BRITISH COLUMBIA | Ministry of Environment

COASTAL AIR ZONE REPORT

(2011-2013)

OVERVIEW

This is the first air quality report for the Coastal Air Zone, which covers coastal areas of B.C. outside of the Georgia Basin, and includes Haida Gwaii, the north and central coasts and northern Vancouver Island. Air zone reports are a commitment under the national Air Quality Management System (AQMS) to annually report on the achievement of the Canadian Ambient Air Quality Standards (CAAQS) for ground-level ozone and fine particulates ($PM_{2.5}$).

Over the current reporting period of 2011 to 2013, ozone was not routinely monitored in the Coastal Air Zone. $PM_{2.5}$ concentrations ranged from 6-9 $\mu g/m^3$ (24-hour) and 1.6-3.0 $\mu g/m^3$ (annual). These levels were well below the national standards of 28 and 10 $\mu g/m^3$, respectively.

The Air Zone Management Framework defines colour-coded management levels associated with air quality. On this basis, the Coastal Air Zone has been assigned a management level of "green" for $PM_{2.5}$, indicating that air management actions should focus on keeping clean areas clean. No management levels are assigned for ozone at this time.

1. Introduction

Fine particulates ($PM_{2.5}$) and ground-level ozone are considered among the most important outdoor air pollutants from a public health perspective. Both pollutants are key components of urban smog and associated with short-term and long-term impacts on human health and the environment.

In 2012, the Canadian Council of Ministers of the Environment committed to implementing a new comprehensive air management system designed to better protect human health and the environment. The Air Quality Management System (AQMS) is comprised of the following key elements:

- Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ and ozone, to drive air quality improvements,
- Base-Level Industrial Emission Requirements (BLIERS) for major industries to set a consistent level of good performance across Canada,
- Air zone management that supports actions to improve air quality and keep clean areas clean,
- Enhanced coordination where air pollution crosses jurisdictional borders, and
- Increased collaboration on actions to reduce transportation emissions

Under AQMS, air zones are the basis for monitoring, reporting and taking action on air quality. Air zones are areas that exhibit similar air quality characteristics, issues and trends. Individual provinces and territories are responsible for delineating and managing their air zones based on local conditions. The level of response is expected to be proportional to the level of air quality degradation. As outlined in the *Air Zone Management Framework*, air quality is assigned to one of four colour-coded management levels (i.e. red, orange, yellow and green), with recommended actions associated with each level.

Table 1. Air Zone Management Framework, including CAAQS for ozone and $PM_{2.5}$ for 2015 and 2020 achievement. Ozone metric based on annual 4th highest value, averaged over three years. $PM_{2.5}$ 24-hour metric based on annual 98th percentile, averaged over three years. $PM_{2.5}$ annual metric averaged over three years.

Management Level	Ozone Daily max 8h (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					

Under the AQMS, provinces and territories are expected to report on CAAQS achievement. This includes the assignment of a colour-coded management level to each air zone, based on the highest concentrations within the air zone, and a summary of actions being taken to protect local air quality.

As part of the province's commitments under AQMS, B.C. has been divided into seven broad air zones as shown in Figure 1. This document represents the first annual report for the Coastal Air Zone. The summarized data are also provided in a map-driven web-based format via Environmental Reporting BC at: http://www.env.gov.bc.ca/soe/indicators/air.

Figure 1. B.C. air zones under AQMS.

2. Coastal Air Zone

The Coastal Air Zone covers those coastal areas of B.C. outside of the Georgia Basin, and includes Haida Gwaii, the north and central coasts, and northern Vancouver Island. The air zone is characterized by rugged terrain, numerous long inlets, and a cool to temperate maritime climate. Prince Rupert is the largest community (11,918), followed by Terrace (11,265), Kitimat (8,452) and Port Hardy (3,978).[1]

Figure 2. Coastal Air Zone.

Major industrial sources within the air zone include the Neucel pulp mill in Port Alice and the Rio Tinto Alcan aluminum smelter in Kitimat. Other locally important emission sources include open burning, residential wood combustion and transportation. A number of new Liquefied Natural Gas (LNG) facilities are currently being proposed for both Prince Rupert and Kitimat, which would result in new emissions of ozone and $PM_{2.5}$ precursors, including oxides of nitrogen (NOx) and sulphur (SO_2) and volatile organic compounds (VOCs).

