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Manitoba Ambient Air Quality

Annual Reports for 2003, 2004 and 2005

B. P. Krawchuk
A. Snitowski, Summer Student
Air Quality Section
Programs Division

Manitoba
Conservation

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Includes at least 10% post-consumer waste

Krawchuk, B.P. & Snitowski, A., 2008 *Manitoba Ambient Air Quality Annual Reports for 2003, 2004 and 2005*, Manitoba Conservation, Air Quality Section, Report No. 2008 01, xvi+ 86

ABSTRACT

As part of an on-going environmental quality monitoring program, Manitoba Conservation monitored the quality of ambient air at several urban locations during 2003, 2004 and 2005. This monitoring consisted of the use of established monitoring sites having dedicated instrumentation primarily for continuous air sampling and analysis. The ambient air quality program is structured to determine air quality in two areas: general urban air quality and air quality near some selected industries. This report covers data from the above activities of Manitoba Conservation and selected other ambient monitoring performed by companies under Manitoba Environment Act requirements.

The general urban air quality program consisted primarily of sampling activities within the Federal/-Provincial National Air Pollution Surveillance (NAPS) program. Sampling at NAPS sites consisted of measurement of the following air pollutants: carbon monoxide, nitrogen dioxide, nitric oxide, nitrogen oxides, ground level ozone, total suspended particulate matter, inhalable particulate, volatile organic compounds, polycyclic aromatic hydrocarbons, aldehydes and ketones, lead, sulphates and nitrates. Of these contaminants, inhalable particulate matter (PM_{10}) most often exceeded the 24-hour provincial objectives/guideline. Based on the Canadian Annual Index of Air Quality, the air quality at the downtown and residential stations in Winnipeg was rated "Good" (the best rating) most of the time (>91%).

The monitoring of air quality near specific industries having (or potentially having) atmospheric emissions was restricted to the areas around the Northern smelters (at Flin Flon and Thompson) and an industrial park in Brandon. Monitoring was specifically for the pollutant(s) of industrial emission. Data from Flin Flon showed a continuing presence within the community of elevated sulphur dioxide levels with occasional excursions above air quality objectives. That said, air quality in Flin Flon continues to improve with fewer excursions than in previous years. Some ammonia levels above air quality objectives were observed in the Brandon industrial park area.

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RÉSUMÉ

Dans le cadre d'un programme permanent de surveillance de la qualité de l'environnement, le ministère de la Conservation du Manitoba a suivi de près la qualité de l'air ambiant dans plusieurs secteurs urbains durant les années 2003, 2004 et 2005. Ce suivi a été effectué par l'intermédiaire de prélèvements d'air en continu à des fins d'analyse dans plusieurs stations de surveillance pourvues d'instruments de mesure essentiellement destinés à cette tâche. Le programme de surveillance de la qualité de l'air a deux grands axes : déterminer la qualité globale de l'air en région urbaine ainsi que celle observée à proximité de certaines industries bien particulières Ce rapport fait le bilan des données recueillies dans le cadre du programme mené par le ministère de la Conservation du Manitoba et incorpore également des résultats du même genre recueillis par des entreprises privées, en vertu de la *Loi sur l'environnement* du Manitoba.

Le programme de surveillance de la qualité générale de l'air en région urbaine relève du Réseau national de surveillance de la pollution atmosphérique (RNSPA) mis en œuvre par les gouvernements fédéral et provincial. Il consistait principalement à prélever des échantillons d'air pour y mesurer les quantités de polluants atmosphériques suivants : le monoxyde de carbone, le dioxyde d'azote, le monoxyde d'azote, les autres oxydes d'azote, l'ozone au niveau du sol, les matières particulaires totales en suspension, les particules en suspension inhalables, les composés organiques volatils, les hydrocarbures aromatiques polycycliques, les aldéhydes et les cétones, le plomb, les sulfates et les nitrates. Les échantillons prélevés ont révélé que la quantité totale de particules en suspension inhalables (PM_{10}) excédait le plus souvent les lignes directrices et les objectifs provinciaux établis pour une période de 24 heures. Selon l'indice annuel canadien, la qualité de l'air aux stations du centre-ville et à celles des secteurs résidentiels de Winnipeg a été qualifiée de « bonne » (meilleure cote de l'indice) dans la grande majorité des cas (+ de 91 %).

La qualité de l'air à proximité d'industries qui émettent des déchets atmosphériques n'a été évaluée que dans les régions proches des fonderies du Nord (à Flin Flon et à Thompson) ainsi qu'à proximité d'un

parc industriel de Brandon. Les analyses étaient plus particulièrement orientées vers la détection des émissions industrielles. Les relevés faits à Flin Flon ont montré une présence continue et élevée de dioxyde de soufre dans l'air ambiant de cette collectivité, qui dépassait occasionnellement les objectifs de qualité de l'air fixés. Ceci étant dit, la qualité de l'air à Flin Flon continue de s'améliorer, et il y a moins de dépassements enregistrés que lors des années précédentes. Des relevés faits dans la zone du parc industriel de Brandon ont montré des niveaux d'ammoniac dépassant les objectifs de qualité de l'air fixés.

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As	Arsenic
Cd	Cadmium
CO	Carbon Monoxide
COH	Coefficient of Haze
Cu	Copper
D.L.	Detection Limit
IQUA	Index of the Quality of Air
MAL	Maximum Acceptable Level
MDL	Maximum Desirable Level
MTL	Maximum Tolerable Level
N/A	Not Available
NAPS	National Air Pollution Surveillance (air quality monitoring network)
N.D.	Not Detected
NH_3	Ammonia
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NO_3^-	Nitrates
O_3	Ozone (ground level)
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCDD/PCDF	PolyChlorinated Dibenzo-*p*-Dioxins/PolyChlorinated Dibenzo-*p*-Furans
$PM_{2.5}$	Inhalable Particulate (particulate matter 2.5 µm or less in diameter)
PM_{10}	Inhalable Particulate (particulate matter 10 µm or less in diameter)
$24PM_{2.5}$	Inhalable particulate measured continuously over a 24 hour period
$24PM_{10}$	Inhalable particulate measured continuously over a 24 hour period
pg/m^3	Picograms (10^{-12} g) per cubic metre
pphm	parts per hundred million (by volume)
ppm	parts per million (by volume)
SO_2	Sulphur Dioxide
$SO_4^=$	Sulphates
TSP	Total Suspended Particulate matter
$\mu g/m^3$	micrograms (10^{-6} g) per cubic metre
µm	micrometre ($1x10^{-6}$ metre)
VOC	Volatile Organic Compounds
Zn	Zinc
>	greater than
<	less than

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INTRODUCTION

The Province of Manitoba has monitored ambient air quality at several locations throughout Manitoba since 1968. During 2003, 2004 and 2005, monitoring activities by Manitoba Conservation and companies, under Environment Act requirements, took place in Winnipeg, Brandon, Thompson, and Flin Flon. This report presents a summary and a discussion of these data generated by the above monitoring activities during 2003, 2004, and 2005 (January 1 through December 31, inclusive).

The majority of sampling is of a continuous nature involving dedicated monitors in permanent stations and can be divided into two basic categories: (1) General or Urban Air Quality monitoring; and (2) Source specific or Industrial monitoring. Much of the General or Urban Air Quality monitoring is performed under the auspices of the Federal-Provincial National Air Pollution Surveillance (NAPS) program, which provides a nationwide data base for determining air quality levels across Canada, and also documents trends arising as a result of changing industrial activity, fuel use, population density and use of pollution control strategies.

Source specific or Industrial monitoring is performed by the Impingement Program within the Air Quality Section as well as by the regulated companies. This monitoring contributes to the evaluation of ambient air quality in the vicinity of specific industries in order to determine compliance with Provincial Air Quality Guidelines and Objectives.

This report covers the 2003, 2004 and 2005 data for the following parameters: Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Nitric Oxide (NO), Nitrogen Oxides (NO_x), Ground Level Ozone (O_3), Ammonia (NH_3), Sulphur Dioxide (SO_2), Total Suspended Particulate (TSP), Inhalable Particulate matter (PM_{10}), Fine Particulate matter ($PM_{2.5}$), Lead (Pb), Sulphates ($SO_4^{=}$), Nitrates (NO_3^-), Arsenic (As), Cadmium (Cd), Copper (Cu), Zinc (Zn), Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Dibenzo-*p*-Dioxins/Furans (PCDDs/PCDFs) and Aldehydes and Ketones.

The purposes of this report is to:

1) Outline ambient air monitoring activities in the Province during 2003, 2004 and 2005;

2) Provide summary statistics and a comparison to air quality objectives and/or guidelines (where applicable);

3) Compare 2003, 2004 and 2005 data with previous years; and

4) Provide a rating of the air quality relative to the Canadian Annual Index of Air Quality for major monitoring sites.

BACKGROUND

A) Manitoba Air Quality Objectives and Guidelines

The Province of Manitoba has adopted the National Ambient Air Quality objectives for those pollutants for which such objectives have been promulgated (sulphur dioxide, suspended particulate matter, carbon monoxide, ozone, and nitrogen dioxide). Air Quality Guidelines have been developed and adopted by the Province for other specific pollutants (Manitoba Conservation 2002 & 2005).

The guidelines have three levels: the maximum tolerable level (MTL), the maximum acceptable level (MAL) and the maximum desirable level (MDL).

In the majority of cases, urban air quality is expected to meet the MAL, whereas, in rural areas, it is the long term goal to ensure that the MDLs are not exceeded.

A list of "Ambient Air Criteria" currently endorsed by Manitoba Conservation can be found in the previous report (Krawchuk, 2002) as well as on the Internet at the following URL: http://www.gov.mb.ca/conservation/airquality/aq-criteria/index.html

B) POLLUTANTS

Characterization of the air pollutants mentioned in this report is as follows:

Carbon Monoxide (CO) is a colourless, odourless and tasteless gas slightly lighter than air. It is considered a dangerous asphyxiant because it combines strongly with the hemoglobin of the blood and reduces the blood's ability to carry oxygen to cell tissues. CO is a product of incomplete combustion of carbon and is emitted by fossil fuel combustion sources (e.g. motor vehicles). CO is measured on a continuous basis by the technique of non-dispersive infrared spectrometry and the data are generally reported in the form of hourly averages from which further time-weighted averages can be determined.

Nitrogen Dioxide (NO_2) is a reddish-brown gas with a pungent, irritating odour. It originates chiefly from combustion sources as well as from conversion of nitric oxide. Nitrogen dioxide exerts its primary toxic effect on the lungs and can be associated with increased susceptibility to respiratory infections and abnormal dilation of the air spaces and distension of the lung's walls. Nitrogen dioxide also suppresses vegetation growth, causes corrosion of metals, reduces visibility, and acts as a precursor in the formation of ground level ozone by reacting with hydrocarbons. It is measured continuously by the technique of chemiluminescence with data reported as hourly averages.

Nitrogen dioxide is also recognized as a significant contributor to the formation of acid rain.

Nitric Oxide (NO) is a colourless, odourless and tasteless gas which in nature is produced by biological action but in polluted atmospheres is produced primarily by fuel combustion in both stationary and mobile sources. By itself nitric oxide is not usually considered a pollutant but, in a polluted atmosphere, it is readily oxidized to nitrogen dioxide through a photochemical secondary reaction. Nitric oxide is measured concurrently with nitrogen dioxide by the technique of chemiluminescence and the data are processed as hourly averages.

Ozone (O_3) is a pungent irritating gas formed naturally at high altitudes (i.e. in the stratosphere) by a photochemical reaction involving molecular and atomic oxygen. Ozone and other oxidants are formed in a polluted atmosphere at ground level as a result of a rather wide variety of photochemical reactions

involving nitrogen oxides and reactive hydrocarbons. In the stratosphere, ozone acts as a beneficial shield to screen unwanted ultraviolet radiation, whereas at ground level it is a pollutant. The overall effect of ozone is a stinging of the eyes and the mucous membranes. It is also responsible for an increase in asthma and other respiratory effects. Ozone reduces crop yields, injures vegetation and weakens materials such as rubber and certain fabrics, and is a major component of smog. Ground level ozone is measured by use of UV photometry and data are reported as hourly averages.

Ammonia (NH_3) is a colourless gaseous alkaline compound of nitrogen and hydrogen. It is lighter than air, has an extremely pungent smell and taste, is very soluble in water, and can be easily condensed by cold and pressure to a liquid state. Ammonia is an important industrial and agricultural compound used both as is and combined with other chemicals. Typical uses are as a fertilizer and as an explosive. Ammonia is not a major air pollutant but, on occasion, it can be a nuisance. It is measured continuously by the technique of chemiluminescence with data reported as hourly averages.

Sulphur Dioxide (SO_2) is a colourless gas with a pungent irritating odour. It is emitted primarily from the combustion of fossil fuels containing sulphur and from primary non-ferrous smelting. It is usually recognized as one of the major atmospheric pollutants. Sulphur dioxide causes an increased frequency of respiratory disease symptoms and lung disease. It also causes marked effects on vegetation, corrodes materials, and may oxidize in the atmosphere to form sulphuric acid and sulphates. Sulphur dioxide is the major contributor to the formation of acid rain. Sulphur dioxide is measured by use of the pulsed fluorescence technique with data reported as hourly averages.

Total Suspended Particulate (TSP) matter is a general term which applies to a large variety of inert solid or liquid particles of a size and configuration such that they remain suspended in the air and can be drawn into the respiratory passages. These types of particles, usually in the size range of 0.1 to 100 microns (μm), may originate as a result of industrial processes, human activities and from natural sources such as wind swept or entrained dust. By itself, or in association with other pollutants, TSP, in high enough concentration, may injure the respiratory system. TSP also may reduce visibility and contribute to property damage and soiling. A high volume air sampler is used to collect the particles on a Teflon or

glass fibre filter and results are reported as integrated 24-hour concentrations of mass of particulate matter per volume of air (volume-weighted).

Inhalable Particulate matter (PM_{10} and $PM_{2.5}$) is a fraction of the total suspended particulate (both solid and liquid) found in the air. It is defined as the range of particles (solid and liquid) between 0.1 and 10 μm and 0.1 and 2.5 μm (respectively) in diameter that can penetrate into the tracheobronchial and alveolar regions of the lungs. A dichotomous sampler is used to collect the sample: a fine fraction less than 2.5 μm, and a coarse fraction between 2.5 and 10 μm. Combining the fine and coarse fractions gives the total for PM_{10} in a 24-hour period. A TEOM model 1400 PM_{10} monitor is also being used to give real time instantaneous readings at the Winnipeg downtown and residential stations, Flin Flon and Brandon. Results are reported as hourly averages and the running 24-hour average is used for calculations in determining the Air Quality Index.

Lead (Pb) exists in the atmosphere primarily as a particulate resulting from certain source industries and from entrainment of dust previously affected by the combustion of leaded gasoline. Exposure to lead will adversely affect human health (especially young children) by absorption into the bloodstream and impairment of heme synthesis in cells. Other adverse effects associated with elevated blood lead levels include the possibility of nervous system damage. Lead is analyzed from a representative portion of the total suspended particulate collected by high volume sampling. Air concentrations are reported as integrated 24-hour concentrations of mass of lead per volume of air.

Other Heavy Metals: Copper (Cu), Cadmium (Cd), Zinc (Zn), and Arsenic (As) are constituents of TSP and are of interest in areas near point sources such as smelters. Up to July 2005 there are no Manitoba air quality Guidelines or Objectives for these substances. At that time the Ontario criteria for these metals have been used where applicable.

Volatile Organic Compounds (VOCs) are a group of organic compounds in the alkaline, aromatic, alkyl halide and halogenated aromatic categories. Many of these are of concern due to their toxicity and role in photochemical oxidation. VOCs in combination with NO_x and sunlight produce ground level ozone, a

major component of urban smog. Sampling is conducted over a 24-hour period once every sixth day. Stainless steel canisters are used for collection and the samples are analyzed by Environment Canada.

Polycyclic aromatic Hydrocarbons (PAHs) are a group of organic compounds in the polycyclic aromatic category (2+ benzene rings fused together). Some of these are of concern due to their mutagenicity and carcinogenicity. Sampling was conducted over a 24-hour period once every twelve days. Teflon filters and Poly Urethane Foam (PUF) plug canisters are used for collection and the samples are analyzed by Environment Canada.

Polychlorinated Dibenzo-p-Dioxins (PCDDs) and Polychlorinated Dibenzo-p-Furans (PCDFs) are chemical compounds containing two benzene rings that are joined by two oxygen atoms in the case of dioxins and by one oxygen and a direct bond between the rings in the case of furans. Both molecules have eight positions which can be chlorinated. There are 75 possible chlorinated dibenzo-p-dioxin isomers ranging from 2 monochloro-species through 22 tetrachoro species to 1 octachloro species. There are 135 possible chlorinated dibenzo-p-furan species. PCDDs and PCDFs can be formed as a byproduct during the combustion (natural or otherwise) of any chlorine containing materials such as plactics, coal, trees, etc. Of the dibenzo-p-dioxins the 2,3,7,8-tetrachlorodibenzo-p-dioxin isomer is the most toxic and is the one to which the toxicity of all the other isomers are compared to by means of a toxic equivalent factor (TEF). Of the 75 possible PCDDs only 7 have been identified as having a toxicity similar to 2,37,8-TCDD. Of the 135 possible PCDFs 10 have been identified with dioxin-like toxicity. These are the 17 compounds that are listed in Table 12. Sampling was conducted over a 24-hour period once every twenty-four days. Teflon filters and Poly Urethane Foam (PUF) plug canisters are used for collection and the samples are analyzed by Environment Canada.

Aldehydes and Ketones (carbonyls) are aliphatic (straight or branched chain) or aromatic (containing a benzene ring) hydrocarbons which also contain a carbonyl (C=O) group in either the end position (in the case of aldehydes) or non-end position (as in the case of ketones). These chemicals are used in a variety of ways. They are solvents and intermediaries in the manufacture of other chemicals and substances. Certain of these compounds also find use as disinfectants, bactericides, fungicides and as flavouring and

preserving agents. They are all flammable and have distinctive odours. In high vapour concentrations, many are irritants of the respiratory tract. Some of these compounds are also classified as mutagens and possible carcinogens. Sampling for these compounds is conducted over a 24-hour period every six days. A pre-coated cartridge is used to collect the sample and analysis is done by Environment Canada.

C) SAMPLING SITES

Figure 1 is a map of the urban areas included in the Manitoba Ambient Air Quality Monitoring Network. Figures 2 through 5 depict the monitoring locations within each of the urban centres.

Air monitoring stations are listed in more detail in Table 1 as to location, code number, pollutants monitored, and monitoring period during 2003, 2004 and 2005.

TABLE 1 **AMBIENT AIR MONITORING SITES (2003-2005)**

AREA	CODE	SAMPLING SITE LOCATION	SAMPLING PERIOD	POLLUTANTS MONITORED
Winnipeg (Downtown) NAPS Station	9119	65 Ellen Street	Jan. - Dec.	CO, NO_2, NO, NO_x, O_3, PM_{10}, $PM_{2.5}$, VOCs, PAHs, PCDD/PCDFs & Carbonyls
Winnipeg (Residential) NAPS Station	9118	299 Scotia Street	Jan. - Dec.	CO, NO_2, NO, NO_x, O_3, $PM_{2.5}$
Brandon (Industrial)	5131	Assiniboine Community College (Lot)	Jan. - Dec.	NH_3, NO_2, NO, NO_x, O_3, PM_{10}, $PM_{2.5}$
Flin Flon	7251	Provincial Building, 143 Main Street	Jan. - Dec.	SO_2, TSP, NO_3^-, $SO_4^=$, PM_{10}, $PM_{2.5}$, Pb, As, Cd, Cu, Zn
	7271*	Aqua Centre	Jan. - Dec.	SO_2
	7281*	HBM&S Staffhouse	Jan. - Dec.	SO_2
	7284*	Ruth Betts	Jan. - Dec.	TSP, As, Cd, Cu, Pb, $SO_4^=$, Zn, PM_{10}
	7283*	Creighton, Sask. - School	From June /97	TSP, As, Cd, Cu, Pb, $SO_4^=$, Zn, PM_{10}
	7291*	Creighton, Sask. Fire Hall	Jan. - Dec.	SO_2
	7301*	Hapnot Collegiate	Jan. - Dec.	SO_2
Thompson	7351*	Water Treatment Plant	Jan. - Dec.	SO_2
	7361*	Eastwood School	Jan. - Dec.	SO_2
	7371*	Riverside School	Jan. - Dec.	SO_2
	7381 *	Westwood School	Jun. – Dec. ‘	SO_2
	7381	Westwood School	Jun – Dec	PM_{10}, PM_2

* denotes company supplied data

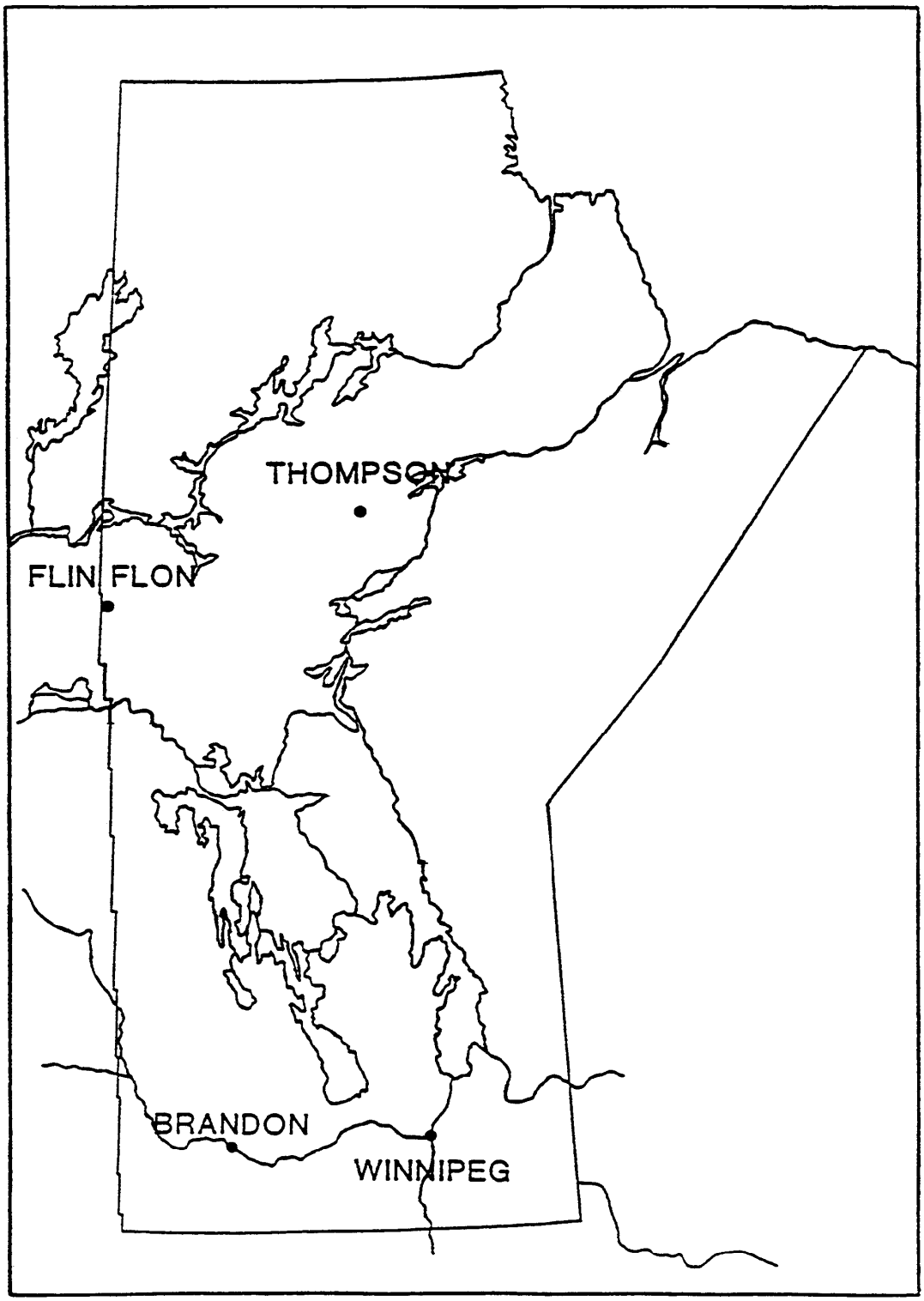

Figure 1. Urban Manitoba Ambient Air Quality Monitoring Network locations.

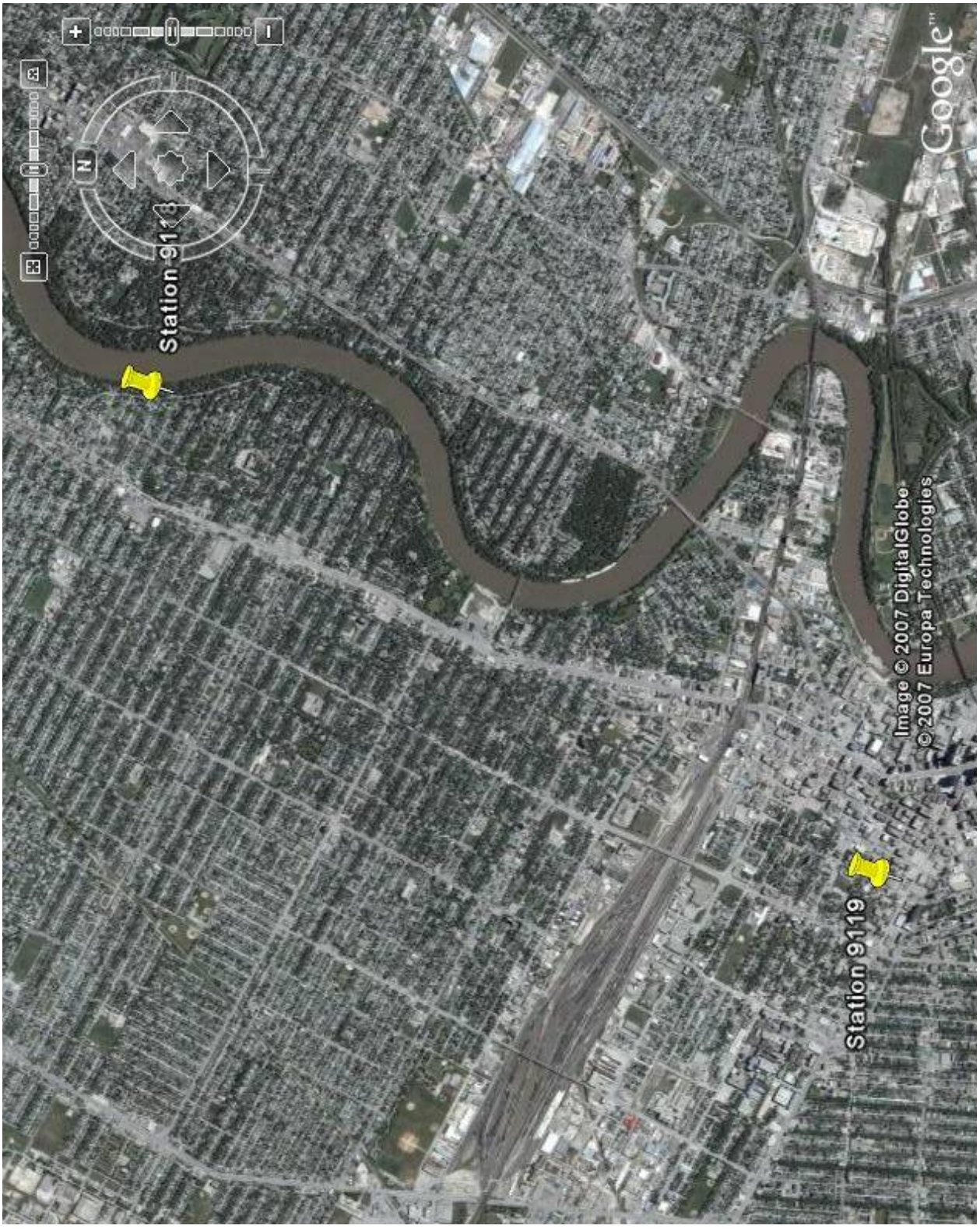

Figure 2. Winnipeg Ambient Air Monitoring Stations (Google Earth view)

Figure 3. Brandon Ambient Air Monitoring Station (Google Earth view).

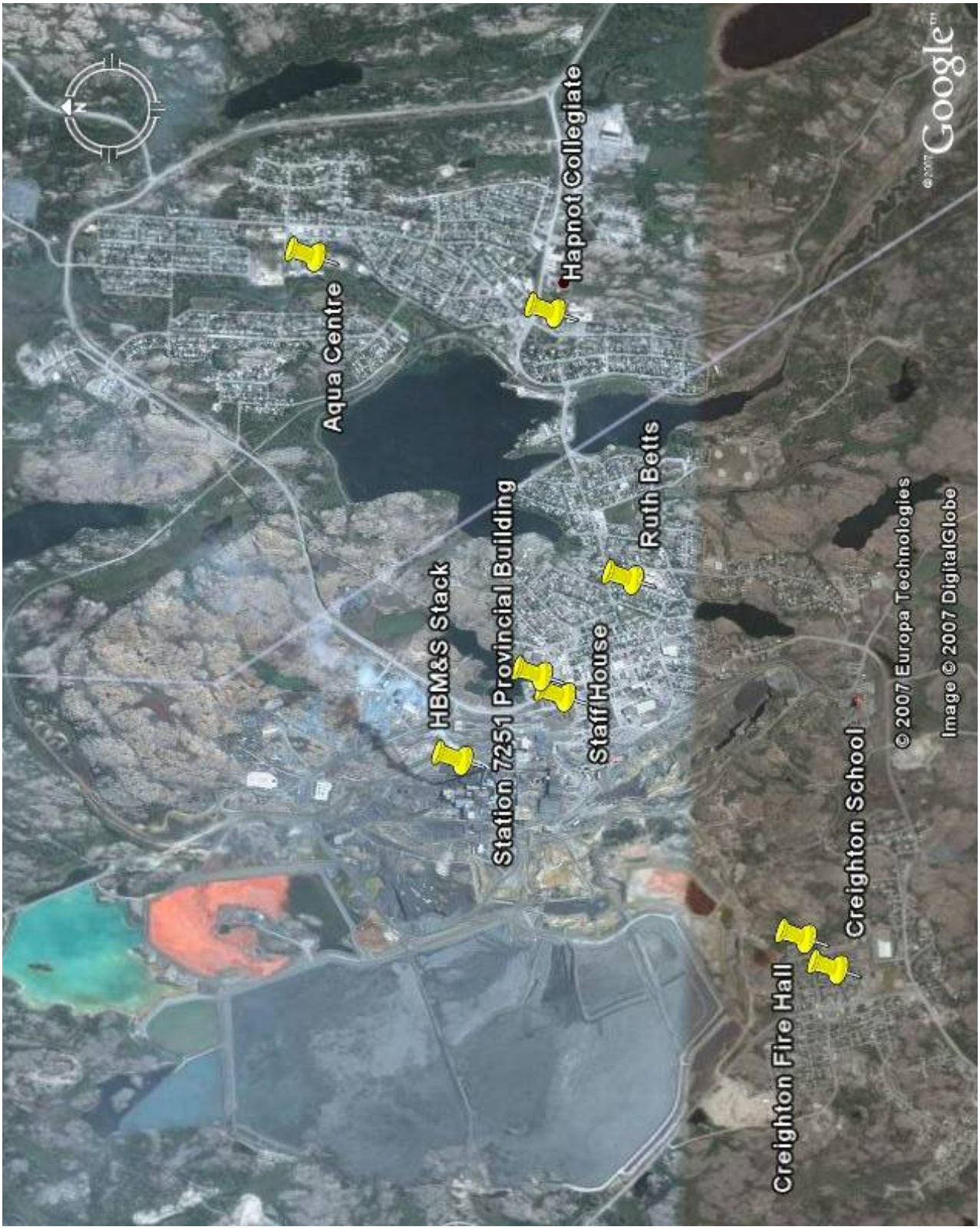

Figure 4. Flin Flon Ambient Air Monitoring Stations (Google Earth view).

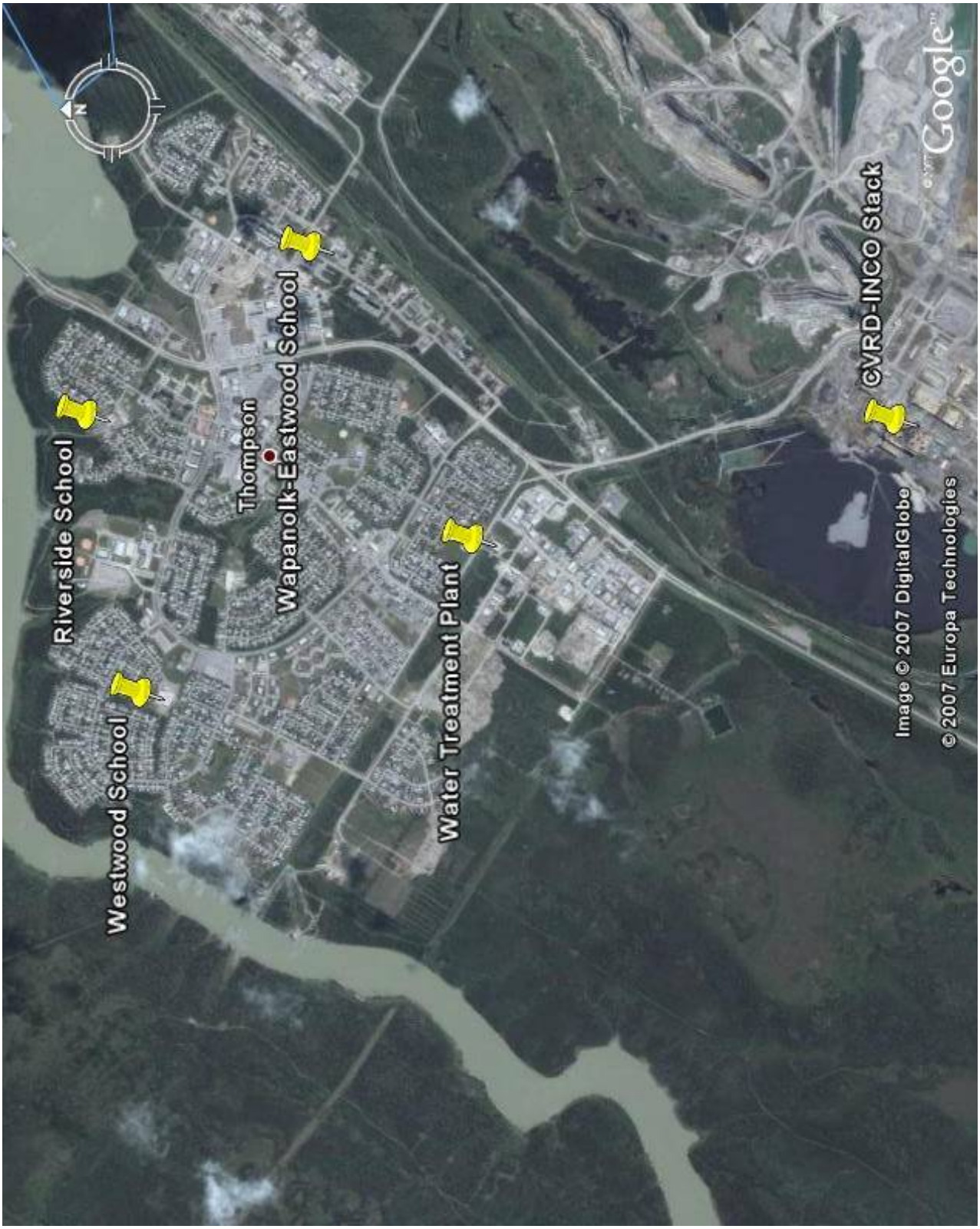

Figure 5. Thompson Ambient Air Monitoring Stations (Google Earth view).

D) THE INDEX OF THE QUALITY OF AIR (IQUA) or Air Quality Index (AQI)

The method for determining air quality indices is based on the Federal/Provincial draft document entitled "Guideline for the Index of the Quality of the Air (August 1993)". This document has been published in report form and can be obtained from Environment Canada (Report EPS 1/AP/3 April 1996). Formulas have been developed to assign air quality indices for all the pollutants for which National Objectives have been set. Although no objective currently exists for PM_{10}, a formula was developed based on the COH level. A general description of the IQUA is as follows:

SHORT TERM INDEX

The index is derived from Canadian National Air Quality Objectives and provides a scale consistent with all areas in Canada. Effects, such as on human health, vegetation, and public perception, provide the bases for establishing the index. In some cases, the effects may not be easily observed by the general public.

Determining the Index

The concentrations of the individual pollutants are converted to a common scale such that an IQUA value of 0 corresponds to a zero level; a value of 25 to a level equal to the Maximum Desirable Air Quality Objective (MDL); a value of 50 to a level equal to the Maximum Acceptable Objective (MAL); and a value of 100 to a level equal to the Maximum Tolerable Objective (MTL). The maximum determined sub-index is the value of the IQUA. The index indicates the worst effect of the pollutants being monitored. The breakpoints between the various Objective levels describing the general air quality are shown as follows:

Breakpoint Description	Objective Level	Numerical Value
GOOD	MDL	0 - 25
FAIR	MAL	26 - 50
POOR	MTL	51 - 100
VERY POOR		> 100

ANNUAL INDEX

The annual index is in the same form and is consistent with the short term index. It reflects the long term air quality, indicates trends, and permits comparison with other areas in Canada. The annual index is the average value of the short term indices measured throughout the year.

Winnipeg's Air Quality Index:

The AQI is derived from valid air quality data from two National Air Pollution Surveillance (NAPS) Class 1 stations located in a residential area and a downtown area of Winnipeg. The index is designed to describe the general quality of air in urban centres, not the condition of the air downwind from a specific source of emissions.

In the spring of 1995, Manitoba Environment in partnership with Environment Canada began dissemination of its monitoring data from the downtown station through the Air Quality Index (AQI) for Winnipeg. The data gathered at the downtown monitoring site are accessed by Environment Canada on an hourly basis and an AQI sub-index is calculated for each of the pollutants. The pollutant with the highest sub-index becomes that hour's determining factor and the value becomes the AQI. The AQI is available to the public in two ways: it can be accessed on Environment Canada's telephone weather service; and by way of the local cable television network's Environment Canada weather channel and national weather network.

RESULTS

EXPLANATION OF DATA STATISTICS

The summary statistics that appear on Tables 2 to 7 are designed to outline, in brief, a profile of the annual air pollutant concentration levels at specific sites with comparison to Manitoba Air Quality Criteria, where applicable criteria are available.

