



Prince George Ambient Air Monitoring Program 2007 Air Quality Data Summary

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Omineca and Peace Regions

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Table of Contents

	Page #
EXECUTIVE SUMMARY	1
HIGHLIGHTS	1
1.0 INTRODUCTION	3
2.0 MONITORING RESULTS	4
2.1 PARTICULATE MATTER < 2.5 µm (PM _{2.5}) RESULTS	4
2.1.1 PM _{2.5} Monthly Summary	5
2.1.2 PM _{2.5} Annual Trend	6
2.2 PARTICULATE MATTER < 10 µm (PM ₁₀) RESULTS	7
2.2.1 PM ₁₀ Monthly Summary	7
2.2.2 PM ₁₀ Annual Trends	9
2.3 TOTAL REDUCED SULPHUR (TRS) RESULTS	11
2.3.1 TRS Monthly Summary	11
2.3.2 TRS Annual Trends	13
2.4 SULPHUR DIOXIDE (SO ₂) RESULTS	15
2.4.1 SO ₂ Monthly Summary	15
2.4.2 SO ₂ Annual Trends	18
2.5 NITROGEN DIOXIDE (NO ₂) RESULTS	20
2.5.1 NO ₂ Monthly Summary	20
2.5.2 NO ₂ Annual Trends	21
2.6 OZONE (O ₃) RESULTS	22
2.6.1 O ₃ Monthly Summary	22
2.6.2 O ₃ Annual Trends	22
2.7 CARBON MONOXIDE (CO) RESULTS	24
2.7.1 CO Monthly Summary	24
2.7.2 CO Annual Trends	25
3.0 SUMMARY	25

List of Tables

	Page #
Table 1.1 Prince George air quality monitoring program for 2007	3
Table 1.2 Provincial air quality objectives ($\mu\text{g}/\text{m}^3$) for pollutants monitored in Prince George in 2007	4
Table 2.1.1 2007 monthly summary of continuous $\text{PM}_{2.5}$ data from the Plaza site	5
Table 2.1.2 2007 monthly summary of continuous $\text{PM}_{2.5}$ data from the Gladstone site	5
Table 2.1.3 Annual trend summary of continuous $\text{PM}_{2.5}$ data from the Plaza site.....	6
Table 2.2.1 2007 monthly summary of continuous PM_{10} data from the Plaza site.....	7
Table 2.2.2 2007 monthly summary of continuous PM_{10} data from the Gladstone site.....	8
Table 2.2.3 2007 monthly summary of continuous PM_{10} data from the BCR site	8
Table 2.2.4 Annual trend summary of the continuous PM_{10} data from the Plaza site	9
Table 2.2.5 Annual trend summary of the continuous PM_{10} data from the Gladstone site.....	10
Table 2.2.6 Annual trend summary of the continuous PM_{10} data from the BCR site	10
Table 2.3.1 2007 monthly summary of TRS data from the Jail site.....	11
Table 2.3.2 2007 monthly summary of TRS data from the Plaza site	12
Table 2.3.3 2007 monthly summary of TRS data from the Lakewood site.....	12
Table 2.3.4 Annual trend summary of TRS data from the Jail site.....	13
Table 2.3.5 Annual trend summary of TRS data from the Plaza site	14
Table 2.3.6 Annual trend summary of TRS data from the Lakewood site.....	15
Table 2.4.1 2007 monthly summary of SO_2 data from the Jail site	16
Table 2.4.2 2007 monthly summary of SO_2 data from the Plaza site.....	16
Table 2.4.3 2007 monthly summary of SO_2 data from the CBC site	17
Table 2.4.4 2007 monthly summary of SO_2 data from the Gladstone site	17
Table 2.4.5 Annual trend summary of SO_2 data from the Jail site	18
Table 2.4.6 Annual trend summary of SO_2 data from the Plaza site	19
Table 2.4.7 Annual trend summary of SO_2 data from the CBC site	19
Table 2.5.1 2007 monthly summary of NO_2 data from the Plaza site.....	20
Table 2.5.2 Annual trend summary of NO_2 data from the Plaza site.....	21
Table 2.6.1 2007 monthly summary of O_3 data from the Plaza site	22
Table 2.6.2 Annual trend summary of O_3 data from the Plaza site	23
Table 2.7.1 2007 monthly summary of CO data from the Plaza site.....	24
Table 2.7.2 Annual trend summary of CO data from the Plaza site	25

EXECUTIVE SUMMARY

The 2007 Prince George Air Quality Data Summary summarizes the data of the joint government/industry program to monitor particulate less than two and half microns ($PM_{2.5}$), particulate less than ten microns (PM_{10}), total reduced sulphur (TRS), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ground level ozone (O_3), and carbon monoxide (CO) in Prince George.

Interpretation of the data is limited in this summary report, but will be more extensive in the final Annual Air Quality Report. Anyone wishing further information on the data in this summary or on the monitoring network should contact one of the people listed at the bottom of page 2.

HIGHLIGHTS

Particulate Matter 2.5 ($PM_{2.5}$)

- Continuous $PM_{2.5}$: 2007 values at the Plaza station were the lowest values ever recorded.
- Weather conditions in 2007 were windier and wetter than the previous year.

Particulate Matter 10 (PM_{10})

- Continuous PM_{10} stations: annual averages at all three sites (BCR, Plaza 400 and Gladstone) were much lower than 2006 values.
- The BCR site recorded the greatest number of exceedances (10.2% of the year, 37 days) of the 24 hour Level B objective ($50 \mu\text{g}/\text{m}^3$).
- PM_{10} values at the Plaza 400 site were the lowest ever recorded.
- Weather conditions in 2007 were windier and wetter than the previous year.
- Air Quality Advisories (exceedances of the 24 hour Level B objective) were issued for the Plaza 400 station on 4 occasions in 2007: January 26-29, January 31-February 3, July 13-14 and September 14-15. These advisories lasted a total of 8 days.

Total Reduced Sulphur (TRS)

- The Provincial Level A 1 hour objective ($7\mu\text{g}/\text{m}^3$) was exceeded a maximum of 10.4% of the year at the Jail station, and a minimum of 1.7%, at the Lakewood station.
- The 2007 annual average at all three TRS monitoring sites was lower than in 2006 and was similar to 2005 levels.

Sulfur Dioxide (SO₂)

- The Plaza, Jail, CBC and Gladstone sites recorded SO₂ annual averages of 5.8 µg/m³, 8.0 µg/m³, 10.5 µg/m³ and 4.5 µg/m³ respectively.
- In 2007, the CBC and Jail stations recorded the lowest annual average ever recorded at these sites.
- The CBC site was the only site that exceeded the Provincial Level A one hour objective (450 µg/m³). This objective was exceeded during 7 hours in 2007.

Nitrogen Dioxide (NO₂)

- There were no exceedances of the provincial objectives for NO₂ in 2007, nor have there been any in the data record from Prince George.
- The annual average for 2007 was the second lowest on record for this site.

Ozone (O₃)

- The Provincial Level A 1 hour objective (100 µg/m³) was exceeded for 55 hours (0.6% of the year) at the Prince George site (Plaza 400)
- The annual average for 2007 was the highest in the last 4 years.
- The Provincial Level B 24 hour objective (50 µg/m³) was exceeded more frequently in 2007 than in the previous 5 years.

Carbon Monoxide (CO)

- There were no exceedances of the provincial objectives for CO in 2007, nor have there been any in the data record from Prince George.
- The annual average for 2007 was the lowest recorded at the Plaza site since monitoring began in 2003.

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1.0 INTRODUCTION

Six air quality monitoring stations monitored continuously in 2007. The parameters monitored at each site are listed in Table 1.1.

