Executive Summary

For the 2017-2019 reporting period, the Coastal Air Zone is assigned yellow management level for fine particulate matter and green management level for ozone.

Introduction

This is the seventh 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 (O_3) and fine particulate matter ($PM_{2.5}$), 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 B.C. 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 the AQMS management levels and objectives in Table 1.

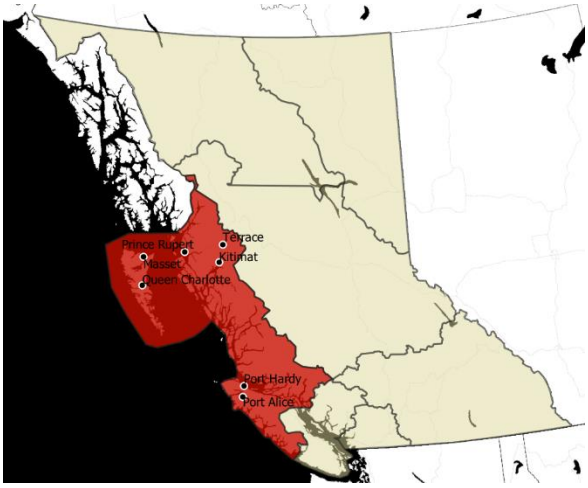


Figure 1. Coastal Air Zone.

Table 1. AQMS management levels and objectives for $PM_{2.5}$ and ozone based on 2015 CAAQS.

Management Level	Objectives	Ozone	$PM_{2.5}$	
		8-hour (ppb)	Annual ($\mu g/m^3$)	24-hour ($\mu g/m^3$)
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

Ground-level ozone refers to the colourless and irritating gaseous pollutant. It forms just above the earth's surface through chemical reactions between "ozone precursor" emissions. Unlike naturally occurring ozone in the ozone layer, ground-level ozone can be harmful to people, animals, and plants.

Ozone monitoring was initiated at the Terrace Skeena Middle School site in late 2015. Based on data collected since then, ozone levels have remained well below the national standard of 63 ppb.[1]

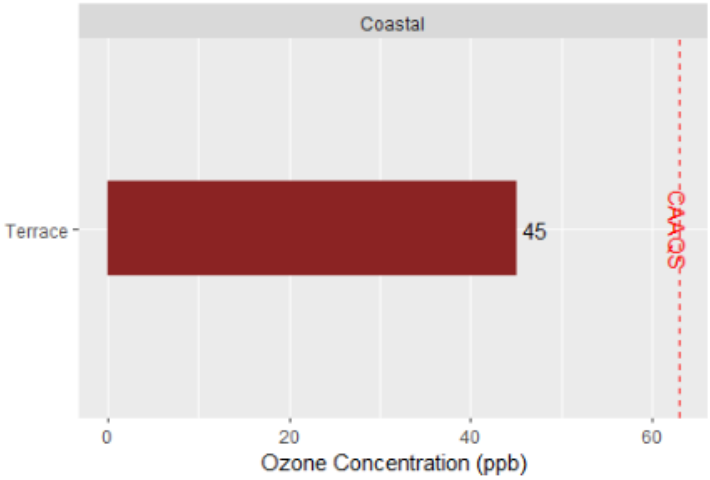


Figure 2. Ozone concentrations in the Coastal Air Zone, based on annual 4th highest daily 8-hour maximums, averaged over 2017-2019. Red dashed line identifies the 2015 CAAQS of 63 ppb.

