BRITISH COLUMBIA | Ministry of Environment

SOUTHERN INTERIOR AIR ZONE REPORT

(2011-2013)

OVERVIEW

This is the first air quality report for the Southern Interior Air Zone, which covers a broad area of southern BC to the east of the Coast Mountains, including Kamloops, Kelowna, Vernon, Penticton and Cranbrook. 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 50-60 ppb, and were below the CAAQS of 63 ppb. $PM_{2.5}$ concentrations ranged from 10-20 $\mu g/m^3$ (24-hour) and 3.8-8.2 $\mu g/m^3$ (annual), and were below the respective $PM_{2.5}$ CAAQS of 28 and 10 $\mu g/m^3$.

The Air Zone Management Framework defines colour-coded management levels associated with air quality. On this basis, the Southern Interior Air Zone has been assigned a management level of "orange" for ozone and "orange" for $PM_{2.5}$, indicating that actions are warranted to prevent future exceedances of the national standards.

1. 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

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 Southern 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.

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

2. Southern Interior Air Zone

The Southern Interior Air Zone lies between the Coast Mountains and the B.C.-Alberta border, and to the south of 100 Mile House and Clearwater. It encompasses the southern parts of the Interior Plateau, and rugged terrain of the Monashee, Selkirk, Purcell and Rocky Mountain ranges to the east. It is characterized by a continental climate, with coastal influences in the western parts of the air zone. Major population centres include Kelowna, Kamloops, Vernon and Penticton, with more sparsely populated areas outside of these communities.

Figure 2. Southern Interior Air Zone

Locally important emission sources include open burning, residential woodstoves and transportation. The largest industrial

sources include the Teck-Cominco lead-zinc smelter in Trail, pulp and paper mills in Kamloops and Robson (Castlegar), and the Roxul facility in Grand Forks. Wildfires are an intermittent source of air pollution during dry summer months, and can have a profound effect on local air quality, such as observed in Kelowna in 2003 and Williams Lake in 2010, when hourly $PM_{2.5}$ concentrations reached 421 $\mu g/m^3$.

3. Ozone Levels

Ozone measurements are reported for five sites in the Southern Interior air zone. As summarized in Figure 3, all monitoring sites were below the national standard of 63 ppb, based on the annual 4th highest 8-hour maximum, averaged over three years. Ozone levels ranged from 50-60 ppb, with the highest concentrations observed in Kelowna.