Table 1.1 Prince George air quality monitoring program for 2007

Site No.	Location	Parameters
0450322	Jail	TRS, SO ₂
0450307	Plaza	PM _{2.5} , PM ₁₀ , TRS, NO _x , SO ₂ , O ₃ , CO
0450324	Lakewood Jr. School	TRS
0450270	Gladstone School	PM ₁₀ , PM _{2.5} , SO ₂
E224013	BCR Warehouse	PM ₁₀
E209179	CBC Transmitter Site	SO ₂

- TRS = Total Reduced Sulphur Compounds (as H₂S)
- SO₂ = Sulphur Dioxide
- NO_x = Nitrogen Oxides (includes nitric oxide (NO) and nitrogen dioxide (NO₂))
- PM₁₀ = Particulate Matter less than 10 microns in size
- PM_{2.5} = Particulate Matter less than 2.5 microns in size
- O₃ = Ozone
- CO = Carbon Monoxide

Air quality objectives of B.C. are generally based on objectives set by the Federal Government in the Clean Air Act (Table 1.2). The objectives are based on protecting human health and protecting the environment and are often set at three levels:

- Level A **Maximum Desirable** for the long-term goal for air quality and forms the basis for anti-degradation policy for the pristine parts of the country and for continuing development of control technology.
- Level B **Maximum Acceptable** is intended to provide adequate protection against the effects of pollution on soil, water, vegetation, materials animals, visibility, personal comfort and well being.
- Level C **Maximum Tolerable** denotes time based concentrations of air contaminants beyond which, due to diminishing margins of safety, appropriate action is required without delay to protect the health of the general population.

Table 1.2 Provincial air quality objectives ($\mu\text{g}/\text{m}^3$) for pollutants monitored in Prince George in 2007

	Averaging Period	Level A	Level B	Level C
Total Reduced Sulphur	1 hour	7.5	28	42
	24 hour	4	6	7.5
Sulphur Dioxide	1 hour	450	900	1300
	24 hour	160	260	360
	Annual	25	50	80
Nitrogen Dioxide	1 hour		400	1000
	24 hour		200	300
	Annual	60	100	
Particulate Matter (PM ₁₀)	24 hour		50	
Ozone	1 hour	100	160	300
	24 hour	30	50	
	Annual		30	
Carbon Monoxide	1 hour	14,300	28,000	35,000
	8 hour	5500	11,000	14,300

2.0 MONITORING RESULTS

2.1 PARTICULATE MATTER < 2.5 μm (PM_{2.5}) RESULTS

Recent health and medical studies have shown that very fine particles may have more serious health impacts than coarser particles (Vedal, 1995; CEPA/FPAC Working Group, 1998; Pope et. al., 2002). Very fine particles have more serious health impacts than coarser particles as they are able to reach deeper into lungs. Also, they remain longer in the atmosphere (sometimes for weeks) and are more complex chemically than the coarser particles. Most PM_{2.5} in Prince George comes from the exhaust from fuel combustion in motor vehicles, space heaters and industrial facilities. The primary natural source of PM_{2.5} is forest fires, due to the high temperatures.

The Ministry operates two continuous PM_{2.5} (particulate matter less than 2.5 micrometres) monitors, which are located at the Plaza and Gladstone sites. The data from these sites is summarized in Tables 2.1.1 and 2.1.2.

2.1.1 PM_{2.5} Monthly Summary

Table 2.1.1 2007 monthly summary of continuous PM_{2.5} data from the Plaza site

	Monthly Average (µg/m ³)	Maximum Hourly (µg/m ³)	No. of Daily Values		Maximum 24 Hour (µg/m ³)	Minimum 24 Hour (µg/m ³)
			>15µg/m ³	>30µg/m ³		
January	7.9	55	6	0	29.1	0.2
February	9.2	58	4	1	43.1	0.9
March	4.0	44	0	0	14.4	0.6
April	5.2	37	1	0	16.9	1.0
May	5.8	36	0	0	11.5	0.3
June	5.8	46	1	0	17.7	0.6
July	6.3	70	3	0	22.0	0.4
August	6.0	49	1	0	19.2	1.1
September	4.3	44	1	0	25.9	0.7
October	7.0	35	1	0	19.2	0.7
November	8.6	44	3	0	24.3	1.0
December	7.3	38	2	0	19.4	0.6
Annual	6.4	70	23	1	43.1	0.2

Table 2.1.2 2007 monthly summary of continuous PM_{2.5} data from the Gladstone site

	Monthly Average (µg/m ³)	Maximum Hourly (µg/m ³)	No. of Daily Values		Maximum 24 Hour (µg/m ³)	Minimum 24 Hour (µg/m ³)
			>15µg/m ³	>30µg/m ³		
January	7.7	41	6	0	29.3	0.1
February	6.3	38	1	0	22.2	0.6
March	3.9	41	0	0	15.4	0.4
April	3.9	32	0	0	16.4	0.5
May	4.6	25	0	0	11.5	0.2
June	6.0	57	0	0	17.4	0.7
July	5.8	60	3	0	22.7	0.5
August	5.0	31	0	0	12.9	0.7
September	3.5	50	1	0	17.8	0.3
October	6.7	38	2	0	20.3	0.8
November	8.7	41	0	0	13.9	1.3
December	-	41	2	0	22.1	0.4
Annual	5.6	60	15	0	29.3	0.1

At the Plaza site, the highest monthly average and maximum 24-hour average occurred in February. The maximum hourly value occurred in July. (Table 2.1.1) At the Gladstone site, the maximum monthly average and 24-hour average occurred in January. The highest maximum hourly value also occurred in July at the Gladstone site (Table 2.1.2).

2.1.2 PM_{2.5} Annual Trend

Table 2.1.3 shows the annual trend summary of PM_{2.5} data for the continuous monitor at Plaza. Monitoring at Gladstone was not long enough to provide a trend (monitoring began February 2005). The annual average in 2007 was the lowest ever recorded at the Plaza site (6.4 µg/m³). The number of daily exceedances of 15 µg/m³ in 2007 was about half of those recorded in previous years.

Table 2.1.3 Annual trend summary of continuous PM_{2.5} data from the Plaza site

Year	Annual Average (µg/m ³)	Maximum Hourly Average (µg/m ³)	No. (%) of Days > 15 µg/m ³		No. (%) of Days > 30 µg/m ³		Maximum Daily Average (µg/m ³)	Hours Instrument Operated
			No.	(%)	No.	(%)		
1997	-	87	14	(28.6%)	5	(10.2%)	52.7	1167*
1998	8.2	119	53	(14.6%)	6	(1.6%)	52.1	8722
1999	6.9	117	33	(9.1%)	3	(0.8%)	31.1	8657
2000	8.5	92	55	(15.2%)	10	(2.8%)	41.1	8634
2001	8.5	139	48	(13.3%)	10	(2.8%)	52.2	8575
2002	8.2	84	42	(11.6%)	8	(2.2%)	58.6	8685
2003	9.8	158	64	(17.7%)	12	(3.3%)	61.4	8614
2004	9.5	127	68	(18.6%)	12	(3.3%)	60.8	8752
2005	7.8	89	45	(12.5%)	4	(1.1%)	47.5	8618
2006	7.5	119	40	(11.0%)	1	(0.3%)	44.3	8729
2007	6.4	70	23	(6.3%)	1	(0.3%)	43.1	8723

*Note: Monitoring started Sept. 1997

2.2 PARTICULATE MATTER < 10 µm (PM₁₀) RESULTS

Larger particles may cause a nuisance or irritation, but PM₁₀, either alone or in combination with other pollutants in the air, causes the greatest health effects because some can be inhaled deep into the lung cavities. Particles less than 10 µm (PM₁₀) tend to stay suspended longer in the atmosphere than larger particles. In Prince George, the major PM₁₀ emission sources are pulp mills, sawmills and road dust.

