BRITISH COLUMBIA | Ministry of Environment

CENTRAL INTERIOR AIR ZONE REPORT

(2011-2013)

OVERVIEW

This is the first air quality report for the Central Interior Air Zone, which covers areas of the Central Plateau and Bulkley Valley-Lakes District, and includes the communities of Prince George, Quesnel, Williams Lake and Smithers. 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, 8-hour ozone concentrations ranged from 53-54 ppb, and were well below the CAAQS of 63 ppb. $PM_{2.5}$ concentrations ranged from 15-36 $\mu g/m^3$ (24-hour) and 4.5-10.8 $\mu g/m^3$ (annual). Monitoring sites in Smithers and Vanderhoof exceeded the 24-hour CAAQS for $PM_{2.5}$ of 28 $\mu g/m^3$, and Vanderhoof also exceeded the annual CAAQS of 10 $\mu g/m^3$.

The Air Zone Management Framework defines colour-coded management levels associated with air quality. On this basis, the Central Interior Air Zone has been assigned a management level of “yellow” for ozone, indicating ozone-related actions should focus on preventing further deterioration, and “red” for $PM_{2.5}$, indicating actions are needed particularly in the communities of Smithers and Vanderhoof to achieve the national standards.

Introduction

Fine particulates ($PM_{2.5}$) and ground-level ozone are considered 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. 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.

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

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 Central Interior 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.

1. Central Interior Air Zone

The Central Interior Air Zone, as shown in Figure 2, covers areas of the Central Plateau and Bulkley Valley-Lakes District. Major population centres include Prince George, Quesnel, Williams Lake and Smithers.

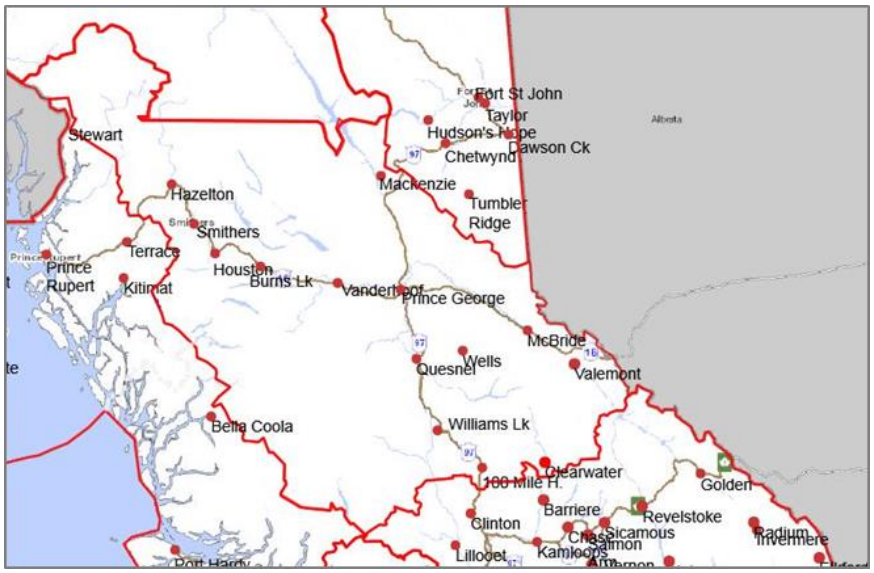

Figure 2. Central Interior Air Zone

The largest industrial sources within the air zone include pulp and paper mills in Prince George and Quesnel, the Husky petroleum refinery in Prince George, and various wood manufacturing industries throughout the region. Other locally important emission sources include open burning, residential wood stoves and transportation.

2. Ozone Levels

Between 2011 and 2013, ozone measurements were reported for four sites in the Central Interior Air Zone. As shown in Figure 3, 8-hour ozone levels were relatively uniform among the four sites, with concentrations ranging from 53-54 ppb. All monitoring sites were below the national standard of 63 ppb.

> Ozone is a secondary pollutant formed from reactions involving nitrogen oxides and hydrocarbons in the presence of sunlight.

