Climate Change Strategy to notify the public of rapidly changing smoke conditions;
- NASA satellite images showing smoke impacts over the region; and
- Multiple monitoring sites in the area of concern showing elevated pollutant levels, suggesting a common regional source of air pollutants.

Wildfire-influenced data were excluded from the calculation of air zone management levels. Excluded data are as summarized in Appendix II.

Appendix II – Wildfire-influenced Data in the Coastal Air Zone (2016-2018)

Ozone and PM_{2.5} data from 2016-2018 for the Coastal Air Zone were evaluated based on the criteria set out in Appendix I for TF/EE influences. Various pieces of evidence were used to support identification of wildfire-influenced periods. These included the following:

- Wildfires of note – either due to size or proximity to populated areas – are tracked by the BC Wildfire Service (see: <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary>).
 - 2016 was below-average in terms of the amount of land burned (0.10 million hectares).
 - In contrast, 2017 (1.22 million hectares) and 2018 (1.35 million hectares) were record-breaking years in terms of area of land burned.
 - Monitoring sites in the Coastal Air Zone were particularly affected during the summer of 2018. While numerous fires contributed to the overall loading of B.C. valleys with smoke, examples of those fires particularly relevant to the Coastal Air Zone are listed in Table II-1.
- Days flagged as wildfire-influenced (Table II-2) coincided with Smoky Skies Bulletins issued by the Ministry. Elevated PM_{2.5} levels were observed across the Kitimat-Terrace airshed.
- Satellite images during this period (see Figure II-1) provide additional supporting information on both the number of wildfires and the spatial extent of wildfire smoke in and adjacent to the Coastal Air Zone.

Table II-1. Examples of notable wildfires in the central interior during 2018.⁸

Date Discovered	Size (ha)	Geographic Location	Description
2018-07-27	92,412	Fraser Complex - Shovel Lake	6.7 km northwest of Endako; caused by equipment use
2018-07-30	20,813	Fraser Complex - Chutanli Lake	11 km northeast of Tatelkuz Lake; caused by equipment use
2018-07-31	79,394	Tweedsmuir Complex – Ramsey Creek	Tweedsmuir Provincial Park; lightning-caused
2018-07-31	86,767	Babine Complex – Nadina Lake	40 km south of Burns Lake
2018-08-01	21,381	Fraser Complex - Island Lake	Adjacent to Island Lake; lightning-caused
2018-08-01	44,817	Tweedsmuir Complex - Dean River	Tweedsmuir Provincial Park; lightning-caused
2018-08-03	60,631	Tweedsmuir Complex – Pondosy Bay	Tweedsmuir Provincial Park; lightning-caused

⁸ <https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary>

Table II-2 – Wildfire-influenced PM_{2.5} data from 2018. No wildfire-influenced smoke events were identified in 2016 or 2017.

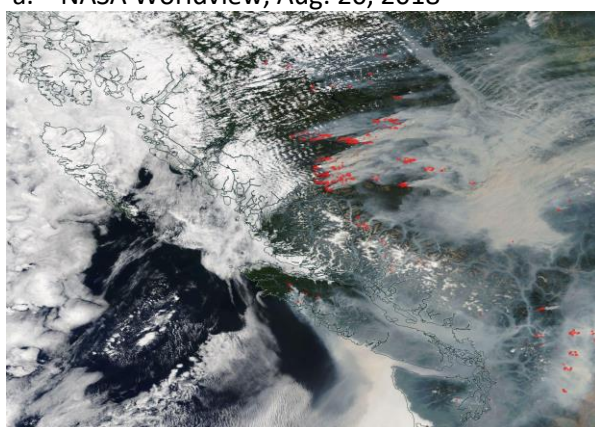
Location	Date	Daily Mean (µg/m ³)	Smoky Skies Bulletin?
Kitimat Whitesail	2018-08-20	28.3	Y
Kitimat-Riverlodge	2018-08-21	57.9	Y
Kitimat Whitesail	2018-08-21	61.0	Y
Kitimat Haisla Village	2018-08-21	67.1	Y
Terrace-Skeena	2018-08-21	43.5	Y



a. NASA Worldview, Aug. 20, 2018



b. NASA Worldview, Aug. 21, 2018



c. NASA Worldview, Aug. 22, 2018

Figure II-1. Satellite images covering Aug. 20-22, 2018, showing wildfire smoke (grey plumes) over the west coast of B.C., including the Coastal Air Zone. Red dots indicate fires and thermal anomalies. Large red circle in Figure II-1(a) identifies the approximate location of Kitimat on the map. Source of images: NASA Worldview Snapshots at: <https://worldview.earthdata.nasa.gov/>.