PM₁₀ is measured either non-continuously (once every third day when samplers are run for 24 hours at a time) (five locations in Prince George), or continuously, using a tapered element oscillating microbalance technology (TEOM) (three locations in Prince George). Continuous data is included in this report.

2.2.1 PM₁₀ Monthly Summary

PM₁₀ is continuously sampled at three locations in Prince George: Plaza 400 building, Gladstone Elementary, and the BCR Warehouse (currently owned by CNR). Tables 2.2.1 to 2.2.3 summarize the PM₁₀ monitoring data at the three continuous monitoring sites in Prince George.

Table 2.2.1 2007 monthly summary of continuous PM₁₀ data from the Plaza site

	Monthly Average (µg/m ³)	Maximum Hourly (µg/m ³)	No. of Daily Values		Maximum 24 Hour (µg/m ³)	Minimum 24 Hour (µg/m ³)
			>50µg/m ³	>100µg/m ³		
January	19.7	166	3	0	66.3	2.4
February	20.3	129	1	0	79.6	4.0
March	16.2	130	0	0	45.6	4.0
April	19.2	106	0	0	48.6	4.8
May	21.6	127	0	0	44.6	5.8
June	18.3	133	2	0	60.9	3.9
July	18.5	121	0	0	58.2	3.2
August	17.0	147	0	0	45.1	3.9
September	16.3	142	1	0	65.2	4.2
October	17.9	88	0	0	48.3	4.9
November	16.6	79	0	0	36.3	4.5
December	12.8	50	0	0	28.0	3.8
Annual	17.8	166	7	0	79.6	2.4

Table 2.2.2 2007 monthly summary of continuous PM₁₀ data from the Gladstone site

	Monthly Average (µg/m ³)	Maximum Hourly (µg/m ³)	No. of Daily Values		Maximum 24 Hour (µg/m ³)	Minimum 24 Hour (µg/m ³)
			>50µg/m ³	>100µg/m ³		
January	16.8	120	2	0	68.6	1.5
February	15.3	95	2	0	68.3	1.9
March	11.5	95	0	0	42.6	3.4
April	11.2	64	0	0	35.3	2.7
May	12.9	61	0	0	29.4	3.0
June	14.1	110	0	0	41.6	4.0
July	12.6	87	0	0	34.4	2.5
August	12.9	66	0	0	32.2	4.2
September	12.5	116	0	0	38.0	4.0
October	13.4	69	0	0	32.9	4.1
November	15.0	82	0	0	32.2	4.6
December	12.6	56	0	0	34.0	3.0
Annual	13.4	120	4	0	68.6	1.5

Table 2.2.3 2007 monthly summary of continuous PM₁₀ data from the BCR site

	Monthly Average (µg/m ³)	Maximum Hourly (µg/m ³)	No. of Daily Values		Maximum 24 Hour (µg/m ³)	Minimum 24 Hour (µg/m ³)
			>50µg/m ³	>100µg/m ³		
January	26.1	411	6	1	104.5	4.5
February	23.3	183	3	0	84.9	4.2
March	21.6	367	3	0	84.0	2.3
April	21.6	128	1	0	57.2	3.5
May	31.8	338	8	0	95.0	5.3
June	26.6	375	2	0	94.8	5.1
July	32.9	335	6	0	111.3	5.7
August	23.8	140	1	0	62.0	7.5
September	24.1	280	4	0	78.5	6.2
October	23.8	132	3	0	69.8	5.5
November	20.3	102	0	0	48.9	5.6
December	15.5	58	0	0	35.5	4.3
Annual	24.3	411	37	1	111.3	2.3

At the Plaza site, the maximum monthly PM₁₀ value occurred in May, the maximum hourly value in January and the maximum 24-hour average in February (Table 2.2.1). There were 7 exceedances of the provincial Level B 24-hour objective of 50 µg/m³ at this site. At the Gladstone site, the maximum monthly average, hourly value and 24-hour average all occurred in January (Table 2.2.2). There were 4 exceedances of the provincial Level B 24-hour objective at this site in 2007. At the BCR site, the highest monthly average and 24-hour average occurred in July with the maximum hourly value in January (Table 2.2.3).

2.2.2 PM₁₀ Annual Trends

In 2007, the annual average at the Plaza, BCR, and Gladstone monitoring sites showed a considerable decrease ranging from 1.8 µg/m³ to 4.9 µg/m³ from the previous year (Tables 2.2.4-2.2.6). The annual average at Plaza was the lowest ever recorded at that site. The annual average for 2007 at Gladstone was the lowest recorded in the past nine years (13.4 µg/m³) and at BCR was the lowest recorded in the past five years (24.5 µg/m³). The number of daily exceedances at the Plaza site in 2007 was also the lowest ever recorded at that site (7 days).

Table 2.2.4 Annual trend summary of the continuous PM₁₀ data from the Plaza site

Year	Annual Average (µg/m ³)	Maximum Hourly Average (µg/m ³)	No. (%) of Days > 50 µg/m ³	No. (%) of Days > 100 µg/m ³	Maximum Daily Average (µg/m ³)	Hours Instrument Operated
1992	21.6	488	18 (6.1%)	0 (0%)	80	7083
1993	22.3	171	11 (4.5%)	0 (0%)	75	5828
1994*	22.3	284	19 (5.6%)	4 (1.2%)	117	8162
1995	24.2	291	33 (9.1%)	2 (0.6%)	108	8686
1996	20.5	373	10 (2.8%)	3 (0.8%)	152	8567
1997	20.2	208	13 (3.6%)	0 (0%)	76	8719
1998	22.7	319	20 (5.5%)	2 (0.5%)	114	8719
1999	17.8	211	10 (2.7%)	0 (0%)	98	8609
2000	18.0	175	9 (2.5%)	0 (0%)	71	8695
2001	18.1	170	9 (2.6%)	1 (0.3%)	110	8442
2002	18.2	154	12 (3.4%)	0 (0%)	75	8495
2003	19.5	199	15 (4.1%)	0 (0%)	100	8669
2004	20.3	170	12 (3.3%)	0 (0%)	69	8713
2005	20.6	202	15 (4.2%)	0 (0%)	78	8532
2006	21.1	201	18 (4.9%)	0 (0%)	82	8723
2007	17.8	166	7 (1.9%)	0 (0%)	80	8688

- Monitor returned in January after upgrades

Table 2.2.5 Annual trend summary of the continuous PM₁₀ data from the Gladstone site

Year	Annual Average (µg/m ³)	Maximum Hourly Average (µg/m ³)	No. (%) of Days > 50 µg/m ³	No. (%) of Days > 100 µg/m ³	Maximum Daily Average (µg/m ³)	Hours Instrument Operated
1996	15.0	253	7 (1.9%)	1 (0.3%)	102	8688
1997	14.8	155	7 (1.9%)	0 (0%)	61	8673
1998	17.2	207	7 (1.9%)	0 (0%)	74	8642
1999	12.7	127	0 (0%)	0 (0%)	47	8663
2000	13.6	148	4 (1.1%)	0 (0%)	55	8686
2001	13.5	164	2 (0.6%)	0 (0%)	78	8610
2002	13.6	109	4 (1.1%)	0 (0%)	68	8707
2003	14.8	237	5 (1.4%)	0 (0%)	74	8623
2004	14.6	175	1 (0.3%)	0 (0%)	57	8594
2005	15.1	217	6 (1.7%)	0 (0%)	64	8270
2006	15.2	163	1 (0.3%)	0 (0%)	57	8543
2007	13.4	120	4 (1.1%)	0 (0%)	69	8650