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

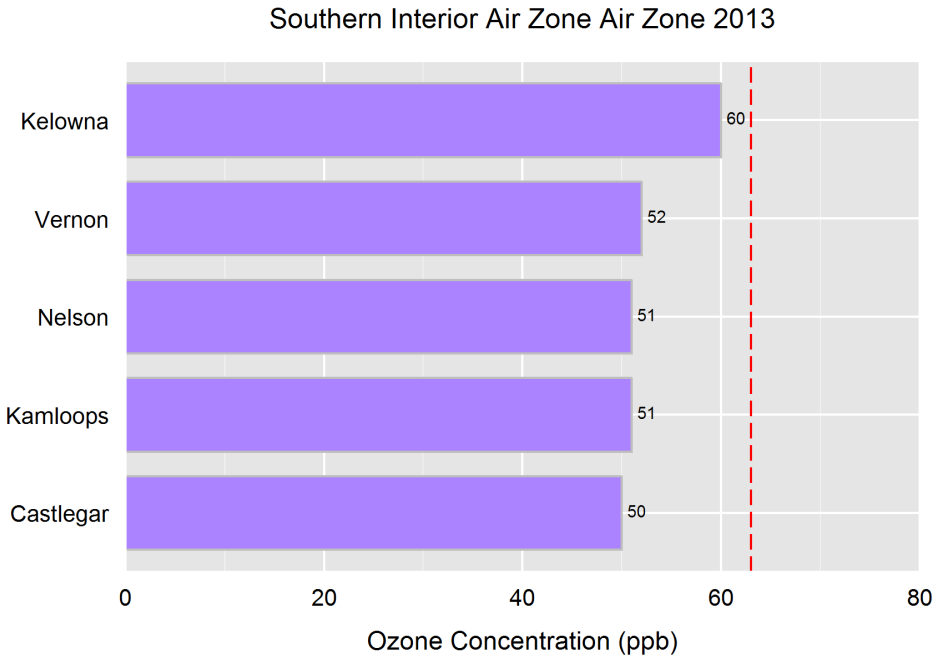

Figure 3. Ozone concentrations in Georgia Strait Air Zone (2011-2013), based on CAAQS metric (i.e. annual 4th highest daily 8-hour maxima, averaged over three consecutive years). Red dashed line identifies CAAQS of 63 ppb.

Ten-year trends in annual ozone levels are shown in Figure 4. The highest concentrations during this period were observed in Kelowna in 2012, when ozone levels (based on the annual 4th highest 8-hour maximum) exceeded 63 ppb. Emissions from local and Siberian wildfires may have contributed to the elevated concentrations in 2012 (Teakles, pers. comm.). Increasing trends were detected for Vernon over the 10-year period, but have largely been stable over the past seven years

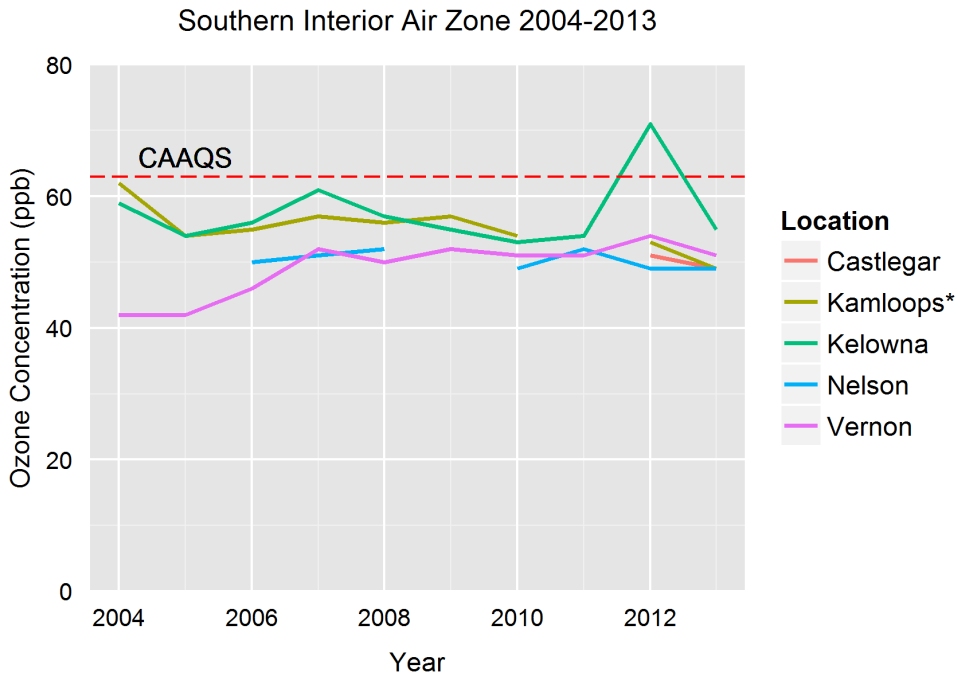

Figure 4. Annual trends in ozone concentrations (2004-2013), based on annual 4th highest daily 8-hour maxima. Red dashed line identifies national standard (CAAQS) of 63 ppb. Kamloops data (flagged by asterisk) include measurements from Brocklehurst (2004-2010) and Fire Station (2011-2012) monitoring sites.

