



Ministry of
Environment and
Climate Change Strategy

Air Quality in Kamloops

Updated tables and figures prepared for Kamloops Air Quality
Committee

Compiled September 19, 2019

Prepared by: Ralph Adams
Environmental Protection Division
Monitoring, Assessment and Stewardship
Kamloops
(250-371-6279) ralph.adams@gov.bc.ca

Data used in this summary

This summary is based on air quality measurements which are available at the Ministry air quality site www.bcairquality.ca. The data used in preparing this summary were downloaded on February 19th, 2019. The analysis and document preparation were done using the R statistical package and L^AT_EX text-processor. The scripts used to generate the analysis and this handout are available on request.

The complete record of fine particulate matter (PM_{2.5}) measurements available for Kamloops were used in the preparation of this summary. This means that both the older TEOM instruments, and the newer Federal Equivalency Method, or FEM, monitors were used in the calculations. The FEM instrument became operational in 2010, with the first full year of data in 2011. The older TEOM instruments are known to underestimate PM_{2.5}, especially under cold winter conditions. This must be kept in mind when interpreting these data.

These data were measured at Ministry Air Quality stations located at the old Mayfair City Works yard in Brocklehurst and the Federal Building downtown. Data from the Upper Aberdeen air station, which was in operation from October 2015 until January 2018, have not been included in this summary.

SUMMARY

- As in 2017, the wildfires of 2018 again had a major impact on air quality in Kamloops. While both the magnitude and duration of elevated levels were lower in 2018 than 2017, the values were far higher than any other previous years. Similar impacts were seen in many interior communities, e.g. Williams Lake and Quesnel. In all these communities annual statistics for fine particulate matter (PM_{2.5}) exceeded ambient air quality objectives in 2018.
- When the effects of the wildfires are removed from the data, there is little indication of a trend in PM_{2.5} statistics in Kamloops since the new FEM instruments became operational in 2010. When wildfire effects are removed, Kamloops meets all ambient air quality objectives except the Provincial annual objective for PM_{2.5}. This objective was not met in 2013, 2014 and 2015. The objective was met in 2011, 2012, 2016, 2017 and 2018.
- In 2020 the Federal CAAQ Objectives for PM_{2.5} will decrease, i.e. become more stringent. The annual average objective (averaged of three consecutive years, with wildfires removed) will decrease from 10 to 8.8 µgm⁻³. Based on the current values and trends, Kamloops will meet the new objectives.
- Available data from the Upper Aberdeen station, historical Partisol data from numerous locations in Kamloops, and the network of Purple Air monitors installed by residents, all indicate that the values measured at the Federal building are representative of the highest values, and, as expected, overall air quality improves with elevation.
- Total Reduced Sulphur gasses (TRS, referred to in the Kamloops Airshed plan as Odorous Reduced Sulphur Gasses or ORSG) do not have health effects at the concentrations observed in Kamloops. However, they result in an objectionable odour which is associated with pulp mills, sewage treatment plants and some natural processes. A common way of reporting levels of these odourous gasses is to count the number of hours in each year where the average measured level was greater than 5 ppb. In Kamloops there was an increase in levels in 2017 and 2018. Part of this is due to the fact that wildfire smoke at high concentrations, as we experienced during the fire seasons of 2017 and 2018, can cause measured TRS levels to rise; however, even when the fire seasons are removed there is still an increase.
- The air contaminant of greatest concern in Kamloops continues to be fine particulate matter (PM_{2.5}). All other contaminants of concern remain well below objective levels.

Table 1: Ambient air quality objectives for fine particulate matter (PM_{2.5}). Objectives include Canadian Objectives (CAAQS), BC Objectives (BCAQO), and World Health Organisation (WHO) objectives. Note that BC also has an annual planning goal of 6 µgm⁻³. The planning goal is intended as a voluntary target to guide airshed planning efforts and encourage communities to maintain good air quality in the face of economic and growth and development.

Contaminant	Avg. Period	Air Quality Objective	Source	Date
PM _{2.5}	annual	8 ¹	BCAQO	2009
		10 ²	CAAQS	2013
		10 ¹	WHO	2016
	24 hr.	25 ³	BCAQO	2009
		28 ⁴	CAAQS	2013
		25 ³	WHO	2016

¹Achievement based on annual average, over one year.

²Achievement based on annual average, averaged over three consecutive years.

³Achievement based on 98th percentile of daily averages, over one year.

⁴Achievement based on 98th percentile of daily averages, averaged over three consecutive years.

