Introduction

This is the fifth 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 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 $PM_{2.5}$. The CAAQS define the upper threshold, separating the "red" and "orange" management levels.

Management Level	O_3 (ppb)		$PM_{2.5}$ – Annual ($\mu g/m^3$)		$PM_{2.5}$ - 24h ($\mu g/m^3$)	
	2015	**2020**	**2015**	**2020**	**2015**	**2020**
Red	Actions for Achieving Air Zone CAAQS					
Threshold (CAAQS)	63	62	10	8.8	28	27
Orange	Actions for Preventing CAAQS Exceedance					
Threshold	56		6.4		19	
Yellow	Actions for Preventing Air Quality Deterioration					
Threshold	50		4		10	
Green	Actions for Keeping Clean Areas Clean					

Ozone Levels

Ozone monitoring was initiated at the Terrace Skeena Middle School site in 2015. Based on data collected between 2015 and 2017, ozone concentrations at this site reached 45 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.

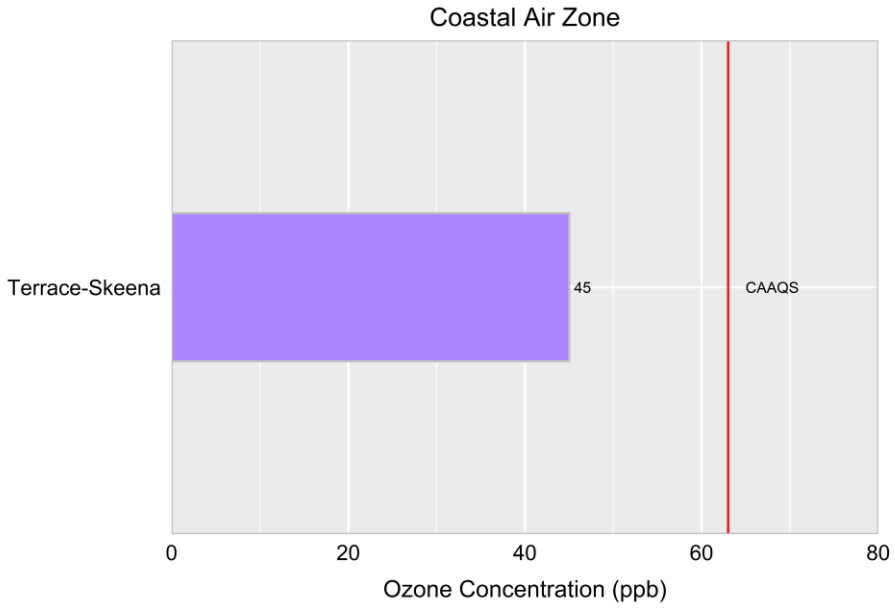

Figure 2. Ozone concentrations in the Coastal Air Zone, based on annual 4th highest daily 8-hour maxima, averaged over 2015-2017. Red dashed line identifies the CAAQS of 63 ppb.

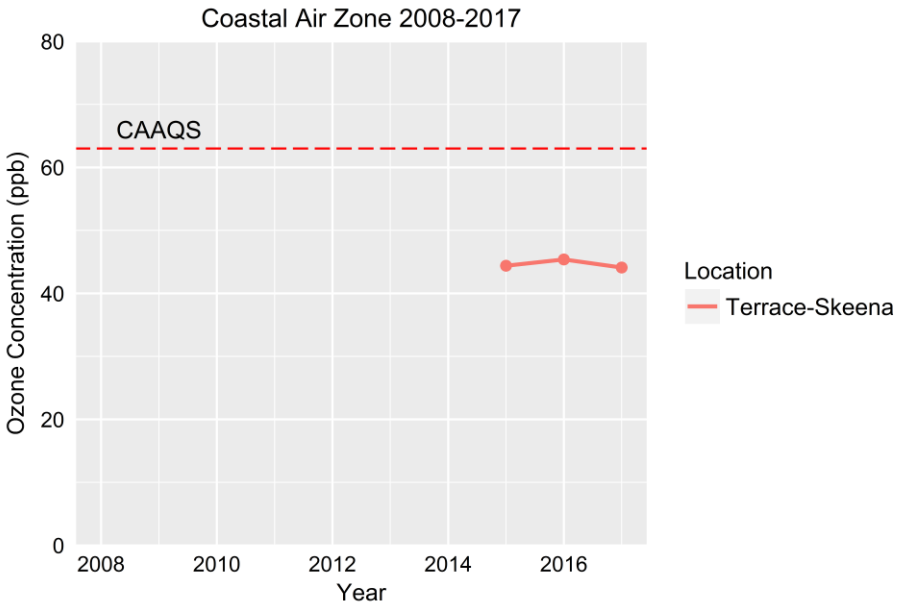

Figure 3. Annual trends in ozone concentrations (2008-2017), based on annual 4th highest daily 8-hour maxima for a single year. Red dashed line identifies CAAQS of 63 ppb.