Immediately below the pollutant is the indication of the units in which the air pollutant concentration levels are reported. Each air sampling site is identified by a station number and location. More information on the specific sampling site can be found by referring to Table 1.

The quantity of data available from which the calculated statistics are drawn is indicated by the two following references:

"# of months of data" - this refers to the number of months in the year for which at least 75% of the data are valid and available (not applicable to non-continuous measurements such as TSP, Pb, sulphates, and nitrates).

"Percent of data available" - this refers to the percentage of unit data (e.g. hourly averages) per year that are valid and available.

These two statistics are reflective of the representativeness of the data statistics for that year. To representatively reflect annual air quality, two months of each quarter and 75% of the total annual data should be available for statistical calculation.

The "Percentile Distribution" is the data distribution of the unit data as shown (i.e. hourly for most pollutants, 24-hour integrated samples for TSP, PM_{10}, $PM_{2.5}$, Pb, $SO_4^{=}$, and NO_3^{-}). The pth percentile (e.g. 10%) is the pollutant concentration such that p% (e.g. 10%) of the data values are less than that indicated value of pollutant concentration and (100-p%) (e.g. 90%) are greater.

The annual mean is an arithmetic mean (unless otherwise shown) of the available unit data values. The maximum data values are the highest levels present or calculated for the time period listed within the year

shown. Other than for the unit data, longer time-based averages are arithmetic and are running averages of consecutive unit data and can overlap for days and/or months. For example, 24-hour running samples are based on increments of one hour and could result in a maximum of 24 hours/day x 365 days = 8760 24-hour sampling periods within a year. At least 75% of the data values within one running period must be available for the calculation of that running mean average.

A comparison of the data to the Manitoba Ambient Air Criteria is shown under the heading "# of Samples Above MDL/MAL/MTL". This listing is a count of the number of time-based averages or unit data concentrations that are larger than the appropriate time-based objective or guideline level.

Tables 2-7 show the statistical annual results of monitoring at the various stations during 2003-2005.

Tables 8-10 show the statistical analyses of the 24-hour average daily VOC samples collected in 2003-2005. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the year.

Table 11 shows the statistical analyses of the 24-hour average daily PAH samples collected from May 2003 through December 2005. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the three year period.

Table 12 shows the statistical analyses of the 24-hour average daily polychlorinated dibenzodioxin/dibenzofuran samples collected for the period May 2003 through to December 2005. The columns show the compound analyzed, the number of samples analyzed, the arithmetic mean, the standard deviation, the median, and the maximum and minimum values recorded during the three year period.

Table 13 shows the statistical analyses of the 24-hour average daily Aldehyde/ketone samples collected from January 2003 through December 2005. The columns show the compound analyzed, the arithmetic mean, the median, the maximum and minimum values recorded during the three year period and the number of samples in which the compound or family of compounds were detected.

Table 2 Manitoba Ambient Air Quality Data - **2003** Annual Pollutant Summary - Continuous Monitoring.

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.9%	0.1	0.2	0.2	0.3	0.5	1.2	0.29	3.3	2.0$^{\Delta}$	0	0$^{\Delta}$	0	0$^{\Delta}$	--	0$^{\Delta}$
MONOXIDE (CO)	9119 WINNIPEG, 65 ELLEN STREET	12	94.9%	0.3	0.4	0.5	0.6	0.8	1.3	0.52	4.7	2.4$^{\Delta}$	0	0$^{\Delta}$	0	0$^{\Delta}$	--	0$^{\Delta}$
ppm																		
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.8%	0.1	0.3	0.4	0.7	1.4	2.8	0.61	4.6	2.6	--	--	0	0	0	--
DIOXIDE (NO2)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.1%	0.2	0.4	0.7	1.1	2.1	3.9	0.97	9.3	3.6	--	--	0	0	0	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	94.8%	0.6	0.9	1.2	1.7	2.6	4.2	1.42	12.6	4.0	--	--	0	0	0	--
NITRIC	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.9%	0.0	0.1	0.1	0.3	0.7	3.7	0.35	11.7	2.6	--	--	--	--	--	--
OXIDE (NO)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.1%	0.0	0.1	0.1	0.2	0.7	6.3	0.44	24.9	7.12	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	94.8%	0.1	0.3	0.5	0.9	1.9	7.1	0.89	31.2	8.0	--	--	--	--	--	--
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.7%	0.2	0.4	0.6	1.0	2.1	5.9	0.96	14.9	4.7	--	--	--	--	--	--
OXIDES (NO_X)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.1%	0.3	0.5	0.8	1.3	2.9	9.2	1.39	29.8	10.6	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	94.8%	0.7	1.2	1.7	2.6	4.3	10.9	2.32	36.4	12.0	--	--	--	--	--	--
SULPHUR	7251 FLIN FLON, 143 MAIN STREET	12	94.9%	0.00	0.00	0.00	0.00	0.02	0.18	0.01	0.81	0.13	96	215°	13	10°	--	0°
DIOXIDE (SO2)	7271‡ FLIN FLON, AQUA CENTRE	12	95.7%	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.67	0.09	35	48°	10	0°	--	0°
ppm	7281‡ FLIN FLON, HBM&S STAFFHOUSE	12	94.6%	0.00	0.00	0.00	0.00	0.00	0.13	0.01	0.77	0.08	38	51°	3	0°	--	0°
	7291‡ CREIGHTON, SASK. CITY HALL	12	95.6%	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.64	0.14	36	69°	9	20°	--	0°
	7301‡ FLIN FLON, HAPNOT COLLEGIATE	12	95.6%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.59	0.04	6	0°	1	0°	--	0°
	7351‡ THOMPSON, WATER TREAT. PLANT	12	95.4%	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.77	0.09	11	22°	2	0°	--	0°
	7361‡ THOMPSON, EASTWOOD SCHOOL	12	94.8%	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.41	0.08	30	43°	4	0°	--	0°
	7371‡ THOMPSON, RIVERSIDE SCHOOL	12	95.4%	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.89	0.12	51	63°	18	6°	--	0°
OXIDANTS	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.7%	1.3	2.1	2.8	3.4	4.3	5.6	2.77	7.7	5.1	326	~	1	~	0	--
OZONE (O_3)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.2%	0.5	1.5	2.2	2.9	4.0	5.7	2.29	6.8	5.4	237	~	0	~	0	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	94.9%	0.5	1.3	1.9	2.7	3.8	5.3	2.05	7.0	4.9	129	~	0	~	0	--
AMMONIA (NH_3)	5131 BRANDON, ASSIN. COMM.COLLEGE	12	91.2%	0.0	0.0	0.0	0.0	0.0	0.5	0.01	3.4	0.5	--	--	4	--	--	--
ppm																		

Notes:

$^{\Delta}$ averaged over 8 hours
‡ denotes company supplied data
$^{\circ}$ using 24-hour moving average
~ numerous exceedences of the 24 hour MDL and MAL which are currently under review
-- no guideline or objective

Table 3a Manitoba Ambient Air Quality Data - 2003 Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10}).

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[4] FLIN FLON, 143 MAIN STREET	1-Hr	99.3%	4.1	7.6	12.2	21.4	45.8	107.6	20.2/ -	100.1/578.0	--	--	--	14[6]	--	--
	7283[2,5] FLIN FLON, CREIGHTON	24-Hr	62	7.7	11.2	15.6	19.9	27.7	41.4	16.9/14.6	42.6/ -	--	--	--	0[6]	--	--
	7283[3,5] FLIN FLON, CREIGHTON	24-Hr	210	7.1	10.8	14.6	19.2	31.7	52.9	17.1/14.5	58.7/ -	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	5.5	10.1	11.3	15.1	21.3	26.1	12.9/11.4	28.0/ -	--	--	--	0[6]	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-Hr	99.3%	5.4	9.9	15.0	24.9	48.5	102.4	22.3/ -	88.7/262.9	--	--	--	32[6]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	57	5.6	11.6	17.8	26.0	37.9	45.5	19.8/15.9	45.7/ -	--	--	--	0[6]	--	--
	5131[4] BRANDON, ASSIN. COMM.COLLEGE	1-Hr	96.5%	3.9	7.8	12.9	23.2	53.5	142.1	23.3/ -	154.3/819.5	--	--	--	39[6]	--	--
LEAD (Pb)	7283[2,5] FLIN FLON, CREIGHTON SCHOOL A	24-Hr	62	0.022	0.023	0.023	0.024	0.059	0.311	0.041/0.029	0.456	--	--	--	0	--	--
	7283[3,5,9] FLIN FLON, CREIGHTON SCHOOL B	24-Hr	210	0.417	0.417	0.417	0.417	0.417	0.458	0.418/0.418	0.521	--	--	--	0	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	33	0.02	0.02	0.03	0.15	0.28	0.45	0.11/0.06	0.47	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7283[2,5,8] FLIN FLON, CREIGHTON	24-Hr	62	0.66	0.94	1.34	1.72	2.41	6.50	1.55/1.23	8.81	--	--	--	--	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	21	0.98	1.59	1.99	2.12	3.05	4.32	2.01/1.82	4.56	--	--	--	--	--	--
ARSENIC (As)	7283[2,5] FLIN FLON, CREIGHTON	24-Hr	62	0.000	0.001	0.002	0.005	0.017	0.199	0.012/0.004	0.258	--	--	--	0[6]	--	--
	7283[3,5,9] FLIN FLON, CREIGHTON SCHOOL B	24-Hr	210	0.002	0.002	0.003	0.005	0.010	0.047	0.006/0.000	0.074	--	--	--	0[6]	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	33	0.002	0.003	0.008	0.025	0.078	0.187	0.028/0.010	0.202	--	--	--	0[6]	--	--
CADMIUM (Cd)	7283[2,5] FLIN FLON, CREIGHTON SCHOOL A	24-Hr	62	0.003	0.003	0.003	0.003	0.004	0.066	0.006/0.004	0.067	--	--	--	0[6]	--	--
	7283[3,5,9] FLIN FLON, CREIGHTON SCHOOL B	24-Hr	210	0.042	0.042	0.042	0.042	0.042	0.044	0.042/0.042	0.063	--	--	--	0[6]	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	33	0.003	0.007	0.007	0.012	0.039	0.073	0.015/0.009	0.083	--	--	--	0[6]	--	--
COPPER (Cu)	7283[2,5] FLIN FLON, CREIGHTON	24-Hr	62	0.012	0.021	0.034	0.042	0.119	0.486	0.063/0.034	0.501	--	--	--	0[6]	--	--
	7283[3,5,9] FLIN FLON, CREIGHTON SCHOOL B	24-Hr	210	0.083	0.083	0.083	0.188	0.313	0.479	0.152/0.128	0.563	--	--	--	0[6]	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	33	0.022	0.043	0.109	0.286	0.602	0.912	0.223/0.111	1.020	--	--	--	0[6]	--	--
ZINC (Zn)	7283[2,5] FLIN FLON, CREIGHTON	24-Hr	62	0.089	0.161	0.190	0.357	0.542	1.441	0.318/0.224	1.973	--	--	--	0[6]	--	--
	7283[3,5,9] FLIN FLON, CREIGHTON SCHOOL B	24-Hr	210	0.167	0.167	0.167	0.208	0.398	1.133	0.244/0.215	1.417	--	--	--	0[6]	--	--
	7284[1,7] FLIN FLON, RUTH BETTS	24-Hr	33	0.218	0.415	0.476	0.636	1.070	2.501	0.631/0.443	2.783	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4a are in ug/m^3.

-- No guideline or objective

- No data available

[1] – 24 Hour sample collected every six days according to NAPS schedule

[2] – 24 Hour sample collected every 2nd day

[3] – 24 Hour sample collected daily

[4] – Real-time continuous monitoring

[5] – Station instrument changed from hivol (A) to dichotomous (B) in May 2003

[6] – Ontario 24-hour guideline

[7] – Metals analysis "biased" in that it was based on selected wind directions and/or TSP loading

[8] – Data collected to May 2003

[9] – Majority of data at or below detection limit

Table 3b Manitoba Ambient Air Quality Data - 2003 Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$).

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[4] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	98.0%	1.1	2.6	4.3	6.6	11.7	22.7	5.6/ -	21.5/44.3	--	--	--	--	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	57	2.9	5.1	7.8	10.4	14.4	22.8	8.6/7.2	25.2/ -	--	--	--	--	--	--
	9119[4] WINNIPEG, 65 ELLEN STREET	1-HR	99.4%	0.9	2.6	4.2	6.3	11	21.7	5.3/ -	23.2/43.6	--	--	--	--	--	--
	5131[4] BRANDON, ASSIN. COMM.COLLEGE	1-HR	97.4%	0.8	2.5	4.2	7.0	13.4	28.5	6.0/ -	22.8/144.3	--	--	--	--	--	--

Notes:

All Concentration units for the above Table 4b are in ug/m^3.

-- No guideline or objective

- No data available

1 – 24 Hour sample collected every six days according to NAPS schedule

4 – Real-time continuous monitoring

Table 3c Manitoba Ambient Air Quality Data - 2003 Annual Pollutant Summary - Particulate Matter Monitoring (TSP).

POLLUTANT	STATION NUMBER & LOCATION	Collect. Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	14	25	38	59	99	150	47/37	207	--	--	--	4	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	171	11	18	24	32	49	124	30/24	365	--	--	--	2	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	114	9	14	22	32	57	83	27/21	96	--	--	--	0	--	--
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.03	0.04	0.06	0.15	0.64	1.61	0.23/0.10	2.54	--	--	--	0	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	172	0.02	0.02	0.02	0.03	0.06	0.25	0.04/0.03	0.26	--	--	--	0	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	69	0.02	0.03	0.03	0.09	0.23	0.52	0.09/0.05	0.54	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.85	1.31	1.80	2.63	5.78	11.76	2.68/2.00	17.22	--	--	--	--	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	172	0.47	0.80	1.15	1.53	2.15	3.47	1.29/1.07	6.25	--	--	--	--	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	45	0.74	1.40	2.05	2.28	3.23	4.61	1.97/1.57	5.10	--	--	--	--	--	--
NITRATES (NO_3^-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.05	0.05	0.06	0.06	0.10	0.17	0.07/0.06	0.50	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.005	0.008	0.016	0.041	0.159	0.351	0.053/0.022	0.691	--	--	--	4[6]	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	172	0.001	0.002	0.003	0.005	0.019	0.111	0.009/0.000	0.186	--	--	--	0[6]	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	69	0.002	0.003	0.008	0.021	0.062	0.181	0.025/0.009	0.223	--	--	--	0[6]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.003	0.004	0.005	0.020	0.104	0.238	0.033/0.011	0.255	--	--	--	0[6]	--	--
	7283[1,9,+] CREIGHTON, SCHOOL	24-Hr	172	0.003	0.003	0.003	0.003	0.005	0.031	0.004/0.000	0.038	--	--	--	0[6]	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	69	0.003	0.003	0.008	0.010	0.033	0.076	0.014/0.008	0.080	--	--	--	0[6]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.154	0.280	0.512	1.216	2.694	5.543	1.040/0.580	8.744	--	--	--	0[6]	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	172	0.215	0.349	0.541	0.759	1.152	1.937	0.647/0.498	5.577	--	--	--	0[6]	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	69	0.143	0.287	0.394	0.726	1.338	2.535	0.620/0.410	2.862	--	--	--	0[6]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	148	0.490	0.741	1.140	1.948	3.613	11.694	1.820/1.240	17.530	--	--	--	0[6]	--	--
	7283[1,+] CREIGHTON, SCHOOL	24-Hr	172	0.148	0.304	0.357	0.467	0.692	1.686	0.427/0.327	3.600	--	--	--	0[6]	--	--
	7284[3,7,+] FLIN FLON, RUTH BETTS	24-Hr	69	0.271	0.424	0.541	0.861	1.550	5.740	0.888/0.562	7.608	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4c are in ug/m^3. -- No guideline or objective + Company supplied data

1 – 24 Hour sample collected every 2nd day

2 – 24 Hour sample collected every three days, at each of two samplers until May, then every 3rd day sampling, synchronized with NAPS schedule at 1 sampler started

3 – 24 Hour sample collected every three days, synchronized with the NAPS schedule

6 – Ontario 24-hour guideline

7 – Metals analysis "biased" in that it was based on selected wind directions and/or TSP loading

9 – Majority of data at or below detection limit

Table 4 Manitoba Ambient Air Quality Data - 2004 Annual Pollutant Summary - Continuous Monitoring.

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON	9118 WINNIPEG, SCOTIA & JEFFERSON	12	91.1%	0.1	0.1	0.2	0.3	0.4	1.1	0.24	2.6	1.47*	0	0Δ	0	0Δ	--	0Δ
MONOXIDE (CO)	9119 WINNIPEG, 65 ELLEN STREET	12	95.0%	0.2	0.3	0.3	0.4	0.6	1.2	0.36	3.5	1.38*	0	0Δ	0	0Δ	--	0Δ
ppm																		
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	95.1%	0.1	0.2	0.4	0.6	1.2	2.9	0.54	6.6	3.05°	--	--	0	0	0	--
DIOXIDE	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.0%	0.2	0.4	0.6	1.0	2.0	3.7	0.86	5.6	3.25°	--	--	0	0	0	--
(NO2)	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.5	0.8	1.1	1.6	2.5	4.2	1.33	9.9	4.50°	--	--	0	0	0	--
pphm																		
NITRIC	5131 BRANDON, ASSIN. COMM.COLLEGE	12	95.1%	0.1	0.1	0.2	0.4	0.8	3.8	0.41	13.2	3.44°	--	--	--	--	--	--
OXIDE (NO)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.0%	0.1	0.1	0.1	0.2	0.8	6.2	0.45	24.2	7.09°	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.1	0.3	0.5	0.8	2.1	8.0	0.93	28.2	9.53°	--	--	--	--	--	--
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	95.1%	0.2	0.4	0.6	1.0	1.9	6.2	0.94	19.6	6.48°	--	--	--	--	--	--
OXIDES (NOX)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.0%	0.3	0.4	0.7	1.2	2.9	9.0	1.28	28.0	8.98°	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.6	1.1	1.6	2.5	4.5	11.4	2.26	31.7	13.35°	--	--	--	--	--	--
SULPHUR	7251 FLIN FLON, 143 MAIN STREET	12	95.5%	0.00	0.00	0.00	0.00	0.02	0.15	0.01	0.65	0.15°	63	78°	8	15°	--	0°
DIOXIDE	7271‡ FLIN FLON, AQUA CENTRE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.39	0.11°	15	33°	2	0°	--	0°
(SO2)	7281‡ FLIN FLON, HBM&S STAFFHOUSE	12	94.8%	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.39	0.08°	24	43°	1	0°	--	0°
ppm	7291‡ CREIGHTON, SASK. CITY HALL	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.11	0.01	0.68	0.11°	30	81°	7	0°	--	0°
	7301‡ FLIN FLON, HAPNOT COLLEGIATE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.32	0.03°	4	0°	0	0°	--	0°
	7351‡ THOMPSON, WATER TREAT. PLANT	12	95.5%	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.34	0.08°	15	19°	0	0°	--	0°
	7361‡ THOMPSON, EASTWOOD SCHOOL	12	95.4%	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.61	0.09°	43	54°	7	0°	--	0°
	7371‡ THOMPSON, RIVERSIDE SCHOOL	12	94.4%	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.59	0.15°	45	103°	11	9°	--	0°
OXIDANTS	5131 BRANDON, ASSIN. COMM.COLLEGE	12	91.7%	0.8	1.6	2.2	2.8	3.6	4.4	2.22	5.3	4.5°	4	~	0	~	0	--
OZONE (O3)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	93.5%	0.4	1.3	2.1	2.7	3.4	4.3	1.99	5.7	4.2°	6	~	0	~	0	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	95.2%	0.4	1.1	1.7	2.3	3.1	4.1	1.74	5.3	3.8°	7	~	0	~	0	--
AMMONIA (NH3)	5131 BRANDON, ASSIN. COMM.COLLEGE	12	95.0%	0.0	0.0	0.0	0.0	0.0	0.2	0.00	2.3	0.2°	--	--	1	--	--	--
ppm																		

Notes:

* averaged over 8 hours

‡ denotes company supplied data

° using 24-hour moving average

~ numerous exceedences of the 24 hour MDL and MAL which are currently under review

-- no guideline or objective

Table 5a Manitoba Ambient Air Quality Data - 2004 Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10}).

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[5] FLIN FLON, 143 MAIN STREET	1-Hr	99.6%	3.6	6.3	9.8	16.4	37.1	90.5	16.3/-	66.7/245.1	--	--	--	10[6]	--	--
	7283[4,8] FLIN FLON, CREIGHTON	24-Hr	338	8.21	12.96	17.50	22.92	34.17	57.52	20.0/17.0	103.8/-	--	--	--	7[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	59	4.73	6.93	9.12	12.40	24.45	34.35	12.0/9.7	35.2/-	--	--	--	0[6]	--	--
	7381[5,10] THOMPSON, WESTWOOD	1-Hr	40.8%	2.3	4.0	5.8	8.5	17.5	46.5	8.5/-	32.1/159.5	--	--	--	0[6]	--	--
	9119[5] WINNIPEG, 65 ELLEN STREET	1-Hr	99.4%	4.5	8.5	12.6	19.5	36.0	75.3	17.3/-	104.4/248.6	--	--	--	3[6]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	57	7.1	9.9	12.7	16.6	31.1	44.6	15.9/13.4	45.7/-	--	--	--	0[6]		
	5131[5] BRANDON, ASSIN. COMM.COLLEGE	1-Hr	99.4%	2.8	6.8	11.2	19.9	48.2	139.6	20.9/-	156.6/496.9	--	--	--	27[6]	--	--
LEAD (Pb)	7283[4,8,9] FLIN FLON, CREIGHTON SCHOOL	24-Hr	340	0.42	0.42	0.42	0.42	0.42	0.61	0.4/0.421	0.845/-	--	--	--	0	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	0.02	0.02	0.02	0.03	0.07	0.14	0.0/0.0323	0.1517/-	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	16	0.18	1.33	1.68	2.19	2.92	3.49	1.70/1.21	3.51/-	--	--	--	--	--	--
ARSENIC (As)	7283[4,8,9] FLIN FLON, CREIGHTON SCHOOL	24-Hr	340	0.00	0.00	0.00	0.01	0.02	0.07	0.01/0.004	0.225/-	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	0.00	0.00	0.00	0.01	0.03	0.07	0.01/0.005	0.0765/-	--	--	--	0[6]	--	--
CADMIUM (Cd)	7283[4,8,9] FLIN FLON, CREIGHTON SCHOOL	24-Hr	340	0.04	0.04	0.04	0.04	0.04	0.08	0.044/0.044	0.119/-	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	0.00	0.00	0.00	0.00	0.01	0.02	0.0/0.0067	0.0238/-	--	--	--	0[6]	--	--
COPPER (Cu)	7283[4,8,9] FLIN FLON, CREIGHTON SCHOOL	24-Hr	340	0.08	0.08	0.08	0.12	0.23	0.49	0.1/0.1114	0.781/-	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	0.02	0.03	0.05	0.10	0.31	0.91	0.1/0.0647	1.147/-	--	--	--	0[6]	--	--
ZINC (Zn)	7283[4,8,9] FLIN FLON, CREIGHTON SCHOOL	24-Hr	340	0.17	0.17	0.17	0.20	0.34	0.91	0.23/0.208	1.859/-	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	58	0.01	0.05	0.39	0.86	2.14	4.14	0.76/0.1905	4.1654/-	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4a are in ug/m^3.

-- No guideline or objective

- No data available

1 – 24 Hour sample collected every six days according to NAPS schedule

4 – 24 Hour sample collected daily

5 – Real-time continuous monitoring

6 – Ontario 24-hour guideline

8 – Station instrument changed from hivol to dichotomous in May 2003

9 – Majority of data at or below detection limit

10 – New station established August, 2004

Table 5b Manitoba Ambient Air Quality Data - 2004 Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$) (revised August 2005)

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[5] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	99.2%	0.7	2.0	3.3	5.2	9.3	20.8	4.5/-	18.1/67.8	--	--	--	--	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	57	3.4	4.5	5.9	8.5	16.5	26.4	8.0/6.5	26.5/-	--	--	--	--	--	--
	9119[5] WINNIPEG, 65 ELLEN STREET	1-HR	99.5%	0.5	1.9	3.2	5.0	8.8	19.0	4.2/-	19.6/86.9	--	--	--	--	--	--
	5131[5] BRANDON, ASSIN. COMM.COLLEGE	1-HR	99.3%	0.7	2.0	3.5	5.6	10.6	25.9	5.0/-	22.9/109.3	--	--	--	--	--	--
	7251[5] FLIN FLON, 143 MAIN STREET	1-Hr	46.8%	0.9	1.7	2.6	4.0	8.6	29.5	4.2/-	15.5/82.2	--	--	--	--	--	--
	7381[5,10] THOMPSON, WESTWOOD	1-Hr	27.9%	0.0	1.0	2.0	3.8	8.3	30.4	3.7/-	15.7/63.5	--	--	--	--	--	--

Notes:

All Concentration units for the above Table 4b are in ug/m^3.

-- No guideline or objective

- No data available

[1] – 24 Hour sample collected every six days according to NAPS schedule

[5] – Real-time continuous monitoring

[10] - New station established August, 2004

Table 5c Manitoba Ambient Air Quality Data - 2004 Annual Pollutant Summary - Particulate Matter Monitoring (TSP).

POLLUTANT	STATION NUMBER & LOCATION	Collect. Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	9.90	17.00	27.00	40.50	73.80	242.33	41/28	423	--	--	--	2	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	10.57	17.38	24.32	34.09	51.31	118.32	32/24	545	--	--	--	2	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	7.46	12.20	17.35	26.80	45.21	74.60	23/18	97	--	--	--	0	--	--
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.03	0.04	0.05	0.10	0.28	0.57	0.11/0.07	0.77	--	--	--	0	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	0.02	0.02	0.02	0.02	0.03	0.09	0.03/0.03	0.42	--	--	--	0	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	0.02	0.02	0.02	0.02	0.10	0.22	0.04/0.03	0.22	--	--	--	0	--	--
SULPHATES (SO4=)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.88	1.30	1.71	2.26	3.81	10.38	2.40/1.81	29.27	--	--	--	--	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	0.41	0.85	1.18	1.71	2.85	6.60	1.51/1.12	9.84	--	--	--	--	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	31	0.64	1.52	1.89	2.26	3.14	3.54	1.88/1.58	3.56	--	--	--	--	--	--
NITRATES (NO3-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.05	0.05	0.06	0.06	0.12	0.33	0.08/0.07	0.65	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.00	0.01	0.01	0.03	0.11	0.30	0.038/0.017	0.344	--	--	--	1[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	0.00	0.00	0.00	0.01	0.01	0.04	0.006/0.003	0.130	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	0.00	0.00	0.00	0.01	0.05	0.14	0.016/0.005	0.184	--	--	--	0[6]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.00	0.00	0.00	0.01	0.04	0.08	0.015/0.008	0.087	--	--	--	0[6]	--	--
	7283[3,9,+] CREIGHTON, SCHOOL	24-Hr	175	0.00	0.00	0.00	0.00	0.00	0.02	0.003/0.003	0.025	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	0.00	0.00	0.00	0.00	0.02	0.03	0.006/0.004	0.042	--	--	--	0[6]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.15	0.36	0.63	0.88	2.44	4.76	0.980/0.575	5.299	--	--	--	0[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	0.17	0.27	0.40	0.59	0.95	1.563	0.495/0.394	1.743	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	0.13	0.27	0.44	0.63	1.14	1.95	0.576/0.412	3.022	--	--	--	0[6]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	90	0.55	0.95	1.83	3.10	5.21	8.20	2.457/1.741	8.670	--	--	--	0[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	175	0.01	0.01	0.01	0.32	1.67	3.22	0.470/0.050	3.314	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	114	0.01	0.03	0.38	1.02	2.64	4.64	0.898/0.165	4.713	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4c are in ug/m^3.

-- No guideline or objective

[+] Company supplied data

[2] – 24 Hour sample collected every three days, synchronized with the NAPS schedule (with numerous exceptions)

[3] – 24 Hour sample collected every second day

[6] – Ontario 24-hour guideline

[9] – Majority of data at or below detection limit

Table 6 Manitoba Ambient Air Quality Data - 2005 Annual Pollutant Summary - Continuous Monitoring.

POLLUTANT Conc. Units	STATION NUMBER & LOCATION	# OF MONTHS AVAIL.	PERCENT OF DATA AVAIL.	PERCENTILE DISTRIBUTION (1-HOUR SAMPLES) 10%	30%	50%	70%	90%	99%	ANNUAL MEAN	MAXIMUM DATA VALUES 1-HR	24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
CARBON	9118 WINNIPEG, SCOTIA & JEFFERSON	12	94.0%	0.0	0.1	0.2	0.2	0.4	1.0	0.21	2.9	1.51*	0	0Δ	0	0Δ	--	0Δ
MONOXIDE (CO) ppm	9119 WINNIPEG, 65 ELLEN STREET	12	93.8%	0.1	0.2	0.3	0.3	0.5	1.1	0.31	3.4	1.91*	0	0Δ	0	0Δ	--	0Δ
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.1%	0.1	0.2	0.4	0.6	1.1	2.6	0.53	4.2	2.59°	--	--	0	0°	0	--
DIOXIDE	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.3%	0.1	0.3	0.5	0.9	1.9	3.8	0.80	6.4	3.64°	--	--	0	0°	0	--
(NO2) pphm	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.4	0.7	1.0	1.5	2.4	4.1	1.25	7.9	3.97°	--	--	0	0°	0	--
NITRIC	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.1%	0.0	0.1	0.1	0.3	0.8	3.8	0.36	13.3	4.14°	--	--	--	--	--	--
OXIDE (NO)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.3%	0.1	0.1	0.1	0.2	0.8	5.8	0.46	24.9	5.65°	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.2	0.3	0.4	0.8	1.8	6.4	0.85	33.6	7.54°	--	--	--	--	--	--
NITROGEN	5131 BRANDON, ASSIN. COMM.COLLEGE	12	94.1%	0.2	0.3	0.5	0.9	1.9	5.8	0.88	16.9	6.73°	--	--	--	--	--	--
OXIDES (NO_X)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.3%	0.3	0.4	0.7	1.1	2.7	9.1	1.24	31.3	9.20°	--	--	--	--	--	--
pphm	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.6	1.0	1.5	2.3	4.0	10.2	2.10	40.4	11.50°	--	--	--	--	--	--
SULPHUR	7251 FLIN FLON, 143 MAIN STREET	12	95.3%	0.00	0.00	0.00	0.00	0.01	0.16	0.01	1.16	0.11°	68	195°	13	0°	--	0°
DIOXIDE	7271+ FLIN FLON, AQUA CENTRE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.80	0.07°	34	39°	10	0°	--	0°
(SO2)	7281+ FLIN FLON, HBM&S STAFFHOUSE	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.12	0.01	0.84	0.17°	51	97°	10	16°	--	0°
Ppm[10]	7291+ CREIGHTON, SASK. CITY HALL	12	95.8%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.66	0.15°	15	26°	6	20°	--	0°
	7301+ FLIN FLON, HAPNOT COLLEGIATE	10	90.2%	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.45	0.04°	12	0°	3	0°	--	0°
	7351+ THOMPSON, WATER TREAT. PLANT	12	95.5%	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.45	0.08°	27	10°	2	0°	--	0°
	7361+ THOMPSON, EASTWOOD SCHOOL	12	95.5%	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.77	0.08°	60	37°	9	0°	--	0°
	7371+ THOMPSON, RIVERSIDE SCHOOL	12	95.3%	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.35	0.06°	20	0°	1	0°	--	0°
	7371+ THOMPSON, WESTWOOD SCHOOL	4	29.8%	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.60	0.08°	7	13°	2	0°	--	0°
OXIDANTS	5131 BRANDON, ASSIN. COMM.COLLEGE	9	83.4%	0.8	1.6	2.2	2.7	3.6	4.7	2.19	6.2	4.5°	37	~	0	~	0	--
OZONE (O_3)	9118 WINNIPEG, SCOTIA & JEFFERSON	12	95.2%	0.4	1.4	2.0	2.6	3.5	4.9	2.03	6.0	4.8°	67	~	0	~	0	--
Pphm[11]	9119 WINNIPEG, 65 ELLEN STREET	12	93.7%	0.5	1.1	1.7	2.3	3.2	4.7	1.82	5.6	4.6°	39	~	0	~	0	--
AMMONIA (NH_3) Ppm[12]	5131 BRANDON, ASSIN. COMM.COLLEGE	11	91.9%	0.0	0.0	0.0	0.0	0.0	0.4	0.02	5.1	1.2°	--	--	9	--	--	--

Notes: * averaged over 8 hours + denotes company supplied data ° using 24-hour moving average

~ numerous exceedences of the 24 hour MDL and MAL which are currently under review -- no guideline or objective

[10] SO_2 guidelines (ppm): MDL: 1-hr = 0.170, 24-hr = 0.06; MAL: 1-hr = 0.34, 24-hr = 0.11; MTL: 24-hr = 0.31

[11] O_3 guidelines (pphm): MDL: 1-hr = 5.0, 24-hr = 1.50; MAL: 1-hr = 8.20, 24-hr = 2.50; MTL: 1-hr = 20.00

[12] NH_3 guideline (ppm): MAL: 1-hr = 2.0

Table 7a Manitoba Ambient Air Quality Data - 2005 Annual Pollutant Summary - Particulate Matter Monitoring (PM_{10}).

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # of Samples	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE (PM_{10})	7251[5] FLIN FLON, 143 MAIN STREET	1-Hr	99.7%	3.50	6.00	9.70	17.70	39.40	107.53	17.57/10.76	136.21/476.20	--	--	--	17[6]	--	0
	7283[4,8] FLIN FLON, CREIGHTON	24-Hr	97.0%	4.58	10.79	15.00	20.00	32.92	51.76	17.09/13.00	97.08/ -	--	--	--	4[6]	--	0
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	96.7%	4.31	6.53	8.29	12.62	22.79	27.75	10.53/8.69	28.86/ -	--	--	--	0[6]	--	0
	7381[5] THOMPSON, WESTWOOD	1-Hr	86.7%	2.30	4.30	6.30	9.70	20.50	54.45	9.79/6.42	45.85/373.60	--	--	--	0[6]	--	0
	9119[5] WINNIPEG, 65 ELLEN STREET	1-Hr	98.0%	4.40	8.20	12.80	20.70	38.00	79.86	18.16/12.65	93.65/433.80	--	--	--	10[6]	--	0
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	75.4%	6.06	9.60	13.21	15.06	21.43	46.64	14.15/11.42	47.19/ -	--	--	--	0[6]	--	0
	5131[5] BRANDON, ASSIN.COMM.COLLEGE	1-Hr	98.8%	3.20	6.80	11.10	20.20	47.50	108.35	19.67/11.31	140.04/608.30	--	--	--	19[6]	--	0
LEAD (Pb)	7283[4,8,9] FLIN FLON, CREIGHTON	24-Hr	97.0%	0.42	0.42	0.42	0.42	0.42	0.60	0.42/0.42	1.04/ -	--	--	--	0	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	60.7%	0.01	0.02	0.03	0.08	0.17	0.33	0.07/0.03	0.34/ -	--	--	--	0	--	--
SULPHATES ($SO_4^=$)	7284[1] FLIN FLON, RUTH BETTS	24-Hr	32.8%	0.51	0.92	1.28	1.52	3.28	4.27	1.57/1.22	4.35/ -	--	--	--	--	--	--
ARSENIC (As)	7283[4,8,9] FLIN FLON, CREIGHTON	24-Hr	97.0%	0.00	0.00	0.00	0.01	0.03	0.08	0.01/0.00	0.11/ -	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	60.7%	0.00	0.00	0.00	0.02	0.05	0.07	0.02/0.01	0.07/ -	--	--	--	0[6]	--	--
CADMIUM (Cd)	7283[4,8,9] FLIN FLON, CREIGHTON	24-Hr	97.0%	0.04	0.04	0.04	0.04	0.08	0.13	0.06/0.05	0.83/ -	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	60.7%	0.00	0.00	0.00	0.01	0.03	0.06	0.01/0.00	0.06/ -	--	--	--	0[6]	--	--
COPPER (Cu)	7283[4,8,9] FLIN FLON, CREIGHTON	24-Hr	97.0%	0.08	0.08	0.08	0.08	0.23	0.93	0.13/0.10	1.17/ -	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	60.7%	0.03	0.04	0.11	0.19	0.31	1.38	0.18/0.09	1.86/ -	--	--	--	0[6]	--	--
ZINC (Zn)	7283[4,8,9] FLIN FLON, CREIGHTON	24-Hr	97.0%	0.17	0.17	0.22	0.32	0.68	1.83	0.36/0.27	4.95/ -	--	--	--	0[6]	--	--
	7284[1] FLIN FLON, RUTH BETTS	24-Hr	60.7%	0.01	0.09	0.21	0.38	0.85	2.24	0.37/0.14	2.48/ -	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4a are in ug/m^3.

-- No guideline or objective

- No data available

[1] – 24 Hour sample collected every six days according to NAPS schedule (Dichotomous)

[4] – 24 Hour sample collected daily (Dichotomous)

[5] – Real-time continuous monitoring (TEOM)

[6] – Ontario 24-hour guideline

[8] – Station instrument changed from hivol to dichotomous in May 2003

[9] – Majority of data at or below detection limit

Table 7b Manitoba Ambient Air Quality Data - 2005 Annual Pollutant Summary - Particulate Matter Monitoring ($PM_{2.5}$).

POLLUTANT	STATION NUMBER & LOCATION	Collect Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24/1-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
INHALABLE PARTICULATE ($PM_{2.5}$)	9118[5] WINNIPEG, SCOTIA & JEFFERSON	1-Hr	99.1%	0.70	2.00	3.40	5.30	10.00	21.70	4.60/3.03	22.00/52.90	--	--	--	0[7]	--	--
	9119[1] WINNIPEG, 65 ELLEN STREET	24-Hr	75.4%	3.07	4.38	5.49	6.52	8.78	20.29	6.13/5.28	22.86/ -	--	--	--	0[7]	--	--
	9119[5] WINNIPEG, 65 ELLEN STREET	1-HR	97.6%	0.60	1.80	3.20	5.00	9.30	22.55	4.48/2.84	37.76/390.90	--	--	--	1[7]	--	--
	5131[5] BRANDON, ASSIN. COMM.COLLEGE	1-HR	98.9%	0.60	1.80	3.10	5.10	10.21	26.34	4.70/2.82	21.60/120.20	--	--	--	0[7]	--	--
	7251[5] FLIN FLON, 143 MAIN STREET	1-Hr	98.8%	0.30	1.20	2.40	4.10	8.84	33.24	4.21/2.17	26.14/132.70	--	--	--	0[7]	--	--
	7381[5] THOMPSON, WESTWOOD	1-Hr	98.9%	0.20	0.90	1.80	3.50	7.30	22.80	3.25/1.76	18.28/53.50	--	--	--	0[7]	--	--

Notes:

All Concentration units for the above Table 4b are in ug/m^3.