4. $PM_{2.5}$ Levels

$PM_{2.5}$ measurements are reported for eight sites in the air zone. Kamloops and Castlegar data were obtained using new technology FEM monitors. Elsewhere, FEM data were either insufficient for the reporting period of 2011 to 2013 (e.g. Kelowna, Vernon) or unavailable so TEOM data were used. As the transition to FEM monitoring continues, more data from FEM monitors will be reported.

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 10-20 $\mu g/m^3$, and were below the national standard of 28 $\mu g/m^3$. Annually averaged levels ranged from 3.8-8.2 $\mu g/m^3$, and were below the national standard of 10 $\mu g/m^3$.

$PM_{2.5}$ 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.

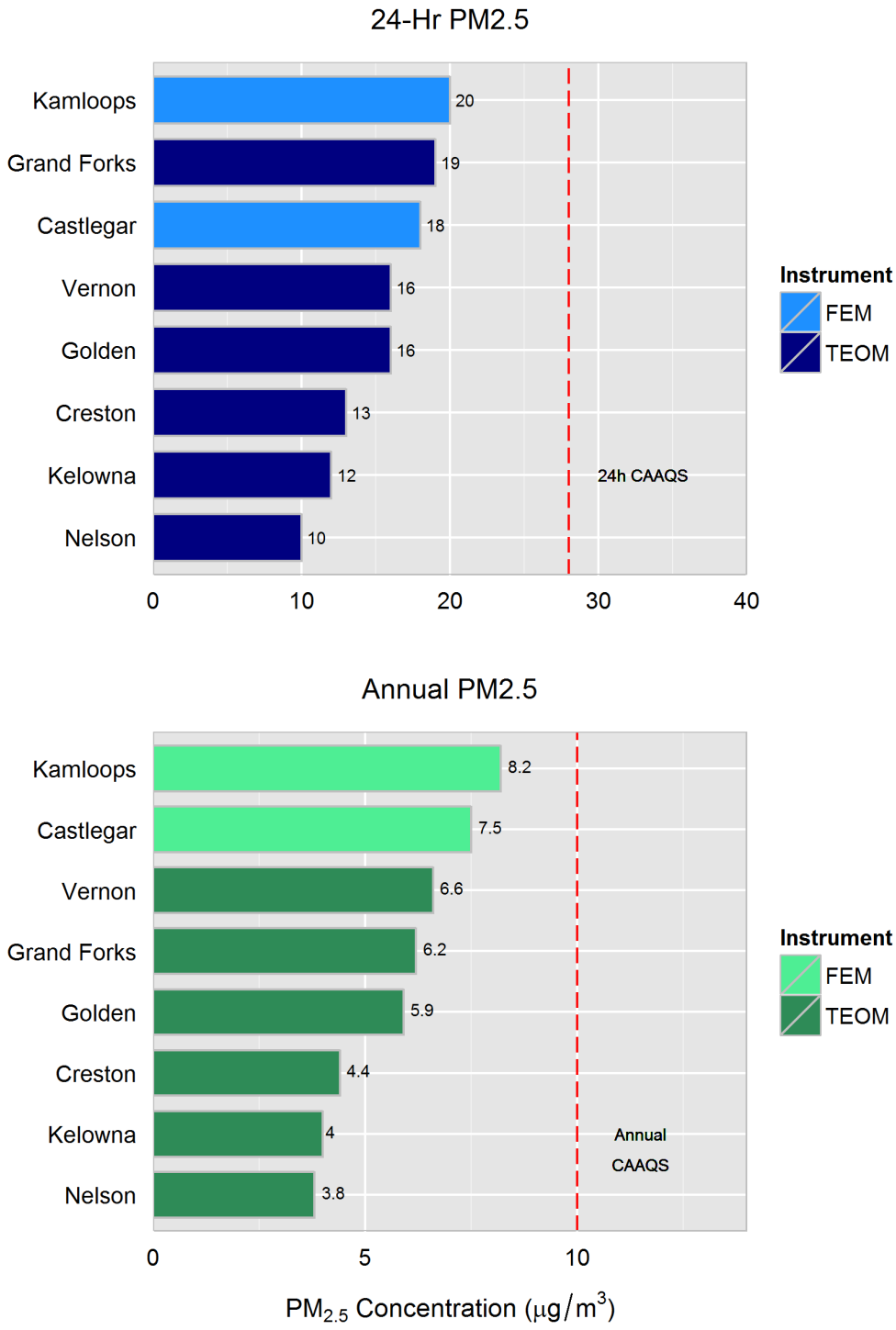

Figure 5. $PM_{2.5}$ concentrations in Southern Interior Air Zone (2011-2013). Upper plot based on 24-hour concentration (annual 98th percentile, averaged over three years). Lower plot based on annual mean concentration (averaged over three years). Red dashed lines identify CAAQS of 28 µg/m^3 (upper plot) and 10 µg/m^3 (lower plot).