Table 2.2.6 Annual trend summary of the continuous PM₁₀ data from the BCR site

Year	Annual Average (µg/m ³)	Maximum Hourly Average (µg/m ³)	No. (%) of Days > 50 µg/m ³	No. (%) of Days > 100 µg/m ³	Maximum Daily Average (µg/m ³)	Hours Instrument Operated
1996*	-	125	5 (5.3%)	0 (0%)	68	2263*
1997	24.2	401	32 (8.8%)	2 (0.5%)	111	8705
1998	29.1	582	49 (13.5%)	4 (1.1%)	127	8702
1999	21.3	380	19 (5.5%)	0 (0%)	79	8718
2000	20.0	288	13 (3.6%)	0 (0%)	86	8739
2001	20.1	387	17 (4.7%)	0 (0%)	98	8634
2002	22.1	430	27 (7.4%)	0 (0%)	84	8696
2003	24.4	262	29 (8.1%)	1 (0.3%)	106	8534
2004	25.9	332	50 (14.0%)	0 (0%)	100	8604
2005	27.5	444	43 (11.8%)	3 (0.8%)	114	8666
2006	29.2	455	57 (15.7%)	1 (0.3%)	111	8718
2007	24.3	411	37 (10.2%)	1 (0.3%)	111	8718

* Note: Monitoring started September 28, 1996.

2.3 TOTAL REDUCED SULPHUR (TRS) RESULTS

TRS describes a group of sulphur compounds containing gases made up primarily of one or more of the following four compounds; dimethyl disulphide (DMDS), dimethyl sulphide (DMS), methyl mercaptan (MESH), and hydrogen sulphide (H₂S).

These compounds are largely by-products of the pulping process, that is, these compounds are not added directly but form because of the use of other sulphides in the pulping process. In Prince George, the largest sources of TRS are: pulp mills using the kraft process, oil and gas refineries, and to a small extent automobiles associated with the use of catalytic converters. Natural sources include swamps, bogs, and marshes.

At low levels, TRS is considered to be a nuisance pollutant, causing no adverse health effects, but producing odour problems. However, at levels > 1000 µg/m³, sensitive individuals may suffer headaches and nausea due to extreme odour. It should be noted that levels as high as this have never been recorded at the monitoring sites in Prince George.

2.3.1 TRS Monthly Summary

Tables 2.1 to 2.3 provide monthly and annual summaries of TRS concentrations for each of the Prince George TRS ambient air stations for 2007. Monthly averages ranged from a high of 3.1 µg/m³ at the Plaza site (February) to a low of 0.2 µg/m³ at Lakewood (September). The jail site had the highest annual average followed by Plaza and then Lakewood. The highest monthly averages at all sites occurred during the winter (January and February).

Table 2.3.1 2007 monthly summary of TRS data from the Jail site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>7µg/m ³	>28µg/m ³		>3µg/m ³	>6µg/m ³	
January	2.7	98	1	28	8	6	17.4
February	2.7	99	2	28	8	5	17.0
March	1.2	40	2	40	5	0	6.0
April	2.3	75	3	40	6	3	13.2
May	1.7	69	0	20	8	1	6.4
June	2.5	80	10	61	11	2	12.0
July	2.5	85	5	37	8	5	12.1
August	2.7	91	8	67	10	2	22.2
September	2.8	65	12	81	6	3	18.7
October	1.9	78	0	27	6	2	13.5
November	1.7	43	1	34	5	2	8.2
December	1.8	44	0	26	6	1	7.3
Annual	2.2	867	44	81	87	32	22.2

Table 2.3.2 2007 monthly summary of TRS data from the Plaza site

	Monthly Average ($\mu\text{g}/\text{m}^3$)	No. of 1-Hour Values		Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. of Daily Values		Maximum 24 Hour Average ($\mu\text{g}/\text{m}^3$)
		$>7\mu\text{g}/\text{m}^3$	$>28\mu\text{g}/\text{m}^3$		$>3\mu\text{g}/\text{m}^3$	$>6\mu\text{g}/\text{m}^3$	
January	3.0	116	4	95	9	7	17.3
February	3.1	99	3	31	7	4	17.7
March	0.9	26	1	34	3	0	4.7
April	1.3	39	0	27	5	1	8.1
May	1.1	26	0	11	2	0	3.7
June	1.5	41	1	34	4	1	6.2
July	1.5	47	0	20	5	1	7.5
August	1.9	47	3	67	6	1	12.0
September	1.1	27	1	28	3	1	8.0
October	1.2	39	2	38	2	2	8.5
November	1.5	46	0	23	5	1	7.6
December	1.9	56	0	14	7	1	7.8
Annual	1.6	609	15	95	58	20	17.7

Table 2.3.3 2007 monthly summary of TRS data from the Lakewood site

	Monthly Average ($\mu\text{g}/\text{m}^3$)	No. of 1-Hour Values		Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. of Daily Values		Maximum 24 Hour Average ($\mu\text{g}/\text{m}^3$)
		$>7\mu\text{g}/\text{m}^3$	$>28\mu\text{g}/\text{m}^3$		$>3\mu\text{g}/\text{m}^3$	$>6\mu\text{g}/\text{m}^3$	
January	1.2	36	0	18	3	2	8.4
February	1.2	39	0	26	3	2	12.9
March	0.5	6	0	11	0	0	2.6
April	0.4	5	0	10	0	0	2.9
May	0.3	0	0	6	0	0	1.6
June	0.3	3	0	9	0	0	1.6
July	0.5	0	0	4	0	0	2.0
August	0.6	12	0	26	2	0	4.6
September	0.2	5	0	11	1	0	3.4
October	0.5	12	0	18	2	0	5.2
November	0.6	8	0	9	1	0	3.9
December	1.0	11	0	10	5	0	4.6
Annual	0.6	137	0	26	17	4	12.9

2.3.2 TRS Annual Trends

The TRS data from the Plaza, the Jail and Lakewood stations were examined to reveal trends in Prince George. The following tables (Table 2.3.4 - Table 2.3.6) summarize the TRS data from the three stations over the last 25 to 27 years. In terms of proximity and exposure to major TRS sources, the Jail site has the highest exposure, followed by the Plaza and Lakewood stations.

A major improvement in TRS levels occurred between 1988 and 1991, and since 1991, TRS levels have declined gradually. The annual average concentrations at all three sites were less than 2006 averages. Exceedances of the Level B one-hour TRS objective at the Plaza and Jail sites were the highest recorded over the past three years. Please note that the maximum daily average (from midnight to midnight) calculated in the annual trends may be different from the maximum 24-hour average (rolling average) calculated in the monthly summaries.