[1] http://www.bcstats.gov.bc.ca/StatisticsBySubject/Demography/PopulationEstimates.aspx

3. Ozone Levels

Ozone was not routinely monitored in the Coastal Air Zone between 2011 and 2013. Short-term monitoring studies in Kitimat (May-Nov., 2011) and Prince Rupert (Apr.-Aug., 2013) measured relatively low ozone levels compared to the CAAQS level of 63 ppb, with maximum 8-hour concentrations reaching 49 ppb in Kitimat and 47 ppb in Prince Rupert. A new air monitoring station in Terrace began operating in January 2015. Data from this station are available in real-time on www.bcairquality.ca, and will be presented in future air zone reports.

> Ozone is a secondary pollutant formed from reactions involving nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of sunlight.

4. $PM_{2.5}$ Levels

$PM_{2.5}$ is measured continuously in Port Alice, Terrace and several sites in Kitimat. For the reporting period of 2011 to 2013, there were sufficient data (i.e. at least two complete years) to report on CAAQS achievement for two sites in Kitimat and one in Terrace.[2] Data are summarized in Figure 3 and compared to the national standards based on short-term (24-hour) and long-term (annual) averaging periods. The 24-hour $PM_{2.5}$ levels ranged from 6-9 $\mu g/m^3$ and were below the national standard of 28 $\mu g/m^3$. Annually averaged levels ranged from 1.6-3.0 $\mu g/m^3$, and were below the national standard of 10 $\mu g/m^3$.

Limited trend information is available over the past 10 years, as shown in Figure 3. With the exception of the monitoring site in Port Alice, generally low concentrations were observed throughout this period. A distinction is made between data collected using the new FEM instrument in Port Alice and the older TEOM instruments in Kitimat and Terrace, as the FEMs generally provide a more complete measure of $PM_{2.5}$ and higher reported concentrations. During 2013, the Kitimat monitoring network was transitioning to the new FEM monitors. Data from the new monitors will be included in the next Coastal Air Zone report.

> $PM_{2.5}$ refers to inhalable particles up to 2.5 micrometres in diameter but of varying size, shape and chemical composition. This makes $PM_{2.5}$ a challenge to measure. The TEOM instruments were the first used in B.C. that could measure $PM_{2.5}$ concentrations in real-time. These instruments heated the sample air to remove excess water, and in the process, lost some of the sample due to evaporation. New monitors (the "FEMs") provide a more complete measure by accounting for the $PM_{2.5}$ that was previously lost to evaporation. As a result, higher concentrations are expected with the new monitors, even though actual air quality has not changed.

[2] At Port Alice (Rumble Beach Hospital), monitoring was conducted between 2011 and 2013, but only one complete year of data (2012) was available.