Table 2: PM_{2.5} statistics at the Mayfair Street and Federal Building air stations from 1998 until 2018. Values based on both the older TEOM and newer FEM instruments are shown. The statistics shown are those used in the objectives used in table 1: the annual average, the three year running average, the 98th percentile of the daily averages, and the three year running average of the 98th percentile of the daily averages. The TEOM instruments are known to underestimate PM_{2.5} concentrations, particularly in cold winter conditions. The increase in both annual average and the 98th percentile of the daily averages when the FEM instruments are used is clear.

year	annual		annual (3yr)		24 hour		24 hour (3yr)	
	Mayfair	Federal	Mayfair	Federal	Mayfair	Federal	Mayfair	Federal
(all units in μgm^{-3})								
1998	5.7				16			
1999	4.6		5.1		13		14	
2000	5.6		5.3		15		14	
2001	5.3		5.2		13		14	
2002	6.7		5.9		20		16	
2003	7.9		6.6		41		25	
2004	5.7		6.8		17		26	
2005	4.7		6.1		13		24	
2006	5.0		5.1		16		15	
2007	4.9		4.9		14		14	
2008	5.1		5.0		14		15	
2009	5.7		5.2		24		17	
2010	5.4		5.4		32		23	
2011		7.7	5.5			18	28	
2012		7.9		7.8		19		19
2013		8.9		8.2		21		20
2014		9.0		8.6		28		23
2015		8.5		8.8		21		24
2016		7.8		8.5		16		22
2017		15.3		10.6		128		55
2018		12.5		11.9		68		71

Table 3: PM_{2.5} statistics at the Federal Building air station from 2011 until 2018. These values are based only on newer FEM instruments, the first full year of FEM derived data at the Federal air station was 2011. For each year, and for both the annual average and the 98th percentile of the daily average, statistics with and without fires removed are shown. The technique used to remove the effects of wildfires was to replace daily averages during the summer forest fire season (July, August and September), that exceeded 28 µgm⁻³ with the average values for the same day based on years where fires did not have a significant effect on PM_{2.5} levels. For each day replaced, the average for that day in 2011, 2013 and 2016 was used.

year	annual		24 hour	
	fires included	fires removed	fires included	fires removed
	(all units in µgm ⁻³)			
2011	7.7	7.7	18	18
2012	7.9	7.9	19	19
2013	8.9	8.9	21	21
2014	9.0	8.7	28	24
2015	8.5	8.1	21	20
2016	7.8	7.8	16	16
2017	15.3	7.2	128	21
2018	12.5	8.0	68	22

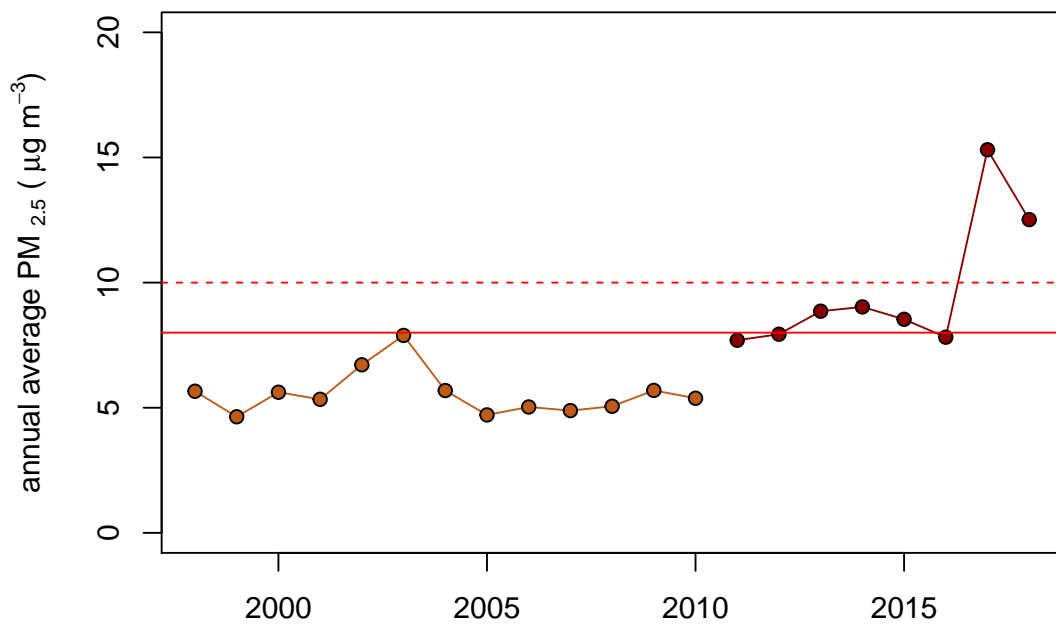


Figure 1: Trend in annual average PM_{2.5} concentrations at the Mayfair (TEOM) and Federal (FEM) air stations. Values from the older TEOM instruments are shown in orange, those from the newer FEM instruments in red. The increase in measured values between the TEOM and FEM instruments is clear. The solid red line indicates the provincial BCAQO of 8 µg m⁻³ and the dashed red line indicates the Canadian CAAQO of 10 µg m⁻³. The effects of fires have not been removed from the data used to calculate these statistics. The effect of wildfires in 2017 and 2018 is clear.