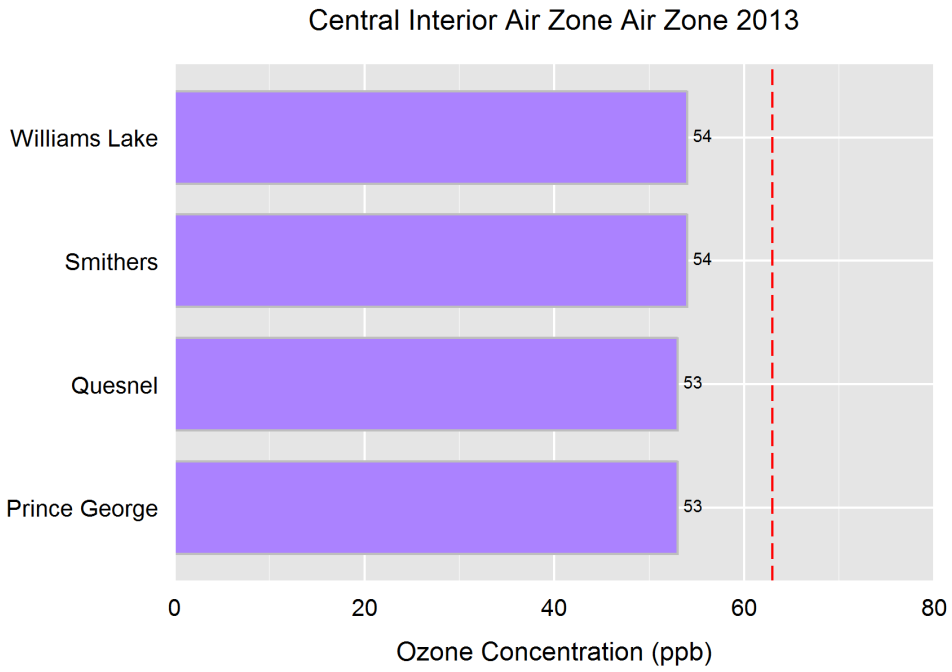

Figure 3. Ozone concentrations in Central Interior Air Zone (2011-2013), based on CAAQS metric (i.e. annual 4th highest daily 8-hour maxima, averaged over three consecutive years). Red dashed line identifies CAAQS of 63 ppb.

Trends in annual 8-hour ozone levels are shown in Figure 4. No significant changes were identified. Elevated concentrations in Williams Lake in 2006 are believed to have been associated with wildfire infuences.