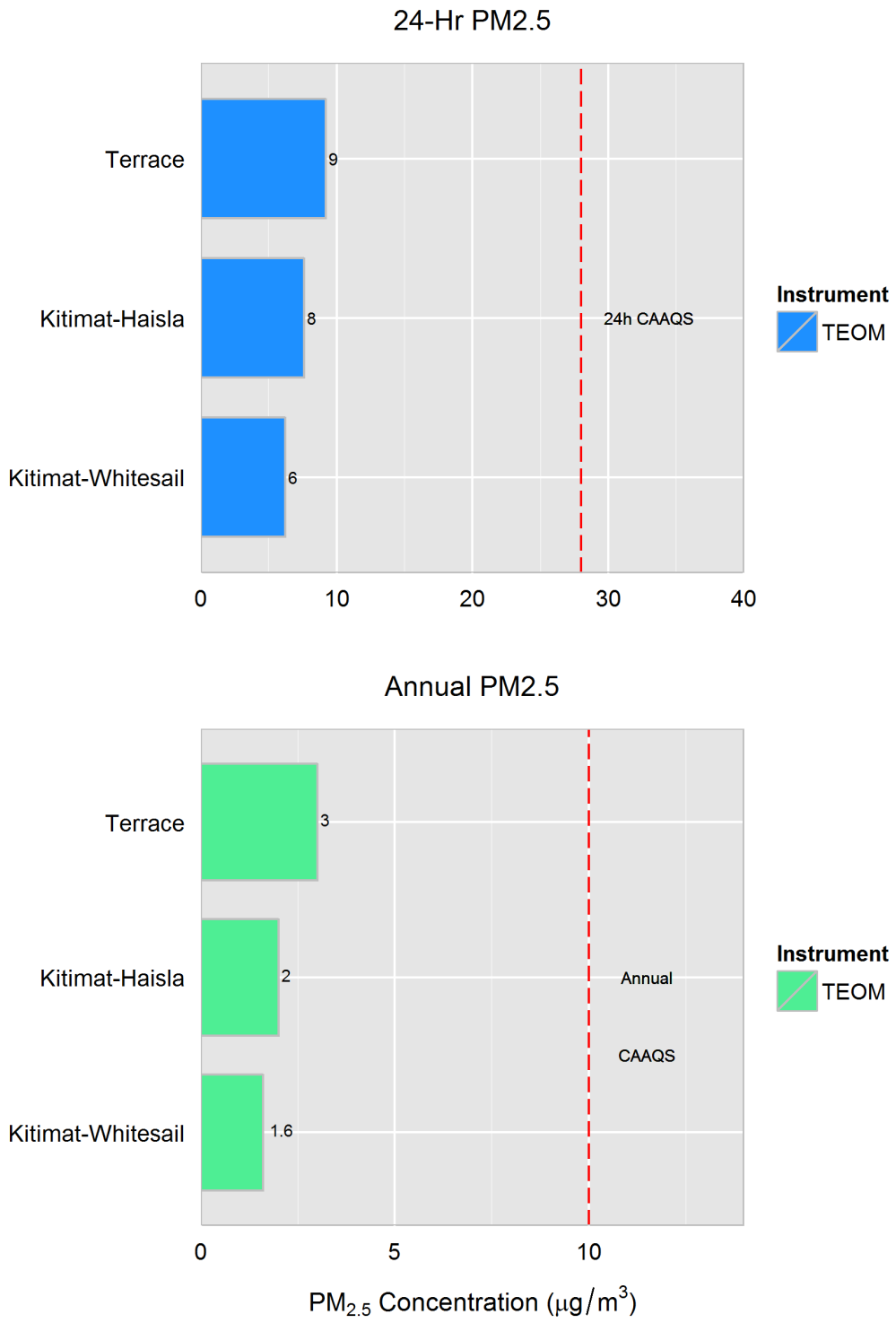

Figure 3. $PM_{2.5}$ concentrations in Coastal Air Zone (2011-2013). Upper plot based on 24-hour concentration (annual 98th percentile, averaged over three years). Lower plot based on annual mean concentration (averaged over three years). Red dashed lines identify CAAQS of 28 µg/m^3 (upper plot) and 10 µg/m^3 (lower plot).