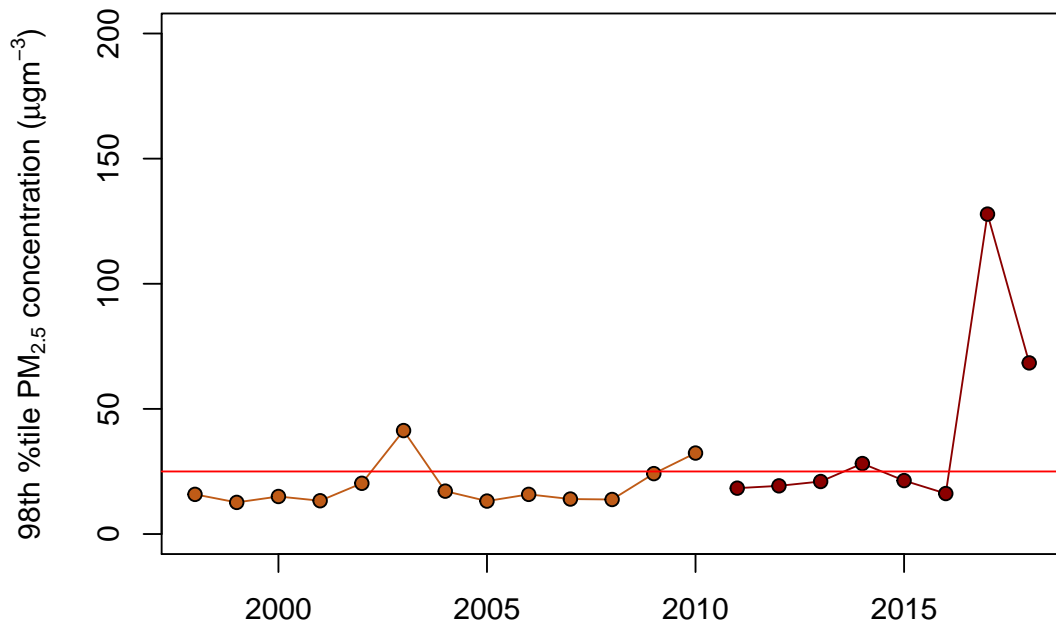


Figure 2: Trend in the 98th percentile of daily average PM_{2.5} concentrations at the Mayfair and Federal air stations. Values from the older TEOM instruments are shown in orange, those from the newer FEM instruments in red. The increase in measured values between the TEOM and FEM instruments is clear. The solid red line indicates the provincial BCAQO of 25 µgm⁻³. The effects of fires have not been removed from the data used to calculate these statistics. The effect of the wildfires in 2003, 2010, 2014, 2017 and 2018 are visible.