-- No guideline or objective

- No data available

[1] – 24 Hour sample collected every six days according to NAPS schedule (Dichotomous)

[5] – Real-time continuous monitoring (TEOM)

[7] – based on Canada Wide Standard for $PM_{2.5}$

Table 7c Manitoba Ambient Air Quality Data - 2005 Annual Pollutant Summary - Particulate Matter Monitoring (TSP).

POLLUTANT	STATION NUMBER & LOCATION	Collect. Duration	% Data or # OF SAMPLES	PERCENTILE DISTRIBUTION 10%	30%	50%	70%	90%	99%	ANNUAL ARITH/GEO MEAN	MAXIMUM DATA VALUES 24-HR	# OF SAMPLES ABOVE M.D.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.A.L. 1-HR	24-HR	# OF SAMPLES ABOVE M.T.L. 1-HR	24-HR
TOTAL SUSPENDED PARTICULATE (TSP)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	8.30	15.00	34.00	52.00	86.80	171.07	43.00/28.59	299.00	--	--	--	10	--	0
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	9.80	13.49	19.36	29.93	50.78	169.44	32.52/21.36	958.67	--	--	--	5	--	1
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	117	7.18	11.83	16.82	24.42	51.96	71.40	22.46/17.36	96.47	--	--	--	0	--	0
LEAD (Pb)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.03	0.04	0.05	0.12	0.42	1.40	0.17/0.08	2.54	--	--	--	1	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	0.01	0.02	0.02	0.02	0.07	0.35	0.04/0.02	0.55	--	--	--	0	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	73	0.01	0.02	0.03	0.11	0.28	0.37	0.09/0.05	0.38	--	--	--	0	--	--
SULPHATES (SO4=)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.70	1.04	1.44	2.12	4.63	8.27	2.12/1.58	22.79/ -	--	--	--	--	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	0.33	0.80	1.03	1.52	2.37	6.06	1.32/0.97	7.88/ -	--	--	--	--	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	41	0.49	1.19	1.61	2.02	3.44	5.82	1.84/1.43	6.27/ -	--	--	--	--	--	--
NITRATES (NO3-)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.05	0.06	0.06	0.06	0.08	0.43	0.07/0.06	0.94/ -	--	--	--	--	--	--
ARSENIC (As)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.00	0.01	0.01	0.03	0.12	0.35	0.04/0.02	0.62	--	--	--	2[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	0.00	0.00	0.00	0.01	0.02	0.13	0.01/0.00	0.19	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	73	0.00	0.00	0.01	0.03	0.08	0.09	0.02/0.01	0.10	--	--	--	0[6]	--	--
CADMIUM (Cd)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.00	0.00	0.00	0.01	0.06	0.22	0.02/0.01	0.31	--	--	--	0[6]	--	--
	7283[3,9,+] CREIGHTON, SCHOOL	24-Hr	181	0.00	0.00	0.00	0.00	0.01	0.09	0.01/0.00	0.18	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	73	0.00	0.00	0.00	0.01	0.04	0.07	0.01/0.01	0.08	--	--	--	0[6]	--	--
COPPER (Cu)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.11	0.23	0.38	0.78	2.36	6.64	0.89/0.44	10.87	--	--	--	0[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	0.18	0.30	0.37	0.48	0.67	1.44	0.42/0.36	1.70	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	73	0.25	0.40	0.58	0.85	1.71	2.49	0.76/0.59	2.76	--	--	--	0[6]	--	--
ZINC (Zn)	7251[2] FLIN FLON, 143 MAIN STREET	24-Hr	184	0.42	0.64	0.90	1.54	3.93	7.86	1.65/1.09	15.17	--	--	--	0[6]	--	--
	7283[3,+] CREIGHTON, SCHOOL	24-Hr	181	0.01	0.04	0.14	0.27	0.86	2.48	0.33/0.09	5.34	--	--	--	0[6]	--	--
	7284[2,+] FLIN FLON, RUTH BETTS	24-Hr	73	0.04	0.20	0.41	0.77	1.35	2.38	0.60/0.30	2.48	--	--	--	0[6]	--	--

Notes:

All Concentration units for the above Table 4c are in ug/m^3.

-- No guideline or objective

+ Company supplied data

[2] – 24 Hour sample collected every three days, synchronized with the NAPS schedule (with numerous exceptions)

[3] – 24 Hour sample collected every second day

[6] – Ontario 24-hour guideline

[9] – Majority of data at or below detection limit

Table 8 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2003**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1,1,1-Trichloroethane	60	0.17	0.03	0.17	0.37	0.14
1,1,2,2-Tetrachloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethane	60	0.00	0.00	0.00	0.01	0.00
1,1-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
1,2,3-Trimethylbenzene	60	0.11	0.08	0.09	0.34	0.00
1,2,4-Trichlorobenzene	60	0.01	0.00	0.00	0.02	0.00
1,2,4-Trimethylbenzene	60	0.52	0.42	0.43	1.82	0.00
1,2-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,2-Dichloroethane	60	0.04	0.01	0.04	0.06	0.02
1,2-Dichloropropane	60	0.01	0.00	0.01	0.02	0.00
1,2-Diethylbenzene	60	0.01	0.00	0.01	0.02	0.00
1,3,5-Trimethylbenzene	60	0.16	0.12	0.13	0.54	0.00
1,3-Butadiene	60	0.15	0.09	0.13	0.51	0.04
1,3-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,3-Diethylbenzene	60	0.03	0.02	0.02	0.08	0.00
1,4-Dichlorobenzene	60	0.07	0.05	0.06	0.25	0.02
1,4-Dichlorobutane	60	0.00	0.00	0.00	0.00	0.00
1,4-Diethylbenzene	60	0.09	0.07	0.08	0.31	0.00
1-Butene/Isobutene	60	0.47	0.24	0.44	1.34	0.15
1-Butyne	60	0.01	0.00	0.01	0.02	0.00
1-Decene	60	0.00	0.01	0.00	0.03	0.00
1-Heptene	60	0.00	0.00	0.00	0.00	0.00
1-Hexene	60	0.07	0.04	0.06	0.19	0.02
1-Methylcyclohexene	60	0.01	0.01	0.01	0.04	0.00
1-Methylcyclopentene	60	0.04	0.03	0.03	0.12	0.00
1-Nonene	60	0.00	0.01	0.00	0.05	0.00
1-Octene	60	0.01	0.01	0.01	0.06	0.00
1-Pentene	60	0.11	0.06	0.09	0.36	0.04
1-Propyne	60	0.09	0.05	0.09	0.28	0.03
1-Undecene	60	0.08	0.10	0.04	0.41	0.00
2,2,3-Trimethylbutane	60	0.01	0.00	0.01	0.03	0.00
2,2,4-Trimethylpentane	60	0.43	0.24	0.39	1.14	0.15
2,2,5-Trimethylhexane	60	0.02	0.01	0.02	0.06	0.01
2,2-Dimethylbutane	60	0.15	0.10	0.12	0.65	0.05
2,2-Dimethylhexane	60	0.01	0.01	0.01	0.04	0.00
2,2-Dimethylpentane	60	0.02	0.02	0.02	0.11	0.01
2,2-Dimethylpropane	60	0.02	0.01	0.02	0.07	0.01
2,3,4-Trimethylpentane	60	0.12	0.07	0.11	0.37	0.05
2,3-Dimethylbutane	60	0.21	0.12	0.17	0.74	0.08
2,3-Dimethylpentane	60	0.39	0.21	0.35	1.14	0.16
2,4-Dimethylhexane	60	0.07	0.04	0.07	0.21	0.03
2,4-Dimethylpentane	60	0.16	0.09	0.14	0.49	0.06
2,5-Dimethylhexane	60	0.06	0.03	0.05	0.15	0.03
2-Ethyl-1-Butene	60	0.00	0.00	0.00	0.03	0.00

Table 8 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2003**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2-Ethyltoluene	60	0.11	0.08	0.10	0.38	0.01
2-Methyl-1-butene	60	0.17	0.10	0.14	0.46	0.05
2-Methyl-2-butene	60	0.22	0.13	0.18	0.69	0.03
2-Methylheptane	60	0.15	0.09	0.13	0.41	0.05
2-Methylhexane	60	0.41	0.24	0.36	1.31	0.16
2-Methylpentane	60	0.80	0.55	0.62	3.38	0.22
3,6-Dimethyloctane	60	0.03	0.05	0.01	0.24	0.00
3-Ethyltoluene	60	0.30	0.23	0.25	1.08	0.00
3-Methyl-1-butene	60	0.04	0.02	0.04	0.12	0.01
3-Methyl-1-pentene	60	0.01	0.01	0.01	0.04	0.00
3-Methylheptane	60	0.14	0.08	0.13	0.42	0.05
3-Methylhexane	60	0.45	0.30	0.39	1.65	0.14
3-Methylpentane	60	0.58	0.36	0.48	2.27	0.20
4-Ethyltoluene	60	0.15	0.11	0.13	0.49	0.00
4-Methyl-1-pentene	60	0.02	0.05	0.01	0.41	0.00
4-Methylheptane	60	0.06	0.03	0.05	0.18	0.02
Acetylene	60	1.43	0.81	1.27	4.61	0.44
a-Pinene	59	0.12	0.15	0.07	0.92	0.00
Benzene	60	0.99	0.49	0.87	3.13	0.44
Benzylchloride	60	0.00	0.00	0.00	0.01	0.00
b-Pinene	59	0.04	0.06	0.02	0.24	0.00
Bromodichloromethane	60	0.02	0.02	0.02	0.09	0.00
Bromoform	60	0.02	0.01	0.01	0.04	0.01
Bromomethane	60	0.06	0.01	0.06	0.08	0.05
Butane	60	3.77	2.68	3.23	17.34	0.96
Camphene	59	0.04	0.05	0.02	0.23	0.00
Carbontetrachloride	60	0.62	0.05	0.62	0.73	0.53
Chlorobenzene	60	0.01	0.00	0.01	0.01	0.00
Chloroethane	60	0.03	0.02	0.02	0.09	0.01
Chloroform	60	0.11	0.03	0.10	0.19	0.08
Chloromethane	60	1.25	0.20	1.22	1.62	0.97
cis-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
cis-1,2-Dimethylcyclohexane	60	0.02	0.01	0.02	0.06	0.00
cis-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
cis-1,3-Dimethylcyclohexane	60	0.06	0.04	0.05	0.25	0.02
cis-1,4/t-1,3-Dimethylcyclohexane	60	0.03	0.02	0.02	0.11	0.01
cis-2-Butene	60	0.11	0.08	0.09	0.46	0.03
cis-2-Heptene	60	0.01	0.03	0.00	0.15	0.00
cis-2-Hexene	60	0.02	0.01	0.02	0.07	0.01
cis-2-Pentene	60	0.09	0.05	0.08	0.24	0.03
cis-3-Heptene	56	0.07	0.06	0.06	0.31	0.00
cis-3-Methyl-2-pentene	60	0.06	0.04	0.05	0.18	0.00
cis-4-Methyl-2-pentene	60	0.03	0.02	0.02	0.08	0.01
Cyclohexane	60	0.13	0.07	0.11	0.35	0.06
Cyclohexene	60	0.01	0.01	0.01	0.04	0.00

Table 8 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2003**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Cyclopentane	60	0.14	0.08	0.11	0.53	0.05
Cyclopentene	60	0.03	0.02	0.03	0.08	0.01
Decane	60	0.17	0.13	0.13	0.59	0.01
Dibromochloromethane	60	0.00	0.00	0.00	0.01	0.00
Dibromomethane	60	0.03	0.00	0.03	0.03	0.02
Dichloromethane	60	0.44	0.21	0.38	1.49	0.18
d-Limonene	59	0.05	0.05	0.04	0.25	0.00
Dodecane	60	0.06	0.05	0.06	0.22	0.00
EDB	60	0.00	0.00	0.00	0.00	0.00
Ethane	60	3.09	1.55	2.62	10.28	1.47
Ethylbenzene	60	0.49	0.29	0.43	1.56	0.19
Ethylbromide	60	0.00	0.00	0.00	0.00	0.00
Ethylene	60	2.27	1.26	2.10	7.56	0.74
Freon11	60	1.75	0.10	1.75	2.12	1.56
Freon113	60	0.61	0.07	0.61	0.77	0.46
Freon114	60	0.11	0.01	0.11	0.16	0.09
Freon12	60	2.65	0.22	2.68	3.12	2.11
Freon22	60	0.78	0.25	0.74	2.25	0.49
Heptane	60	0.38	0.26	0.33	1.45	0.09
Hexachlorobutadiene	60	0.00	0.00	0.00	0.04	0.00
Hexane	60	1.03	4.01	0.43	31.49	0.14
Hexylbenzene	53	0.02	0.08	0.01	0.62	0.00
Indane	60	0.05	0.04	0.05	0.17	0.00
Isobutane	60	1.67	1.26	1.23	6.42	0.44
iso-Butylbenzene	60	0.01	0.01	0.01	0.02	0.00
Isopentane	60	3.01	1.86	2.32	11.24	0.81
Isoprene	60	0.45	0.73	0.12	2.71	0.01
iso-Propylbenzene	60	0.02	0.01	0.02	0.07	0.01
m and p-Xylene	60	1.74	1.15	1.48	5.73	0.25
Methylcyclohexane	60	0.25	0.16	0.22	0.91	0.07
Methylcyclopentane	60	0.45	0.72	0.30	5.65	0.11
MTBE	59	0.00	0.00	0.00	0.03	0.00
Naphthalene	60	0.16	0.11	0.15	0.44	0.00
n-Butylbenzene	60	0.03	0.02	0.02	0.10	0.00
Nonane	60	0.12	0.07	0.09	0.36	0.04
n-Propylbenzene	60	0.09	0.06	0.08	0.31	0.01
Octane	60	0.14	0.10	0.11	0.56	0.05
o-Xylene	60	0.55	0.36	0.47	1.80	0.12
p-Cymene	60	0.02	0.01	0.02	0.06	0.00
Pentane	60	1.09	0.63	0.95	3.95	0.37
Propane	60	2.65	2.45	1.97	17.96	0.69
Propylene	60	0.79	0.44	0.68	2.53	0.30
sec-Butylbenzene	60	0.01	0.01	0.01	0.03	0.00
Styrene	60	0.16	0.19	0.10	1.07	0.00
tert-Butylbenzene	60	0.00	0.00	0.00	0.01	0.00

Table 8 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2003**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Tetrachloroethylene	60	0.28	0.38	0.15	2.47	0.05
Toluene	60	4.10	2.46	3.44	11.62	1.23
trans-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.02	0.00
trans-1,2-Dimethylcyclohexane	60	0.00	0.00	0.00	0.02	0.00
trans-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
trans-1,4-Dimethylcyclohexane	60	0.03	0.02	0.03	0.13	0.01
trans-2-Butene	60	0.12	0.08	0.11	0.53	0.03
trans-2-Heptene	60	0.01	0.01	0.01	0.05	0.00
trans-2-Hexene	60	0.04	0.03	0.04	0.12	0.01
trans-2-Octene	60	0.04	0.03	0.04	0.20	0.01
trans-2-Pentene	60	0.17	0.10	0.15	0.42	0.05
trans-3-Heptene	60	0.02	0.01	0.02	0.07	0.00
trans-3-Methyl-2-pentene	60	0.02	0.01	0.02	0.09	0.00
trans-4-Methyl-2-pentene	60	0.00	0.00	0.00	0.02	0.00
Trichloroethylene	60	0.14	0.12	0.11	0.77	0.02
Undecane	60	0.13	0.10	0.11	0.45	0.00
Vinylchloride	60	0.00	0.00	0.00	0.01	0.00

The average detection limit varies between 0.5 and 1 µg/m^3.

Table 9 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2004**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1,1,1-Trichloroethane	60	0.13	0.02	0.13	0.17	0.11
1,1,2,2-Tetrachloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1,2-Trichloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethane	60	0.00	0.00	0.00	0.01	0.00
1,1-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
1,2,3-Trimethylbenzene	60	0.12	0.10	0.09	0.47	0.02
1,2,4-Trichlorobenzene	60	0.01	0.00	0.00	0.01	0.00
1,2,4-Trimethylbenzene	60	0.55	0.50	0.38	2.59	0.10
1,2-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,2-Dichloroethane	60	0.04	0.01	0.04	0.11	0.02
1,2-Dichloropropane	60	0.01	0.01	0.01	0.01	0.00
1,2-Diethylbenzene	60	0.01	0.01	0.01	0.03	0.00
1,3,5-Trimethylbenzene	60	0.17	0.17	0.12	1.01	0.03
1,3-Butadiene	60	0.16	0.11	0.13	0.68	0.04
1,3-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,3-Diethylbenzene	60	0.03	0.02	0.02	0.11	0.00
1,4-Dichlorobenzene	60	0.08	0.05	0.06	0.28	0.02
1,4-Dichlorobutane	60	0.00	0.00	0.00	0.00	0.00
1,4-Diethylbenzene	60	0.10	0.08	0.07	0.37	0.01
1-Butene/Isobutene	60	0.48	0.31	0.39	1.88	0.19
1-Butyne	60	0.01	0.00	0.00	0.03	0.00

Table 9 VOC Concentrations (μg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2004**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1-Decene	60	0.00	0.01	0.00	0.08	0.00
1-Heptene	60	0.00	0.02	0.00	0.15	0.00
1-Hexene	60	0.09	0.12	0.06	0.88	0.02
1-Methylcyclohexene	60	0.01	0.02	0.01	0.17	0.00
1-Methylcyclopentene	60	0.05	0.11	0.03	0.82	0.01
1-Nonene	60	0.00	0.02	0.00	0.13	0.00
1-Octene	60	0.01	0.02	0.01	0.09	0.00
1-Pentene	60	0.10	0.10	0.08	0.77	0.03
1-Propyne	60	0.10	0.07	0.07	0.43	0.03
1-Undecene	60	0.00	0.01	0.00	0.09	0.00
2,2,3-Trimethylbutane	60	0.01	0.01	0.01	0.07	0.00
2,2,4-Trimethylpentane	60	0.39	0.43	0.24	2.94	0.10
2,2,5-Trimethylhexane	60	0.02	0.02	0.01	0.10	0.00
2,2-Dimethylbutane	60	0.17	0.25	0.12	1.96	0.05
2,2-Dimethylhexane	60	0.02	0.03	0.01	0.19	0.00
2,2-Dimethylpentane	60	0.03	0.05	0.02	0.37	0.01
2,2-Dimethylpropane	60	0.02	0.01	0.01	0.08	0.00
2,3,4-Trimethylpentane	60	0.11	0.12	0.08	0.82	0.03
2,3-Dimethylbutane	60	0.23	0.30	0.17	2.21	0.07
2,3-Dimethylpentane	60	0.36	0.40	0.23	2.25	0.11
2,4-Dimethylhexane	60	0.08	0.11	0.05	0.78	0.02
2,4-Dimethylpentane	60	0.17	0.20	0.11	1.23	0.05
2,5-Dimethylhexane	60	0.06	0.08	0.04	0.52	0.01
2-Ethyl-1-Butene	60	0.00	0.00	0.00	0.00	0.00
2-Ethyltoluene	60	0.13	0.13	0.09	0.79	0.03
2-Methyl-1-butene	60	0.16	0.21	0.12	1.60	0.04
2-Methyl-2-butene	60	0.24	0.39	0.16	3.01	0.05
2-Methylheptane	60	0.18	0.28	0.11	2.06	0.04
2-Methylhexane	60	0.46	0.62	0.30	4.49	0.15
2-Methylpentane	60	0.95	1.19	0.72	8.71	0.27
3,6-Dimethyloctane	60	0.01	0.02	0.01	0.12	0.00
3-Ethyltoluene	60	0.33	0.36	0.21	2.42	0.07
3-Methyl-1-butene	60	0.04	0.04	0.03	0.27	0.01
3-Methyl-1-pentene	60	0.02	0.02	0.01	0.16	0.00
3-Methylheptane	60	0.17	0.30	0.10	2.28	0.04
3-Methylhexane	60	0.50	0.67	0.31	4.75	0.17
3-Methylpentane	60	0.65	0.77	0.48	5.66	0.19
4-Ethyltoluene	60	0.16	0.17	0.11	1.12	0.03
4-Methyl-1-pentene	60	0.02	0.02	0.01	0.11	0.00
4-Methylheptane	60	0.07	0.11	0.04	0.84	0.01
Acetylene	60	1.26	0.67	1.07	3.42	0.37
a-Pinene	60	0.10	0.13	0.05	0.74	0.00
Benzene	60	1.02	0.64	0.84	4.23	0.26
Benzylchloride	60	0.00	0.00	0.00	0.01	0.00
b-Pinene	60	0.03	0.04	0.02	0.16	0.00

Table 9 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2004**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Bromodichloromethane	60	0.01	0.01	0.00	0.05	0.00
Bromoform	60	0.01	0.01	0.01	0.03	0.01
Bromomethane	60	0.05	0.01	0.05	0.10	0.04
Butane	60	3.34	2.89	2.64	18.12	0.95
Camphene	60	0.03	0.03	0.02	0.17	0.00
Carbontetrachloride	60	0.59	0.05	0.58	0.73	0.50
Chlorobenzene	60	0.00	0.00	0.00	0.01	0.00
Chloroethane	60	0.01	0.00	0.01	0.02	0.01
Chloroform	60	0.10	0.03	0.09	0.20	0.06
Chloromethane	60	1.09	0.13	1.11	1.32	0.86
cis-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.01	0.00
cis-1,2-Dimethylcyclohexane	60	0.02	0.02	0.01	0.17	0.00
cis-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
cis-1,3-Dimethylcyclohexane	60	0.06	0.08	0.04	0.57	0.02
cis-1,4/t-1,3-Dimethylcyclohexane	60	0.03	0.04	0.02	0.33	0.01
cis-2-Butene	60	0.11	0.12	0.08	0.84	0.03
cis-2-Heptene	60	0.00	0.01	0.00	0.05	0.00
cis-2-Hexene	60	0.04	0.07	0.02	0.37	0.00
cis-2-Pentene	60	0.10	0.14	0.07	1.07	0.02
cis-3-Heptene	4	0.06	0.02	0.06	0.08	0.04
cis-3-Methyl-2-pentene	60	0.06	0.12	0.04	0.92	0.01
cis-4-Methyl-2-pentene	60	0.03	0.05	0.02	0.39	0.01
Cyclohexane	60	0.15	0.19	0.10	1.13	0.04
Cyclohexene	60	0.02	0.02	0.01	0.13	0.01
Cyclopentane	60	0.15	0.16	0.11	1.15	0.05
Cyclopentene	60	0.04	0.05	0.03	0.39	0.01
Decane	60	0.19	0.19	0.13	1.12	0.04
Dibromochloromethane	60	0.00	0.00	0.00	0.01	0.00
Dibromomethane	60	0.02	0.00	0.02	0.03	0.02
Dichloromethane	60	0.38	0.29	0.29	1.93	0.14
d-Limonene	60	0.08	0.11	0.04	0.52	0.00
Dodecane	52	0.09	0.07	0.08	0.35	0.00
EDB	60	0.00	0.00	0.00	0.00	0.00
Ethane	60	2.82	1.34	2.48	7.47	1.20
Ethylbenzene	60	0.57	0.65	0.39	4.65	0.14
Ethylbromide	60	0.00	0.00	0.00	0.01	0.00
Ethylene	60	2.26	1.45	1.86	8.77	0.70
Freon11	60	1.66	0.25	1.58	2.99	1.42
Freon113	60	0.59	0.05	0.59	0.69	0.47
Freon114	60	0.11	0.01	0.10	0.13	0.09
Freon12	60	2.59	0.18	2.58	3.05	2.28
Freon22	60	0.77	0.23	0.70	1.93	0.56
Heptane	60	0.38	0.53	0.25	3.77	0.09
Hexachlorobutadiene	60	0.00	0.00	0.00	0.01	0.00
Hexane	60	1.07	3.67	0.47	28.56	0.18

Table 9 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2004**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Hexylbenzene	49	0.01	0.01	0.00	0.02	0.00
Indane	60	0.07	0.07	0.05	0.46	0.01
Isobutane	60	1.99	1.87	1.61	11.22	0.53
iso-Butylbenzene	60	0.01	0.01	0.01	0.04	0.00
Isopentane	60	3.04	3.22	2.12	23.65	0.91
Isoprene	60	0.22	0.26	0.11	1.16	0.02
iso-Propylbenzene	60	0.03	0.03	0.02	0.21	0.01
m and p-Xylene	60	1.99	2.20	1.44	15.73	0.47
Methylcyclohexane	60	0.24	0.32	0.14	2.01	0.04
Methylcyclopentane	60	0.74	2.03	0.35	15.27	0.11
MTBE	60	0.00	0.00	0.00	0.00	0.00
Naphthalene	60	0.20	0.17	0.16	0.76	0.00
n-Butylbenzene	60	0.03	0.03	0.02	0.12	0.00
Nonane	60	0.14	0.15	0.09	0.91	0.04
n-Propylbenzene	60	0.10	0.12	0.07	0.85	0.02
Octane	60	0.15	0.25	0.10	1.87	0.03
o-Xylene	60	0.66	0.75	0.49	5.49	0.19
p-Cymene	60	0.02	0.01	0.02	0.06	0.00
Pentane	60	1.08	0.88	0.87	6.00	0.31
Propane	60	2.47	1.58	2.00	8.56	0.65
Propylene	60	0.78	0.52	0.67	3.11	0.25
sec-Butylbenzene	60	0.01	0.01	0.01	0.06	0.00
Styrene	60	0.22	0.37	0.07	2.02	0.01
tert-Butylbenzene	60	0.00	0.00	0.00	0.00	0.00
Tetrachloroethylene	60	0.26	0.35	0.16	1.99	0.05
Toluene	60	3.32	2.76	2.44	15.85	1.04
trans-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
trans-1,2-Dimethylcyclohexane	60	0.00	0.02	0.00	0.14	0.00
trans-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
trans-1,4-Dimethylcyclohexane	60	0.03	0.04	0.02	0.27	0.01
trans-2-Butene	60	0.13	0.14	0.09	0.98	0.04
trans-2-Heptene	60	0.01	0.02	0.01	0.19	0.00
trans-2-Hexene	60	0.05	0.09	0.04	0.67	0.01
trans-2-Octene	60	0.04	0.05	0.02	0.34	0.01
trans-2-Pentene	60	0.17	0.25	0.12	1.88	0.04
trans-3-Heptene	60	0.02	0.03	0.01	0.21	0.00
trans-3-Methyl-2-pentene	60	0.03	0.06	0.02	0.43	0.01
trans-4-Methyl-2-pentene	60	0.01	0.01	0.00	0.09	0.00
Trichloroethylene	60	0.12	0.11	0.09	0.50	0.02
Undecane	60	0.16	0.16	0.11	0.84	0.01
Vinylchloride	60	0.00	0.00	0.00	0.01	0.00

The average detection limit varies between 0.5 and 1 µg/m^3.

Table 10 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2005**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
1,1,1-Trichloroethane	60	0.11	0.01	0.11	0.13	0.09
1,1,2,2-Tetrachloroethane	60	0.00	0.00	0.00	0.01	0.00
1,1,2-Trichloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethane	60	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethylene	60	0.00	0.00	0.00	0.01	0.00
1,2,3-Trimethylbenzene	60	0.08	0.05	0.07	0.26	0.00
1,2,4-Trichlorobenzene	52	0.00	0.00	0.00	0.02	0.00
1,2,4-Trimethylbenzene	60	0.35	0.22	0.30	1.29	0.00
1,2-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,2-Dichloroethane	60	0.03	0.01	0.04	0.05	0.02
1,2-Dichloropropane	60	0.01	0.00	0.01	0.01	0.00
1,2-Diethylbenzene	60	0.00	0.00	0.00	0.02	0.00
1,3,5-Trimethylbenzene	60	0.11	0.07	0.10	0.39	0.00
1,3-Butadiene	60	0.12	0.07	0.10	0.38	0.04
1,3-Dichlorobenzene	60	0.00	0.00	0.00	0.01	0.00
1,3-Diethylbenzene	60	0.02	0.01	0.01	0.06	0.00
1,4-Dichlorobenzene	60	0.07	0.05	0.06	0.28	0.01
1,4-Dichlorobutane	60	0.00	0.00	0.00	0.00	0.00
1,4-Diethylbenzene	60	0.05	0.04	0.04	0.19	0.00
1-Butene/Isobutene	60	0.38	0.17	0.34	0.95	0.13
1-Butyne	60	0.00	0.00	0.00	0.01	0.00
1-Decene	60	0.00	0.00	0.00	0.01	0.00
1-Heptene	39	0.00	0.00	0.00	0.00	0.00
1-Hexene	60	0.05	0.02	0.04	0.12	0.01
1-Methylcyclohexene	60	0.01	0.00	0.01	0.02	0.00
1-Methylcyclopentene	60	0.02	0.02	0.02	0.07	0.00
1-Nonene	60	0.00	0.01	0.00	0.04	0.00
1-Octene	60	0.00	0.01	0.00	0.02	0.00
1-Pentene	60	0.06	0.03	0.05	0.15	0.02
1-Propyne	60	0.07	0.04	0.06	0.23	0.02
1-Undecene	60	0.00	0.00	0.00	0.02	0.00
2,2,3-Trimethylbutane	60	0.01	0.00	0.01	0.02	0.00
2,2,4-Trimethylpentane	60	0.30	0.19	0.27	0.99	0.00
2,2,5-Trimethylhexane	60	0.02	0.01	0.01	0.04	0.00
2,2-Dimethylbutane	60	0.11	0.06	0.10	0.38	0.03
2,2-Dimethylhexane	60	0.01	0.01	0.01	0.09	0.00
2,2-Dimethylpentane	60	0.02	0.01	0.02	0.06	0.01
2,2-Dimethylpropane	60	0.01	0.01	0.01	0.04	0.00
2,3,4-Trimethylpentane	60	0.08	0.05	0.08	0.25	0.02
2,3-Dimethylbutane	60	0.17	0.09	0.16	0.52	0.05
2,3-Dimethylpentane	60	0.29	0.16	0.27	0.96	0.09
2,4-Dimethylhexane	60	0.05	0.03	0.05	0.15	0.00
2,4-Dimethylpentane	60	0.12	0.07	0.11	0.38	0.04
2,5-Dimethylhexane	60	0.04	0.02	0.04	0.11	0.01
2-Ethyl-1-Butene	60	0.00	0.00	0.00	0.00	0.00

Table 10 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2005**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2-Ethyltoluene	60	0.08	0.04	0.07	0.26	0.01
2-Methyl-1-butene	60	0.09	0.05	0.08	0.28	0.03
2-Methyl-2-butene	60	0.14	0.09	0.11	0.45	0.04
2-Methylheptane	60	0.11	0.05	0.10	0.31	0.03
2-Methylhexane	60	0.34	0.18	0.31	1.21	0.11
2-Methylpentane	60	0.67	0.39	0.58	2.11	0.00
3,6-Dimethyloctane	60	0.01	0.01	0.01	0.03	0.00
3-Ethyltoluene	60	0.21	0.12	0.18	0.69	0.02
3-Methyl-1-butene	60	0.03	0.01	0.02	0.07	0.01
3-Methyl-1-pentene	60	0.01	0.01	0.01	0.02	0.00
3-Methylheptane	60	0.10	0.05	0.09	0.31	0.03
3-Methylhexane	60	0.35	0.19	0.33	1.27	0.12
3-Methylpentane	60	0.49	0.25	0.45	1.46	0.16
4-Ethyltoluene	60	0.10	0.06	0.09	0.37	0.01
4-Methyl-1-pentene	60	0.01	0.02	0.00	0.12	0.00
4-Methylheptane	60	0.04	0.02	0.04	0.13	0.01
Acetylene	60	1.18	0.60	1.13	2.74	0.34
a-Pinene	60	0.09	0.09	0.06	0.47	0.00
Benzene	60	0.78	0.36	0.74	1.91	0.23
Benzylchloride	52	0.00	0.00	0.00	0.00	0.00
b-Pinene	60	0.03	0.05	0.01	0.33	0.00
Bromodichloromethane	60	0.00	0.00	0.00	0.01	0.00
Bromoform	60	0.01	0.01	0.01	0.04	0.01
Bromomethane	60	0.06	0.01	0.05	0.13	0.05
Butane	60	3.72	2.16	3.23	11.95	0.91
Camphene	60	0.04	0.07	0.02	0.50	0.00
Carbontetrachloride	60	0.59	0.04	0.59	0.65	0.51
Chlorobenzene	60	0.00	0.00	0.00	0.01	0.00
Chloroethane	60	0.02	0.01	0.01	0.04	0.00
Chloroform	60	0.10	0.03	0.09	0.21	0.07
Chloromethane	60	1.12	0.07	1.12	1.25	0.97
cis-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
cis-1,2-Dimethylcyclohexane	60	0.01	0.01	0.01	0.04	0.00
cis-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
cis-1,3-Dimethylcyclohexane	60	0.04	0.03	0.04	0.13	0.01
cis-1,4/t-1,3-Dimethylcyclohexane	60	0.02	0.01	0.02	0.06	0.01
cis-2-Butene	60	0.09	0.05	0.08	0.25	0.02
cis-2-Heptene	60	0.00	0.00	0.00	0.01	0.00
cis-2-Hexene	60	0.03	0.02	0.03	0.09	0.00
cis-2-Pentene	60	0.05	0.03	0.05	0.17	0.02
cis-3-Methyl-2-pentene	60	0.03	0.02	0.02	0.09	0.00
cis-4-Methyl-2-pentene	60	0.02	0.01	0.01	0.06	0.00
Cyclohexane	60	0.08	0.05	0.07	0.25	0.02
Cyclohexene	60	0.01	0.01	0.01	0.03	0.00
Cyclopentane	60	0.10	0.05	0.09	0.33	0.04

Table 10 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2005**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Cyclopentene	60	0.02	0.01	0.02	0.06	0.01
Decane	60	0.14	0.10	0.12	0.62	0.02
Dibromochloromethane	60	0.00	0.00	0.00	0.01	0.00
Dibromomethane	60	0.03	0.00	0.03	0.04	0.02
Dichloromethane	60	0.35	0.21	0.28	1.31	0.16
d-Limonene	60	0.07	0.09	0.05	0.51	0.00
Dodecane	60	0.06	0.05	0.05	0.22	0.00
EDB	60	0.00	0.00	0.00	0.01	0.00
Ethane	60	2.43	1.16	2.10	6.55	1.15
Ethylbenzene	60	0.43	0.25	0.40	1.55	0.11
Ethylbromide	60	0.00	0.00	0.00	0.01	0.00
Ethylene	60	1.84	0.99	1.65	5.66	0.63
Freon11	60	1.65	0.19	1.63	2.86	1.38
Freon113	60	0.61	0.05	0.63	0.68	0.46
Freon114	60	0.11	0.01	0.11	0.13	0.10
Freon12	60	2.76	0.15	2.79	3.16	2.39
Freon22	60	0.87	0.31	0.80	2.43	0.63
Heptane	60	0.25	0.16	0.23	0.99	0.07
Hexachlorobutadiene	52	0.00	0.00	0.00	0.01	0.00
Hexane	60	0.44	0.33	0.35	2.14	0.11
Hexylbenzene	42	0.00	0.00	0.00	0.01	0.00
Indane	60	0.04	0.02	0.03	0.13	0.00
Isobutane	60	2.01	1.36	1.69	7.07	0.40
iso-Butylbenzene	60	0.01	0.00	0.00	0.02	0.00
Isopentane	60	3.03	1.75	2.57	8.82	0.84
Isoprene	60	0.29	0.60	0.08	2.70	0.03
iso-Propylbenzene	60	0.02	0.01	0.02	0.05	0.01
m and p-Xylene	60	1.51	0.91	1.40	5.57	0.31
Methylcyclohexane	60	0.15	0.11	0.14	0.54	0.03
Methylcyclopentane	60	0.31	0.17	0.27	0.87	0.09
MTBE	60	0.00	0.00	0.00	0.02	0.00
Naphthalene	56	0.11	0.08	0.11	0.40	0.00
n-Butylbenzene	60	0.02	0.01	0.02	0.07	0.00
Nonane	60	0.09	0.05	0.08	0.33	0.03
n-Propylbenzene	60	0.06	0.03	0.06	0.20	0.02
Octane	60	0.09	0.05	0.08	0.26	0.03
o-Xylene	60	0.45	0.25	0.41	1.51	0.11
p-Cymene	60	0.01	0.01	0.01	0.04	0.00
Pentane	60	0.96	0.47	0.91	3.06	0.33
Propane	60	2.50	1.57	2.00	7.35	0.61
Propylene	60	0.67	0.35	0.58	1.91	0.23
sec-Butylbenzene	60	0.01	0.00	0.01	0.02	0.00
Styrene	60	0.25	0.42	0.07	2.19	0.00
tert-Butylbenzene	60	0.00	0.00	0.00	0.00	0.00
Tetrachloroethylene	60	0.25	0.31	0.14	1.60	0.04

Table 10 VOC Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1 to December 31, **2005**.

Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
Toluene	60	2.85	1.89	2.41	11.57	0.60
trans-1,2-Dichloroethylene	60	0.00	0.00	0.00	0.00	0.00
trans-1,2-Dimethylcyclohexane	60	0.00	0.00	0.00	0.01	0.00
trans-1,3-Dichloropropene	60	0.00	0.00	0.00	0.00	0.00
trans-1,4-Dimethylcyclohexane	60	0.02	0.01	0.02	0.06	0.00
trans-2-Butene	60	0.11	0.06	0.10	0.33	0.03
trans-2-Heptene	60	0.01	0.00	0.01	0.02	0.00
trans-2-Hexene	60	0.03	0.02	0.03	0.10	0.00
trans-2-Octene	60	0.03	0.02	0.03	0.10	0.00
trans-2-Pentene	60	0.11	0.06	0.09	0.35	0.03
trans-3-Heptene	60	0.00	0.00	0.00	0.02	0.00
trans-3-Methyl-2-pentene	60	0.01	0.01	0.01	0.05	0.00
trans-4-Methyl-2-pentene	60	0.00	0.00	0.00	0.01	0.00
Trichloroethylene	60	0.10	0.08	0.07	0.35	0.02
Undecane	60	0.11	0.09	0.10	0.58	0.00
Vinylchloride	60	0.00	0.00	0.00	0.01	0.00

The average detection limit varies between 0.5 and 1 µg/m^3.