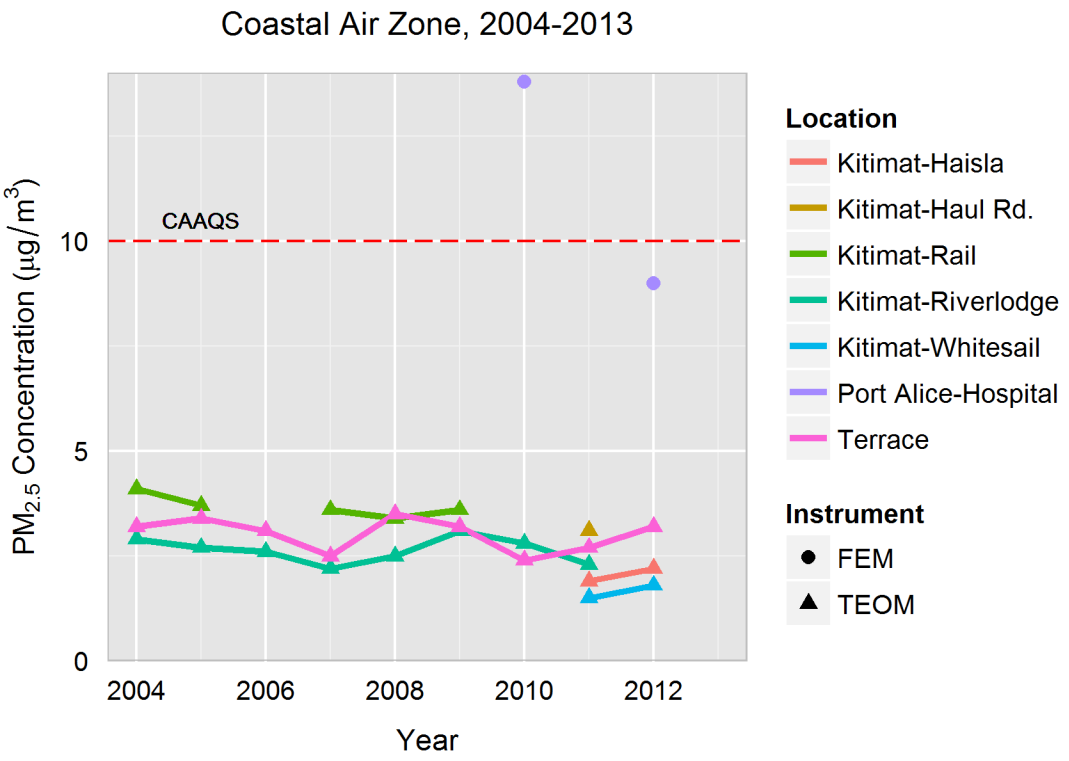

Figure 4. Annual trends in $PM_{2.5}$ concentrations (2004-2013), based on annual mean concentrations. The CAAQS value of 10 µg/m^3 is shown by the red dashed line. $PM_{2.5}$ measurements prior to 2011 are reported at 25°C and 1 atm. From 2011 onward, measurements are reported at local conditions. No data are shown for 2013 due to an incomplete year of monitoring.

5. Influence of Transboundary Flows and Exceptional Events (TF/EE)

In some instances, the CAAQS may be exceeded as a result of external influences (i.e. transboundary flows) or exceptional events (e.g. wildfires). Under the Air Zone Management Framework, where such influences can be demonstrated using a weight-of-evidence approach, the contribution of such events to air quality measurements can be removed. This is done so that long-term management strategies are not developed on the basis of events that are beyond local or provincial control. For the reporting period of 2011 to 2013, no exceedances of the $PM_{2.5}$ or ozone CAAQS were observed.

6. Air Zone Management

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 such as wildfires. Due to the limited ozone data in this air zone over the reporting period of 2011 to 2013, ozone management levels have yet to be determined for the Coastal Air Zone.

Air zone management levels for $PM_{2.5}$ are based on the highest concentrations relative to both the 24-hour and annual national standards, once adjusted for transboundary and exceptional events. As summarized in Table 2, air zone management for $PM_{2.5}$ is assigned a "green" level on the basis of concentrations in Terrace. This suggests that air management actions should be focussed on keeping clean areas clean. Port Alice was not included in Table 2 due to insufficient monitoring data; however, the available data (as shown in Figure 4) does indicate periods of elevated $PM_{2.5}$ levels that warrant ongoing tracking and potentially more rigorous actions in the future, to reduce $PM_{2.5}$ levels.

Table 2. Summary of air zone management levels for $PM_{2.5}$ in the Coastal Air Zone.

Location	Monitor Type	No. Valid Years 2011-2013	Annual Mean		Daily Mean (98th Percentile)		Air Zone Management Level
			2013	2011-2013	2013	2011-2013	
Kitimat Haisla	TEOM	2	-	2.0	-	8	Goal: Keeping Clean Areas Clean
Kitimat Whitesail	TEOM	2	-	1.6	-	6	
Terrace	TEOM	2	-	3.0	-	9	

7. Actions to Protect Air Quality

The Coastal Air Zone is relatively undeveloped outside of Prince Rupert, Terrace and Kitimat. Air quality concerns have largely focussed on emissions near industrial sources and a number of new sources being planned for the Kitimat and Prince Rupert airsheds. To better understand the extent to which the Kitimat airshed can be developed without causing unacceptable impacts on human health and the environment, a modelling study was conducted that looked at various emission scenarios involving emissions of nitrogen oxides and sulphur dioxide (both precursors to $PM_{2.5}$ formation).[3] A similar approach is being taken to assess the capacity of the Prince Rupert airshed.[4]

At the neighbourhood scale, emissions from wood stoves are an important issue for many communities in the Coastal Air Zone and elsewhere in the province. The Provincial Wood Stove Exchange Program is designed to encourage residents to change out their older, smoky wood stoves for low-emission appliances including new CSA-/EPA-certified clean-burning wood stoves. Between 2011 and 2013, the province provided more than $42,000 to support local change-out programs in the Alberni Valley (which overlaps with the Georgia Strait Air Zone) and Port Alice. In 2014/15, an additional $23,000 is being provided to support change-outs in the Nuxalt Nation (Bella Coola Valley) and the Alberni Valley.

[3] ESSA (2014) *Kitimat Airshed Emissions Effects Assessment. Final Report*. Prepared for British Columbia Ministry of Environment, Environmental Protection Program, Smithers, BC.
[4] For more information, see: http://www2.news.gov.bc.ca/news_releases_2013-2017/2014ENV0105-001815.htm