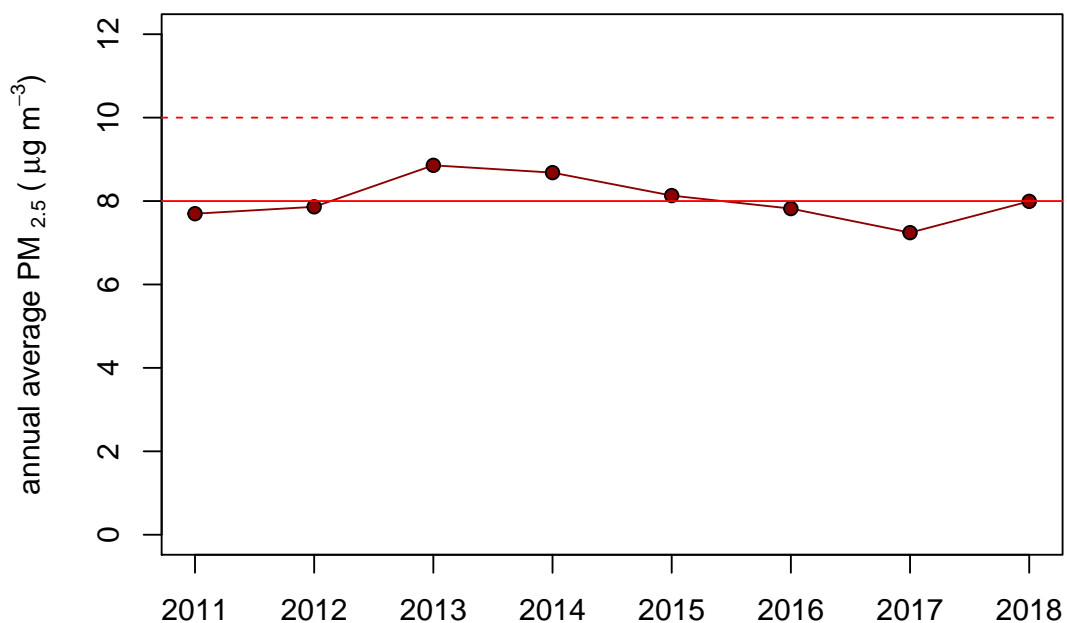


Figure 3: Annual average PM_{2.5} levels at the Federal Building air station from 2011 until 2018. The solid red line indicates the provincial BCAQO of 8 µg m⁻³. The effects of fires have been removed from the data used to calculate these statistics. PM_{2.5} statistics at the Federal Building air station from 2011 until 2018. These values are based only on newer FEM instruments, the first full year of FEM derived data at the Federal air station was 2011. The technique used to remove the effects of wildfires was to replace daily averages during the summer forest fire season (July, August and September), that exceeded 28 µg m⁻³, with the average values for the same day based on years where fires did not have a significant effect on PM_{2.5} levels. For each day replaced, the average for that day in 2011, 2013 and 2016 was used.

Table 4: Total reduced sulphur (TRS) gasses do not carry a health risk at the concentrations encountered in Kamloops, but are considered a nuisance and are included in the airshed plan. The maximum desirable level is 5 ppb averaged over 1 hour. The usual method of reporting these gasses is by adding all the hours in a year above 5 ppb. Hours per year when TRS was greater than 5 ppb, at the Mayfair Street, Firehall 2, and Federal Building air stations from 1983 until 2018. A mobile monitor was located at Firehall 2 for several years after the Mayfair site was closed.

year	Mayfair	Federal	Firehall 2
1983		30	
1984		94	
1985		56	
1986		197	
1987	385	64	
1988	454	29	
1989	344	127	
1990	323	148	
1991	125	96	
1992	113	79	
1993	170	118	
1994	116	104	
1995	125	61	
1996	168	77	
1997	172	92	
1998	204	47	
1999	230	42	
2000	171	46	
2001	131	41	
2002	221	134	
2003	111	42	
2004	70	45	
2005	32	14	
2006	16	3	
2007	21		
2008	8		
2009	41		
2010	77	17	
2011	9	13	1
2012		2	2
2013		6	2
2014		8	
2015		4	
2016		13	
2017		86	
2018		76	

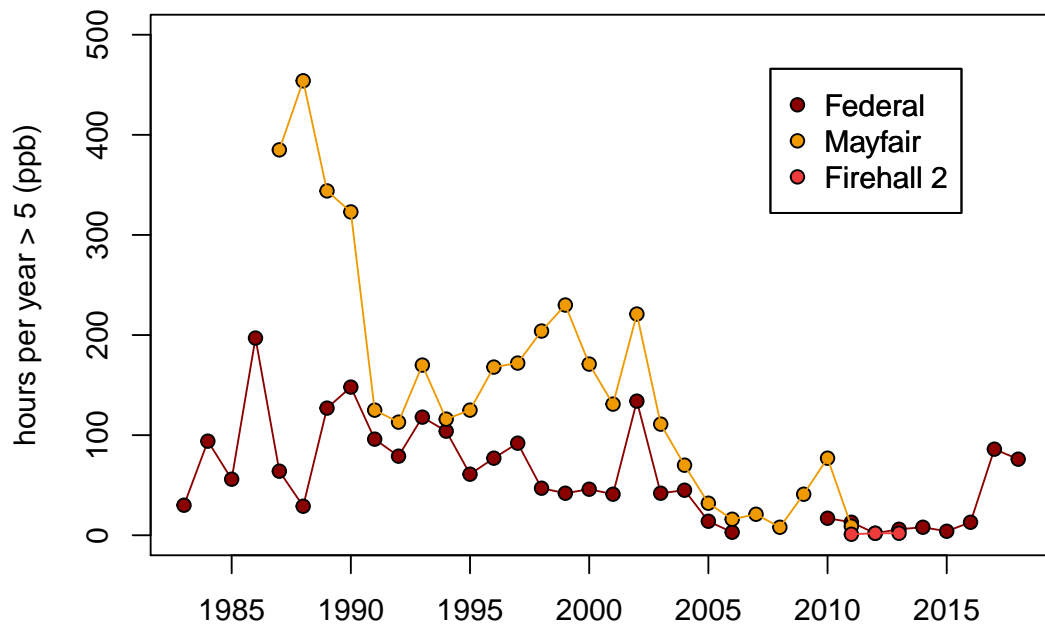


Figure 4: Trend in TRS exceedances at the Mayfair, Federal and Firehall 2 air stations.