Table 11 PAH Concentrations (ng/m³) at Station 9119, 65 Ellen Street, Winnipeg from May 9, 2003 to December 31, 2005.

COMPOUNDS	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum Concentration	Minimum Concentration
1-Me-Pyrene	67	0.08	0.08	0.06	0.55	0.01
2-Me-Cholanthrene	67	0.02	0.01	0.01	0.05	0.01
2-Me-Fluorene	67	0.81	0.49	0.71	2.68	0.24
7-Me-Benz(a)Anthracene	67	0.01	0.01	0.01	0.02	0.00
Acenaphthene	67	1.20	0.88	1.00	4.76	0.16
Acenaphthylene	67	1.74	2.61	0.83	15.53	0.09
Anthanthrene	64	0.03	0.03	0.01	0.22	0.01
Anthracene	67	0.54	0.35	0.48	2.12	0.15
Benz(a)Anthracene	67	0.11	0.15	0.08	1.23	0.02
Benzo(a)Fluorene	67	0.09	0.07	0.07	0.58	0.01
Benzo(a)Pyrene	67	0.08	0.11	0.06	0.93	0.00
Benzo(b)Chrysene	67	0.03	0.03	0.01	0.08	0.01
Benzo(b)Fluoranthene	67	0.24	0.22	0.19	1.67	0.07
Benzo(b)Fluorene	67	0.05	0.05	0.04	0.40	0.00
Benzo(e)Pyrene	67	0.12	0.10	0.10	0.79	0.04
Benzo(g,h,i)Fluoranthene	67	0.15	0.16	0.10	1.19	0.03
Benzo(g,h,i)Perylene	67	0.18	0.17	0.13	1.28	0.04
Benzo(k)Fluoranthene	67	0.07	0.06	0.05	0.45	0.02
Chrysene	67	0.19	0.21	0.14	1.64	0.05
Dibenz(a,c)&(a,h)Anthracene	67	0.02	0.02	0.02	0.09	0.01
Fluoranthene	67	1.54	0.93	1.26	6.27	0.47
Fluorene	67	2.43	1.22	2.17	6.91	0.68
Indeno(1,2,3-cd)Fluoranthene	67	0.02	0.02	0.01	0.08	0.00
Indeno(1,2,3-cd)Pyrene	67	0.13	0.12	0.11	0.96	0.04
Perylene	67	0.02	0.02	0.01	0.16	0.00
Phenanthrene	67	6.49	4.42	5.26	22.48	2.04
Pyrene	67	1.30	0.84	1.16	6.47	0.30
Retene	67	0.30	0.42	0.19	2.67	0.03
Triphenylene	67	0.06	0.04	0.06	0.24	0.02

Table 12 PCDD/PCDF Concentrations (pg/m³) at Station 9119, 65 Ellen Street, Winnipeg from May 21, 2003 to December 31, 2005.

Congener	Number of Samples	Mean	St. Dev.	Median	Max	Min
1234678-H7CDD	28	0.095511	0.081184	0.072500	0.385000	0.013500
1234678-H7CDF	28	0.026750	0.017768	0.020900	0.072000	0.005900
1234789-H7CDF	22	0.004573	0.004016	0.003450	0.019300	0.001600
123478-H6CDD	25	0.005156	0.003081	0.004500	0.015300	0.001000
123478-H6CDF	28	0.012875	0.009029	0.011000	0.039100	0.001700
123678-H6CDD	27	0.008070	0.006284	0.007300	0.031500	0.001200
123678-H6CDF	27	0.005274	0.004032	0.004600	0.020500	0.000700
123789-H6CDD	27	0.009074	0.006703	0.007400	0.031800	0.001400
123789-H6CDF	12	0.000983	0.000844	0.000800	0.003500	0.000400
12378-P5CDD	27	0.006878	0.002454	0.006100	0.014400	0.004000
12378-P5CDF	27	0.003593	0.002578	0.003200	0.013000	0.000700
234678-H6CDF	28	0.005582	0.004014	0.004000	0.018400	0.000900
23478-P5CDF	26	0.006358	0.005799	0.005400	0.026200	0.000900
2378-TCDD	20	0.001190	0.000523	0.001000	0.002200	0.000600
2378-TCDF	28	0.014229	0.010261	0.011600	0.048100	0.002200
OCDD	28	0.293111	0.223403	0.246250	1.102200	0.071300
OCDF	28	0.026096	0.018108	0.020500	0.068100	0.006400
H6CDD	28	0.124143	0.073581	0.112850	0.318700	0.016200
H7CDD	28	0.182186	0.142602	0.135500	0.614700	0.026200
OCDD	28	0.293111	0.223403	0.246250	1.102200	0.071300
P5CDD	28	0.060764	0.031535	0.059400	0.132000	0.009800
TCDD	28	0.032461	0.025076	0.028900	0.143800	0.003400
TOTAL PCDD	28	0.692646	0.453313	0.643150	2.087000	0.127800
H6CDF	28	0.071743	0.060222	0.058650	0.338400	0.010300
H7CDF	28	0.047925	0.034882	0.035250	0.167000	0.009500
OCDF	28	0.026096	0.018108	0.020500	0.068100	0.006400
P5CDF	28	0.082557	0.068743	0.065400	0.385000	0.014900
TCDF	28	0.124793	0.102271	0.106750	0.549100	0.025100
TOTAL PCDF	28	0.353111	0.267683	0.287200	1.506800	0.071500
TEQ	28	0.014845	0.007366	0.013605	0.032023	0.001359

Table 13 Aldehyde/Ketone Concentrations (µg/m^3) at Station 9119, 65 Ellen Street, Winnipeg from January 1, 2003 to December 31, 2005.

2003 Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2,5-Dimethylbenzaldehyde	54	0.00	0.00	0.00	0.00	0.00
2-Pentanone/Isovaleraldehyde	54	0.09	0.04	0.08	0.23	0.03
Acetaldehyde	54	1.06	0.050	1.00	2.49	0.26
Acetone	54	3.77	1.55	3.67	8.81	1.22
Acrolein	54	0.05	0.05	0.03	0.33	0.00
Benzaldehyde	54	0.11	0.06	0.09	0.34	0.00
Crotonaldehyde	54	0.05	0.06	0.03	0.30	0.00
Formaldehyde	54	1.97	1.21	1.60	6.52	0.40
Hexanal	54	0.11	0.07	0.10	0.36	0.03
MEK	54	1.23	0.76	1.12	3.19	0.15
MIBK	54	0.06	0.05	0.05	0.31	0.00
m-Tolualdehyde	54	0.02	0.01	0.02	0.06	0.00
o-Tolualdehyde	54	0.00	0.00	0.00	0.00	0.00
Propionaldehyde	54	0.24	0.13	0.22	0.67	0.06
p-Tolualdehyde	54	0.00	0.00	0.00	0.00	0.00
Valeraldehyde	54	0.06	0.03	0.06	0.16	0.02

2004 Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2,5-Dimethylbenzaldehyde	53	0.00	0.00	0.00	0.00	0.00
2-Pentanone/Isovaleraldehyde	53	0.08	0.04	0.07	0.21	0.03
Acetaldehyde	53	1.03	0.78	0.88	4.87	0.26
Acetone	53	3.95	1.88	3.37	8.41	1.09
Acrolein	53	0.05	0.06	0.03	0.27	0.00
Benzaldehyde	53	0.08	0.05	0.08	0.21	0.00
Crotonaldehyde	53	0.04	0.04	0.02	0.18	0.00
Formaldehyde	53	1.87	1.53	1.39	9.55	0.40
Hexanal	53	0.09	0.06	0.08	0.37	0.03
MEK	53	2.43	0.95	2.46	5.85	0.73
MIBK	53	0.17	0.25	0.07	1.12	0.00
m-Tolualdehyde	53	0.02	0.02	0.02	0.05	0.00
o-Tolualdehyde	53	0.00	0.01	0.00	0.03	0.00
Propionaldehyde	53	0.20	0.13	0.17	0.69	0.06
p-Tolualdehyde	53	0.01	0.02	0.00	0.09	0.00
Valeraldehyde	53	0.06	0.03	0.05	0.18	0.02

2005 Compounds	Number of Samples	Arithmetic Mean	Standard Deviation	Median	Maximum	Minimum
2,5-Dimethylbenzaldehyde	53	0.00	0.00	0.00	0.00	0.00
2-Pentanone/Isovaleraldehyde	53	0.08	0.04	0.08	0.20	0.00
Acetaldehyde	53	0.92	0.43	0.84	2.18	0.33
Acetone	53	3.12	1.41	2.57	8.81	1.31
Acrolein	53	0.06	0.08	0.03	0.37	0.00
Benzaldehyde	53	0.10	0.05	0.09	0.26	0.02
Crotonaldehyde	53	0.05	0.08	0.03	0.41	0.00
Formaldehyde	53	1.59	0.94	1.38	5.06	0.45
Hexanal	53	0.11	0.05	0.09	0.30	0.03
MEK	53	1.44	0.72	1.39	3.15	0.24
MIBK	53	0.07	0.09	0.05	0.62	0.00
m-Tolualdehyde	53	0.01	0.01	0.00	0.03	0.00
o-Tolualdehyde	53	0.00	0.00	0.00	0.01	0.00
Propionaldehyde	53	0.19	0.10	0.16	0.46	0.05
p-Tolualdehyde	53	0.00	0.00	0.00	0.02	0.00
Valeraldehyde	53	0.06	0.03	0.05	0.19	0.00

DISCUSSION

CAUTIONARY NOTE:

Though it was the intent, within the design of the sampling network, to locate monitoring sites in accordance with generally accepted siting criteria and to use collection and analytical procedures that are common to other networks, it should be noted that the data presented in this report may have limitations and, therefore, caution should be exercised towards their use. In particular, when comparing data between Canadian regions and even between stations in the same city, it must be realized that the data represent the condition of the air in the vicinity of the individual monitoring station and may not necessarily reflect community-wide air quality.

A. WINNIPEG AIR QUALITY

Downtown

Air quality in the downtown area of Winnipeg was represented by monitoring at station #9119, 65 Ellen Street, a NAPS site. Measurements were made for the parameters carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), nitrogen oxides (NO_x), ground level ozone (O_3), inhalable particulates (PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated dibenzodioxins/furans (PCDDs/PCDFs) and aldehydes/ketones.

Air Quality Index

The Air Quality Index (Figures 6, 7 & 8, Table 14) was in the Good range for over 95% of the time (on average) in 2004 and 2005 (discounting N/A times). In 2004 and 2005, there were eight hours and twenty-two hours, respectively where the Air Quality was Poor with no Very Poor hours, whereas in 2003, there were no Poor or Very Poor hours. The short stretch of Poor Air Quality in April of 2004 coincided with the annual street cleaning operation in the City of Winnipeg. Poor Air Quality hours in November of 2005 were the result of a building fire to the north of the monitoring station which affected local air quality. There were fewer hours with air quality in the "Fair" range in 2004 than in 2003 or 2005; however the number of Air Quality hours in the "Fair" range was considerably less in 2004 and

2005 than in the previous three years (2000 to 2002). The bulk of the hours in the "Fair" range in 2003 were distributed through the middle of the first quarter to the end of the second quarter and from the middle of the third quarter to the beginning of the fourth. Air quality hours in the "Fair" range in 2004 were distributed through the beginning to the end of the second quarter and at the beginning of the third quarter. In 2005, most of the "Fair" hours occurred during the spring and could be attributed to road dust entrainment by vehicles and wind prior to the annual street cleaning in the spring. In all three years the major influencing factor was ground-level ozone; followed by PM_{10} (averaged over 24 hours) and then $PM_{2.5}$ (averaged over 24 hours). The number of hours attributable to each of the three influencing factors was similar in all years with averages of 3749, 2697, and 1507 hours for ozone, PM_{10}, and $PM_{2.5}$ respectively.

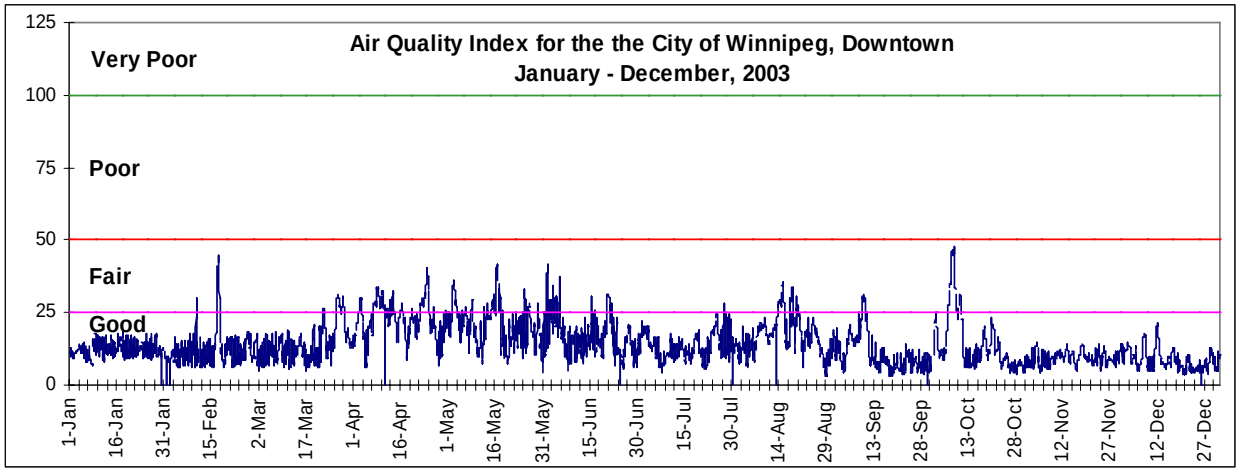

Figure 6. The Air Quality Index for Winnipeg (Downtown) for 2003.

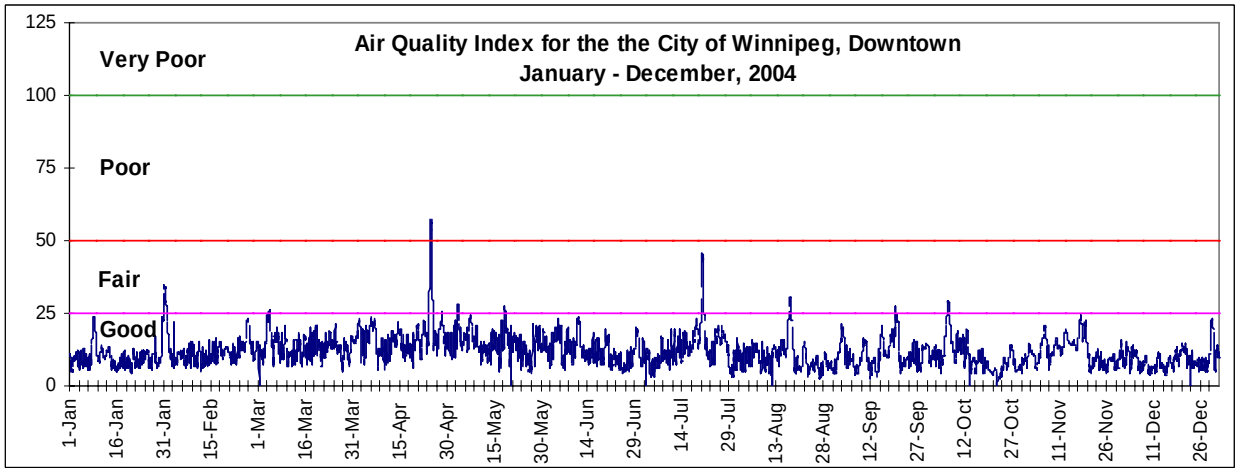

Figure 7. The Air Quality Index for Winnipeg (Downtown) for 2004.

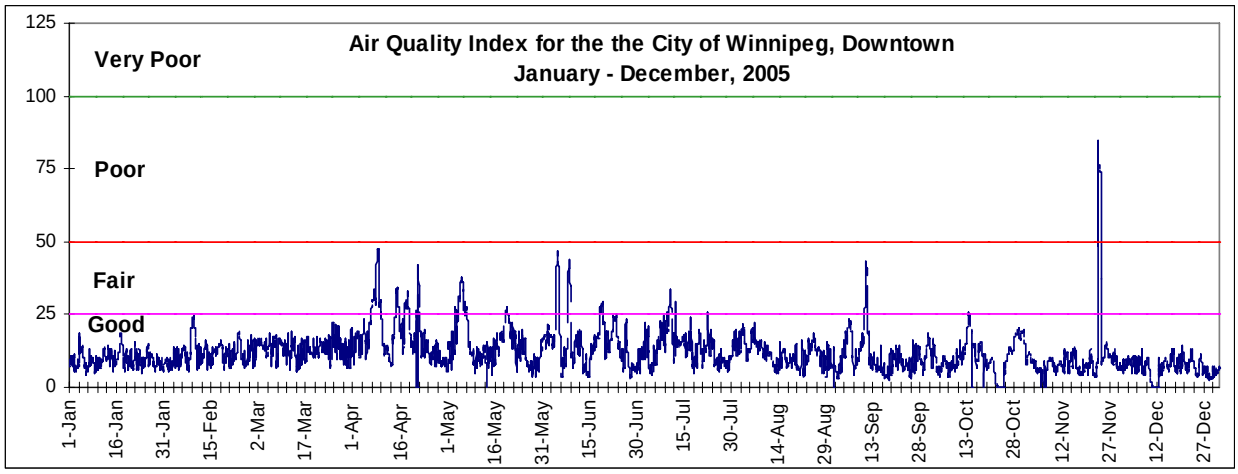

Figure 8. The Air Quality Index for Winnipeg (Downtown) for 2005.

Table 14: Summary of AQI for Winnipeg (Downtown) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

	Number of Hours					
2003	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of available
Good	1977	1641	1998	2004	7620	91.3%
Fair	87	436	112	89	724	8.7%
Poor	0	0	0	0	0	0.0%
V.Poor	0	0	0	0	0	0.0%
N/A	96	107	98	115	416	--
Total	2160	2184	2208	2208	8760	100%
CO	0	0	1	0	1	0.0%
8-Hr CO	7	10	5	5	27	0.3%
24-Hr $PM_{2.5}$	413	67	461	628	1569	18.8%
24-Hr PM_{10}	301	1058	809	707	2875	34.5%
NO_2	173	31	12	136	352	4.2%
O_3	1170	911	822	617	3520	42.2%
N/A	96	107	98	115	416	--
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance,

Table 14 (Continued) Summary of AQI for Winnipeg (Downtown) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

2004	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of available
Good	2058	2041	2072	2093	8264	98.5%
Fair	26	41	38	15	120	1.4%
Poor	0	8	0	0	8	0.1%
V.Poor	0	0	0	0	0	0.0%
N/A	100	94	98	100	392	--
Total	2184	2184	2208	2208	8784	100%
CO	0	0	0	0	0	0.0%
8-Hr CO	0	9	0	18	27	0.3%
24-Hr $PM_{2.5}$	579	9	320	573	1481	17.6%
24-Hr PM_{10}	174	846	938	596	2554	30.4%
NO_2	256	26	7	123	412	4.9%
O_3	1075	1200	845	798	3918	46.7%
N/A	100	94	98	100	392	--
Total	2184	2184	2208	2208	8784	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance,

	Number of Hours					
2005	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of available
Good	2067	1789	2069	2084	8009	95.6%
Fair	0	295	44	4	343	4.1%
Poor	0	0	0	22	22	0.3%
V.Poor	0	0	0	0	0	0.0%
N/A	93	100	95	98	386	--
Total	2160	2184	2208	2208	8760	100%
CO	0	0	0	0	0	0.0%
8-Hr CO	0	0	15	11	26	0.3%
24-Hr $PM_{2.5}$	433	259	266	514	1472	17.6%
24-Hr PM_{10}	296	875	846	646	2663	31.8%
NO_2	204	10	13	176	403	4.8%
O_3	1134	940	973	763	3810	45.5%
N/A	93	100	95	98	386	--
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance, instrument failure and/or repair.

Carbon Monoxide

The maximum 1-hour and the maximum 8-hour concentrations have not exceeded the MAL since 1978. Average monthly levels of CO in the downtown area (shown in Figures 10 to 12) were slightly higher than those observed in the residential area. Yearly trends are shown in Figure 9.

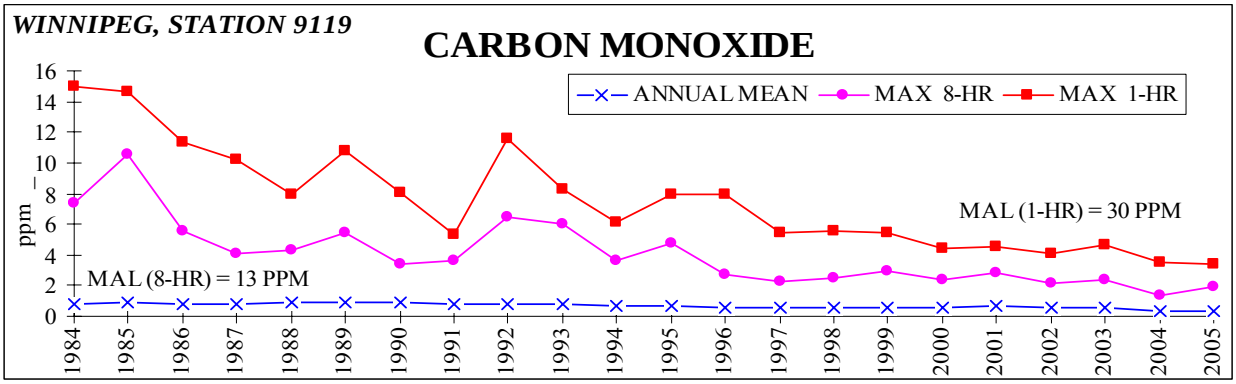

Figure 9 Annual mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site.

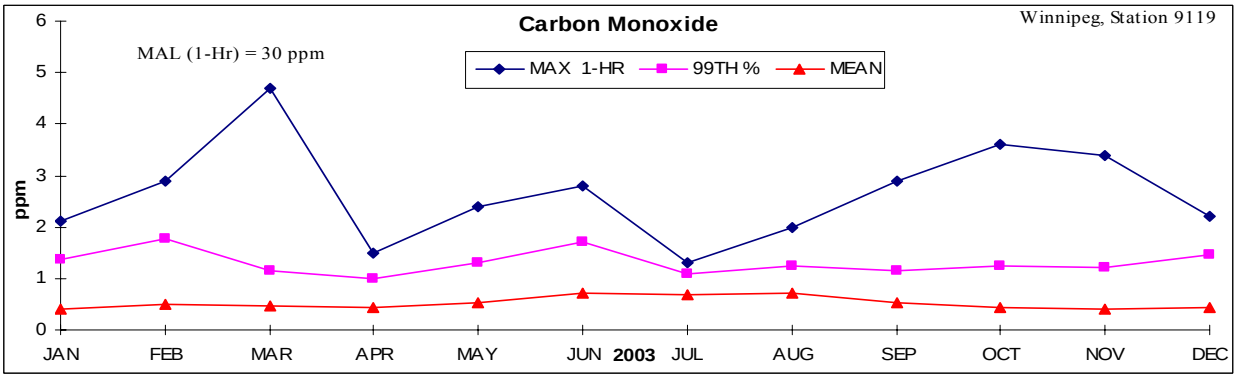

Figure 10 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2003.

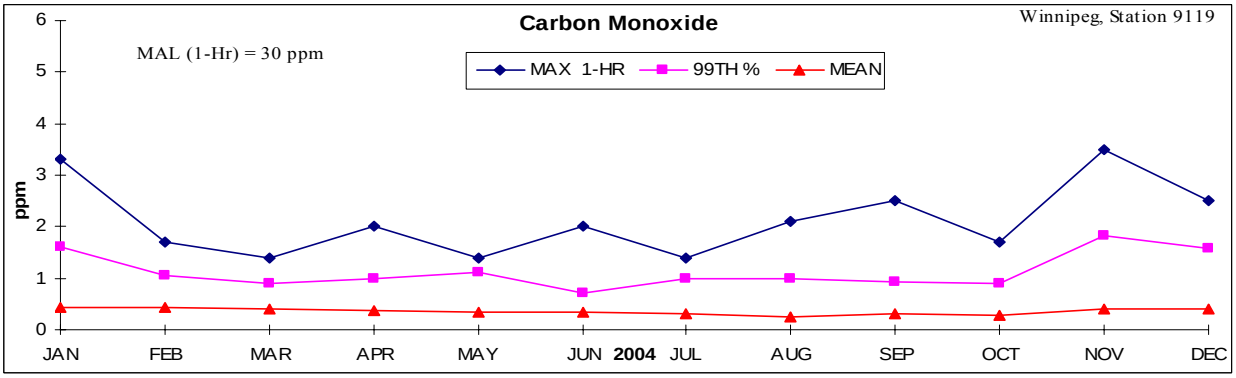

Figure 11 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2004.

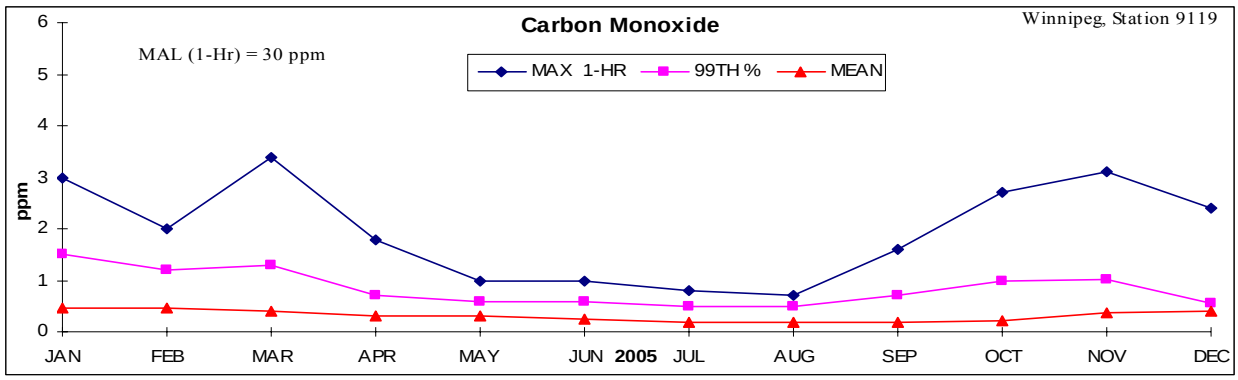

Figure 12 Monthly mean and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg downtown monitoring site for 2005.

Ozone

Ground level O_3 at the downtown station had the lowest annual mean, for 2003, 2004 and 2005, of the three stations monitoring ozone in Manitoba. The annual and monthly trends are shown in Figure 13 and Figures 14, 15 and 16, respectively. The 1-hour MAL of 8.2 pphm (0.082 ppm) has not been exceeded since 1990.

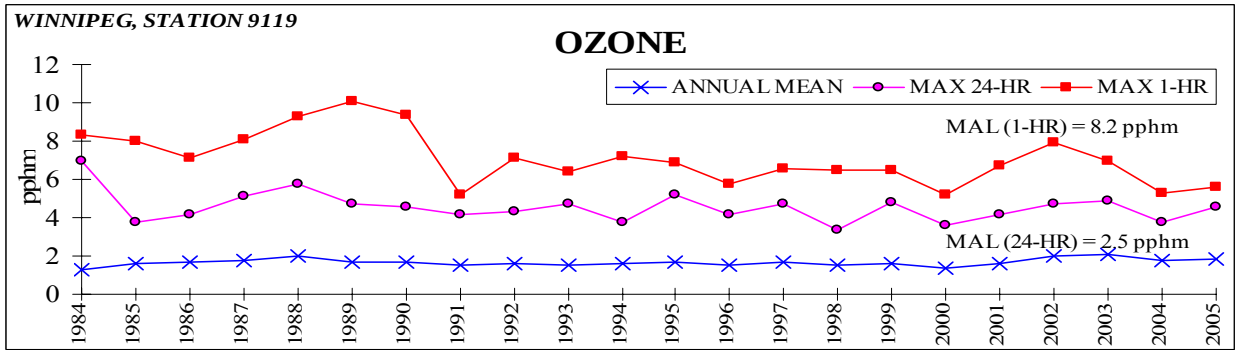

Figure 13 Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site.

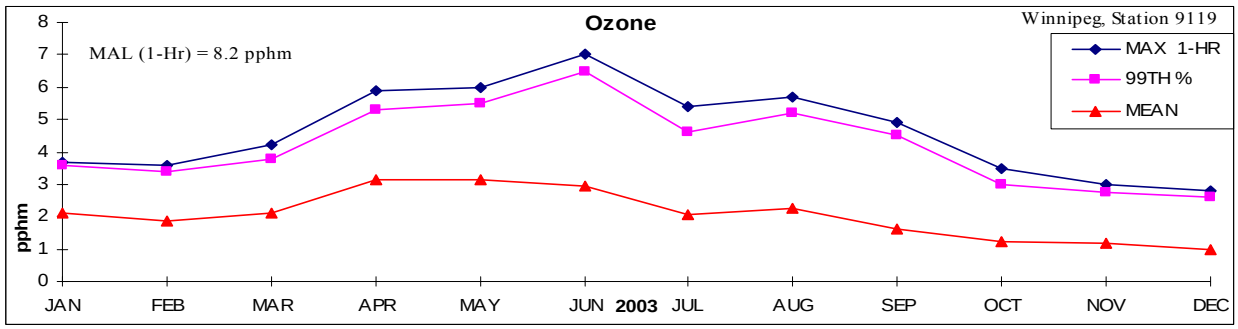

Figure 14 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2003.

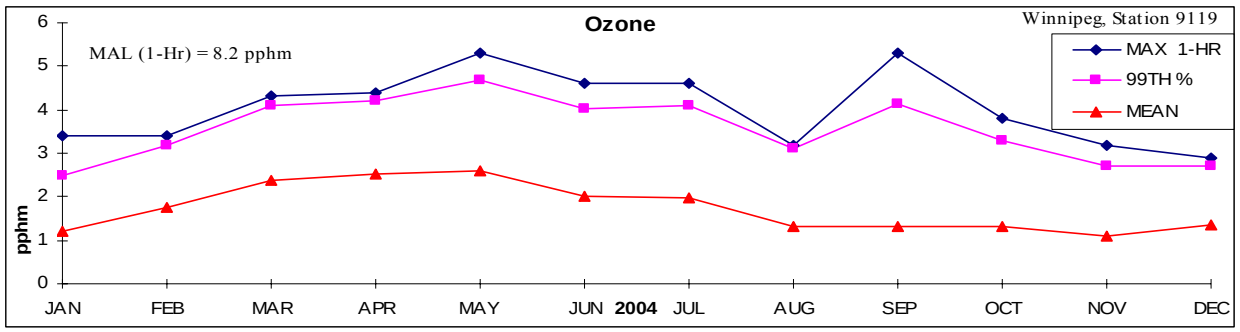

Figure 15 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2004.

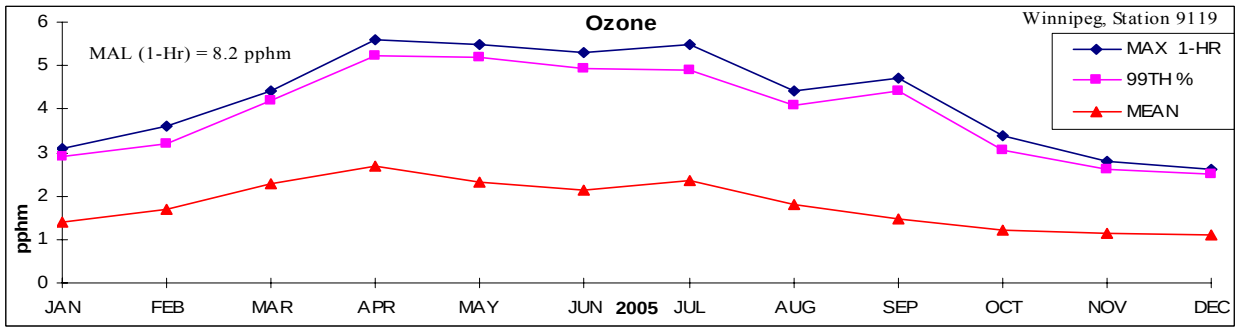

Figure 16 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg downtown monitoring site for 2005.

Nitrogen Dioxide

NO_2 levels in downtown Winnipeg continued to be well below the Manitoba Air Quality Objectives, as in previous years. Average monthly values, for 2003, 2004 and 2005 respectively, are shown in Figures 18 to 20 and were slightly higher than at the residential location. Yearly trends are shown in Figure 17.

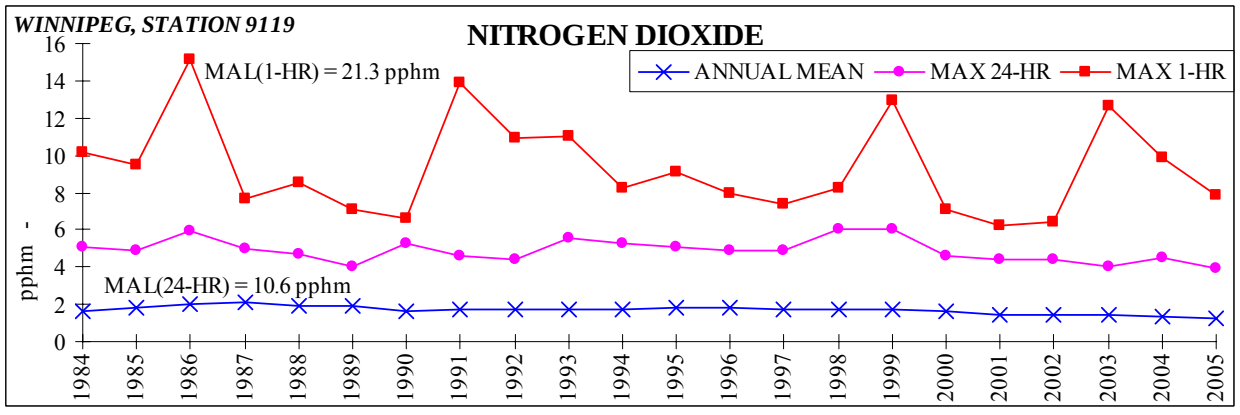

Figure 17 Annual mean, 24-Hr and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site.

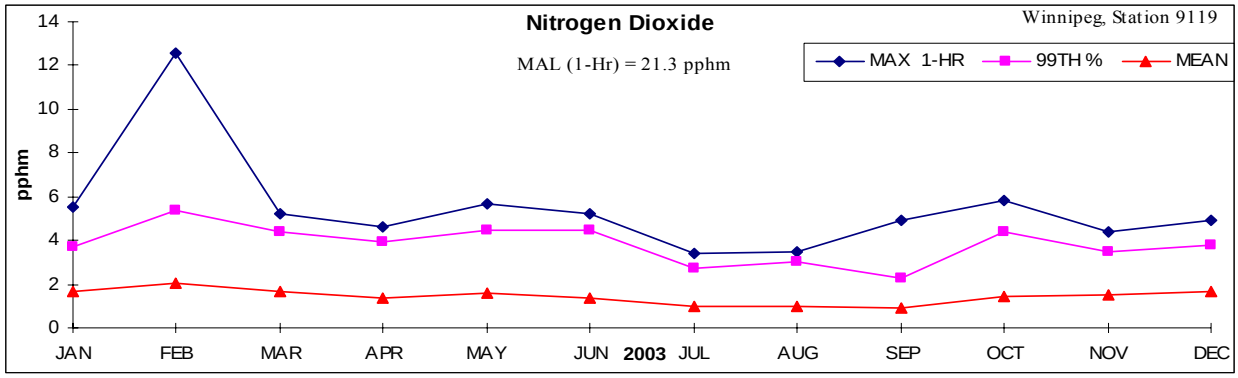

Figure 18 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2003.

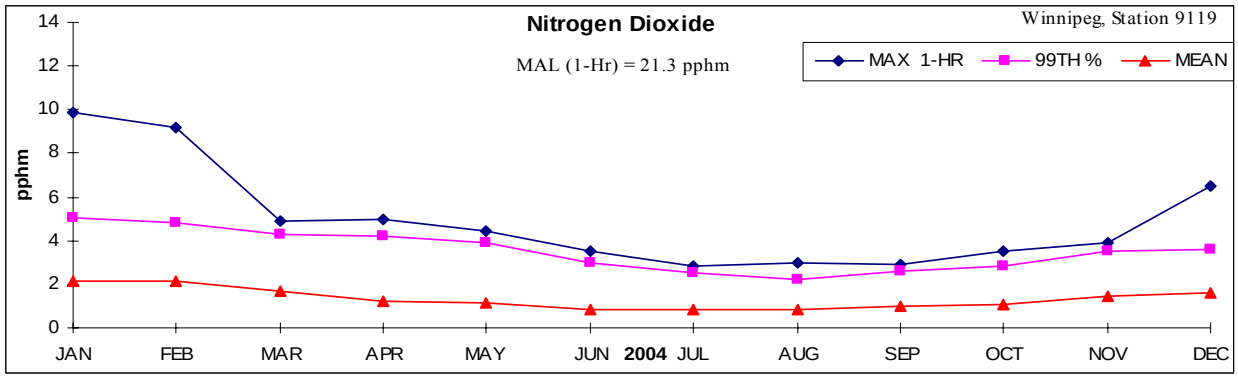

Figure 19 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2004.

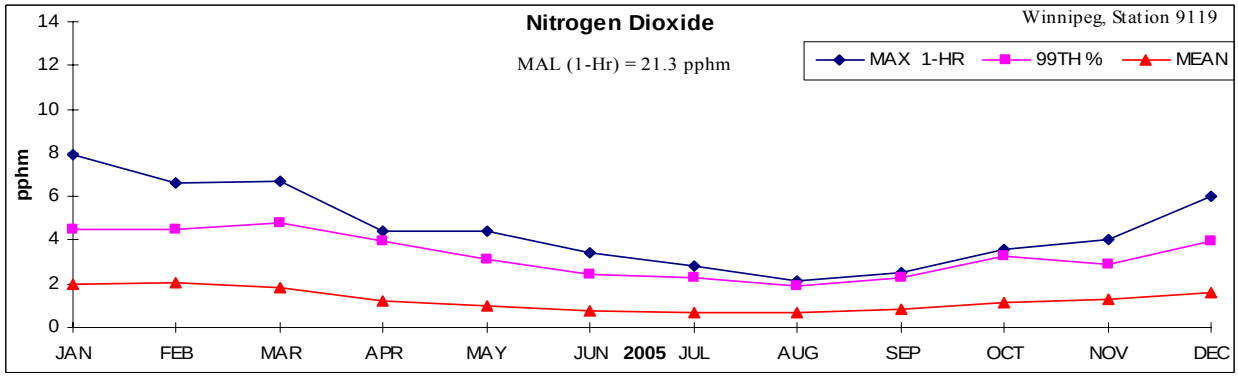

Figure 20 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg downtown monitoring site for 2005.