[1] Concentrations based on the annual 4th highest daily 8-hur maximum, averaged over three years (2015-2017).
[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 2015 to 2017, CAAQS achievement could be determined for only two of four available monitoring sites due to monitoring issues.[3] Daily concentrations (upper plot) ranged from 11 to 17 µg/m^3.[4] Both sites achieved the national standard of 28 µg/m^3. Annual concentrations ranged from 4.7 to 5.9 µg/m^3, and were well below the national standard of 10 µg/m^3.[5]

Annual mean concentrations between 2008 and 2017 are shown in Figure 5.[6] A shift to higher reported concentrations is seen with the change from TEOM to FEM instruments from about 2013 onward.

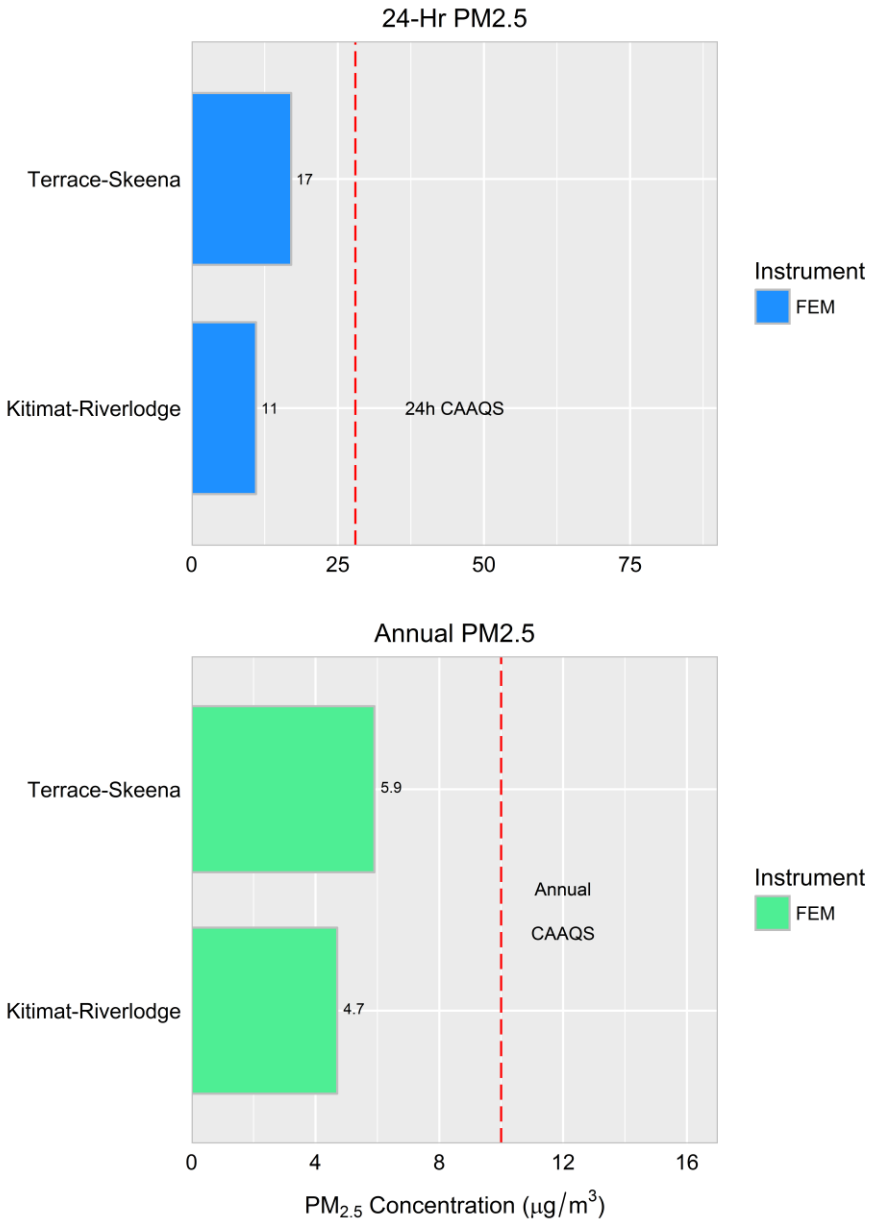

Figure 4. $PM_{2.5}$ concentrations in the Coastal Air Zone. Upper plot based on 24-hour concentration (annual 98th percentile, averaged over 2015-2017). Lower plot based on annual mean concentration (averaged over 2015-2017). Red dashed lines identify CAAQS of 28 µg/m^3 (upper plot) and 10 µg/m^3 (lower plot).