Table 2.3.4 Annual trend summary of TRS data from the Jail site

Year	Annual Average ($\mu\text{g}/\text{m}^3$)	No. (%) of 1-Hour Values		Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. (%) of Daily Values		Maximum Daily Average ($\mu\text{g}/\text{m}^3$)	No. of hours Instrument Operated
		>7 $\mu\text{g}/\text{m}^3$	>28 $\mu\text{g}/\text{m}^3$		>3 $\mu\text{g}/\text{m}^3$	>6 $\mu\text{g}/\text{m}^3$		
1981	7.2	1673 (21.7%)	638 (8.3%)	177	151 (47.0%)	121 (37.7%)	59.6	7701
1982	-	1169 (23.8%)	519 (10.6%)	149	125 (61.0%)	99 (48.3%)	53.5	4915
1983	11.0	2051 (27.3%)	1066 (14.2%)	156	184 (58.8%)	151 (48.2%)	70.2	7511
1984	6.5	1341 (17.6%)	593 (7.8%)	170	136 (42.8%)	109 (34.3%)	54.8	7638
1985	6.4	1483 (19.1%)	546 (7.0%)	149	145 (44.8%)	117 (36.1%)	44.9	7773
1986	9.8	2404 (29.1%)	1028 (12.4%)	347	197 (57.1%)	169 (49.0%)	68.0	8268
1987	11.6	2268 (29.0%)	1306 (16.7%)	382	200 (59.0%)	175 (51.6%)	86.0	7817
1988	11.6	2307 (27.9%)	1343 (16.2%)	312	197 (54.6%)	166 (46.0%)	94.6	8267
1989	9.2	1852 (25.8%)	793 (11.0%)	212	174 (54.5%)	134 (42.0%)	68.3	7183
1990	5.4	927 (14.3%)	215 (3.3%)	177	91 (32.6%)	66 (23.7%)	46.7	6494
1991	3.1	1195 (14.4%)	138 (1.7%)	126	117 (32.3%)	61 (16.9%)	39.2	8316
1992	3.7	1103 (14.9%)	71 (1.0%)	78	109 (34.0%)	66 (20.6%)	17.7	7387
1993	3.8	1343 (16.7%)	201 (2.5%)	69	123 (35.4%)	86 (24.8%)	37.7	8061
1994	3.1	1214 (15.1%)	108 (1.3%)	57	119 (35.0%)	67 (19.7%)	19.7	8017
1995	3.3	1274 (15.2%)	73 (0.9%)	64	157 (43.1%)	64 (17.6%)	23.0	8359
1996	2.6	1043 (12.5%)	42 (0.5%)	62	112 (30.8%)	53 (14.6%)	18.8	8359
1997	2.5	1157 (13.9%)	42 (0.5%)	55	119 (32.7%)	37 (10.2%)	21.3	8347
1998	3.1	1488 (17.9%)	57 (0.7%)	51	138 (38.2%)	62 (17.2%)	26.1	8314
1999	2.4	1085 (13.4%)	44 (0.5%)	123	107 (30.2%)	43 (12.1%)	26.5	8117
2000	2.4	1079 (13.1%)	37 (0.5%)	62	105 (28.8%)	43 (11.8%)	18.4	8214
2001	2.2	1106 (13.2%)	13 (0.2%)	37	93 (25.7%)	42 (11.6%)	20.2	8352
2002	2.1	894 (10.7%)	35 (0.4%)	44	85 (23.2%)	31 (8.5%)	18.5	8375
2003	2.7	1267 (15.1%)	55 (0.7%)	61	120 (32.9%)	56 (15.3%)	21.7	8374
2004	2.8	1300 (15.7%)	64 (0.7%)	84	119 (32.5%)	61 (16.7%)	18.2	8300
2005	2.1	967 (11.6%)	7 (<0.1%)	34	97 (26.6%)	27 (7.4%)	14.1	8347
2006	2.3	1010 (12.1%)	30 (0.4%)	47	98 (27.3%)	38 (10.6%)	15.1	8324
2007	2.2	867 (10.6%)	42 (0.5%)	81	87 (24.2%)	32 (8.9%)	22.2	8152

Table 2.3.5 Annual trend summary of TRS data from the Plaza site

Year	Annual Average ($\mu\text{g}/\text{m}^3$)	No. (%) of 1-Hour Values		Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. (%) of Daily Values		Maximum Daily Average ($\mu\text{g}/\text{m}^3$)	No. of hours Instrument Operated
		$>7\mu\text{g}/\text{m}^3$	$>28\mu\text{g}/\text{m}^3$		$>3\mu\text{g}/\text{m}^3$	$>6\mu\text{g}/\text{m}^3$		
1980	5.9	1085 (16.0%)	449 (6.6%)	163	127 (45.0%)	85 (30.1%)	62.4	6772
1981	6.0	1276 (16.9%)	566 (7.5%)	241	136 (43.2%)	101 (32.1%)	53.8	7558
1982	5.3	1241 (15.1%)	445 (5.4%)	198	156 (45.5%)	111 (32.4%)	41.3	8235
1983	8.6	1670 (20.7%)	817 (10.1%)	177	180 (53.4%)	150 (44.5%)	90.5	8082
1984	4.7	978 (11.9%)	372 (4.5%)	227	121 (35.2%)	84 (24.4%)	51.7	8246
1985	4.8	875 (12.3%)	406 (5.7%)	297	106 (35.8%)	78 (26.4%)	81.6	7115
1986	7.9	1295 (20.1%)	677 (10.5%)	289	126 (46.8%)	102 (37.9%)	61.4	6456
1987	9.0	1806 (21.8%)	972 (11.7%)	218	174 (48.2%)	143 (39.6%)	69.0	8280
1988	7.3	1633 (19.7%)	792 (9.5%)	194	159 (44.0%)	121 (33.5%)	69.4	8297
1989	5.9	1376 (16.9%)	594 (7.3%)	184	140 (40.8%)	111 (32.4%)	41.8	8166
1990	2.7	905 (11.0%)	187 (2.3%)	122	100 (28.0%)	57 (16.0%)	47.0	8234
1991	2.2	925 (11.2%)	43 (0.5%)	58	84 (23.3%)	46 (12.8%)	19.4	8256
1992	2.1	882 (10.6%)	34 (0.4%)	69	89 (24.5%)	49 (13.5%)	18.4	8300
1993	2.4	956 (11.4%)	92 (1.1%)	72	89 (24.6%)	54 (14.9%)	29.8	8360
1994	1.9	790 (9.5%)	22 (0.3%)	67	84 (23.3%)	34 (9.4%)	19.1	8295
1995	1.9	757 (9.2%)	20 (0.2%)	44	93 (26.1%)	32 (9.0%)	20.5	8205
1996	1.7	622 (7.5%)	28 (0.3%)	103	71 (19.8%)	25 (7.0%)	27.2	8262
1997	1.6	654 (7.8%)	13 (0.2%)	40	65 (17.9%)	22 (6.0%)	12.9	8371
1998	2.2	958 (11.6%)	9 (0.1%)	50	88 (24.6%)	32 (8.9%)	19.5	8245
1999	1.7	784 (9.5%)	13 (0.2%)	44	71 (19.8%)	24 (6.7%)	18.5	8247
2000	1.5	675 (8.1%)	16 (0.2%)	45	58 (15.9%)	23 (5.5%)	21.8	8314
2001	1.7	882 (10.7%)	5 (0.1%)	35	68 (18.7%)	25 (6.9%)	21.0	8257
2002	1.7	726 (8.9%)	25 (0.3%)	57	61 (17.3%)	25 (7.1%)	16.4	8167
2003	2.1	963 (11.7%)	41 (0.5%)	61	95 (26.6%)	31 (8.7%)	16.5	8220
2004	2.0	918 (10.9%)	36 (0.4%)	41	83 (22.7%)	26 (7.1%)	22.3	8384
2005	1.5	573 (6.9%)	2 (<0.1%)	37	63 (17.4%)	11 (3.0%)	12.0	8333
2006	1.9	718 (8.6%)	11 (0.1%)	47	73 (20.1%)	23 (6.3%)	16.4	8340
2007	1.6	609 (7.3%)	15 (0.2%)	95	58 (15.9%)	20 (5.5%)	17.7	8352