Ten-year trends in annual mean $PM_{2.5}$ concentrations are shown in Figure 6. A distinction is made between data collected using the new FEM technology and the older TEOM instruments, as the FEMs generally provide a more complete measure of $PM_{2.5}$. This is reflected in the higher concentrations reported by the FEMs in Kamloops and Castlegar from 2011 onward. Over the 10-year period, no exceedances of the CAAQS level were identified.

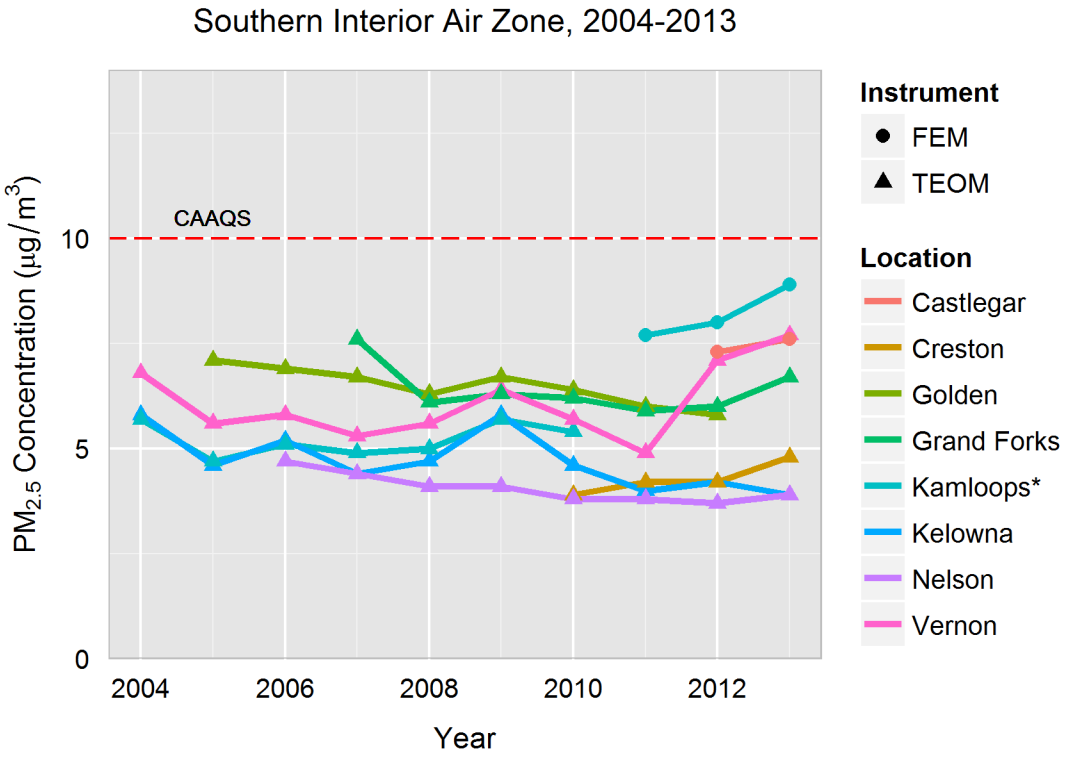

Figure 6. Annual trends in $PM_{2.5}$ concentrations (2004-2013), based on annual mean concentrations. The CAAQS value of 10 µg/m^3 is shown by the red dashed line. $PM_{2.5}$ measurements prior to 2011 are reported at 25°C and 1 atm. From 2011 onward, measurements are reported at local conditions. Kamloops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