[3] Data completeness requirements were not met for Kitimat-Haisla and Kitimat-Riverlodge stations as a result of baseline adjustment issues that resulted in several months of $PM_{2.5}$ data being rendered invalid.
[4] Concentrations based on the annual 98th percentile of 24-hour values, averaged over three years (2015-2017).
[5] Concentrations based on the annual average of 24-hour values, averaged over three years (2015-2017).
[6] Concentrations based on the annual average of 24-hour values over single year.

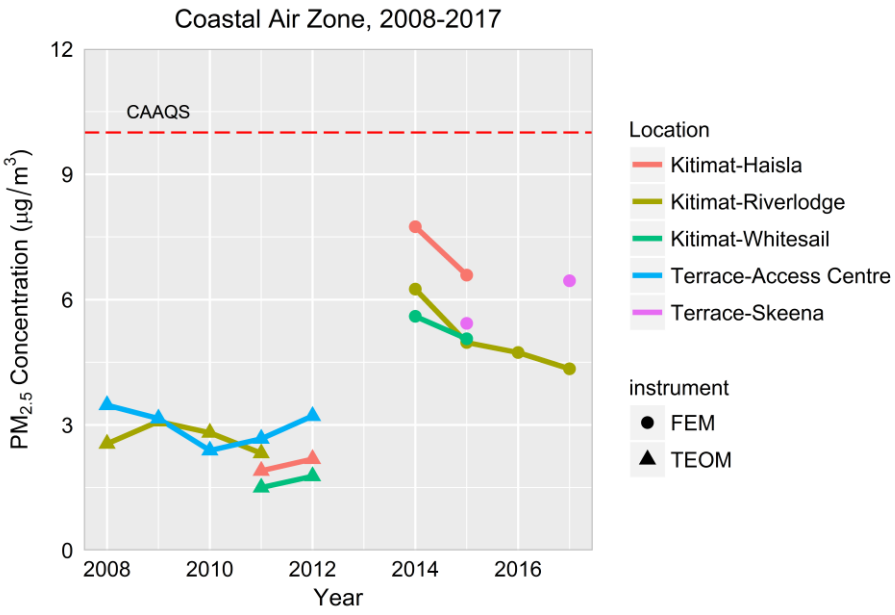

Figure 5. Trends in $PM_{2.5}$ concentrations (2008-2017), based on annual mean concentrations from a single year. The CAAQS value of 10 µg/m^3 is shown by the dashed line. $PM_{2.5}$ measurements prior to 2011 are reported at 25°C and 1 atm. From 2011 onward, measurements are reported at local conditions.

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 2015-2017 data).

Location	No. Valid Years	4th Highest Daily 8-hour Maxima (ppb)		Air Zone Management Level
		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 consideration of potential TF/EE influences, of which none were identified. 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 2015-2017 data).

Location	Monitor Type	No. Valid Years	Daily Mean (98th Percentile)		Annual Mean		Air Zone Management Level
			As Measured	TF/EE Removed	As Measured	TF/EE Removed	
Kitimat-Haisla	FEM	1	N/A	N/A	N/A	N/A	**Goal: Preventing Air Quality Deterioration**
Kitimat-Riverlodge	FEM	3	11	11	4.7	4.7	
Kitimat-Whitesail	FEM	1	N/A	N/A	N/A	N/A	
Terrace-Skeena Middle School	FEM	2	17	17	5.9	5.9	

Actions to Protect Air Quality

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. Over the past three years, wood stove change-out programs have been supported in the Nuxalt Nation (Bella Coola Valley) in 2015 and Strathcona Regional District in 2017.[7] Additional programs in the Alberni-Clayoquot Regional District from 2015 to 2017 have provided enhanced incentives to further encourage the transition away from wood stoves to natural gas or pellet stoves and electric heat pumps.

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 are emitted from wildfires. These include $PM_{2.5}$ and gaseous pollutants such as nitrogen oxides and volatile organic compounds (VOCs) 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 $PM_{2.5}$ or ozone. Criteria used to flag and evaluate wildfire-influenced data included the following:

- 24-hour $PM_{2.5}$ concentrations exceeded the CAAQS level of 28 $\mu g/m^3$ or 8-hour daily maximum ozone concentrations exceeded the CAAQS level of 63 ppb between May and September,
- Nearby wildfires of interest were identified based on data from B.C. Wildfire Management Branch,
- Wildfire smoke advisories had been issued by the Ministry of Environment & Climate Change Strategy during the period of interest,
- NASA satellite images indicated smoke impacts over the region,
- Multiple monitoring sites in the area of concern exhibited similar air quality characteristics, suggesting a common source or contributing source, and
- Modelling studies identified enhanced pollutant concentrations due to wildfire smoke.

Based on the above criteria, no significant wildfire influences were identified for the Coastal Air Zone between and 2015 and 2017.