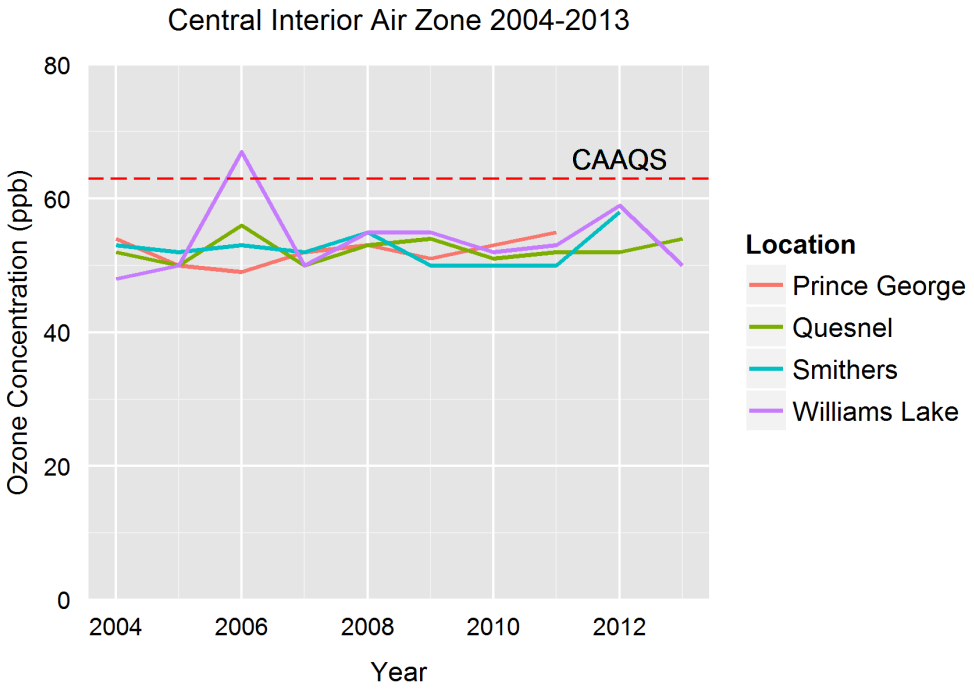

Figure 4. Annual trends in ozone concentrations (2004-2013), based on annual 4th highest daily 8-hour maxima. Red dashed line identifies CAAQS of 63 ppb.

3. $PM_{2.5}$ Levels

$PM_{2.5}$ measurements were reported for 10 sites in the air zone. Data are summarized in Figure 5 and compared to the national standards based on short-term (24-hour) and long-term (annual) averaging periods. The 24-hour levels ranged from 15 to 36 µg/m^3 and annually averaged levels ranged from 4.5 to 10.8 µg/m^3. $PM_{2.5}$ concentrations exceeded the 24-hour standard of 28 µg/m^3 in Smithers and Vanderhoof, and the annually averaged standard of 10 µg/m^3 in Vanderhoof

> $PM_{2.5}$ is a mixture of particles 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") are being introduced that 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.

Ten-year trends in annual mean $PM_{2.5}$ concentrations are shown in Figure 6. A distinction is made between data collected using the old TEOM instruments and new instruments (so-called "Federal Equivalent Methods" or "FEMs"), as the FEMs generally provide a more complete measure of $PM_{2.5}$ and therefore higher $PM_{2.5}$ concentrations. This is demonstrated in the large apparent increase in $PM_{2.5}$ levels in Smithers between 2012 (TEOM data) and 2013 (FEM data). The

influence of wildfires is also reflected in the trends, as high $PM_{2.5}$ levels observed in Prince George, Quesnel and Williams Lake in 2010 were due to wildfire smoke.