Table 2.3.6 Annual trend summary of TRS data from the Lakewood site

Year	Annual Average ($\mu\text{g}/\text{m}^3$)	No. (%) of 1-Hour Values		Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. (%) of Daily Values		Maximum Daily Average ($\mu\text{g}/\text{m}^3$)	No. of hours Instrument Operated
		$>7\mu\text{g}/\text{m}^3$	$>28\mu\text{g}/\text{m}^3$		$>3\mu\text{g}/\text{m}^3$	$>6\mu\text{g}/\text{m}^3$		
1982*	-	176 (3.0%)	22 (0.4%)	85	22 (9.1%)	13 (5.4%)	19.7	5785
1983	2.6	615 (7.9%)	147 (1.9%)	99	79 (24.5%)	43 (13.4%)	40.7	7737
1984	0.9	199 (2.4%)	15 (0.2%)	64	34 (9.9%)	10 (2.9%)	15.4	8269
1985	1.0	216 (2.9%)	28 (0.4%)	50	29 (9.3%)	12 (3.9%)	21.6	7456
1986	1.7	439 (5.6%)	110 (1.4%)	71	51 (15.7%)	32 (9.9%)	27.1	7807
1987	1.6	461 (6.0%)	106 (1.4%)	92	51 (15.6%)	34 (10.4%)	35.7	7680
1988	1.1	270 (3.6%)	38 (0.5%)	64	38 (11.8%)	23 (7.1%)	17.5	7462
1989	0.7	170 (2.8%)	33 (0.5%)	92	22 (8.1%)	8 (2.9%)	28.0	6057
1990	-	66 (1.2%)	3 (< 0.1%)	79	8 (3.4%)	1 (0.4%)	10.5	5484
1991	0.6	173 (2.3%)	3 (< 0.1%)	37	19 (5.7%)	4 (1.2%)	18.7	7667
1992	0.6	214 (2.6%)	0	27	22 (6.0%)	9 (2.5%)	11.7	8351
1993	0.9	307 (4.4%)	5 (< 0.1%)	50	31 (9.7%)	13 (4.4%)	19.4	6952
1994	0.6	147 (1.8%)	2 (< 0.1%)	74	21 (5.9%)	4 (1.1%)	11.5	8196
1995	0.9	270 (3.2%)	2 (< 0.1%)	37	37 (10.2%)	11 (3.0%)	15.0	8358
1996	0.7	227 (2.7%)	8 (0.1%)	44	27 (7.5%)	7 (1.9%)	15.0	8281
1997	0.7	174 (2.1%)	0	27	17 (4.8%)	4 (1.1%)	9.8	8211
1998	0.7	215 (2.6%)	0	18	21 (6.0%)	5 (1.4%)	10.7	8204
1999	0.6	172 (2.1%)	1 (< 0.1%)	28	14 (4.0%)	5 (1.4%)	9.5	8191
2000	0.5	157 (1.9%)	0	23	15 (4.1%)	3 (0.8%)	12.8	8348
2001	0.7	249 (3.0%)	0	23	21 (5.8%)	9 (2.5%)	13.0	8345
2002	0.6	191 (2.3%)	0	23	18 (5.2%)	6 (1.7%)	10.5	8254
2003	0.6	178 (2.1%)	0	23	12 (3.3%)	2 (0.5%)	8.8	8370
2004	0.8	261 (3.4%)	13 (0.2%)	44	22 (6.0%)	10 (2.7%)	28.2	7621
2005	0.8	133 (1.6%)	0	16	13 (3.7%)	3 (0.8%)	7.8	8175
2006	0.8	166 (2.0%)	0	21	15 (4.2%)	3 (0.8%)	12.3	8283
2007	0.6	137 (1.7%)	0	26	17 (4.9%)	4 (1.2%)	12.9	8010

* Instrument Operated June - December 1982

2.4 SULPHUR DIOXIDE (SO₂) RESULTS

Sulphur dioxide is formed primarily by the combustion of material containing sulphur. It is a colourless gas and at concentrations above $900 \mu\text{g}/\text{m}^3$ (the hourly Level B objective), it has a pungent odour. Very high levels of SO₂ can cause breathing discomfort, respiratory illness, alterations in the lung's defences, and aggravation of existing respiratory and cardiovascular diseases. At present, major sources of SO₂ in the Prince George area include the oil refinery and pulp mills.

2.4.1 SO₂ Monthly Summary

The sulphur dioxide (SO₂) data are summarized in Tables 2.4.1- 2.4.4. The annual average ambient SO₂ levels were within the Provincial objectives at all stations. Only the CBC site recorded Level A hourly exceedances. The CBC station recorded seven exceedances with the highest one-hour average concentration ($615 \mu\text{g}/\text{m}^3$).

Table 2.4.1 2007 monthly summary of SO₂ data from the Jail site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>450µg/m ³	>900µg/m ³		>20µg/m ³	>160µg/m ³	
January	7.6	0	0	276	6	0	68.7
February	10.9	0	0	329	7	0	54.9
March	4.0	0	0	209	1	0	46.6
April	12.7	0	0	167	8	0	46.9
May	11.0	0	0	183	8	0	39.9
June	9.1	0	0	162	5	0	36.5
July	9.0	0	0	180	4	0	57.0
August	9.4	0	0	246	6	0	62.7
September	2.1	0	0	61	0	0	17.7
October	6.5	0	0	172	2	0	110.7
November	5.1	0	0	143	1	0	32.2
December	9.2	0	0	127	4	0	77.9
Annual	8.0	0	0	329	52	0	110.7

Table 2.4.2 2007 monthly summary of SO₂ data from the Plaza site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>450µg/m ³	>900µg/m ³		>20µg/m ³	>160µg/m ³	
January	6.7	0	0	94	4	0	29.7
February	8.5	0	0	104	4	0	46.0
March	3.6	0	0	74	0	0	9.6
April	4.7	0	0	75	0	0	20.2
May	5.7	0	0	103	0	0	20.2
June	5.0	0	0	78	1	0	22.5
July	5.7	0	0	131	1	0	30.8
August	7.2	0	0	124	1	0	35.1
September	4.8	0	0	120	1	0	31.8
October	3.6	0	0	52	0	0	16.4
November	5.2	0	0	80	0	0	24.6
December	9.0	0	0	103	4	0	49.8
Annual	5.8	0	0	131	16	0	49.8

Table 2.4.3 2007 monthly summary of SO₂ data from the CBC site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>450µg/m ³	>900µg/m ³		>20µg/m ³	>160µg/m ³	
January	14.8	2	0	485	7	0	134.6
February	17.6	2	0	599	10	0	149.6
March	3.9	0	0	159	2	0	52.2
April	15.6	1	0	456	10	0	85.3
May	11.3	0	0	268	9	0	56.1
June	11.5	0	0	384	5	0	68.2
July	12.7	1	0	554	6	0	129.5
August	14.6	1	0	615	7	0	98.0
September	4.8	0	0	196	3	0	45.7
October	4.1	0	0	193	2	0	64.0
November	4.2	0	0	175	0	0	34.4
December	-	0	0	225	3	0	42.0
Annual	10.4	7	0	615	64	0	149.6

Table 2.4.4 2007 monthly summary of SO₂ data from the Gladstone site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>450µg/m ³	>900µg/m ³		>20µg/m ³	>160µg/m ³	
January	5.8	0	0	59	2	0	28.1
February	6.6	0	0	88	2	0	37.1
March	2.9	0	0	45	0	0	12.7
April	4.1	0	0	54	0	0	17.9
May	3.3	0	0	57	0	0	16.9
June	2.1	0	0	43	0	0	6.6
July	3.5	0	0	117	1	0	22.3
August	5.2	0	0	98	1	0	24.1
September	2.3	0	0	96	0	0	11.7
October	3.7	0	0	75	1	0	24.9
November	5.8	0	0	56	1	0	25.0
December	8.9	0	0	160	5	0	51.2
Annual	4.5	0	0	160	13	0	51.2

Aside from the Jail station, the highest monthly averages at SO₂ monitoring sites in Prince George are either in February or December with the maximum hourly average occurring in the summer months (July & August). At the Jail station, the highest monthly average was recorded in April and the maximum hourly average occurred in February.