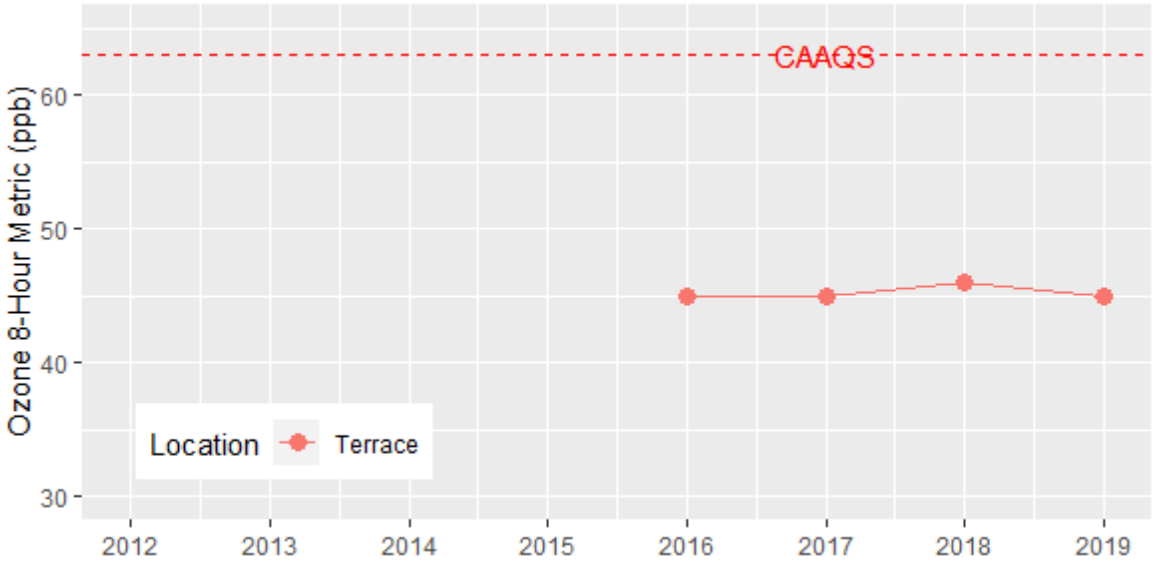


Figure 3. Trends in ozone concentrations (2012-2019), based on annual 4th highest daily 8-hour maximums averaged over three consecutive years. Red dashed line identifies the 2015 CAAQS level of 63 ppb.

[1] Ozone 8-hour metric are based on the 4th highest daily 8-hour maximum, averaged over three years (2017-2019).

$PM_{2.5}$ Levels

$PM_{2.5}$ or fine particulate matter refers to inhalable particles that are smaller than 2.5 microns (µm) in diameter. All $PM_{2.5}$ measurements in this reporting period are based on instruments certified under the US-EPA Federal Equivalent Method (FEM).

$PM_{2.5}$ measurements from Coastal Air Zone locations are summarized in Figure 4. CAAQS achievement can only be determined from two of four monitoring sites due to data availability issues.[2] $PM_{2.5}$ levels ranged from 12 to 17 µg/m^3 for the 24-hour metric[3] (upper plot), and 4.7 to 6.1 µg/m^3 for the annual metric[4] (lower plot), well below the national standard of 28 µg/m^3 and 10 µg/m^3, respectively.

Trends in annual mean concentrations between 2012 and 2019 are shown in Figure 5.[5] A shift towards higher concentrations in 2013 reflects the shift in measurement technology from tapered element oscillating microbalance (TEOM) towards FEM instruments.

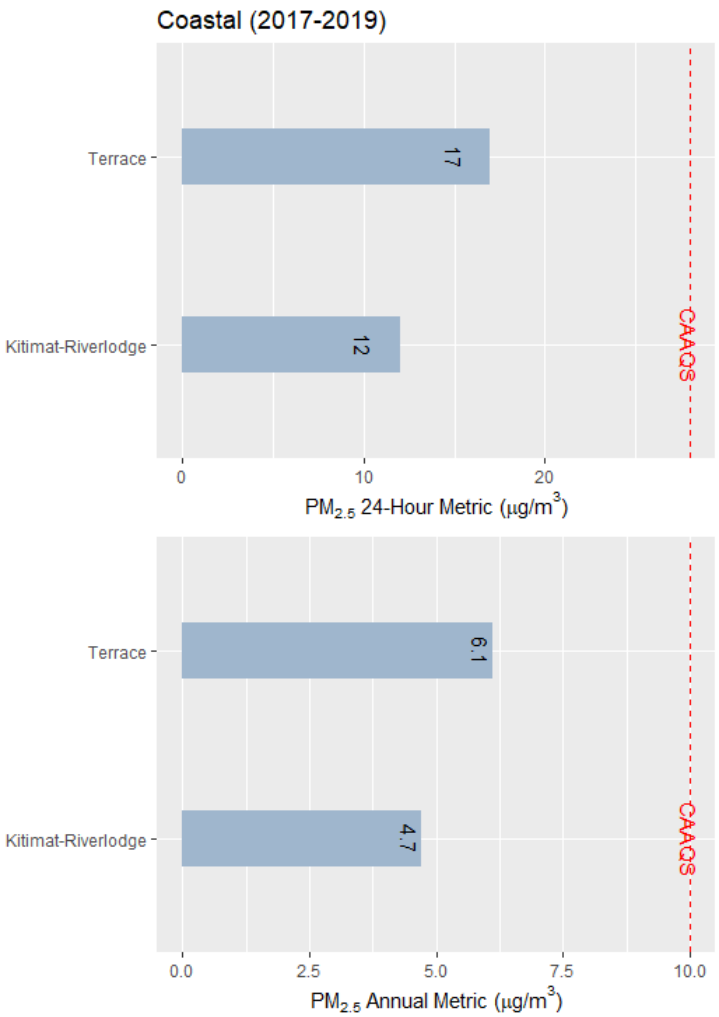


Figure 4. $PM_{2.5}$ concentrations in the Coastal Air Zone. Upper plot based on 24-hour metric (annual 98th percentile, averaged over 2017-2019). Lower plot based on annual mean concentration (averaged over 2017-2019). The red dashed lines identify CAAQS of 28 µg/m^3 (upper plot) and 10 µg/m^3 (lower plot).

[2] Data completeness requirements were not met for Kitimat-Haisla and Kitimat-Whitesail stations.
[3] Concentrations based on the annual 98th percentile of 24-hour values, averaged over three years (2017-2019).
[4] Concentrations based on the annual average of 24-hour values, averaged over three years (2017-2019).
[5] Concentrations based on the annual average of 24-hour values over single year.