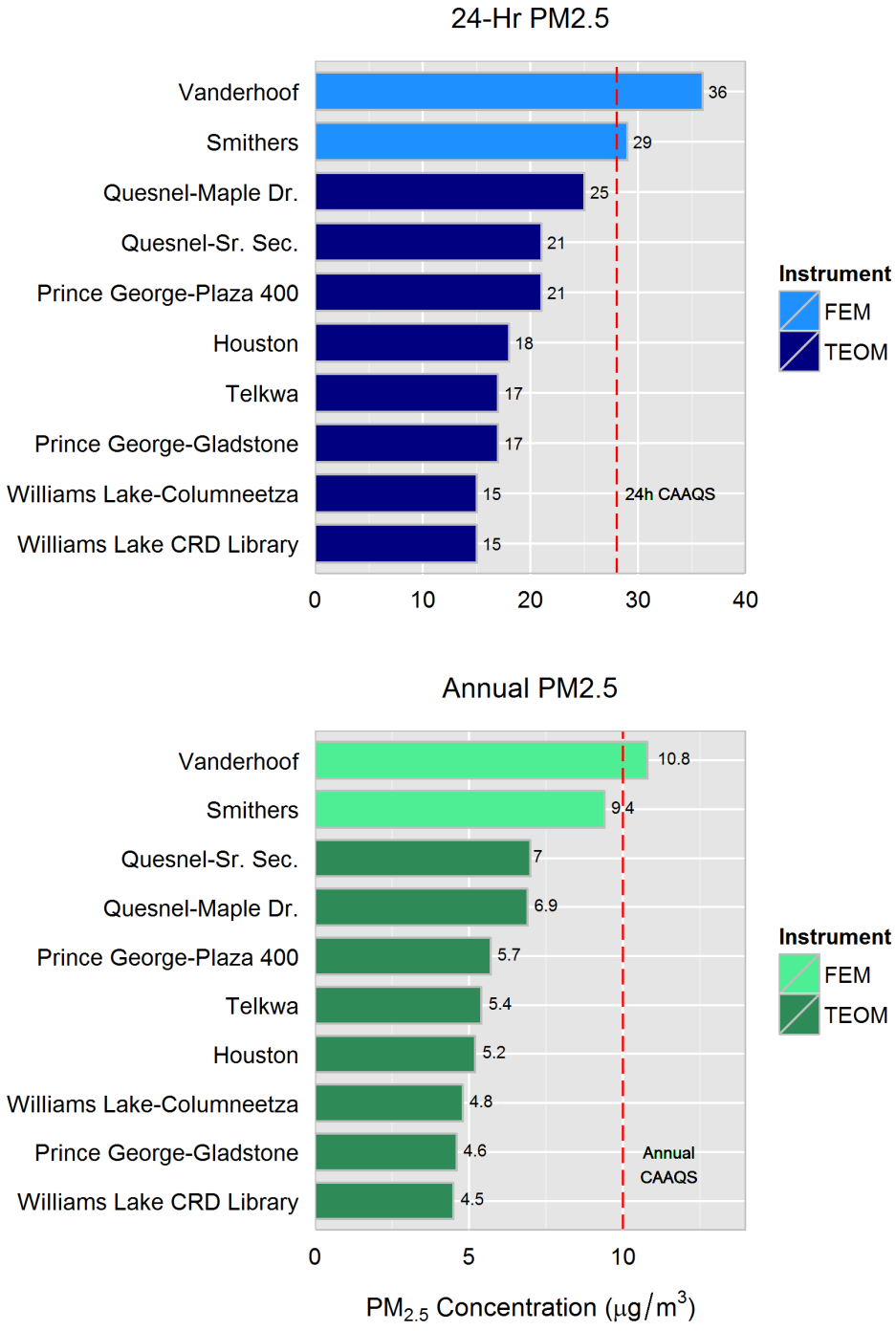

Figure 5. $PM_{2.5}$ concentrations in Central Interior Air Zone (2013). Upper plot based on 24-hour concentration (annual 98th percentile, averaged over three years). Lower plot based on annual mean concentration (averaged over three years). Red dashed lines identify CAAQS of 28 µg/m^3 (upper plot) and 10 µg/m^3 (lower plot).