2.4.2 SO₂ Annual Trends

The annual concentrations at the Jail, Plaza and CBC sites have decreased over the past three years. The 2007 annual average concentration at the CBC site was the lowest since monitoring began at that site. The annual average at the Jail and Plaza sites were the lowest recorded in 17 years and 5 years, respectively. At the Plaza site, the maximum hourly value for 2007 was the lowest recorded at this site. Because of the short duration of monitoring at Gladstone, no trend summary was provided in this report.

Table 2.4.5 Annual trend summary of SO₂ data from the Jail site

Year	Annual Average	No. of 1-Hour Values	Maximum Hourly Average	No. of Daily Values	Maximum Daily Average	No. of Hours Instrument
	(µg/m ³)	>450µg/m ³	(µg/m ³)	>160µg/m ³	(µg/m ³)	Operated
1986	16.9	4	538	0	152.5	8278
1987	12.8	2	666	0	123.0	8348
1988	13.8	8	586	1	173.8	8412
1989	12.0	1	659	0	99.6	8165
1990	5.5	0	283	0	56.7	6719
1991	8.7	1	492	0	118.1	8236
1992	12.1	1	450	0	104.0	8363
1993	10.9	0	363	0	81.8	8225
1994	12.5	1	469	0	123.0	8162
1995	20.5	1	530	0	118.8	8354
1996	23.7	10	735	2	189.8	8368
1997	20.5	4	759	0	143.2	8350
1998	18.6	1	469	0	129.0	7580
1999	10.0	0	306	0	103.9	8358
2000	9.0	0	415	0	96.3	8362
2001	12.1	1	458	1	164.7	8348
2002	11.6	1	519	0	82.3	8367
2003	13.2	0	336	0	91.7	8373
2004	11.7	0	341	0	74.7	8396
2005	11.7	0	339	0	92.9	8360
2006	10.2	0	374	0	80.0	8373
2007	8.0	0	329	0	108.3	8366

Table 2.4.6 Annual trend summary of SO₂ data from the Plaza site

Year	Annual Average	No. of 1-Hour Values	Maximum Hourly Average (µg/m ³)	No. of Daily Values	Maximum Daily Average (µg/m ³)	No. of Hours Instrument Operated
	(µg/m ³)	>450µg/m ³		>160µg/m ³		
1995	-	2	474	0	156.3	5323*
1996	15.8	13	913	1	167.9	8229
1997	14.6	8	663	0	118.3	8363
1998	11.9	0	399	0	93.5	8220
1999	7.2	1	490	0	105.3	8703
2000	7.4	0	341	0	58.7	8071
2001	9.5	1	455	1	173.0	8340
2002	7.2	1	527	0	68.0	8362
2003	5.7	0	333	0	53.5	8365
2004	4.7	0	349	0	48.2	8348
2005	7.6	1	490	0	101.0	8201
2006	7.2	0	244	0	62.4	8369
2007	5.8	0	131	0	46.3	8356

* Instrument installed May 1995

Table 2.4.7 Annual trend summary of SO₂ data from the CBC site

Year	Annual Average	No. of 1-Hour Values	Maximum Hourly Average (µg/m ³)	No. of Daily Values	Maximum Daily Average (µg/m ³)	No. of Hours Instrument Operated
	(µg/m ³)	>450µg/m ³		>160µg/m ³		
1995	-	4	597	0	101.1	5096*
1996	23.9	10	794	4	189.3	8370
1997	20.1	9	778	2	197.7	8312
1998	22.6	10	597	1	224.0	8361
1999	13.0	11	751	1	227.1	8560
2000	-	2	519	0	142.4	6958
2001	16.2	10	969	4	193.7	8347
2002	12.5	4	623	0	104.4	8348
2003	15.9	11	623	1	163.3	8348
2004	15.5	6	703	0	126.8	8371
2005	13.6	6	761	0	146.7	8360
2006	13.0	6	633	0	112.8	8307
2007	10.4	7	615	0	149.6	8072

* Instrument installed May 1995

2.5 NITROGEN DIOXIDE (NO₂) RESULTS

Nitrogen dioxide is a reddish-brown gas with a pungent and irritating odour in concentrations over 250 µg/m³. The NO₂ absorbs short wave blue light, leaving longer wavelengths that cause it to appear reddish-brown.

NO₂ is emitted as either a primary pollutant (emitted directly from high temperature combustion sources) or as a secondary pollutant which is produced by the oxidation of nitric oxide. Nitric oxide is formed during high temperature combustion, primarily from motor vehicle exhaust and stationary combustion (e.g. industrial processes, waste incineration, and residential and commercial heating). Emissions of nitric oxide are greater during winter months when there is an increase in the use of heating fuels and in the vehicle idling.

2.5.1 NO₂ Monthly Summary

The nitrogen dioxide data from the Plaza site (only NO₂ monitor in Prince George) is summarized in Table 2.5.1. Ambient NO₂ levels were well within the Provincial objectives, with no Level A hourly or daily exceedances. The highest monthly averages occurred from January to February and November to December.

Table 2.5.1 2007 monthly summary of NO₂ data from the Plaza site

	Monthly Average (µg/m ³)	No. of 1-Hour Values	Maximum Hourly Average (µg/m ³)	No. of Daily Values	Maximum 24 Hour Average (µg/m ³)
		>400µg/m ³		>200µg/m ³	
January	26.1	0	82	0	58.8
February	27.1	0	90	0	62.1
March	21.8	0	85	0	44.6
April	22.2	0	75	0	41.7
May	18.3	0	72	0	34.1
June	14.2	0	66	0	31.3
July	14.3	0	73	0	29.1
August	15.4	0	51	0	27.2
September	16.4	0	56	0	35.9
October	17.7	0	68	0	38.5
November	24.0	0	74	0	47.1
December	29.9	0	96	0	64.8
Annual	20.6	0	96	0	64.8

2.5.2 NO₂ Annual Trends

Trends were not assessed previously due to periods of missing data in 1995, 2000, 2004 and 2005. This was related to component failures and schedule analyzer replacement. The annual average in 2007 was the second lowest ever recorded at Plaza (Table 2.5.2). The maximum hourly and maximum daily averages have increased over the past 3 years.

Table 2.5.2 Annual trend summary of NO₂ data from the Plaza site

Year	Annual Average (µg/m ³)	No. of 1-Hour Values >400µg/m ³	Maximum Hourly Average (µg/m ³)	No. of Daily Values >200µg/m ³	Maximum Daily Average (µg/m ³)	No. of Hours Instrument Operated
1992	-	0	61	0	97.0	4825*
1993	25.4	0	149	0	83.3	8072
1994	23.7	0	130	0	70.7	7852
1995	-	0	101	0	61.5	4957**
1996	25.9	0	151	0	84.6	7787
1997	24.3	0	186	0	91.5	8242
1998	28.7	0	143	0	67.1	8051
1999	25.6	0	143	0	99.1	8218
2000 (a)	-	0	149	0	81.9	5070**
2001	23.0	0	111	0	81.5	8295
2002	20.2	0	138	0	75.1	8176
2003	20.8	0	105	0	63.4	8297
2004 (b)	-	0	122	0	69.1	7244**
2005	-	0	84	0	56.3	6577**
2006	26.4	0	92	0	58.0	8283
2007	20.6	0	96	0	61.3	8319

* Note: NO₂ Analyzer Installed in June 1992

** Note: NO₂ Operational Problems

(a) Note: NO₂ Analyzer replaced on November 22, 2000

(b) Note: NO₂ Analyzer replaced on April 13, 2004

2.6 OZONE (O₃) RESULTS

Ground level ozone is produced when oxides of nitrogen (NO_x) react with volatile hydrocarbons in the presence of sun light. Ozone is termed a secondary pollutant because it is produced from a photochemical reaction involving primary pollutants (NO_x and volatile hydrocarbons).