Nitric Oxide and Nitrogen Oxides

NO and NO_x annual data statistics are summarized in Tables 2, 4 and 6. Manitoba has no Air Quality Objectives or Guidelines for either NO or NO_x.

Inhalable Particulates (PM_{10} and $PM_{2.5}$)

PM_{10} levels were monitored at the downtown station using both a dichotomous sampler (sampling once every six days) and a real-time TEOM sampler. The samples collected per month dichotomous values are shown in Figures 21, 22 and 23 for 2003, 2004 and 2005, respectively. The relative proportion of fine to coarse inhalable particulate is shown graphically. The annual mean fine/coarse ratio was 0.43 in 2003, 0.5 in 2004, and 0.43 in 2005. The daily average PM_{10} level as determined by continuous (24/7) measurement (TEOM unit) are shown in figures 24a, 25a and 26a for 2003, 2004 and 2005, respectively. Hourly averages are shown in figures 24b, 25b and 26b for 2003, 2004 and 2005, respectively. Yearly statistical results from both the dichotomous (once every sixth day sampling) and real-time (continuous) samplers are shown in Tables 3a, 5a and 7a for 2003, 2004 and 2005, respectively. A PM_{10} guideline of 50 µg/m^3 was adopted by Manitoba in July 2005.

The spikes observed in late November 2005 in both the PM_{10} and $PM_{2.5}$ were due to smoke from a building fire two blocks to the north of the monitoring location.

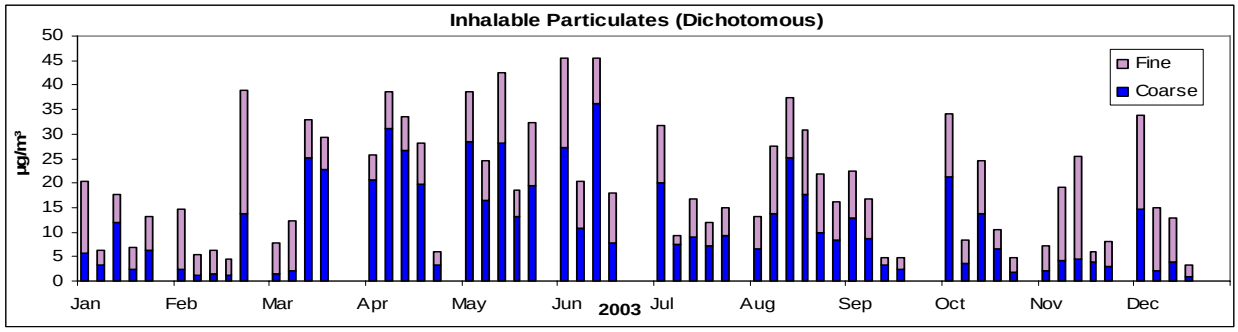

Figure 21 Inhalable particulate levels (fine [≤ 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2003.

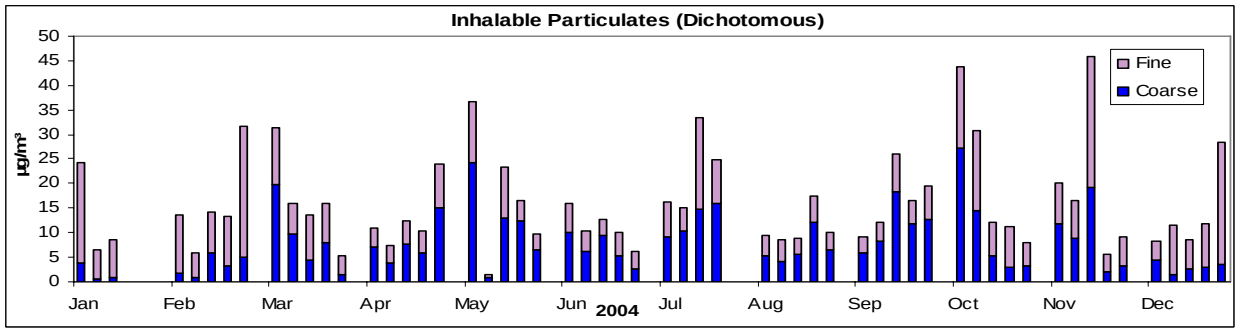

Figure 22 Inhalable particulate levels (fine [≤ 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2004.

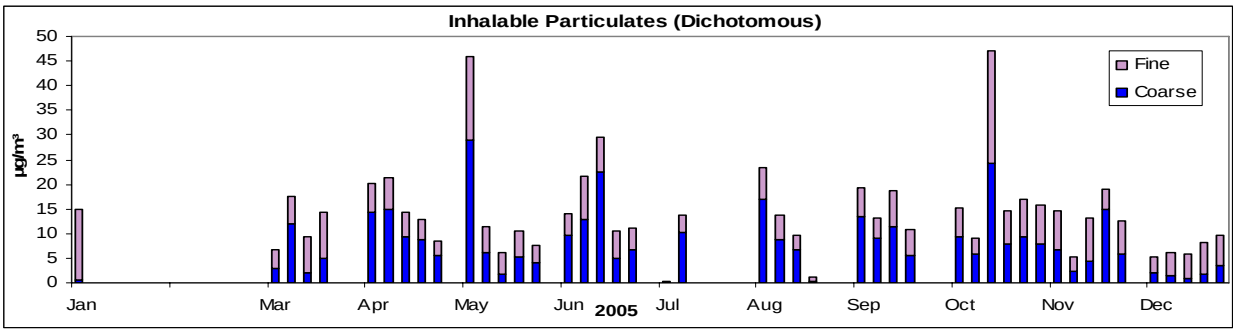

Figure 23 Inhalable particulate levels (fine [≤ 2.5 µm in diameter] plus coarse [2.5 µm to 10 µm in diameter]) by sample date (per 24-Hr sample) for 2005.

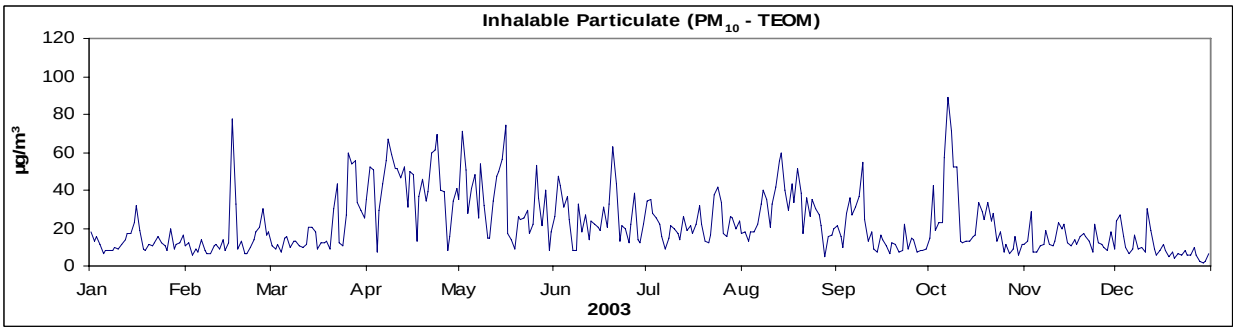

Figure 24a Inhalable particulate levels - PM_{10}: daily averages for 2003.

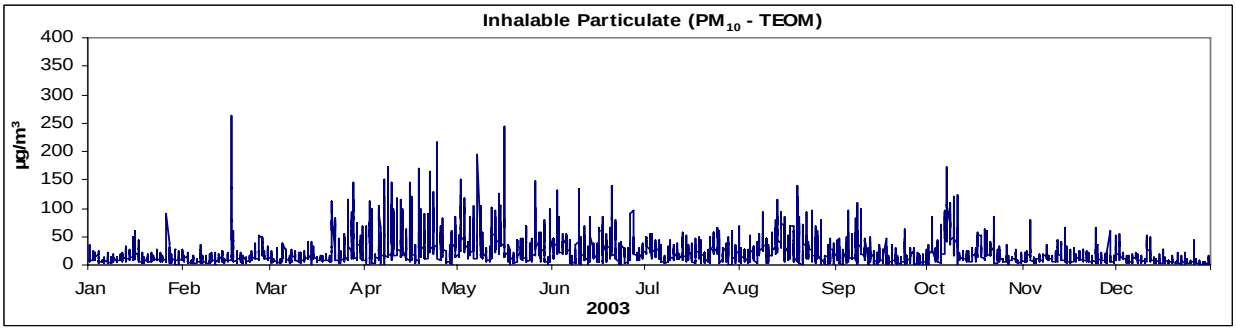

Figure 24b Inhalable particulate levels - PM_{10}: hourly averages for 2003.

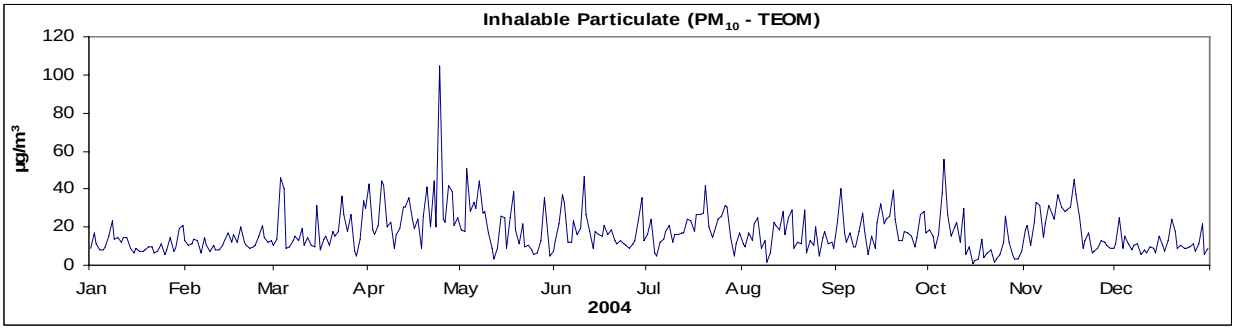

Figure 25a Inhalable particulate levels - PM_{10}: daily averages for 2004.

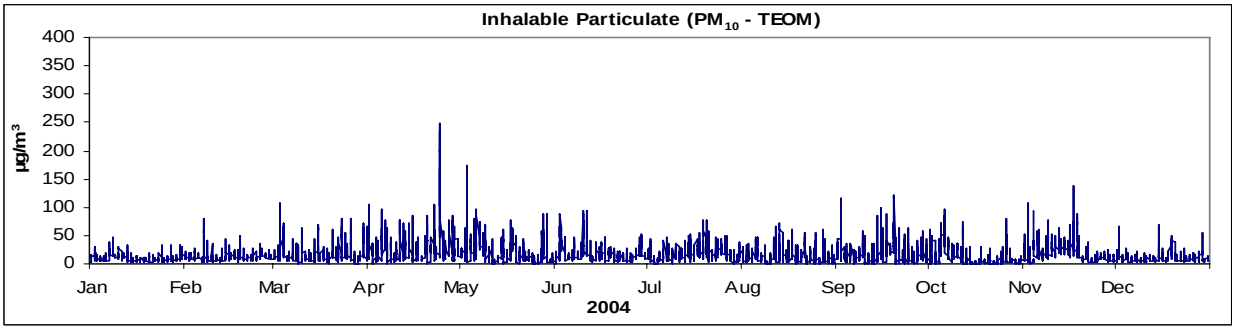

Figure 25b Inhalable particulate levels - PM_{10}: hourly averages for 2004.

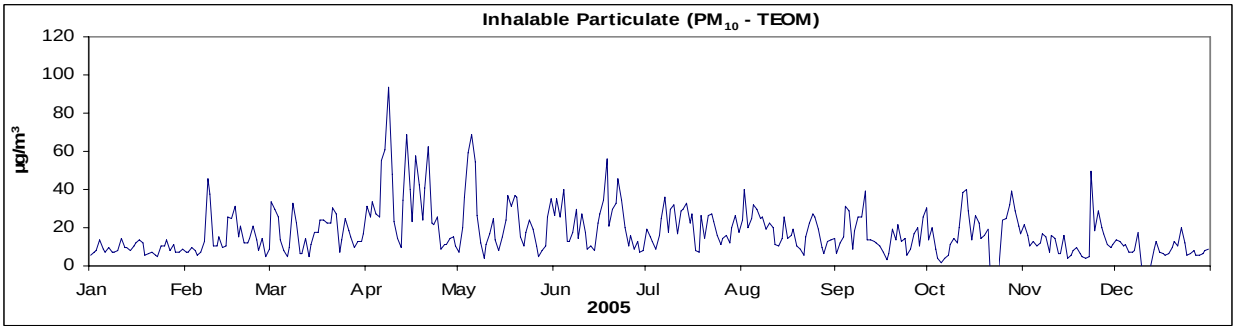

Figure 26a Inhalable particulate levels - PM_{10}: daily averages for 2005.

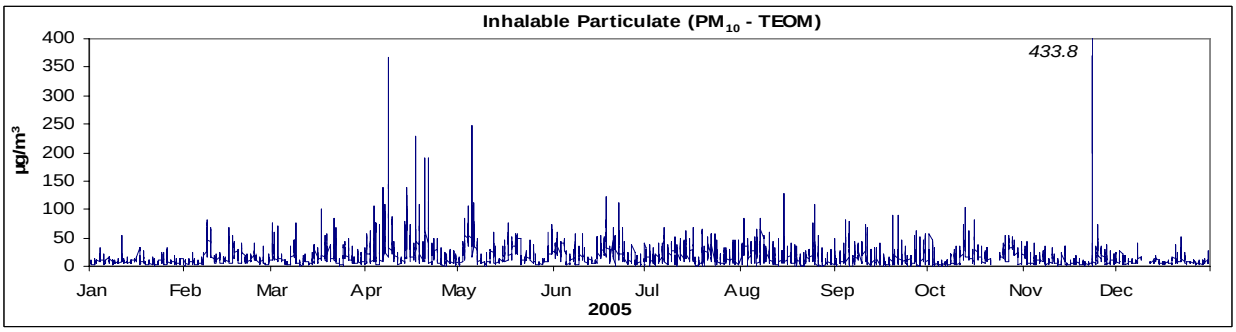

Figure 26b Inhalable particulate levels - PM_{10}: hourly averages for 2005.

Data from the real-time TEOM sampler for $PM_{2.5}$ are presented in Tables 3b, 5b and 7b for 2003, 2004 and 2005 respectively. The fine to coarse ratio (using $PM_{2.5}/[PM_{10} - PM_{2.5}]$) is 0.31 for 2003, 0.32 for 2004 and 0.33 for 2005. All of these values are slightly lower than the ratio determined from the dichotomous sampler. The daily average $PM_{2.5}$ level as determined by the TEOM unit are shown in figures 27a, 28a and 29a for 2003, 2004 and 2005, respectively. Figures 27b, 28b and 29b display the hourly averages as determined by the TEOM unit.

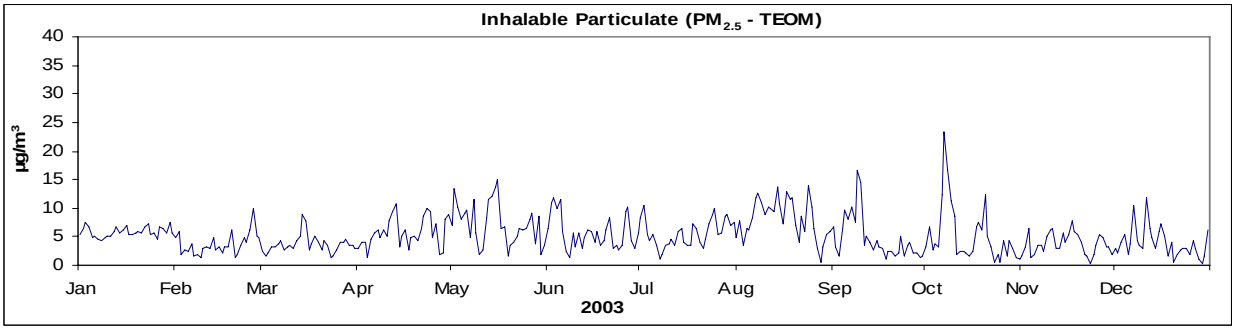

Figure 27a Inhalable particulate levels - $PM_{2.5}$: daily averages for 2003.

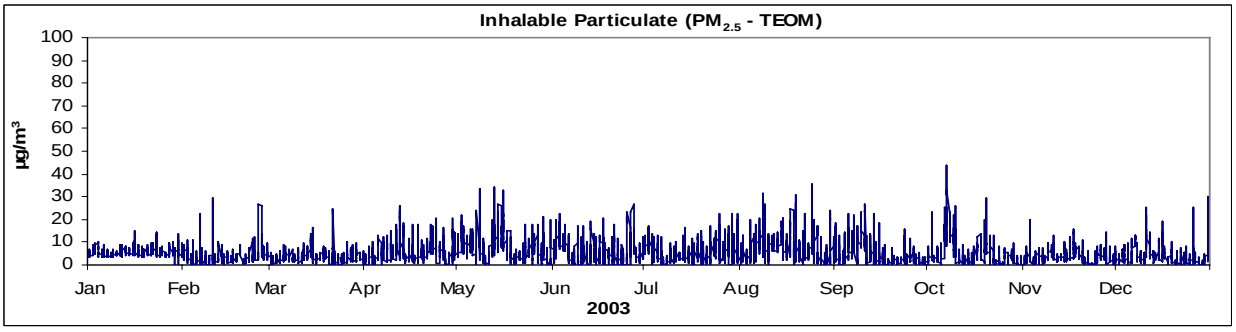

Figure 27b Inhalable particulate levels - $PM_{2.5}$: hourly averages for 2003.

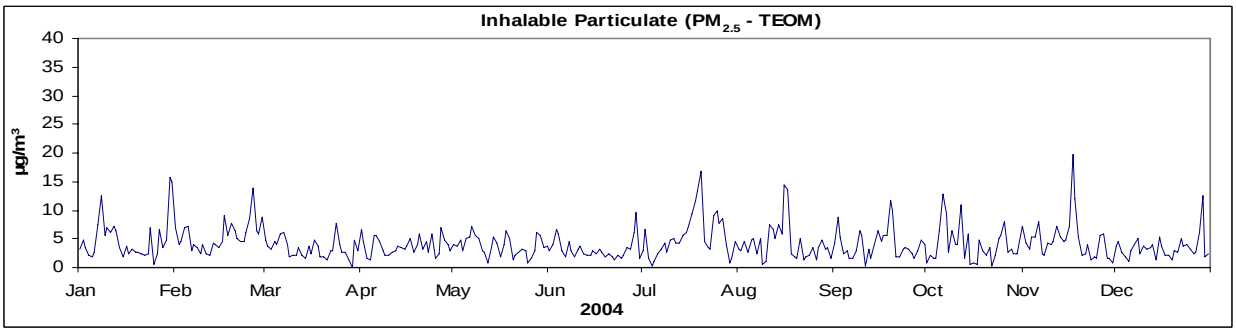

Figure 28a Inhalable particulate levels - $PM_{2.5}$: daily averages for 2004.

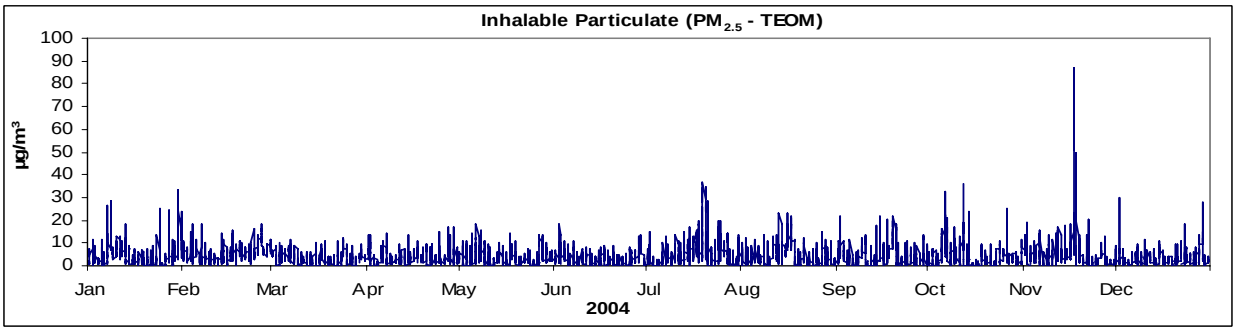

Figure 28b Inhalable particulate levels - $PM_{2.5}$: hourly averages for 2004.

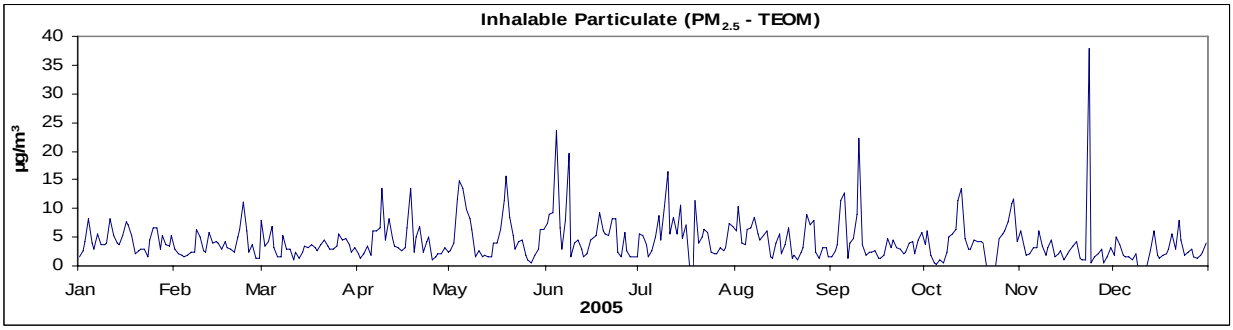

Figure 29a Inhalable particulate levels - $PM_{2.5}$: daily averages for 2005.

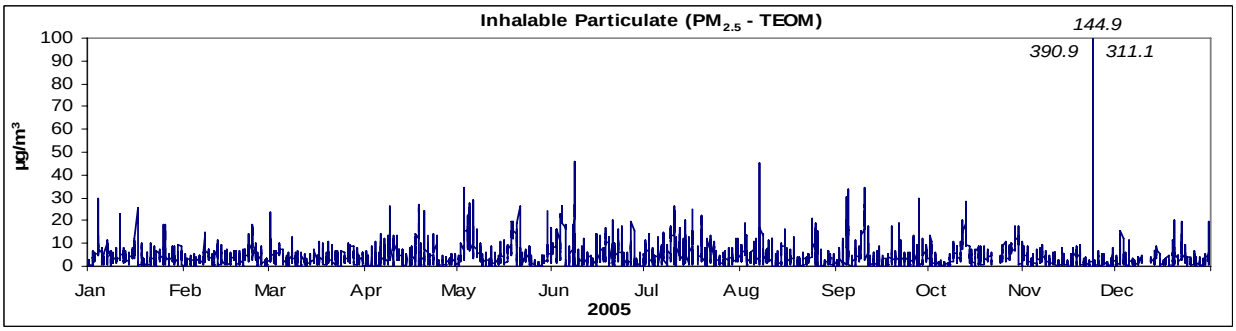

Figure 29b Inhalable particulate levels - $PM_{2.5}$: hourly averages for 2005.

Volatile Organic Compounds (VOCs)

VOC annual statistics for 152 compounds are shown in Tables 8, 9 and 10 for 2003, 2004 and 2005, respectively. Manitoba does not have Objectives or Guidelines for VOCs but Ontario has promulgated standards for some, none of which were exceeded at this station. Benzene, a carcinogen, had a mean level of 0.99, 1.02 and 0.78 ug/m^3 in 2003, 2004 and 2005, respectively. All three values were lower than the level for 2002, which to this point had been the lowest average observed since the 1990's (Fenske 1995, 1996; Krawchuk 2001, 2002, 2005).

Polycyclic-aromatic Hydrocarbons (PAHs)

PAH monitoring (Table 11) found that of the 31 compounds screened for, 29 were detected in all of the 67 samples collected between 9 May, 2003 and 31 December, 2005. Sampling of PAH's did not occur between 1 January, 2003 and 9 May, 2003 due to instrument malfunction. Of the 29 compounds listed, only one, Benzo(a)pyrene, has a Guideline limit (Ontario) of 1.1 ng/m^3 for a 24-hr period and 0.3 ng/m^3 for an annual mean. The maximum observed level of 0.93 ng/m^3 for a 24-hr period and 0.08 ng/m^3 for the

annual mean for benzo(a)pyrene are both well below the Ontario Guideline limit. Manitoba does not have Guidelines or Objectives for any of the other 29 compounds in Table 11.

Polychlorinated Dibenzo-p-dioxins and Dibenzo-p-furans (PCDDs & PCDFs)

Table 12 lists the summary results of the twenty-eight samples collected from May 21, 2003 to December 31, 2005.

Ontario has a 24-hour criteria of 5 pgTEQ/m^3 for chlorinated dibenzo-p-dioxins. A TEQ is a PCDD isomer's toxicity equivalence to 2,3,7,8-TCDD.

The 2003-2005 mean, for the total PCDD/PCDF concentration was 0.35 pg/m^3 and for TEQ was 0.01 TEQ pg/m^3. Generally, for the sampling period the sample day TEQs were on average 1/100 the Ontario criteria.

Aldehydes and Ketones (Carbonyls)

In 1997, on March 11 the NAPS Program began sampling for carbonyl compounds (thirteen aldehydes and four ketones) in ambient air (Krawchuk 2002). Table 13 lists the compounds sampled for, along with the annual average value for each of the three years, from 1 January, 2003 to 31 December, 2005, and the maximum value observed in a 24-hour sample in each of the three years. Of these sixteen compounds Ontario has ambient 24-hour criteria for five of these compounds; formaldehyde (65 µg/m^3), acetaldehyde (500 µg/m^3), acrolein (0.08 µg/m^3), acetone (11880 µg/m^3), and MEK (1000 µg/m^3). In Winnipeg, the concentrations determined for four of the compounds were all well below the Ontario criteria. One compound, acrolein was found to be above the Ontario criteria in six samples from 2003, twelve samples in 2004 and thirteen samples in 2005. The maximum values in each of the three years were 0.33 µg/m^3, 0.27 µg/m^3, and 0.37 µg/m^3,respectively. Acrolein can be formed from the breakdown of certain pollutants found in outdoor air, from burning tobacco, or from burning gasoline. As of July 2005, Manitoba adopted the Ontario criteria levels into the Manitoba guidelines.

Residential

The description of Winnipeg residential air quality is based on sampling conducted at station #9118 (299 Scotia Street), a NAPS site. The parameters measured at this site were: CO, NO_2, NO, NO_x, O_3, and $PM_{2.5}$.

Carbon Monoxide

The annual mean level of CO has not varied much over the last twenty years. Yearly trends are shown in Figure 30 and monthly values in Figures 31, 32 and 33. The average levels were lower than at the Winnipeg downtown station and there were no excursions above the Provincial Criteria in 2003, 2004 and 2005.

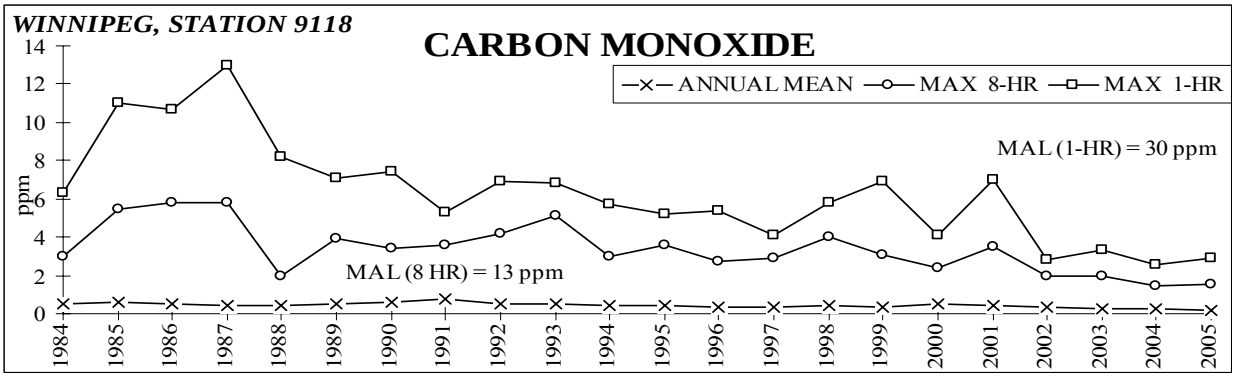

Figure 30 Annual mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site 1984 - 2005.

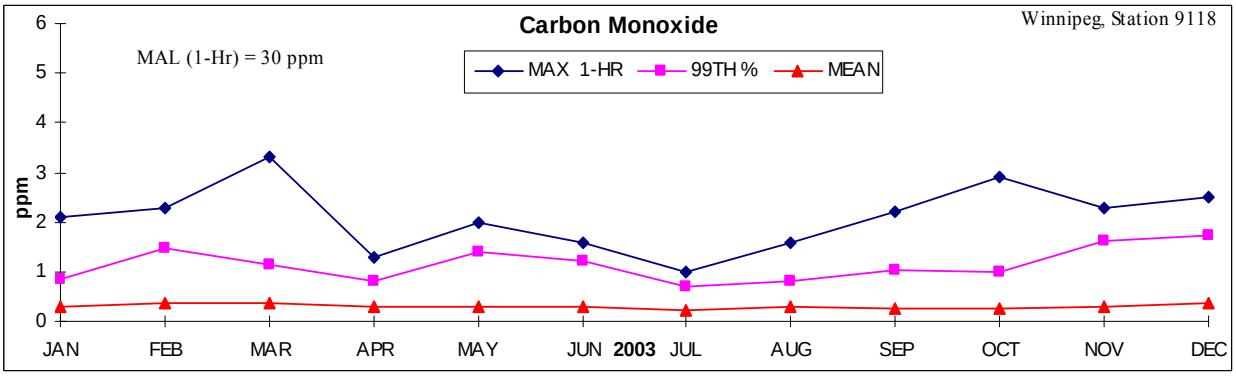

Figure 31 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2003.

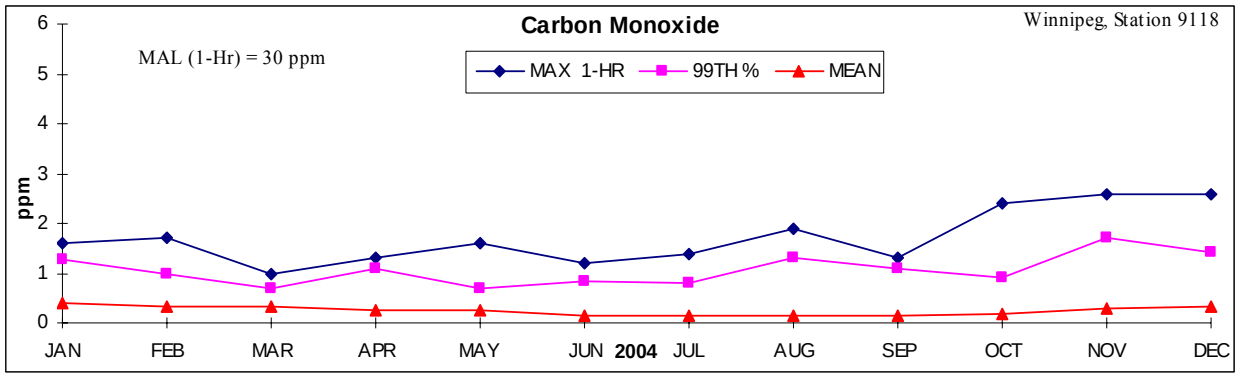

Figure 32 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2004.

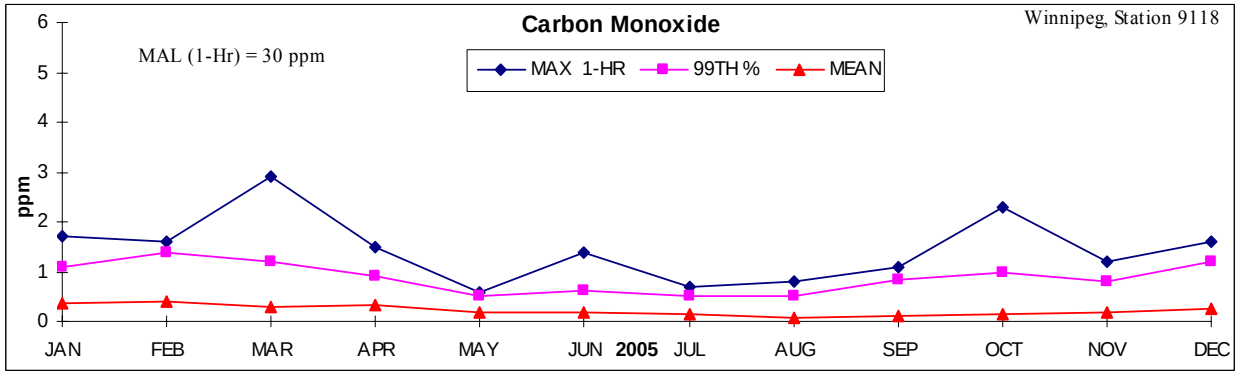

Figure 33 Monthly mean, 8-Hr and 1-Hr maximum carbon monoxide levels calculated and observed for the Winnipeg residential monitoring site for 2005.

Ozone

Ground level O_3 at the residential station had the second lowest annual means, for 2003, 2004 and 2005 of the three stations that monitored ozone in Manitoba. Annual trends are shown in Figure 34. Monthly levels are shown in Figures 35, 36 and 37. The 1-hour MAL of 8.2 pphm (0.082 ppm) has not been exceeded since 1989.

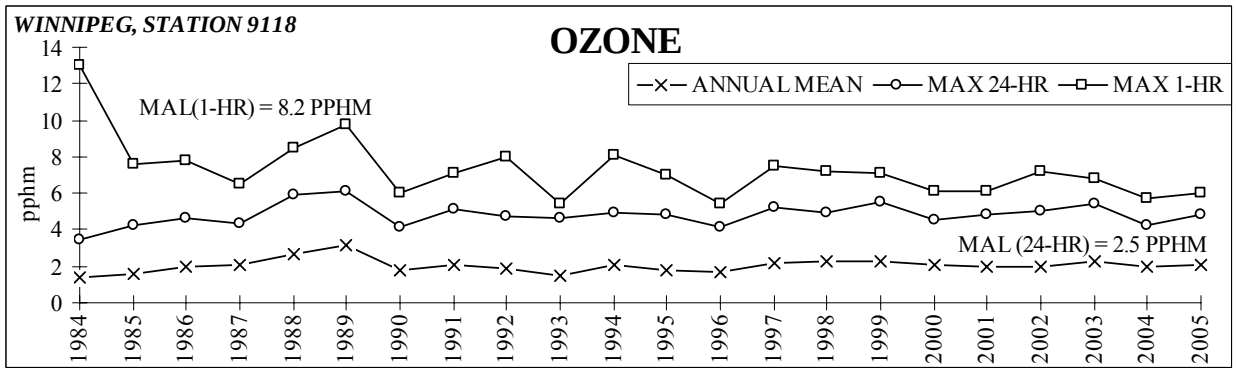

Figure 34 Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site.

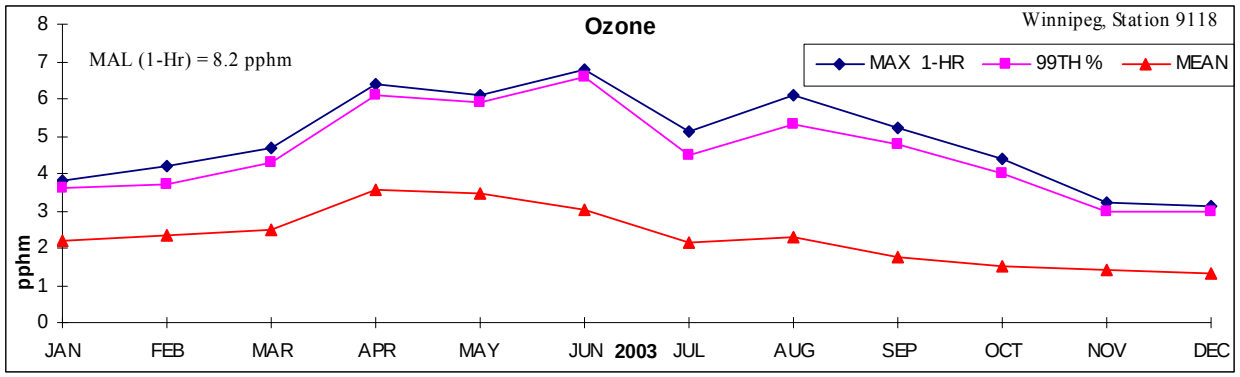

Figure 35 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2003.

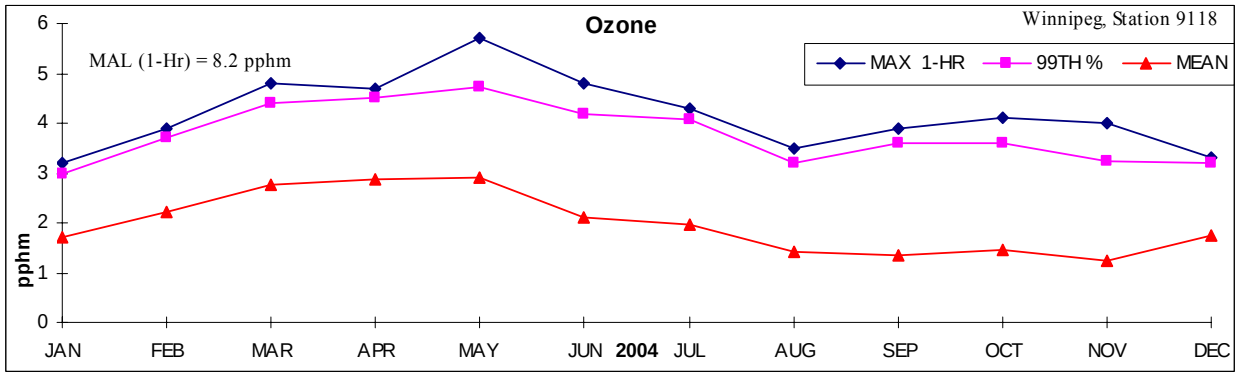

Figure 36 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2004.