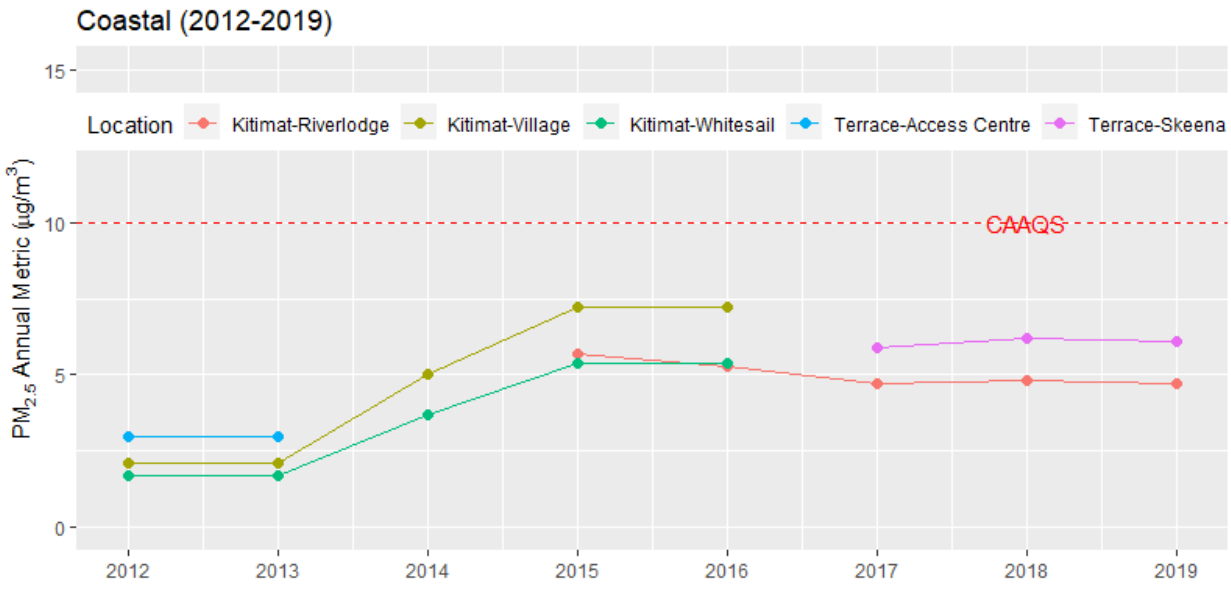


Figure 5. Trends in $PM_{2.5}$ annual metrics (2012-2019) based on the annual average over three consecutive years. Upper plot shows trends without adjustments for wildfire influence. Lower plot is adjusted for wildfire events.

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 and exceptional events (TF/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 metrics and air zone management levels for the Coastal Air Zone (based on 2017-2019 data).

Location	No. Valid Years	Ozone 8-Hour Metric (4th Highest Daily 8-hour Maximums, ppb)		Air Zone Management Level for Ozone
		As Measured	TF/EE Removed	
Terrace-Skeena Middle School	3	45	45	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 $PM_{2.5}$ metrics and air zone management levels for the Coastal Air Zone (based on 2017-2019 data).

Location	No. Valid Years	Daily Mean (98th Percentile)		Annual Mean		Air Zone Management Level for $PM_{2.5}$
		As Measured	TF/EE Removed	As Measured	TF/EE Removed	
Kitimat-Riverlodge	3	12	12	4.7	4.7	Goal: Preventing AQ Deterioration
Terrace-Skeena Middle School	3	17	17	6.1	6.1	

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.[6] 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).

[6] 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 $\mu g/m^3$ 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 (2017-2019)

Ozone and $PM_{2.5}$ data from 2017-2019 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).
    - 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.[7]

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

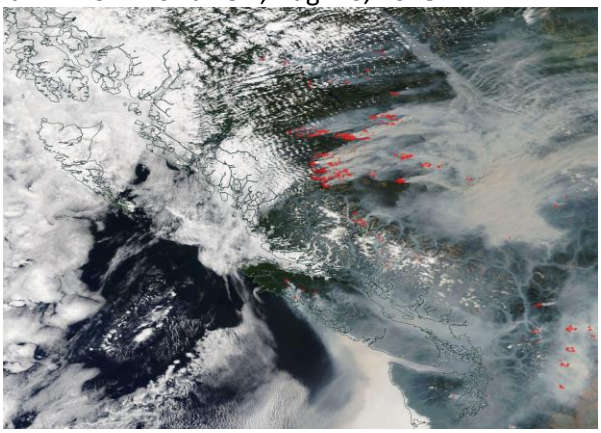
[7] https://www2.gov.bc.ca/gov/content/safety/wildfire-status/about-bcws/wildfire-history/wildfire-season-summary

Table II-2 – Wildfire-influenced $PM_{2.5}$ data from 2018. No wildfire-influenced smoke events were identified in 2017 and 2019.

Location	Date	Daily Mean ($\mu g/m^3$)	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/.