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. As a result, the Southern Interior Air Zone is assigned an ozone management level of "orange" due to air quality in Kelowna (see Table 2). Related air quality actions should therefore focus on avoiding exceedance of the CAAQS, particularly in Kelowna.

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

Location	No. Valid Years 2011-2013	4th Highest Daily 8-hour Maxima		Air Zone Management Level
		2013	2011-2013	
Castlegar	2	49.3	50	Goal: Preventing CAAQS Exceedance
Kamloops	2	48.9	51	
Kelowna	3	54.6	60	
Nelson	3	49.1	51	
Vernon	3	51.3	52	

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 an "orange" level on the basis of $PM_{2.5}$ concentrations in Kamloops. This indicates that $PM_{2.5}$-related actions should focus on preventing exceedance of the standards, particularly in Kamloops and Castlegar.

Table 2. Summary of air zone management levels for $PM_{2.5}$ in Southern 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	
Castlegar	FEM	3	7.6	7.5	19.7	18	Goal: Preventing CAAQS Exceedance
Creston	TEOM	3	4.8	4.4	13.5	13	
Golden Hospital	TEOM	2	-	5.9	-	16	
Grand Forks	TEOM	3	6.7	6.2	22.1	19	
Kamloops Fed. Bldg	FEM	3	8.9	8.2	21.3	20	
Kelowna	TEOM	3	3.9	4	11.4	12	
Nelson	TEOM	3	3.9	3.8	10	10	
Vernon	TEOM	3	7.7	6.6	16.9	16	

7. Actions to Protect Air Quality

Over the past decade, public concerns over local air quality have led to the development of a number of local airshed plans in the Southern Interior Air Zone. Changing local priorities has meant that not all are still actively being implemented or updated. Those areas still active in air quality management include:

- Central Okanagan Regional District – Developed first air quality plan in in 2007, focussing on open burning and residential wood burning, and currently finalizing new Clean Air Strategy, which has a greater focus on transportation sources.[1]
- City of Kamloops[2] - Developed an airshed plan in 2011/12 as a key element of the Sustainable Kamloops Plan. The airshed plan outlines actions across multiple source sectors, and is in the process of being implemented.
- City of Merritt[3] - 2007 plan focuses on actions to reduce emissions of $PM_{2.5}$ and PM_{10}.

The Town of Golden and surrounding Columbia Shuswap Regional District are in the process of developing their first air quality plan.[4]

Across the Southern Interior Air Zone and throughout much of B.C., woodsmoke is a priority air quality issue. Through the Provincial Wood Stove Exchange Program, the province provides funding to encourage residents to change out older, smoky wood stoves for low-emission appliances including new CSA-/EPA-certified clean-burning wood stoves. Between 2011 and 2013, the province provided a total of $138,000 to several communities and regional districts within the Southern Interior Air Zone to support local change-out programs. These areas included: Kootenay Boundary, Central Kootenay, Kimberley, Cranbrook, Golden, Central Okanagan, Okanagan-Similkameen and Nicola Valley. A further $43,600 in funding support has been provided for 2014/15.

[1] http://www.kelowna.ca/CM/page438.aspx.
[2] http://www.kamloops.ca/environment/pdfs/13-05-AirshedManagementPlan.pdf
[3] http://www.bcairquality.ca/reports/pdfs/merritt_aqmp.pdf
[4] http://www.goldenairquality.ca/2014/12/golden-airshed-management-planning/.