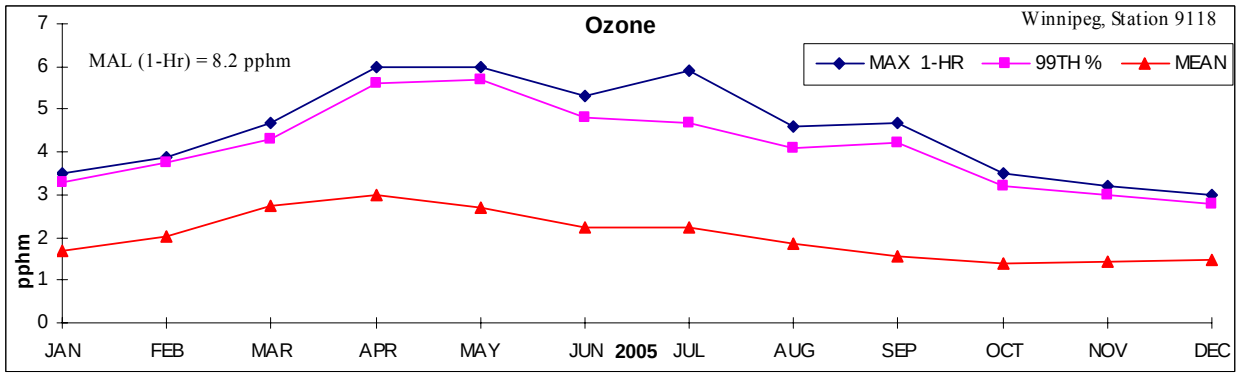

Figure 37 Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Winnipeg residential monitoring site for 2005.

Nitrogen Dioxide

NO_2 levels were generally lower than those measured downtown. Yearly trends are shown in Figure 38 and monthly values are depicted in Figures 39 to 41. Annual mean levels were similar to those found in previous years. All recorded levels were below the Ambient Air Quality Criteria.

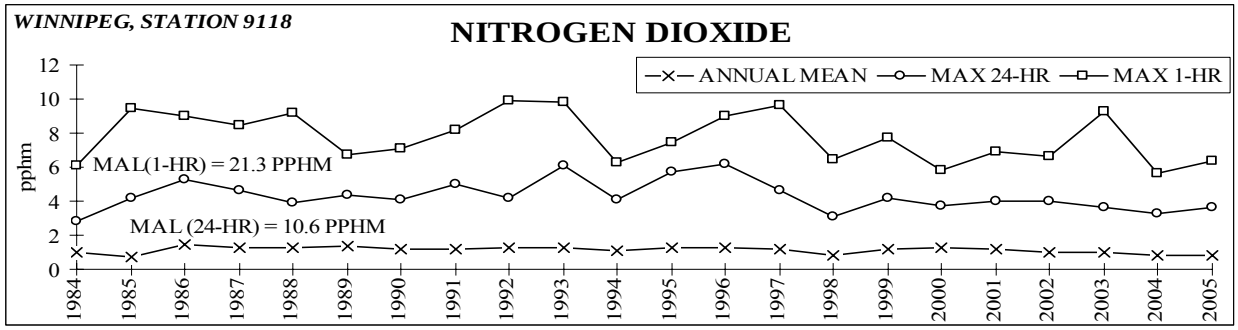

Figure 38 Annual mean, 24-Hr and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site.

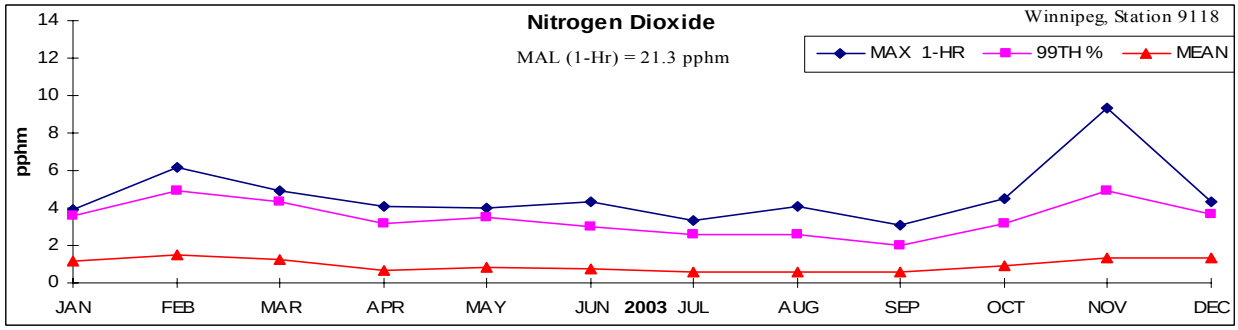

Figure 39 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2003.

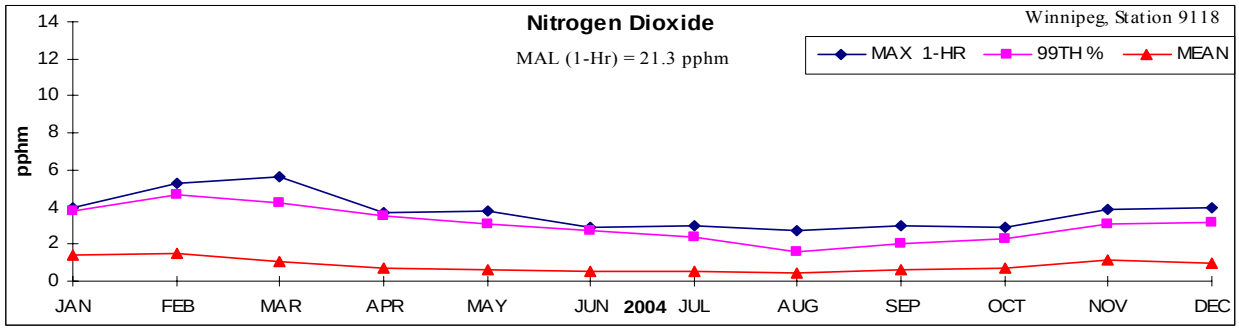

Figure 40 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2004.

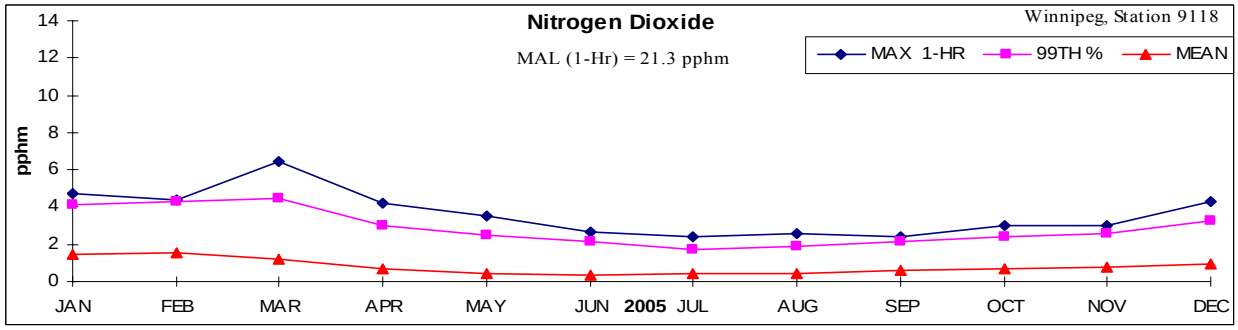

Figure 41 Monthly mean and 1-Hr maximum nitrogen dioxide levels calculated and observed for the Winnipeg residential monitoring site for 2005.

Nitric Oxide and Nitrogen Oxides

NO and NO_x yearly statistical results are shown in Tables 3, 5 and 7. Ambient Air Quality Criteria for NO or NO_x have not been established.

Inhalable Particulates ($PM_{2.5}$)

The hourly and daily average $PM_{2.5}$ level as determined by continuous (24/7) measurement (TEOM unit) are shown in Figures 42a and b, 43a and b and 44a and b for 2003, 2004 and 2005, respectively. Yearly statistical results are shown in Tables 3b, 5b and 7b for $PM_{2.5}$ data for 2003, 2004 and 2005, respectively. A Canada-Wide Standard for $PM_{2.5}$ of 30 µg/m^3 as a 24-hour average was endorsed in 2000 for implementation by 2010. None of the daily 24-hr averages for 2003, 2004 and 2005 exceeded this new standard at the residential site.

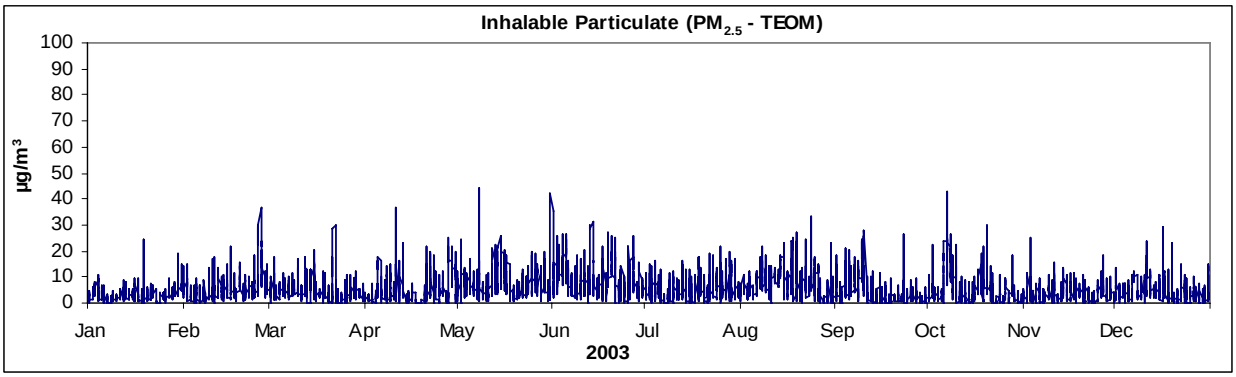

Figure 42a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2003.

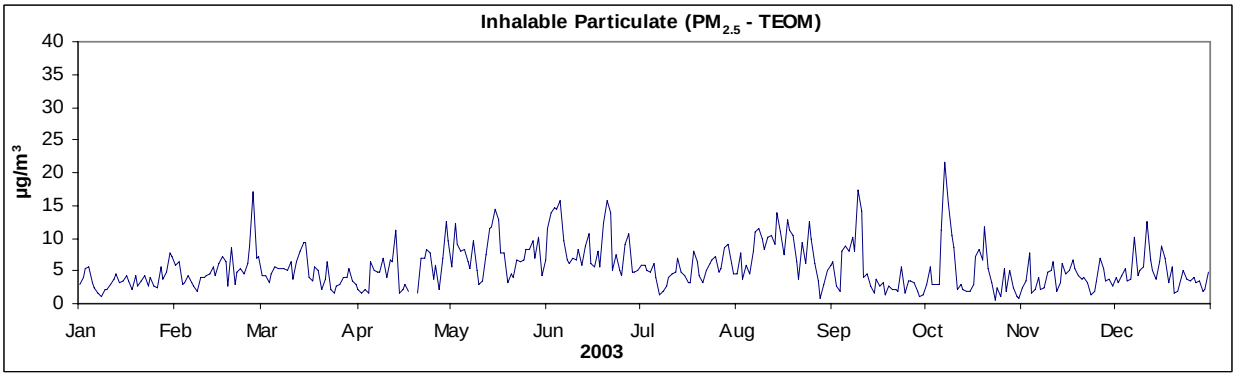

Figure 42b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2003.

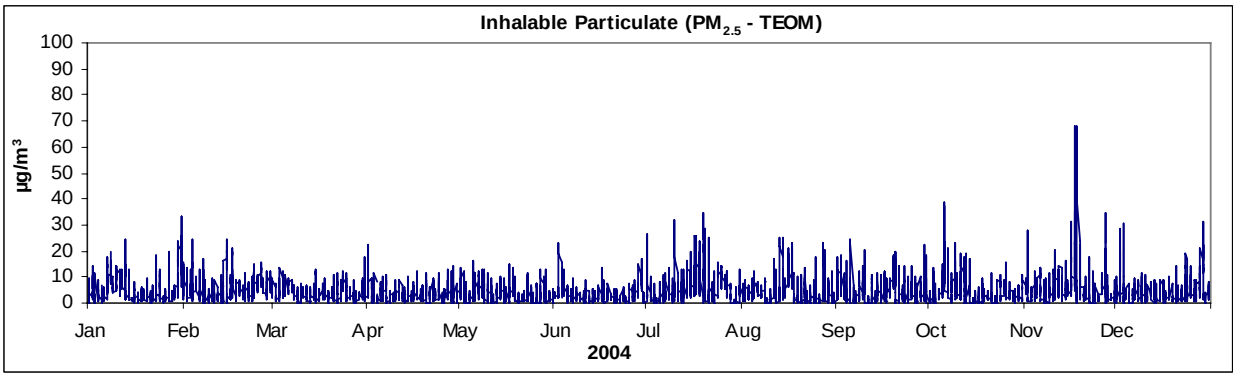

Figure 43a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2004.

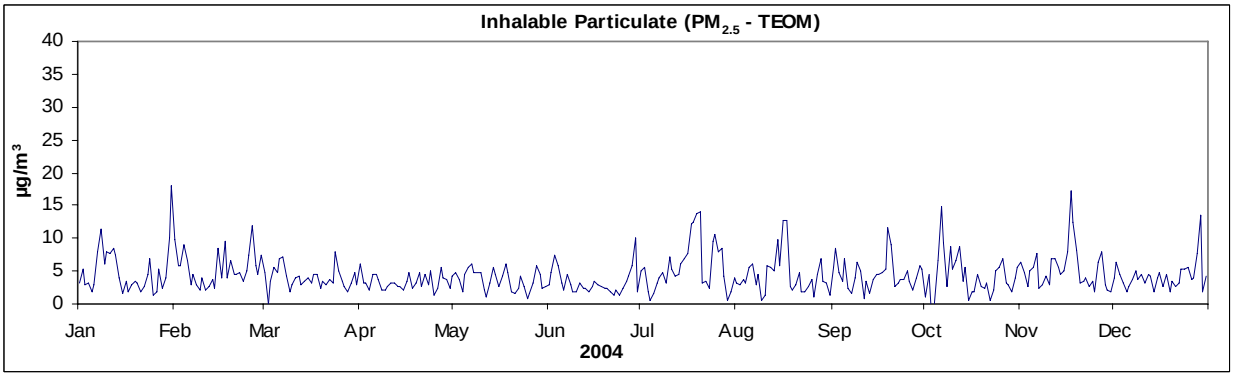

Figure 43b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2004.

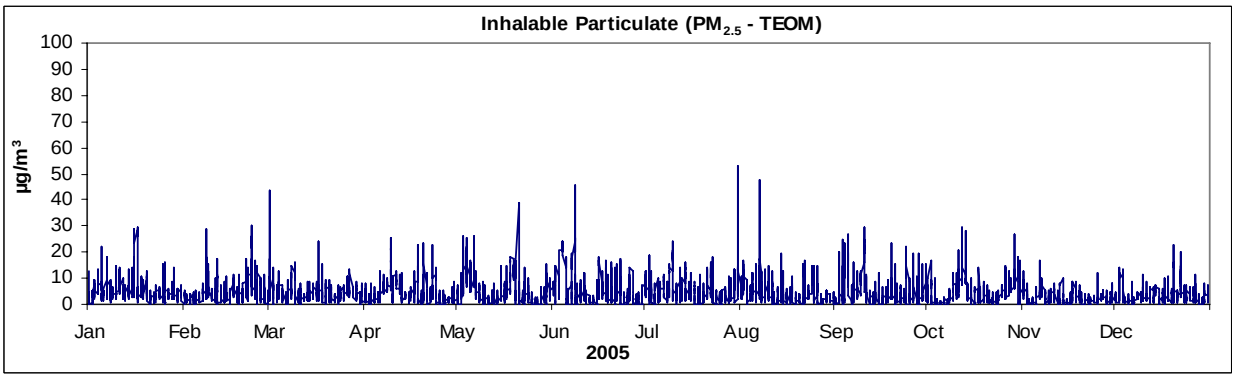

Figure 44a Inhalable particulate ($PM_{2.5}$) levels - Hourly averages for 2005.

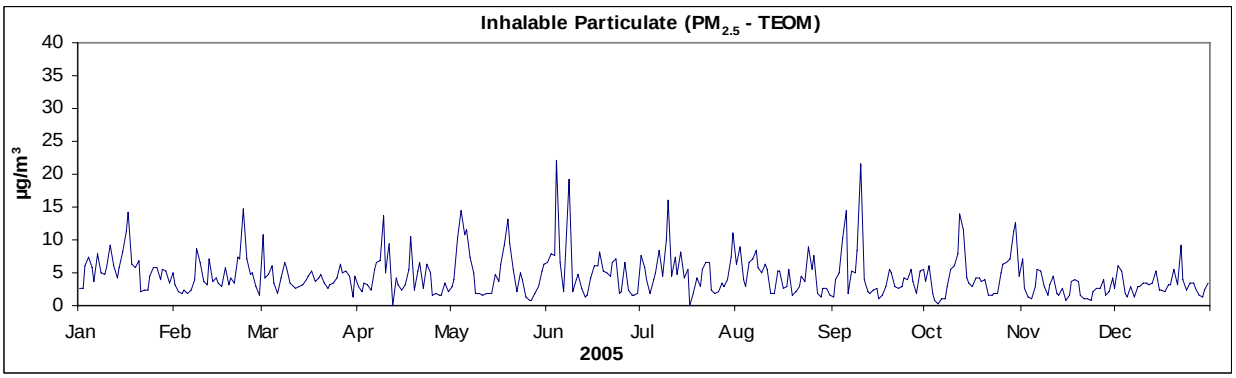

Figure 44b Inhalable particulate ($PM_{2.5}$) levels - Daily averages for 2005.

B. BRANDON AIR QUALITY

Industrial

Air quality in the eastern industrial area of Brandon was monitored at station #5131 on the grounds of Assiniboine Community College. This station monitored NO_x, NO_2, NO, O_3, $PM_{10,}$ $PM_{2.5}$ and NH_3.

Air Quality Index

Although not disseminated, an AQI is generated for the Brandon Industrial site using the following pollutants: 24-Hr PM_{10}, 24-Hr $PM_{2.5}$, NH_3, NO_2, and O_3. The Air Quality Index (Figures 45, 46 and 47, Table 15) was in the Good range for over 86% of the time from 2003 to 2005 (discounting N/A times). In 2003, the number of "Fair" hours was 1006, in 2004 there were 579 "Fair" hours, while in 2005 the number of "Fair" hours decreased to 520. In all three years, the major influencing factor was ground-level ozone followed by 24-hr PM_{10} and then 24-hr $PM_{2.5}$. In 2003, there were 119 hours where the Air Quality was "Poor" while in 2004 and 2005 there were 137 and 26 hours, respectively. The number of "Very Poor" air quality hours decreased from 19 to 13, down to 1, in 2003, 2004 and 2005, respectively. The majority of Fair/Poor/Very Poor air quality events in all three years occurred during the 2nd and 3rd quarter of the year. This could be attributed to smoke from the burning of agricultural residue locally, or smoke from forest fires in other provinces. Additionally, wind swept dust also contributes to higher PM_{10} level affecting the Air Quality readings at this location.

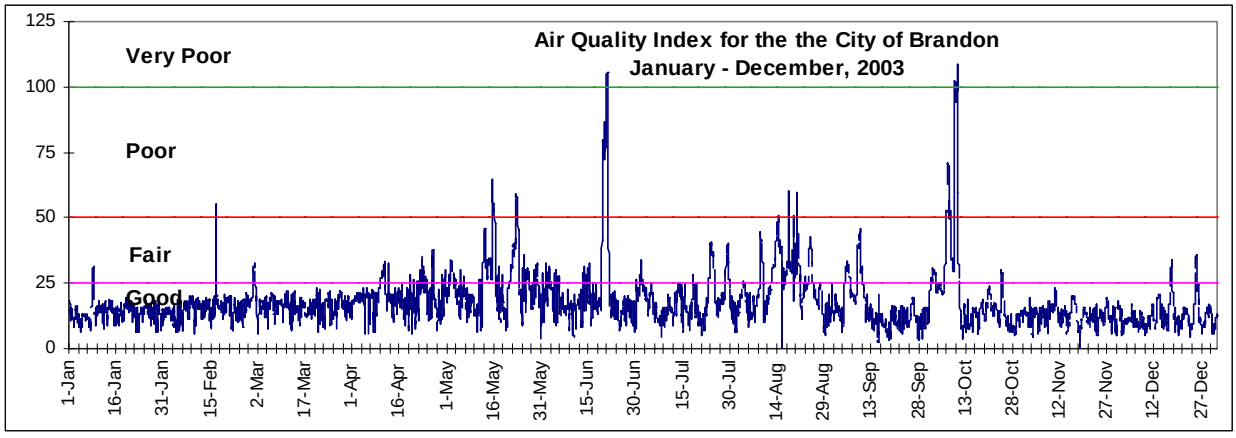

Figure 45. The Air Quality Index for Brandon (Industrial Site) for 2003.

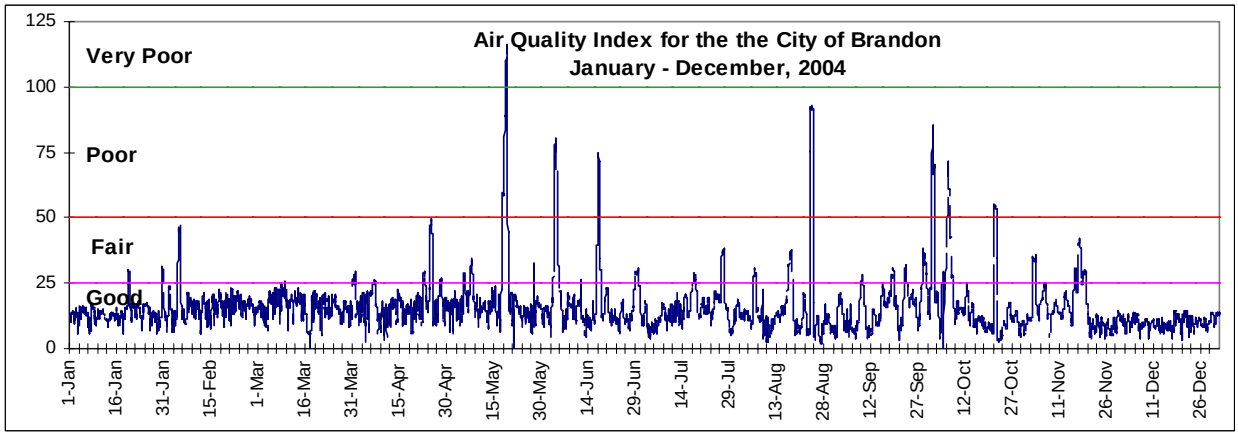

Figure 46. The Air Quality Index for Brandon (Industrial Site) for 2004.

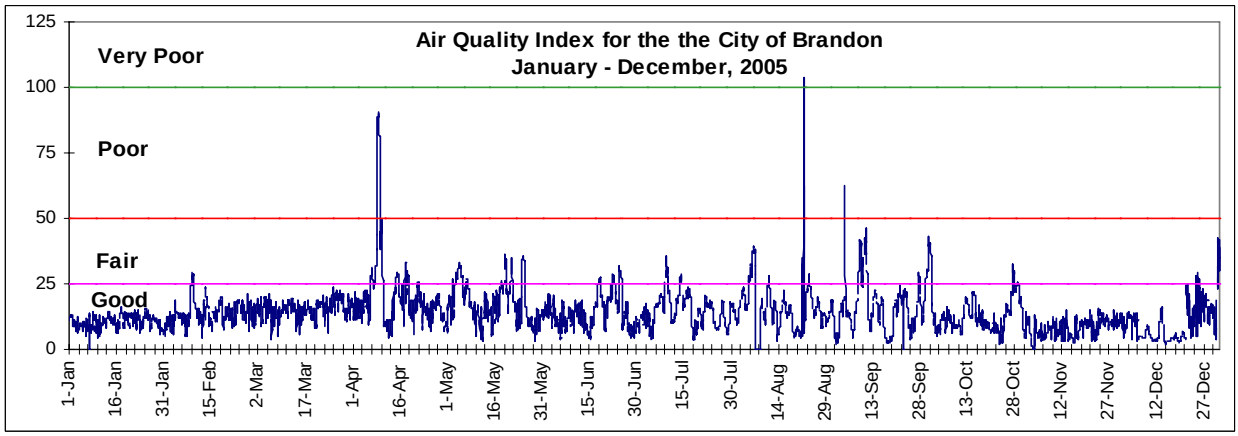

Figure 47. The Air Quality Index for Brandon (Industrial Site) for 2005.

Table 15: Summary of AQI for Brandon (Industrial) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

	Number of Hours					
2003	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of Available
Good	2034	1563	1677	1924	7198	86.3%
Fair	29	432	417	128	1006	12.1%
Poor	1	69	6	43	119	1.4%
V.Poor	0	12	0	7	19	0.2%
N/A	96	108	108	106	418	--
Total	2160	2184	2208	2208	8760	100%
NH3	7	1	2	2	12	0.1%
24 PM_{10}	60	567	906	428	1961	23.5%
24 $PM_{2.5}$	250	210	307	545	1312	15.7%
NO2	31	4	3	24	62	0.7%
O3	1716	1294	882	1103	4995	59.9%
N/A	96	108	108	106	418	--
Total	2160	2184	2208	2208	8760	100%

Table 15: Summary of AQI for Brandon (Industrial) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

	Number of Hours					
2004	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of Available
Good	2021	1830	1919	1887	7657	91.3%
Fair	66	184	169	160	579	6.9%
Poor	0	59	23	55	137	1.6%
V.Poor	0	13	0	0	13	0.2%
N/A	97	98	97	106	398	--
Total	2184	2184	2208	2208	8784	100%
NH_3	0	3	0	0	3	0.0%
24 PM_{10}	36	794	980	796	2606	31.1%
24 $PM_{2.5}$	461	28	553	419	1461	17.4%
NO_2	43	2	2	9	56	0.7%
O_3	1547	1259	576	878	4260	50.8%
N/A	97	98	97	106	398	--
Total	2184	2184	2208	2208	8784	100%

2005	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of Available
Good	2052	1820	1854	2060	7786	93.4%
Fair	13	242	212	53	520	6.2%
Poor	0	23	3	0	26	0.3%
V.Poor	0	0	1	0	1	0.0%
N/A	95	99	138	95	427	--
Total	2160	2184	2208	2208	8760	100%
NH3	3	0	14	16	33	0.4%
24 PM_{10}	105	732	1574	535	2946	35.4%
24 $PM_{2.5}$	368	184	300	492	1344	16.1%
NO_2	26	0	0	25	51	0.6%
O_3	1563	1169	182	1045	3959	47.5%
N/A	95	99	138	95	427	--
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance and repair.

Ozone

Ground level O_3 monthly levels at Brandon site #5131 are shown in Figures 48, 49 and 50. The annual means were higher than at the Winnipeg stations and there has not been an excursion of the 1-hour MAL of 8.2 pphm (0.082 ppm) since 1986. Yearly trends are shown in Figure 51.

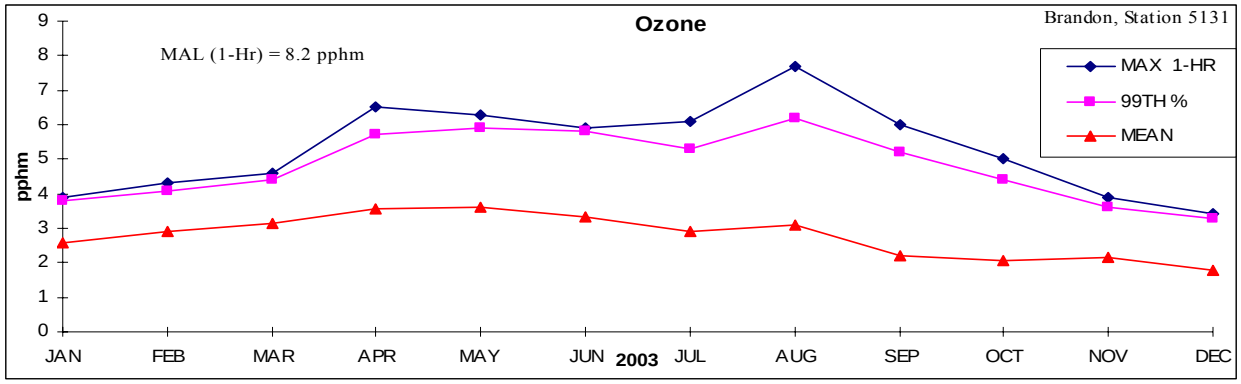

Figure 48. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2003.

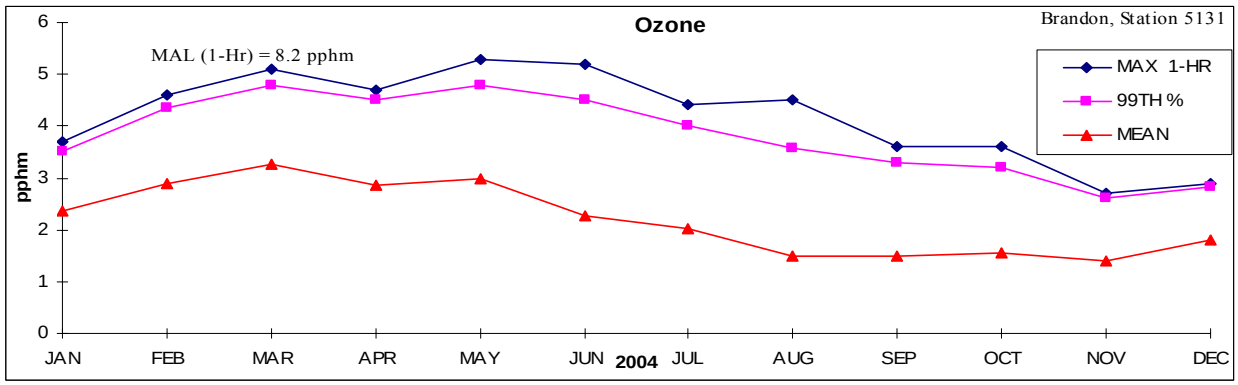

Figure 49. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2004.

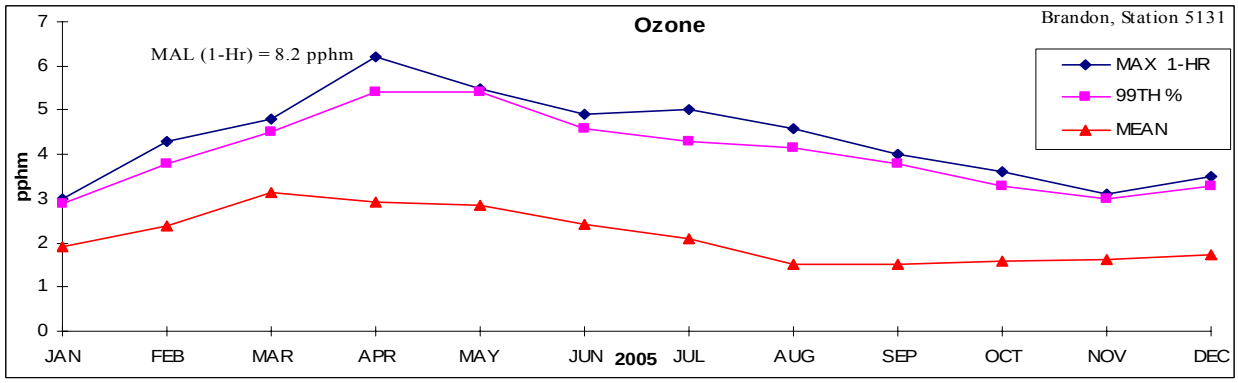

Figure 50. Monthly mean and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site for 2005.

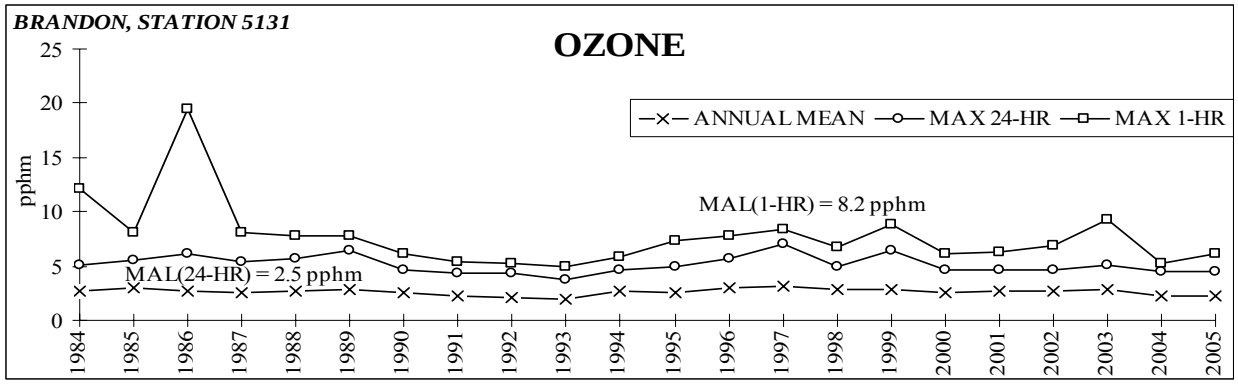

Figure 51. Annual mean, 24-Hr and 1-Hr maximum ground-level ozone levels calculated and observed for the Brandon industrial monitoring site.

Ammonia (NH_3)

NH_3 monitoring at station #5131 is source-specific for air emissions from a fertilizer manufacturer. The monthly levels are shown in Figures 52, 53 and 54, and the yearly trends are shown in Figures 55 and 56. The Manitoba Conservation licensed regulatory limit issued to the fertilizer company of 3.0 ppm (1-hour average) was exceeded twice in 2003 and four times in 2005. There were no exceedences of the License limit in 2004. The MAL Guideline of 2.0 ppm for any one hour period was exceeded on four occasions in 2003, on one occasion in 2004 and on six occasions in 2005.

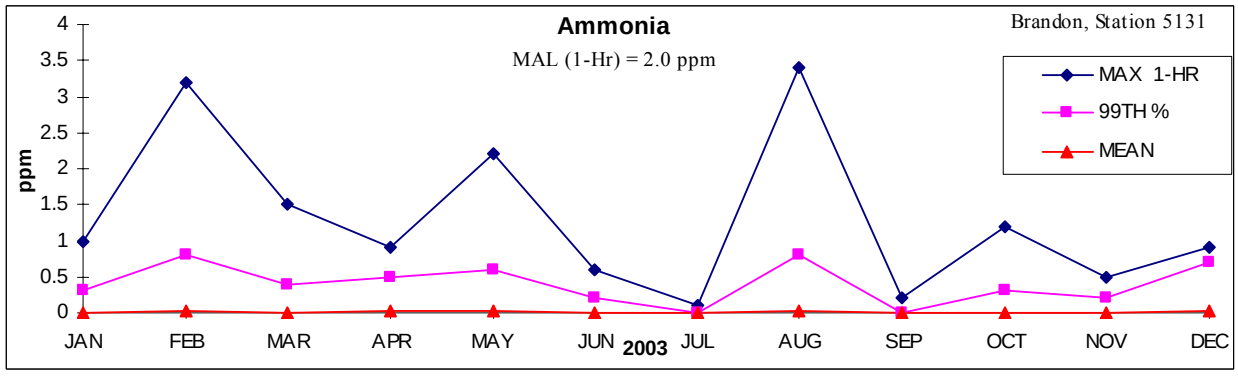

Figure 52. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2003.

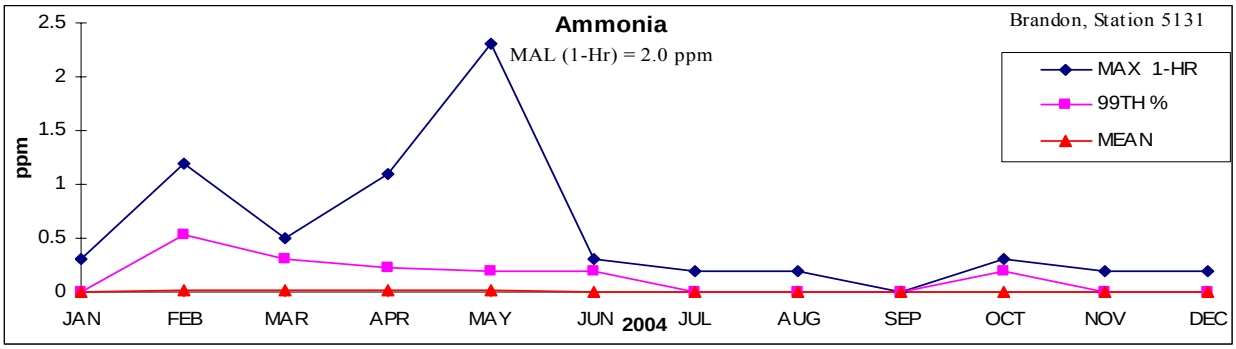

Figure 53. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2004.

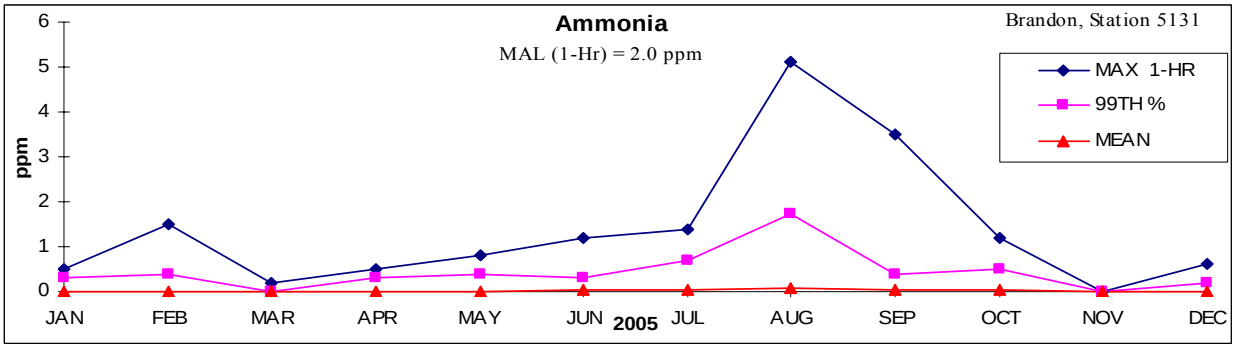

Figure 54. Monthly mean and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site for 2005.