Table 5: Ambient air quality objectives for contaminants other than particulate matter. There are objectives for the gasses nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and ground level ozone (GLO). All units are parts per billion (ppb). Objectives include Canadian Objectives (CAAQS), and Interim BC Objectives.

¹Achievement based on 4th highest daily 8-hour maximum, over three consecutive years.

Contaminant	Avg. Period	Air Quality Objective (ppb)	Source	Date
GLO	8 hr.	63 ¹	CAAQS	2013
NO ₂	1 hr.	100 ²	Interim Prov.	2014
		60 ³	CAAQS	2017
	annual	17 ⁴	CAAQS	2017
SO ₂	1 hr.	75 ⁵	Interim Prov.	2016
		70 ⁶	CAAQS	2017
	annual	5 ⁴	CAAQS	2017

²Achievement based on 98th percentile of daily 1 hour maximum, over one year.

³Achievement based on 98th percentile of daily 1 hour maximum, over three years.

⁴Achievement based on annual average of 1 hour averages, averaged over one year.

⁵Achievement based on 97th percentile of daily 1 hour maximum, over one year.

⁶Achievement based on 99th percentile of daily 1 hour maximum, over three years.

Table 6: 99th percentiles of daily maximum 1 hour sulphur dioxide at the Mayfair Street and Federal Building air stations from 1983 until 2018. The CAAQ Objectives listed in table 5 for both annual and daily values were met in all years.

year	Mayfair	Federal
1983		
1984		15.0
1985		15.0
1986		49.9
1987	30.6	
1988	19.8	17.0
1989	18.0	24.5
1990	16.7	24.5
1991	19.6	22.5
1992	20.4	21.6
1993	14.4	16.4
1994	10.9	7.9
1995	10.1	8.3
1996	10.9	9.0
1997	6.0	6.0
1998	14.0	13.0
1999	16.8	10.0
2000	15.4	11.4
2001	23.6	20.9
2002	20.4	15.4
2003	14.0	13.0
2004	14.3	12.0
2005	14.1	11.4
2006	17.0	15.2
2007	21.8	
2008	20.9	
2009	16.3	
2010	13.8	
2011		14.2
2012		15.0
2013		8.5
2014		10.8
2015		11.0
2016		6.6
2017		10.0
2018		4.4

Table 7: Annual means and 98th percentiles of daily maximum 1 hour nitrogen dioxide at the Mayfair Street, Firehall No. 2, and Federal Building air stations from 1998 until 2018. The CAAQ Objectives listed in table 5 for both annual and daily values were met in all years.

year	annual	daily
1998	10.7	40.0
1999	10.8	39.0
2000	12.1	41.0
2001	11.3	42.0
2002	10.4	37.7
2003	10.8	38.0
2004	10.0	37.0
2005	9.9	36.0
2006	11.4	41.0
2007	9.6	34.2
2008	9.7	36.9
2009	8.8	39.3
2010	8.5	29.7
2011	9.7	36.4
2012	11.0	36.3
2013	10.7	34.2
2014	11.8	37.3
2015	11.2	34.7
2016	10.1	35.5
2017	11.3	43.6
2018	11.7	48.2

Table 8: Annual 4th highest daily maximum 8 hour running average ground level ozone at the Mayfair Street, Firehall No. 2, and Federal Building air stations from 1998 until 2018. The CAAQ annual Objective of 63 ppb listed in table 5 was met in all years.

year	annual	3 year
1998	60.3	
1999	57.2	58.8
2000	53.6	57.1
2001	55.1	55.3
2002	56.4	55.0
2003	61.5	57.7
2004	61.9	59.9
2005	54.4	59.2
2006	54.5	56.9
2007	57.2	55.4
2008	55.9	55.9
2009	56.6	56.6
2010	53.9	55.5
2011	51.3	53.9
2012	52.5	52.6
2013	48.9	50.9
2014	50.7	50.7
2015	57.3	52.3
2016	47.2	51.7
2017	55.3	53.3
2018	53.3	51.9