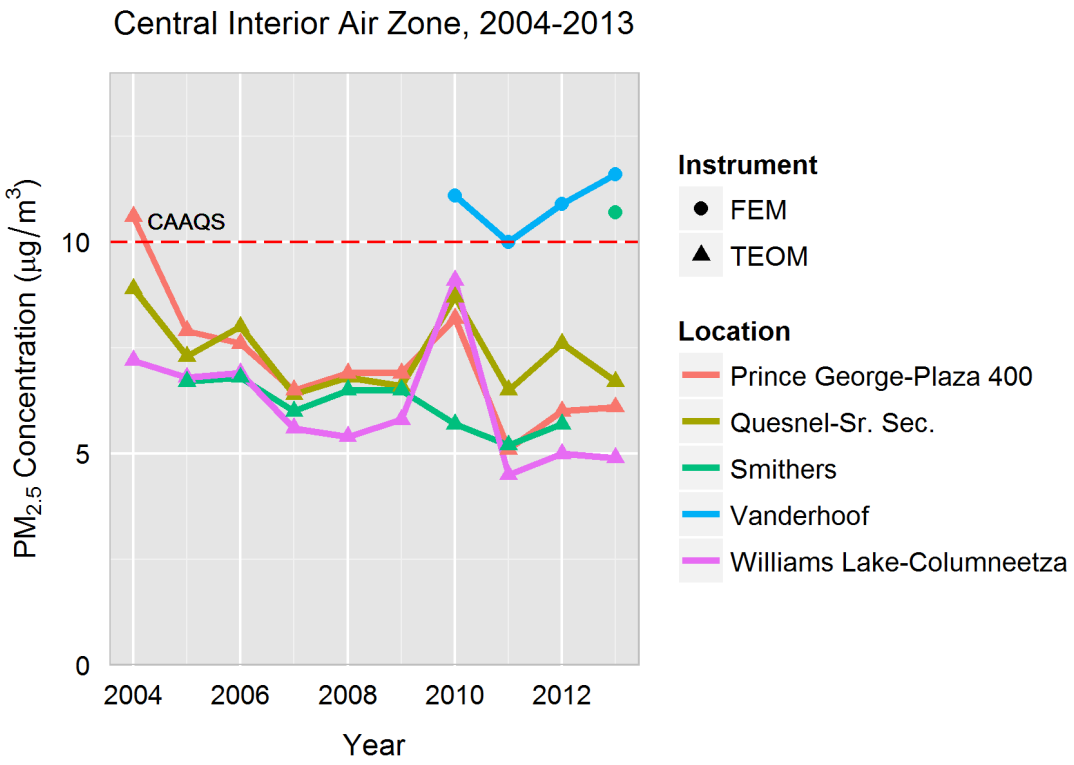

Figure 6. Annual trends in $PM_{2.5}$ concentrations (2004-2013), based on annual mean concentrations. The CAAQS value of 10 µg/m^3 is shown by the red dashed line. $PM_{2.5}$ measurements prior to 2011 are reported at 25°C and 1 atm. From 2011 onward, measurements are reported at local conditions.

4. 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 that were a result of TF/EE influences.

5. 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. On this basis, the Central Interior Air Zone is assigned an ozone management level of “yellow”, indicating that air quality actions should prevent further deterioration of ozone levels.

Table 2. Summary of air zone management levels for ozone in the Central Interior Air Zone.

Location	No. Valid Years 2011-2013	4th Highest Daily 8h Max.		Air Zone Management Level
		2013	2011-2013	
Prince George Plaza 400	3	52.3	53	Goal: Preventing Deterioration
Quesnel Senior Secondary	3	54.3	53	
Smithers St. Josephs	2	-	54	
Williams Lake Columneetza	3	50.4	54	

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 TF/EE events. As summarized in Table 3, air zone management for $PM_{2.5}$ is assigned a "red" level on the basis of high concentrations in Vanderhoof and Smithers. Actions should be taken to reduce $PM_{2.5}$ levels in these communities to achieve the standards.

Table 2. Summary of air zone management levels for $PM_{2.5}$ in the Central Interior 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	
Houston	TEOM	2	5.5	5.2	17.2	18	Goal: Achieving Air Zone CAAQS
Prince George Gladstone School	TEOM	3	4.9	4.7	18	17	
Prince George Plaza 400	TEOM	3	6.1	5.7	17.7	21	
Quesnel Maple Drive	TEOM	3	6.6	6.9	19.6	25	
Quesnel Senior Secondary	TEOM	3	6.7	7.0	17.1	21	
Smithers St. Josephs	FEM	3	10.7	9.4	32.6	29	
Telkwa	TEOM	3	6.1	5.4	18.7	17	
Vanderhoof	FEM	3	11.6	10.8	35.2	36	
Wiliams Lake Columneetza	TEOM	3	4.9	4.8	14.2	15	
Williams Lake CRD Library	TEOM	2	n/a	4.5	n/a	15	

6. Actions to Protect Air Quality

Concerns over particulate levels (PM_{10} and $PM_{2.5}$) over the past decade have led to the development of several local airshed plans in the Central Interior Air Zone. These include:

- Bulkley Valley-Lakes District Clean Air Plan: http://cleanirplan.ca
- Prince George Air Quality Management Plan: http://www.pgairquality.com
- Quesnel: Airshed Management Plan: http://www.quesnelairshed.org
- Williams Lake: Airshed Management Plan: http://www.breatheasywilliamslake.org/about.html

Actions have largely focussed on reducing emissions from biomass combustion (e.g. beehive burners, open burning and residential wood combustion), road dust, and industrial sources.

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 over $58,000 to support change-out programs in Smithers, Prince George and Mackenzie. In the funding period of 2014-2015, an additional $22,000 is being provided to fund change-out programs in Smithers and Prince George.