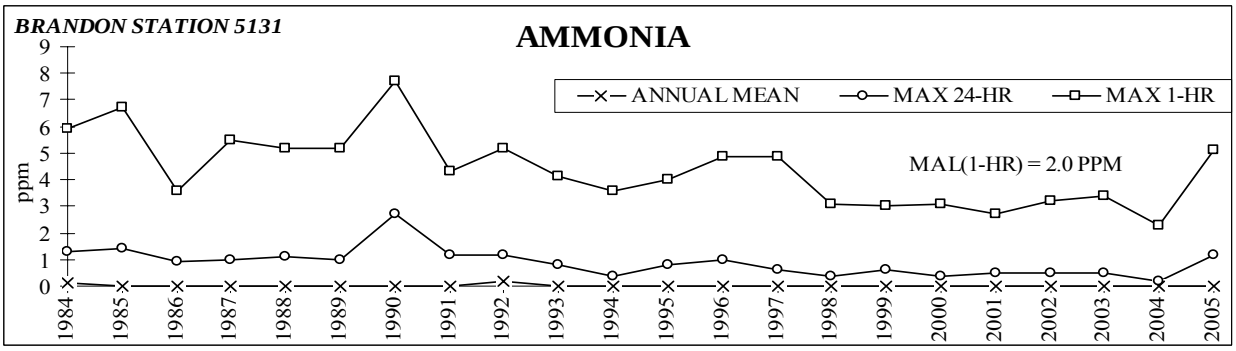

Figure 55. Annual mean, 24-Hr and 1-Hr maximum ammonia levels calculated and observed for the Brandon industrial monitoring site.

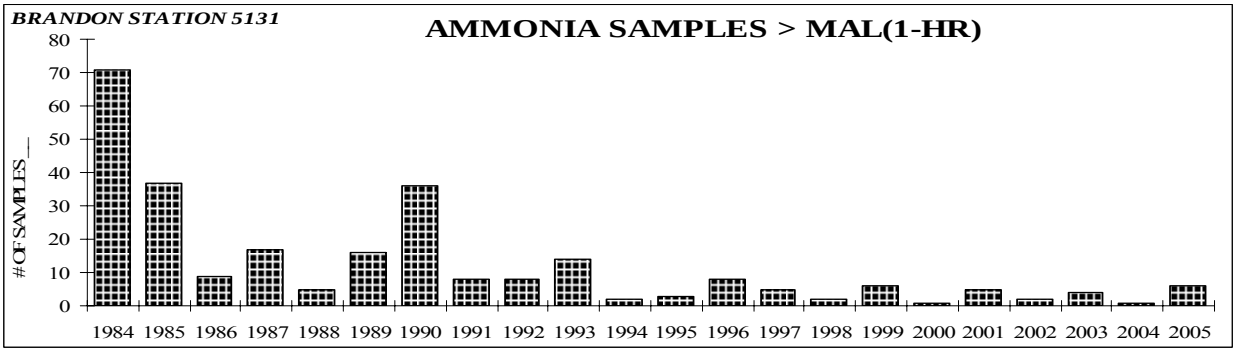

Figure 56. Number of exceedences of the 1-hour MAL (2.0 ppm) observed for the Brandon industrial monitoring site for the period 1984 through 2005 on an annual basis.

C. FLIN FLON AIR QUALITY

Air Quality Index

Since 1997, an AQI has been generated for the downtown Flin Flon site using the following pollutants: 24-Hr PM_{10}, 1- Hr SO_2 and 24-Hr SO_2 (Krawchuk 2002). *[Cautionary Note - Since a full range of monitoring is not undertaken at this site (i.e., O_3 not monitored), there is a potential to underestimate the air quality index.]* In 2002, a $PM_{2.5}$ analyzer was added to the suite of instruments and 24-hr $PM_{2.5}$ was added to the AQI determination (Krawchuk 2005). The Air Quality Index (Figures 57, 58 and 59, Table 16) was in the Good range for over 90% of the time in 2003, 2004 and 2005 (discounting N/A times). From 2003 to 2005, air quality was Fair 8-9% of the time (discounting N/A times) and in the Poor range for 0.4-0.9% of the time.

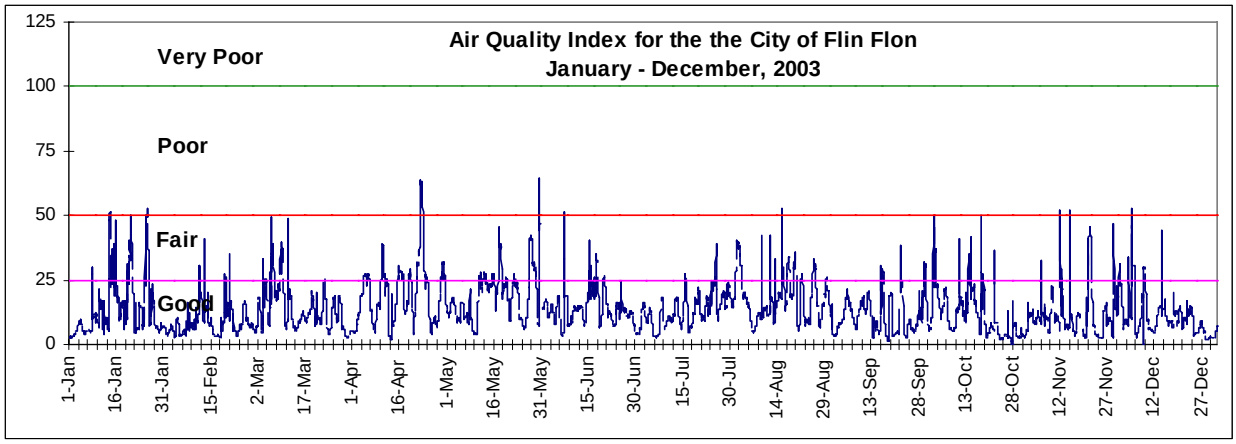

Figure 57. The Air Quality Index for Flin Flon (Downtown Site) for 2003.

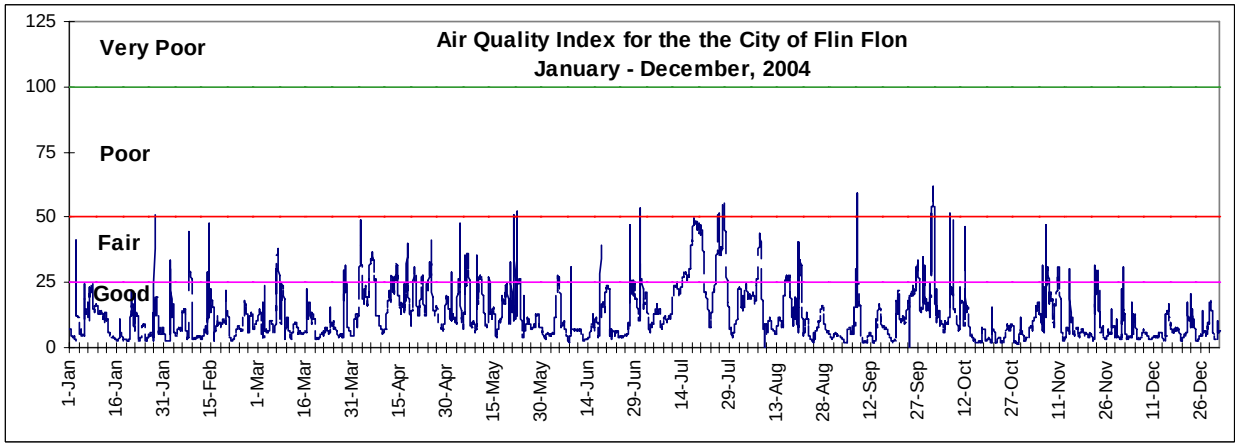

Figure 58. The Air Quality Index for Flin Flon (Downtown Site) for 2004.

Only six Very Poor hours were observed in the 2nd Quarter of 2005 which was considerably less than in 2001 and 2002 (Krawchuk 2005). Overall, an improvement of 10% in AQI was observed in 2003 to 2005 over that of 2000 to 2002 (Krawchuk 2005). In all three years the major influencing factor was PM_{10} (averaged over 24 hours) followed by $PM_{2.5}$ (averaged over 24 hours) and then 24-hour SO_2 (a distant third).

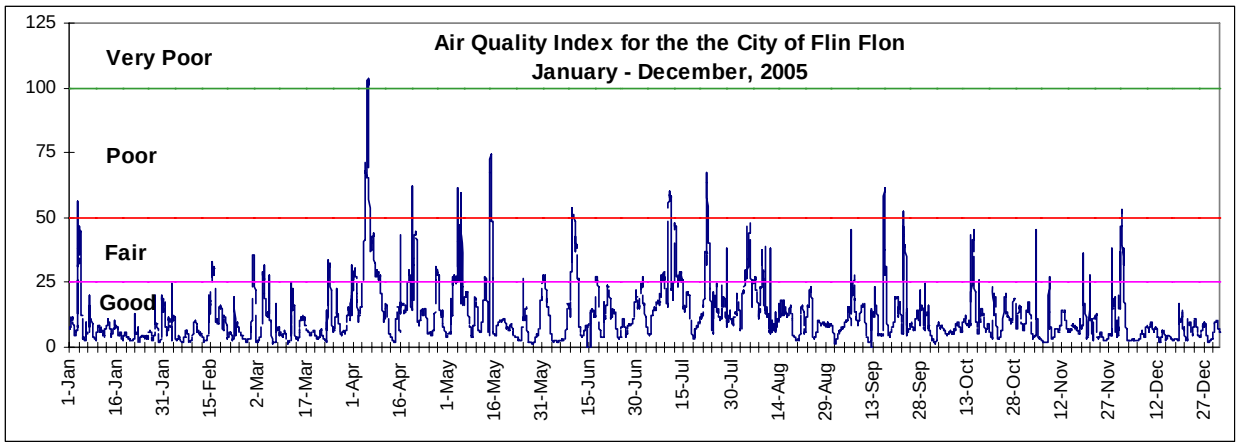

Figure 59. The Air Quality Index for Flin Flon (Downtown Site) for 2005.

Table 16: Summary of AQI for Flin Flon (Downtown) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

	Number of Hours					
2003	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of Available
Good	1921	1709	1916	1976	7522	90.2%
Fair	136	348	194	106	784	9.4%
Poor	8	24	1	3	36	0.4%
V.Poor	0	0	0	0	0	0.0%
N/A	95	103	97	123	418	--
Total	2160	2184	2208	2208	8760	100%
SO_2	94	26	43	70	233	2.8%
24 SO_2	339	49	106	241	735	8.8%
24 PM_{10}	1046	1578	1400	651	4675	56.0%
24 $PM_{2.5}$	586	428	562	1123	2699	32.4%
N/A	95	103	97	123	418	--
Total	2160	2184	2208	2208	8760	100%

Table 16: Summary of AQI for Flin Flon (Downtown) by Category and determining Pollutant for 2003, 2004 and 2005 (by quarters).

	Number of Hours					
2004	1st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Total	% of Available
Good	2041	1853	1742	2026	7662	91.2%
Fair	46	234	351	65	696	8.3%
Poor	1	4	20	17	42	0.5%
V.Poor	0	0	0	0	0	0.0%
N/A	96	93	95	100	384	--
Total	2184	2184	2208	2208	8784	100%
SO_2	62	56	40	77	235	2.8%
24 SO_2	117	80	137	259	593	7.1%
24 PM_{10}	438	1755	1136	1264	4593	54.7%
24 $PM_{2.5}$	1471	200	800	508	2979	35.5%
N/A	96	93	95	100	384	--
Total	2184	2184	2208	2208	8784	100%

2005	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Total	% of Available
Good	1981	1700	1832	2053	7566	90.2%
Fair	87	332	261	57	737	8.8%
Poor	1	47	21	6	75	0.9%
V.Poor	0	6	0	0	6	0.1%
N/A	91	99	94	92	376	--
Total	2160	2184	2208	2208	8760	100%
SO_2	62	32	48	39	181	2.2%
24 SO_2	101	134	114	89	438	5.2%
24 PM_{10}	344	1844	1591	1121	4900	58.4%
24 $PM_{2.5}$	1562	75	361	867	2865	34.2%
N/A	91	99	94	92	376	--
Total	2160	2184	2208	2208	8760	100%

N/A The AQI would not be available 4% of the time or 1 in every 24 hours due to the internal calibrations that occur each day at 3 a.m. CST. Additional N/A times would occur during routine instrument maintenance and repair.

Sulphur Dioxide (SO_2)

SO_2 is monitored in Flin Flon by the Province at 143 Main Street, located in downtown Flin Flon. The primary source of SO_2 is a major zinc-copper smelter located near the downtown area, straddling the Manitoba-Saskatchewan border. This company maintained four monitoring sites of its own.

Reported SO_2 emissions for 2003, 2004 and 2005 from this complex were 166, 184, and 203 kilotonnes per year, respectively. At the downtown site there were 14 excursions above the 1-hour MAL of 0.34 ppm in 2003, 8 in 2004 and 13 exceedences in 2005. Monthly and yearly data are shown in Figures 60 to 65 and Tables 2, 4 and 6. Yearly trends are shown in Figures 66 and 67. For comparison purposes, monthly data for the four company-operated monitoring sites are included (Figures 68 to 91).

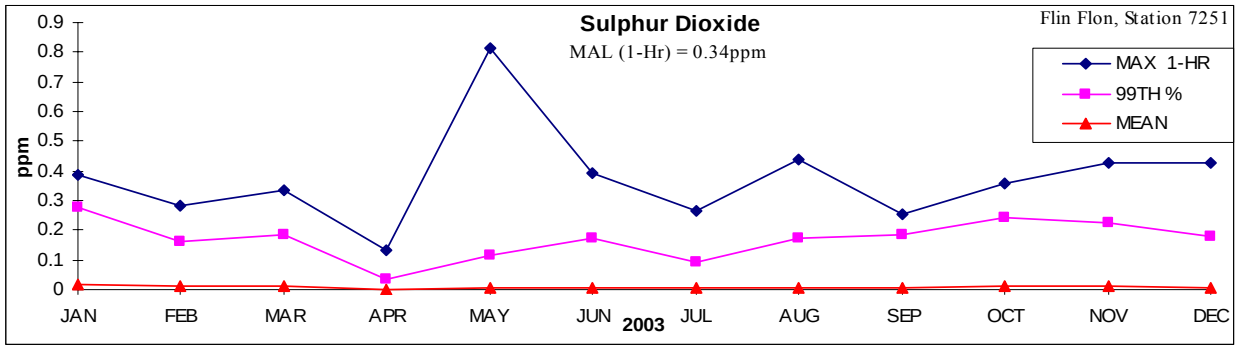

Figure 60. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the Flin Flon Provincial monitoring site for 2003.

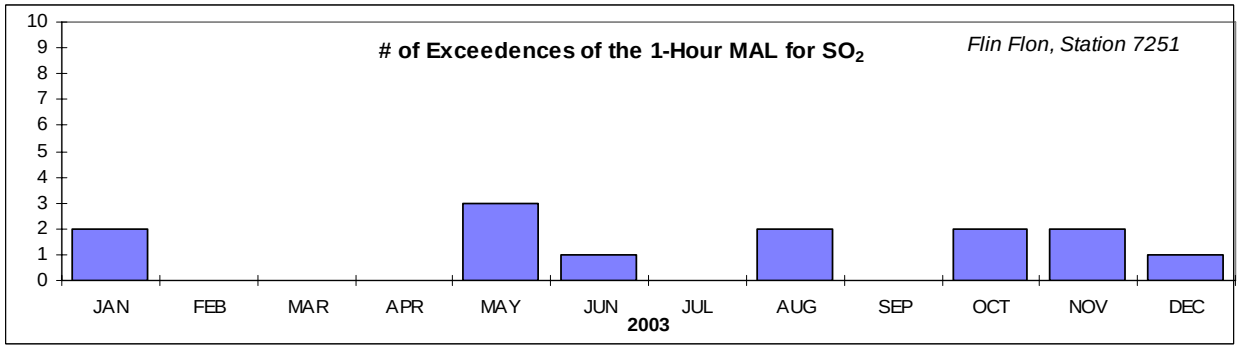

Figure 61. Number of exceedences of the 1-hour MAL for SO_2 for 2003 recorded at the Provincial monitoring site.

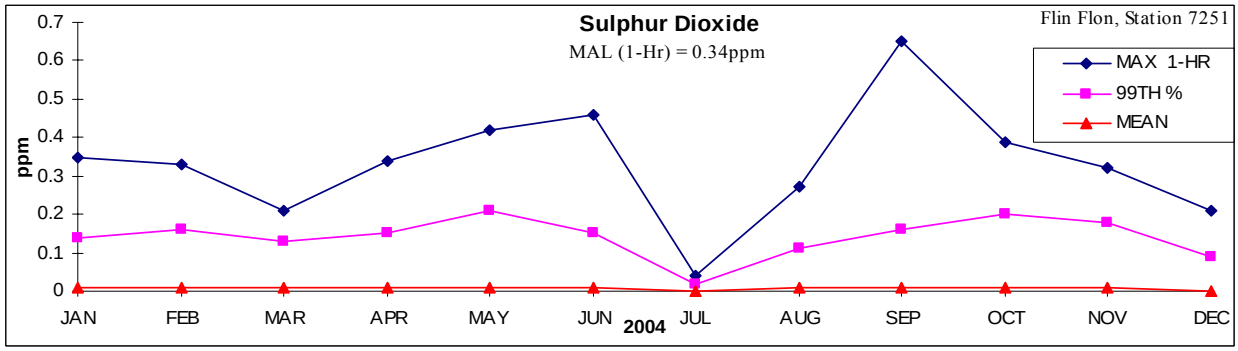

Figure 62 Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site for 2004.

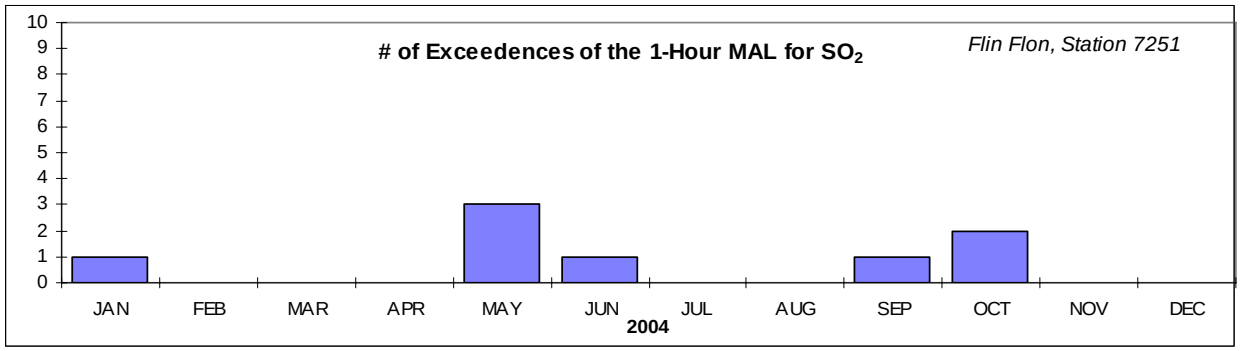

Figure 63. Number of exceedences of the 1-hour MAL for SO_2 for 2004 recorded at the provincial monitoring site.

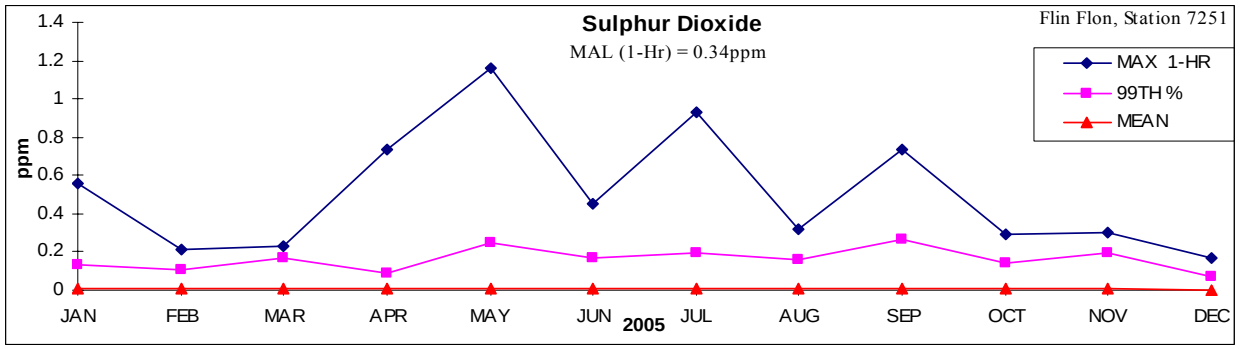

Figure 64. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site for 2005.

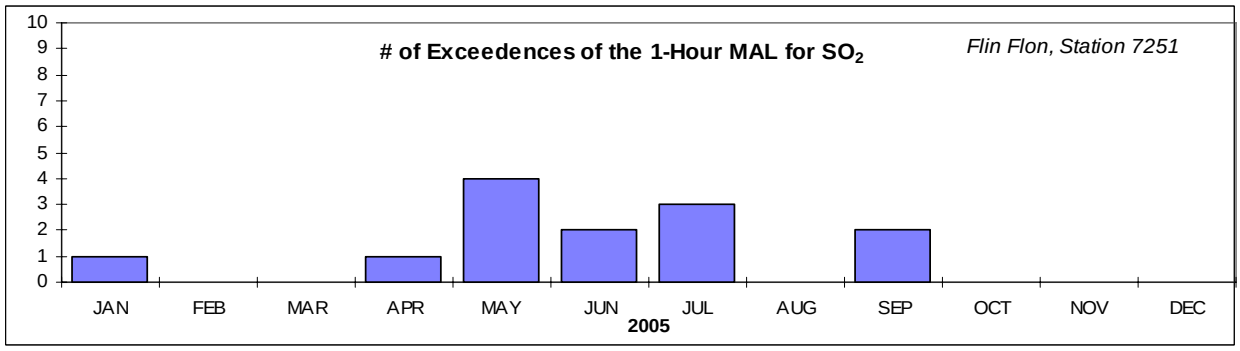

Figure 65. Number of exceedences of the 1-hour MAL for SO_2 for 2005 recorded at the provincial monitoring site.

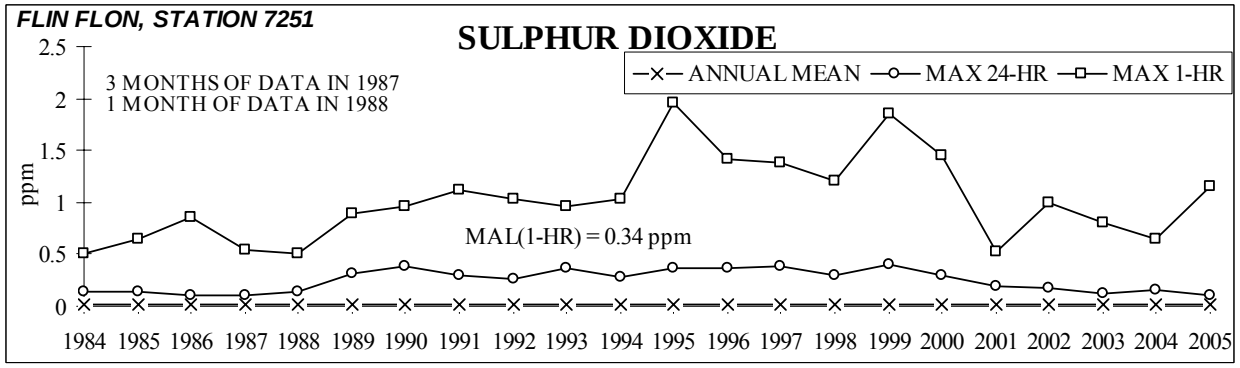

Figure 66. Annual mean, 24-Hr and 1-hour maximum sulphur dioxide levels calculated and observed for the Flin Flon provincial monitoring site from 1984 through 2005.

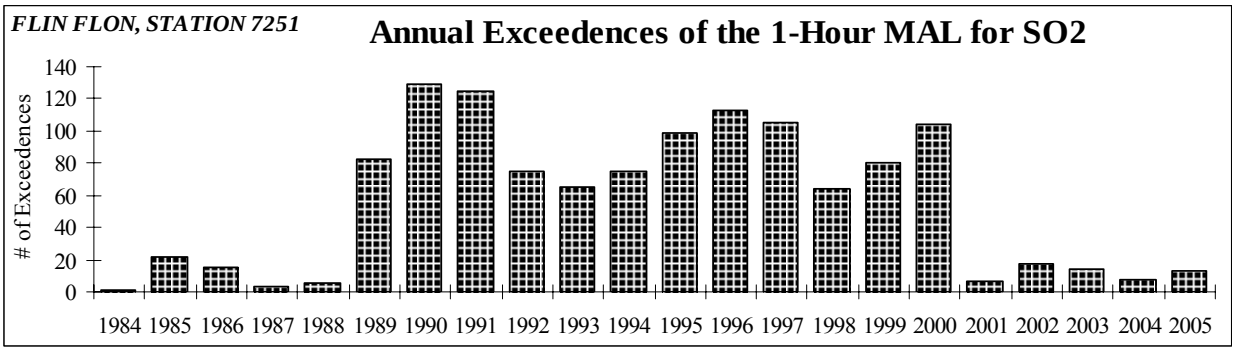

Figure 67. Number of exceedences of the 1-hour MAL for SO_2 recorded at the provincial monitoring site on an annual basis from 1984 through 2005. *Note: The location of monitoring in the uptown area changed in 1989.*

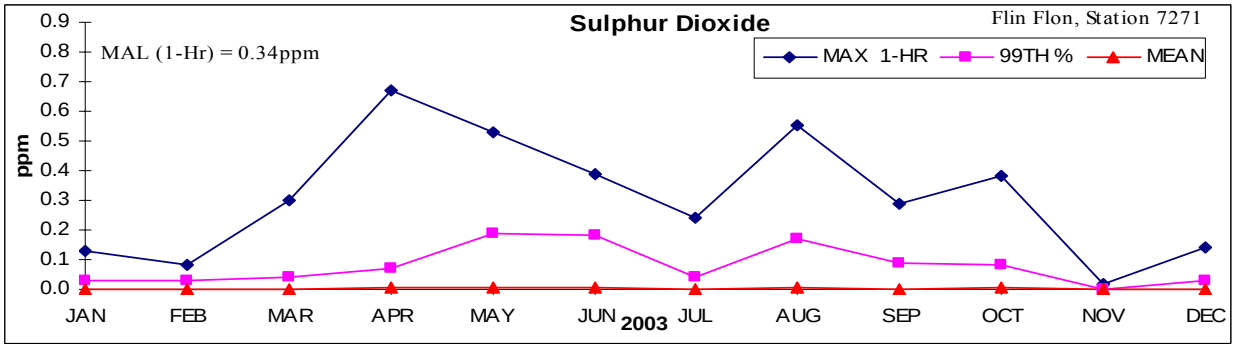

Figure 68. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2003.

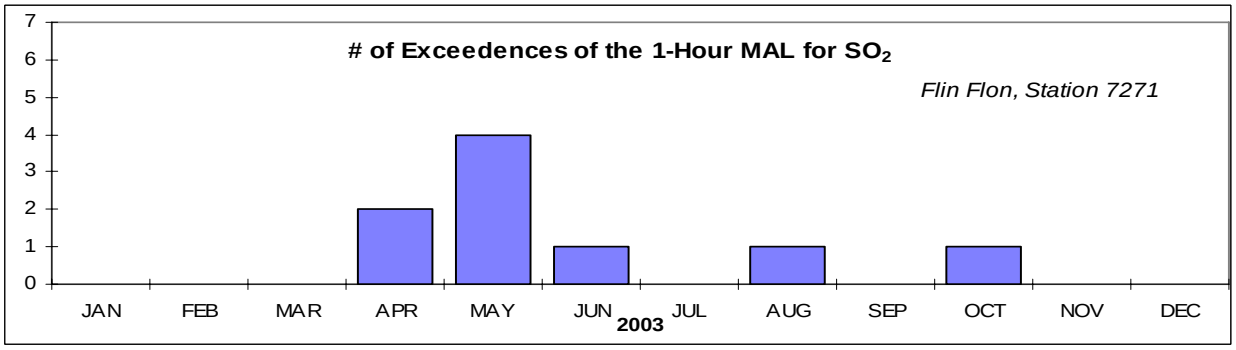

Figure 69. Number of exceedences of the 1-hour MAL for SO_2 for 2003 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

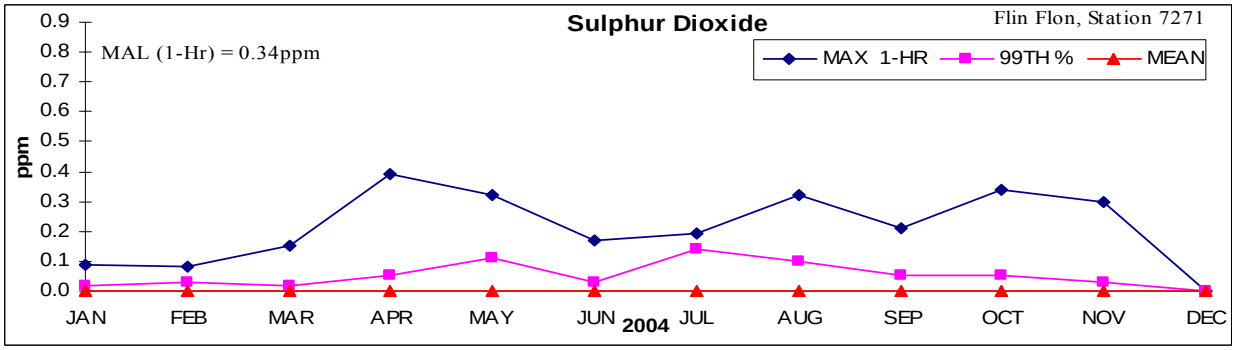

Figure 70. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2004.

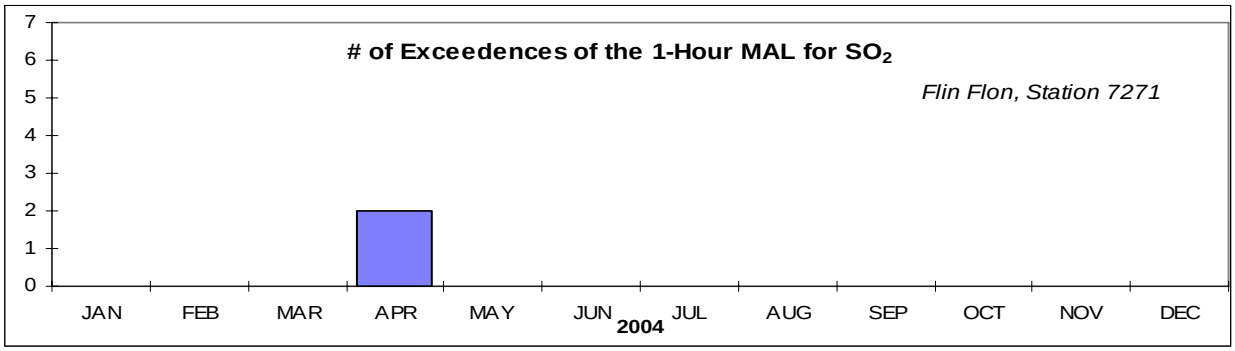

Figure 71. Number of exceedences of the 1-hour MAL for SO_2 for 2004 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

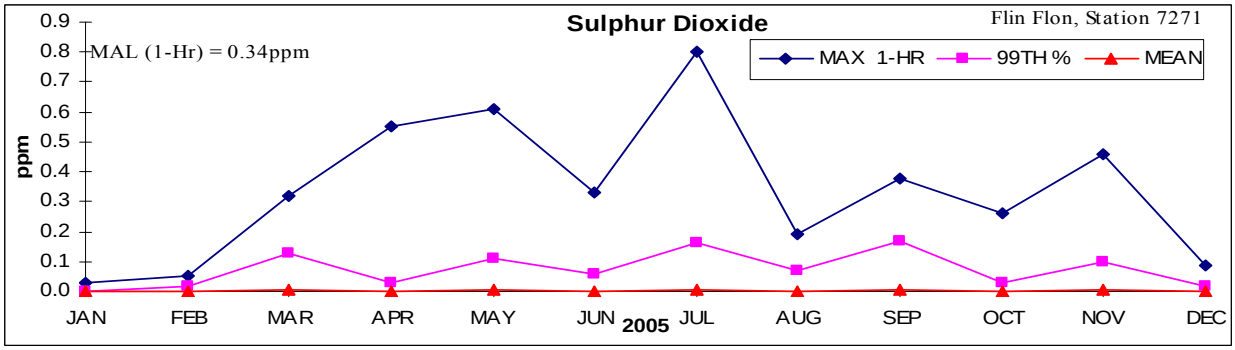

Figure 72. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Aqua Centre in Flin Flon, for 2005.

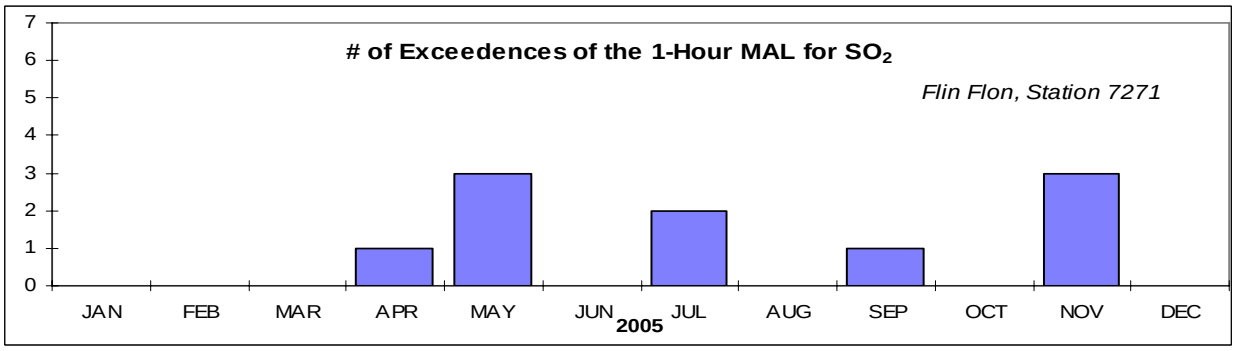

Figure 73. Number of exceedences of the 1-hour MAL for SO_2 for 2005 recorded at the company monitoring site located at the Aqua Centre in Flin Flon.

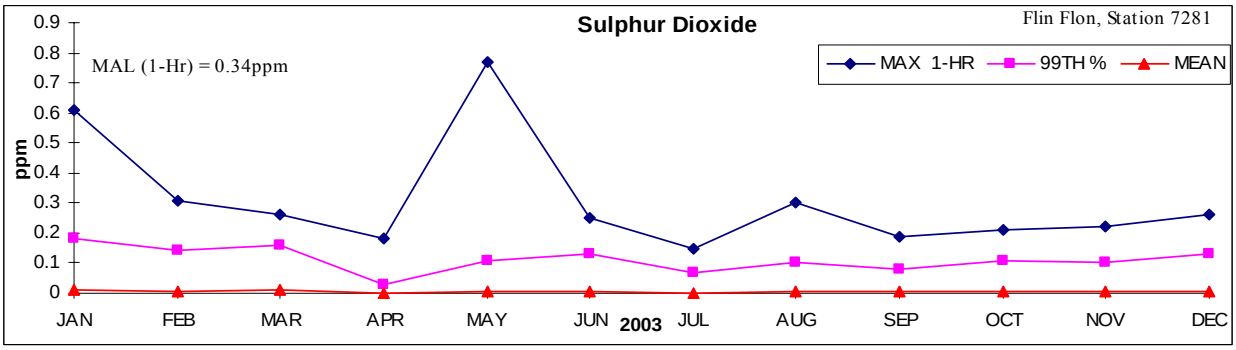

Figure 74. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2003.

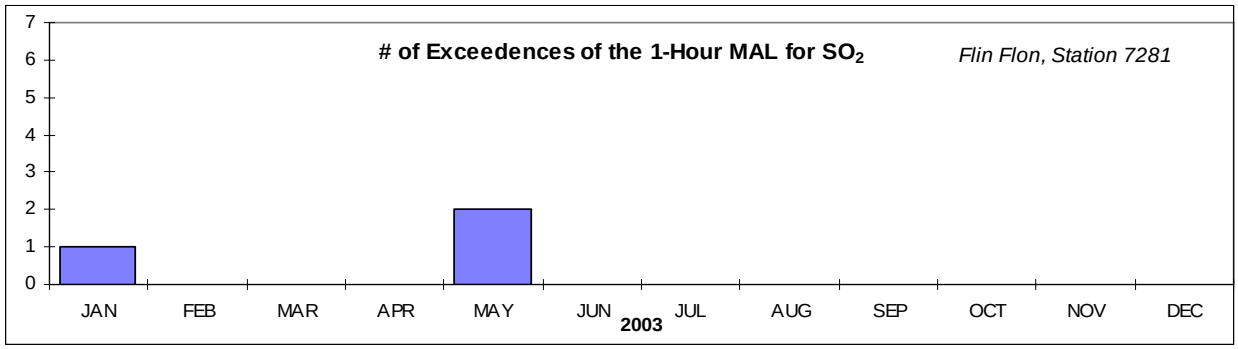

Figure 75. Number of exceedences of the 1-hour MAL for SO_2 for 2003 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

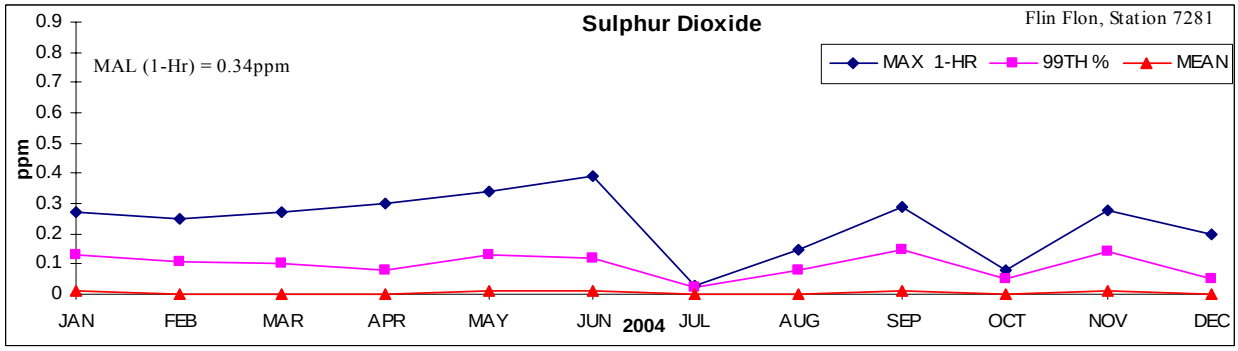

Figure 76. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2004.