2.6.1 O₃ Monthly Summary

Table 2.6.1 summarizes the ozone data recorded at the Plaza station (the only O₃ monitor in Prince George). The maximum one-hour level (128 µg/m³) was recorded on July 14th. The greatest number of exceedances of the one-hour objective occurred in June. Exceedances of the 24-hour Level A objective occurred eleven or more days in every month in 2007. Exceedance of the 24-hour Level B objective occurred for one or more days in every month in 2007. Monthly averages for March, April, and May were higher than the 24-hour Level B objective.

Table 2.6.1 2007 monthly summary of O₃ data from the Plaza site

	Monthly Average (µg/m ³)	No. of 1-Hour Values		Maximum Hourly Average (µg/m ³)	No. of Daily Values		Maximum 24 Hour Average (µg/m ³)
		>100µg/m ³	>160µg/m ³		>30µg/m ³	>50µg/m ³	
January	35.7	0	0	83	18	9	69.0
February	35.4	0	0	81	17	5	73.3
March	56.1	12	0	119	29	26	100.9
April	56.6	1	0	101	27	20	87.5
May	60.5	16	0	110	31	26	89.0
June	43.7	18	0	115	27	8	70.9
July	37.7	8	0	128	23	4	59.9
August	28.8	0	0	86	13	1	62.0
September	30.8	0	0	97	15	2	63.5
October	33.9	0	0	77	20	4	62.7
November	28.6	0	0	85	11	3	65.5
December	30.5	0	0	78	13	4	70.1
Annual	39.9	55	0	128	244	112	100.9

2.6.2 O₃ Annual Trends

Annual averages, since monitoring started in 1995, have been gradually increasing at the Plaza site until 2001, then decreased until 2005. The annual average O₃ level in 2007 was the highest in the last four years and there were more exceedances of the Level B daily objective in 2007 than in the previous five years.

Table 2.6.2 Annual trend summary of O₃ data from the Plaza site

Year	Annual Avg. (µg/m ³)	No. (%) of 1-Hour Values		Max. Hourly Avg. (µg/m ³)	No. of 8-Hr. Values >130µg/m ³	Max. 8-Hr. Avg. (µg/m ³)	No. (%) of Daily Values		Max. 24-Hr. Avg. (µg/m ³)	No. of Hours Instr. Operated
		>100µg/m ³	>160µg/m ³				>30µg/m ³	>50µg/m ³		
1995	-	30 (0.5%)	0	112	0	104	109 (45.2%)	32 (13.3%)	76.7	5548*
1996	35.7	21 (0.2%)	0	120	0	109	209 (58.2%)	87 (24.2%)	91.1	8632
1997	36.5	84 (1.0%)	0	122	0	109	225 (62.0%)	95 (26.2%)	86.0	8674
1998	37.2	175 (2.0%)	0	158	3	134	223 (61.9%)	89 (24.7%)	99.3	8619
1999	38.5	152 (1.8%)	0	140	0	118	224 (62.2%)	94 (26.1%)	107.7	8583
2000	37.4	182 (2.1%)	0	132	0	115	200 (55.1%)	89 (24.5%)	107.2	8632
2001	41.8	214 (2.5%)	2	169	3	136	243 (67.3%)	127 (35.2%)	101.5	8577
2002	41.4	152 (1.8%)	0	128	0	116	245 (67.5%)	124 (34.2%)	101.5	8610
2003	40.2	136 (1.6%)	0	135	0	120	246 (67.4%)	113 (31.0%)	97.4	8581
2004	38.3	130 (1.5%)	1	174	1	132	224 (61.7%)	88 (24.2%)	96.8	8605
2005	34.9	44 (0.5%)	0	121	0	103	192 (54.1%)	78 (22.0%)	94.3	8436
2006	38.0	35 (0.4%)	0	129	0	112	249 (68.6%)	87 (24.0%)	89.8	8545
2007	39.9	55 (0.7%)	0	128	0	110	244 (62.4%)	112 (31.2%)	100.9	8542

* Note: API Analyzer installed in late April 1995

2.7 CARBON MONOXIDE (CO) RESULTS

Carbon monoxide is produced as a product of incomplete combustion of fossil fuels. Carbon monoxide is an odourless, colourless, and tasteless gas. At high concentrations it is toxic and death can result from asphyxiation.

2.7.1 CO Monthly Summary

Table 2.7.1 summarizes the carbon monoxide data recorded at the Plaza station (the only CO monitor in Prince George). The maximum one-hour level ($3890\mu\text{g}/\text{m}^3$) was recorded on January 30th. No exceedances of the one-hour or eight-hour objectives were recorded in 2007. Monthly averages tend to be the highest during winter and the lowest during summer.

Table 2.7.1 2007 monthly summary of CO data from the Plaza site

	Monthly Average ($\mu\text{g}/\text{m}^3$)	No. of 1-Hour Values $>14300\mu\text{g}/\text{m}^3$	Maximum Hourly Average ($\mu\text{g}/\text{m}^3$)	No. of 8-Hour Values $>5500\mu\text{g}/\text{m}^3$	Maximum 8 Hour Average ($\mu\text{g}/\text{m}^3$)
January	487.1	0	3972	0	1908
February	482.7	0	3603	0	1830
March	345.4	0	1350	0	759
April	334.7	0	882	0	687
May	296.1	0	890	0	520
June	266.9	0	732	0	527
July	299.6	0	678	0	513
August	307.9	0	996	0	639
September	294.5	0	1071	0	660
October	380.6	0	1877	0	1003
November	375.4	0	2055	0	1298
December	446.4	0	2250	0	1416
Annual	358.3	0	3972	0	1908

2.7.2 CO Annual Trends

The annual average for CO in 2007 was the lowest ever recorded at this site. Levels since 2004 have been gradually decreasing. No exceedances of the one-hour or eight-hour objectives were ever recorded at this site.

Table 2.7.2 Annual trend summary of CO data from the Plaza site

	Annual Average	No. of 1-Hour Values	Maximum Hourly Average	No. of 8-Hr Values	Maximum 8 Hour Average	No. of Hours Instrument
	($\mu\text{g}/\text{m}^3$)	>14300 $\mu\text{g}/\text{m}^3$	($\mu\text{g}/\text{m}^3$)	>5500 $\mu\text{g}/\text{m}^3$	($\mu\text{g}/\text{m}^3$)	Operated
2003	536.4	0	5007	0	3668	8349
2004	540.1	0	5128	0	3404	7785*
2005	430.0	0	3243	0	2138	8122
2006	407.1	0	3563	0	2080	8378
2007	366.0	0	3890	0	1754	8310

* Note: Instrumentation problems from Nov. 15th – Dec. 31st, 2004

3.0 SUMMARY

More details and interpretation of these results will be provided in the “2007 Annual Air Quality Report for Prince George” which will be made available to the Ministry’s website:

http://www.env.gov.bc.ca/epd/regions/omineca/air/annual_info.htm

Copies of this and the more detailed report are also available by contacting the regional Environmental Protection staff listed at the bottom of the executive summary (Page 2 of this report).