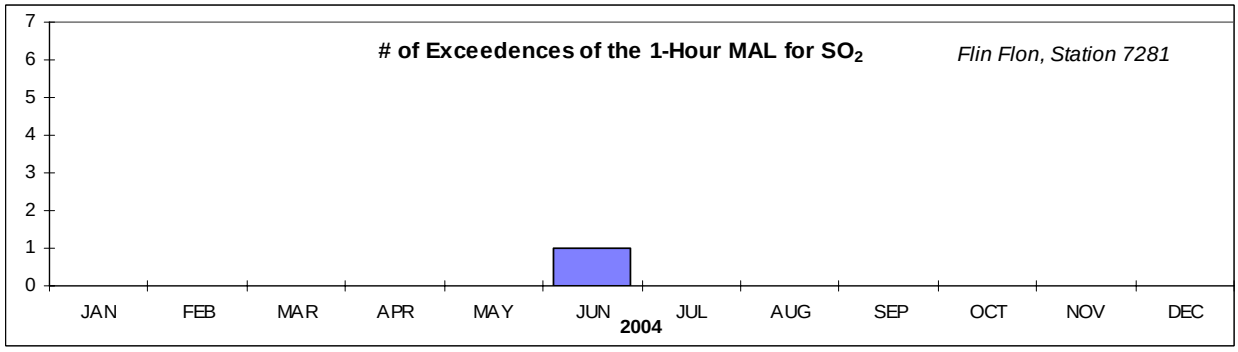

Figure 77. Number of exceedences of the 1-hour MAL for SO_2 for 2004 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

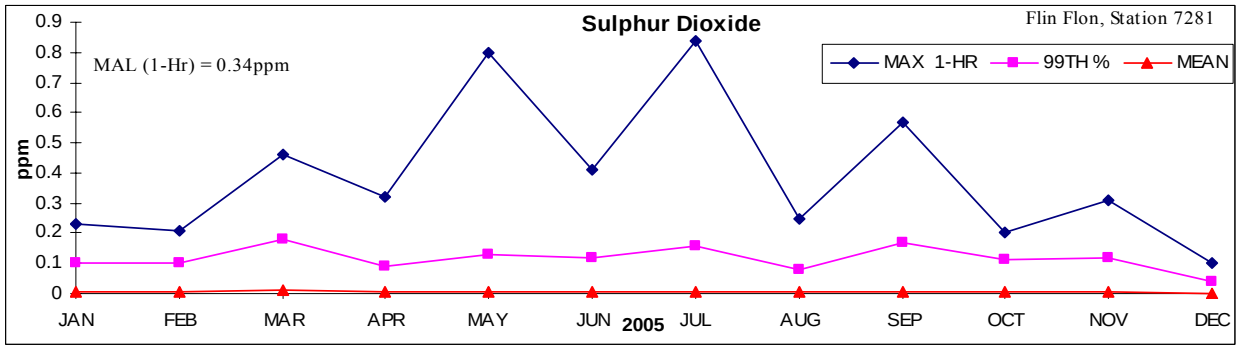

Figure 78. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the HBM&S Staff House in Flin Flon, for 2005.

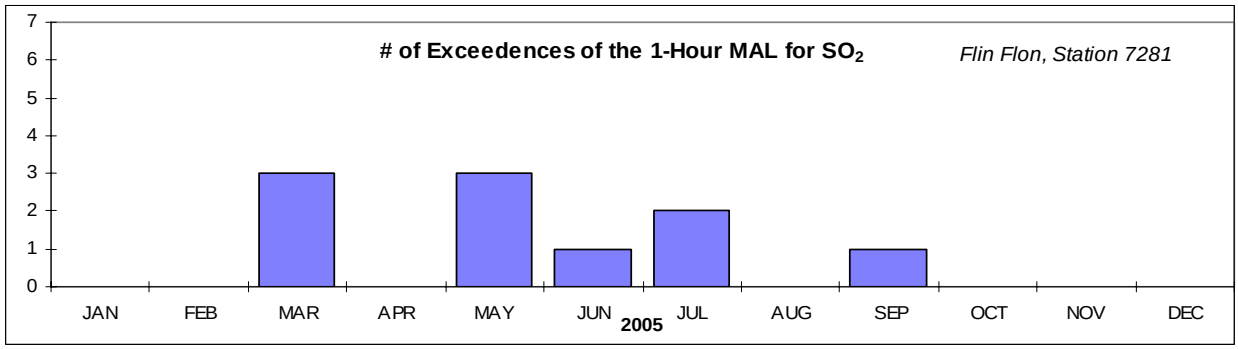

Figure 79. Number of exceedences of the 1-hour MAL for SO_2 for 2005 recorded at the company monitoring site located at the HBM&S Staff House in Flin Flon.

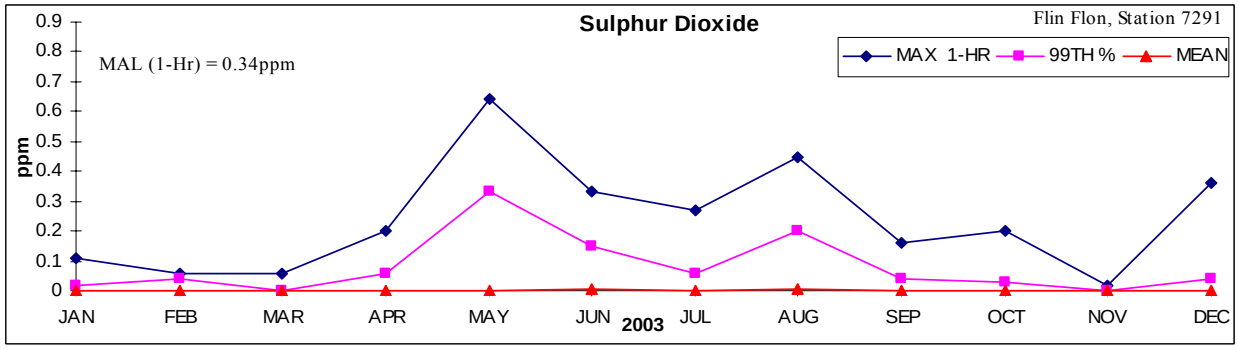

Figure 80. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2003.

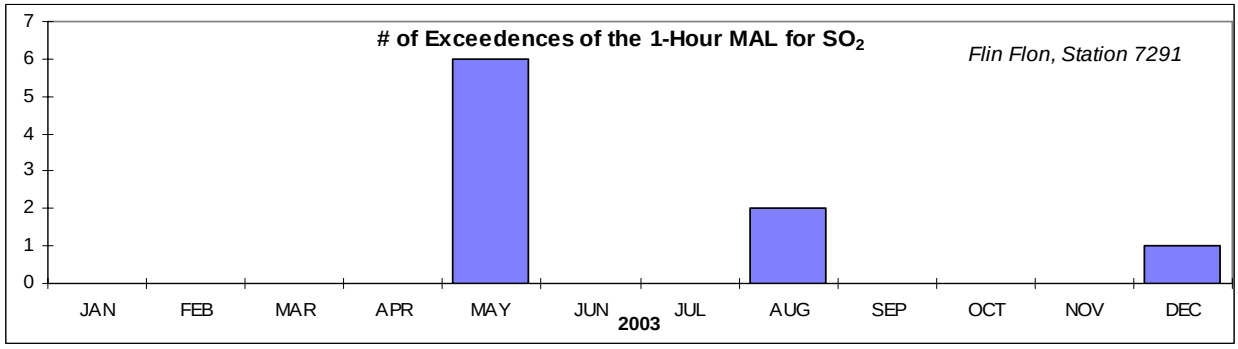

Figure 81. Number of exceedences of the 1-hour MAL for SO_2 for 2003 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

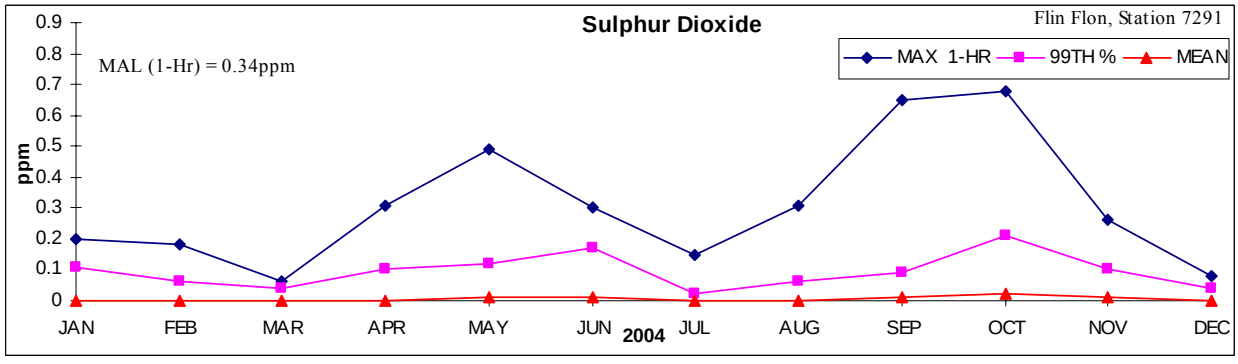

Figure 82. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2004.

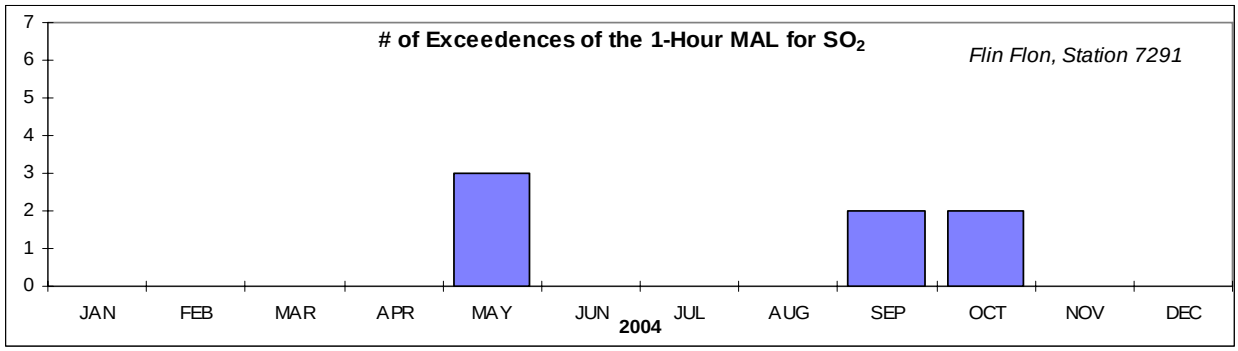

Figure 83. Number of exceedences of the 1-hour MAL for SO_2 for 2004 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

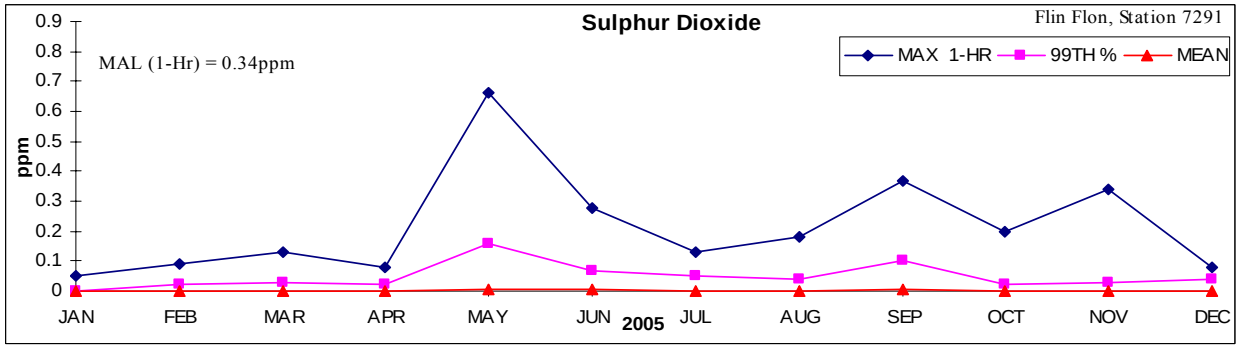

Figure 84. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at the Creighton (Sask.) City Fire Hall, for 2005.

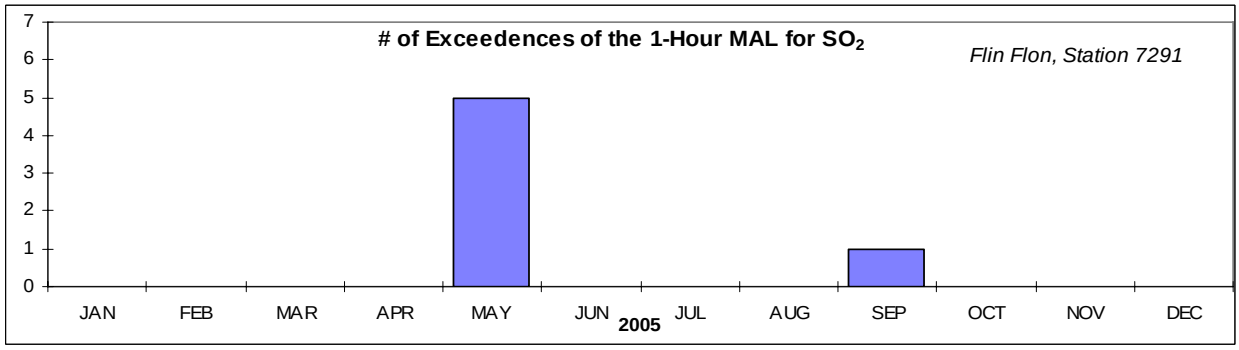

Figure 85. Number of exceedences of the 1-hour MAL for SO_2 for 2005 recorded at the company monitoring site located at the City Fire Hall in Creighton, Sask.

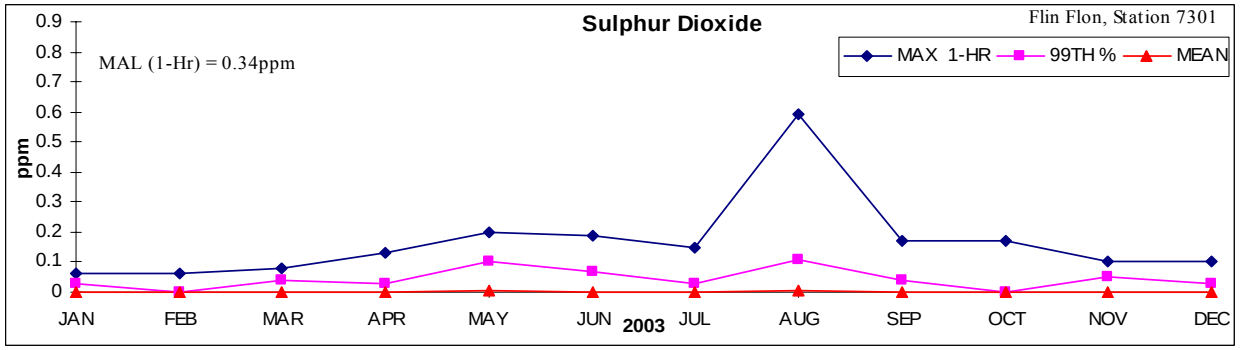

Figure 86. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2003.

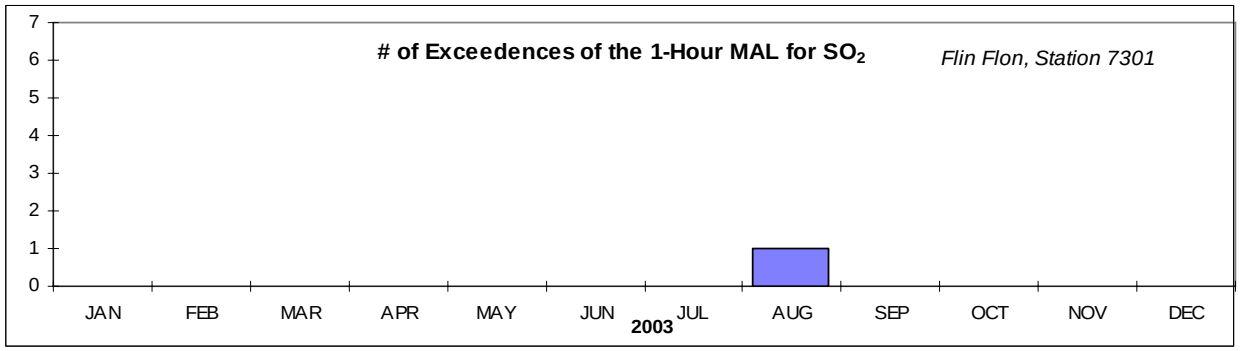

Figure 87. Number of exceedences of the 1-hour MAL for SO_2 for 2003 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

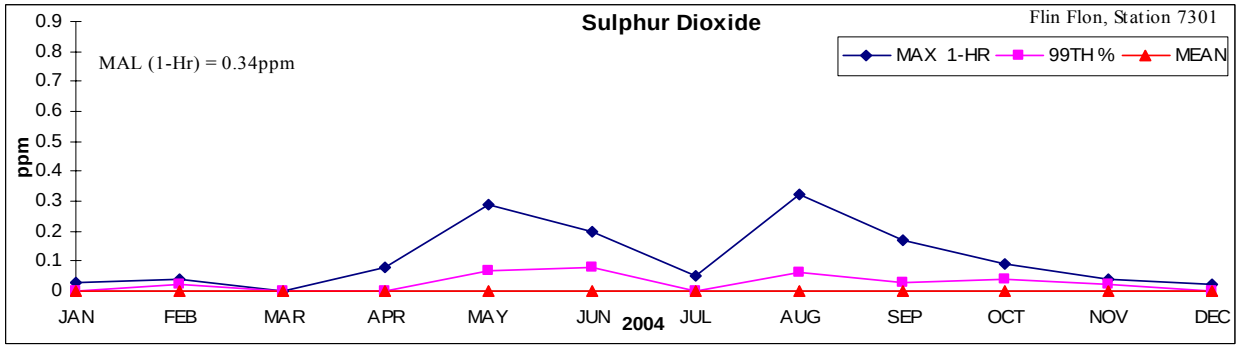

Figure 88. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2004.

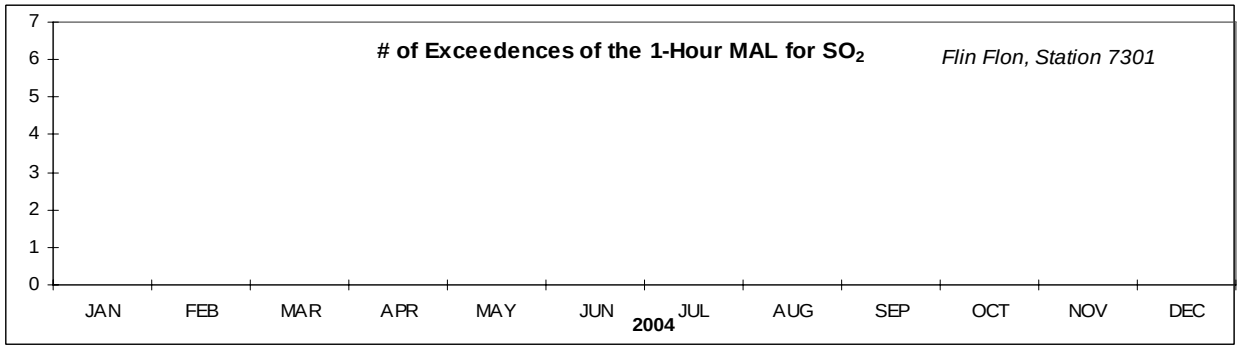

Figure 89. Number of exceedences of the 1-hour MAL for SO_2 for 2004 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

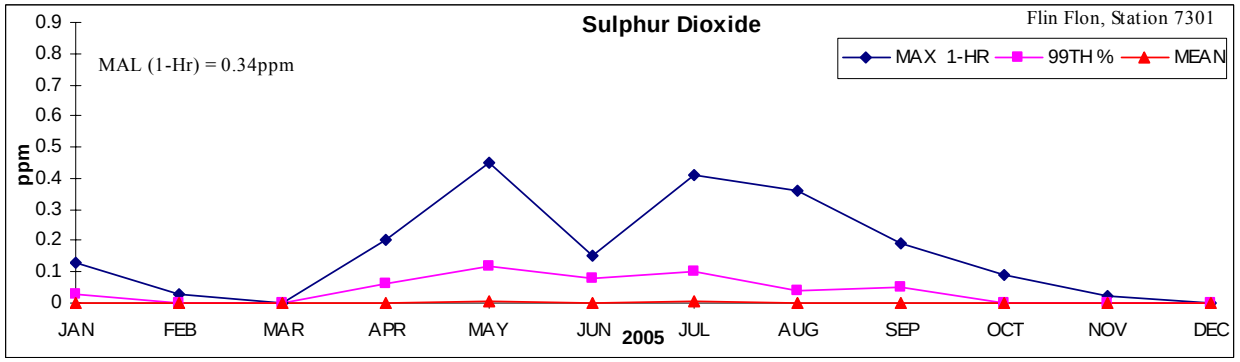

Figure 90. Monthly mean and 1-hour maximum sulphur dioxide levels calculated and observed for the company monitoring site located at Hapnot Collegiate in Flin Flon, for 2005.

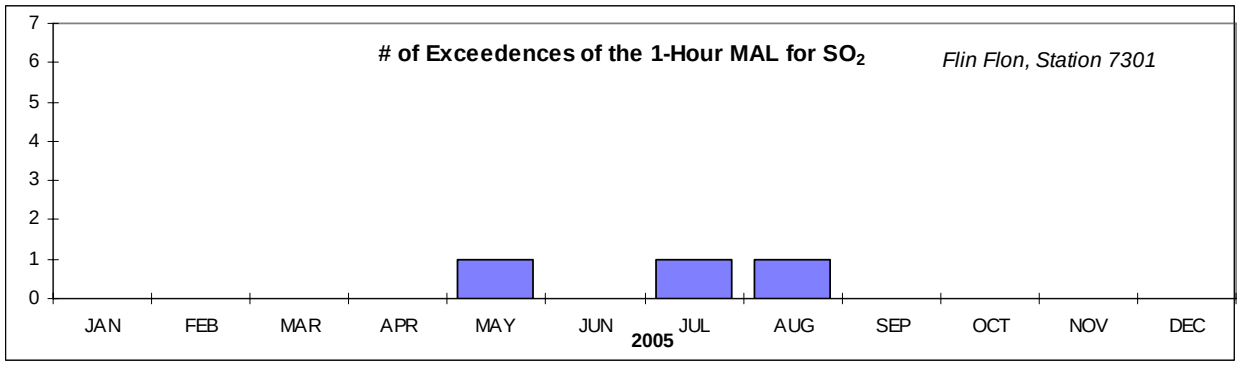

Figure 91. Number of exceedences of the 1-hour MAL for SO_2 for 2005 recorded at the company monitoring site located at Hapnot Collegiate in Flin Flon.

TSP, PM_{10}, Pb, $SO_4^{=}$, NO_3^{-}, Arsenic (As), Cadmium (Cd), Copper (Cu), and Zinc (Zn)

TSP and PM_{10}, $SO_4^{=}$, NO_3^{-}, and the heavy metal (Lead (Pb), Arsenic (As), Cadmium (Cd), Copper (Cu), and Zinc (Zn)) content of these particles were also monitored in 2003, 2004 and 2005 by the Province at one location and the company at two other locations within Flin Flon. Annual summaries are presented in Tables 3a, 5a and 7a for the PM_{10} monitoring and in Tables 3c, 5c and 7c for the TSP monitoring. Monthly summaries are shown in Figures 92 to 110 for TSP for the Provincial monitoring site and the two company-operated monitoring sites in the Flin Flon area. Levels of the sulphate, nitrate and the heavy metals in the PM_{10} samples were generally lower than in the TSP samples.

Four samples in 2003, two samples in 2004 and ten samples in 2005 exceeded the 24-hour MAL for TSP at the provincial monitoring site. For 2003, there were two samples at the Creighton School site that exceeded the 24-hr MAL for TSP and none at Ruth Betts. For 2004 and 2005, there were only two and five exceedences at Creighton School, respectively.

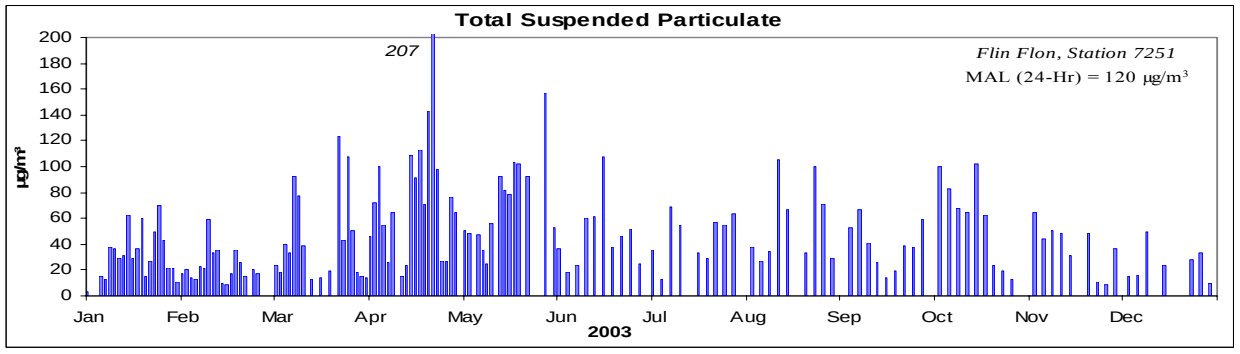

Figure 92. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2003.

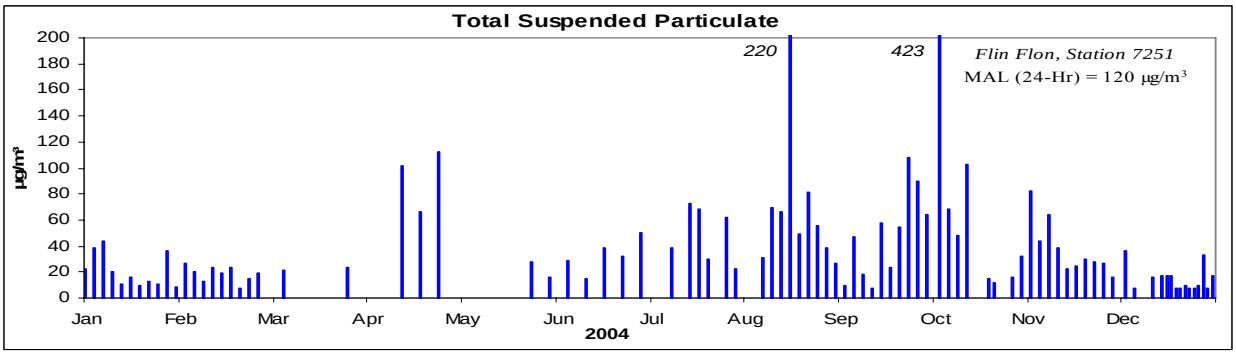

Figure 93. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2004.

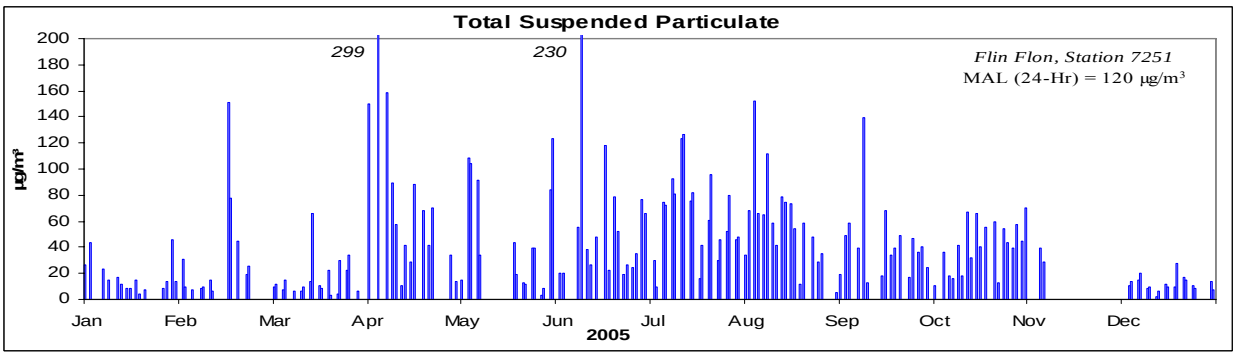

Figure 94. Volume-weighted 24-Hr TSP levels calculated and observed for the Flin Flon downtown monitoring site for 2005.

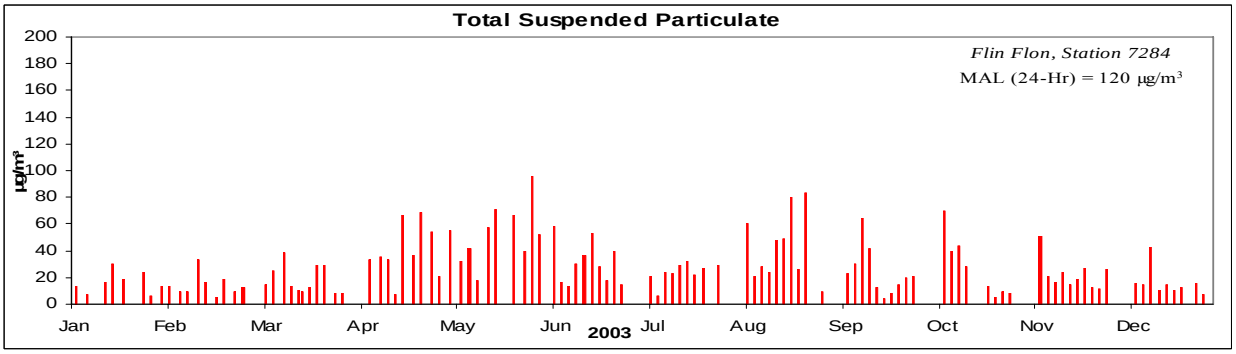

Figure 95. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2003.

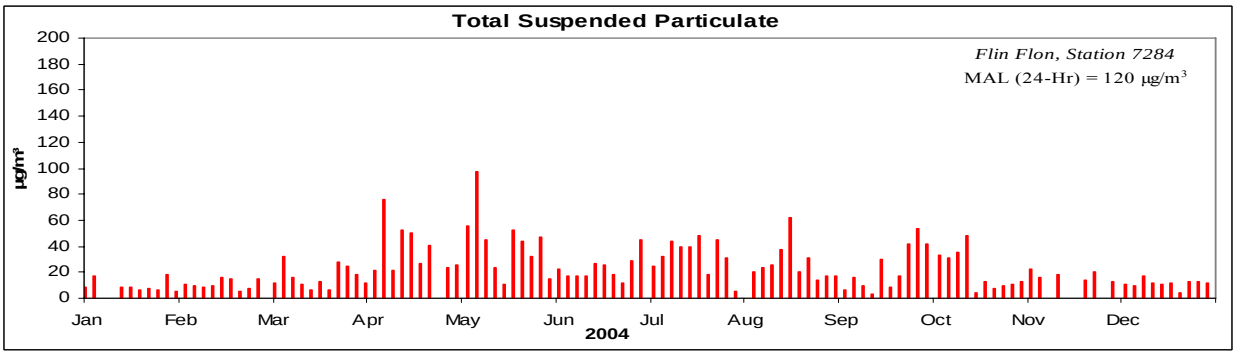

Figure 96. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2004.

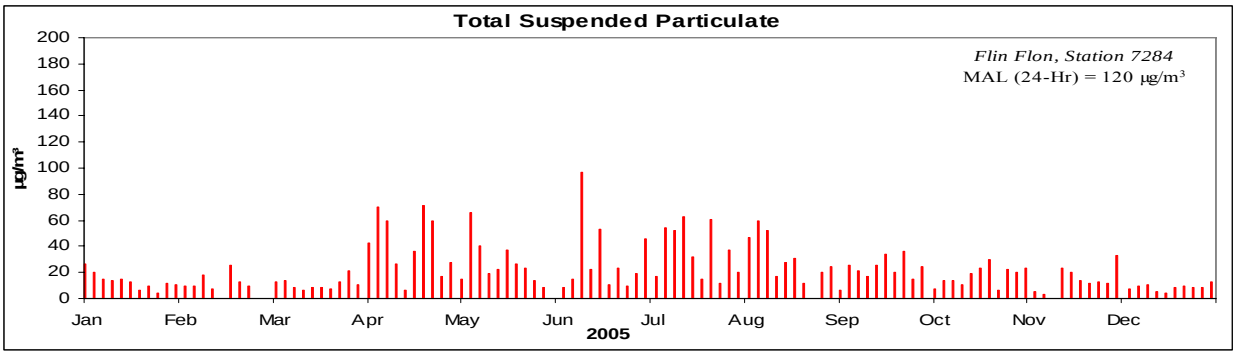

Figure 97. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at Ruth Betts School in Flin Flon for 2005.

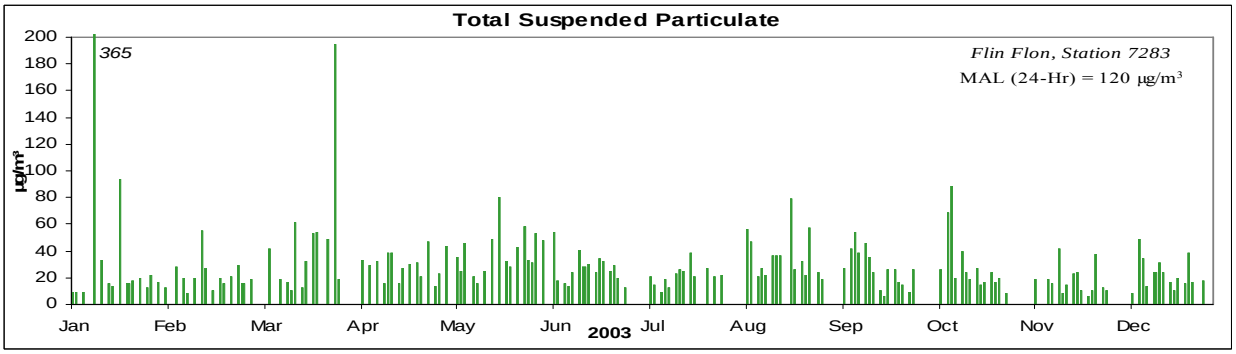

Figure 98. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2003.

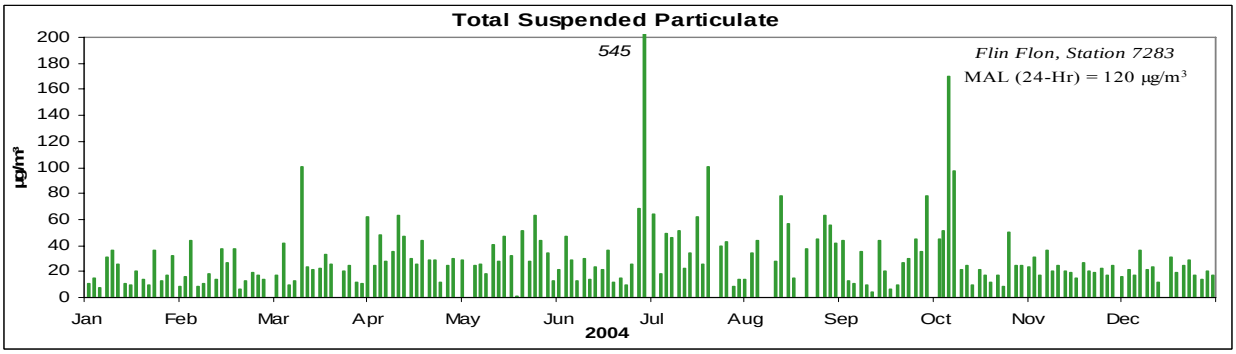

Figure 99. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2004.

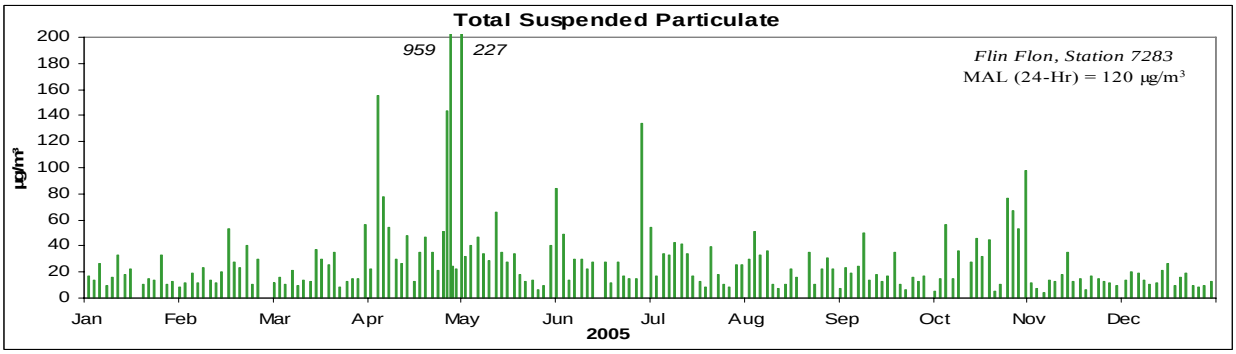

Figure 100. Volume-weighted 24-Hr TSP levels calculated and observed for the company-operated monitoring site located at the School in Creighton, Saskatchewan for 2005.

The exceedences of TSP that occurred in Creighton were fairly independent of each other with the exception of the period between 27 April and 1 May, 2005. An exceedence of 143 µg/m^3 occurred on 27 April and continued into 28 April when levels rose to 959 µg/m^3 with one more elevated level of 227 µg/m^3 occurring on 1 May, 2005.

As of July 2005 the Provincial Guideline for lead (Pb) dropped from 5.0 µg/m^3 to 2.0 µg/m^3. One sample, from the Provincial site, exceeded the Provincial Guideline of 2.0 µg/m^3 for Pb in August of 2005. In 2003 and 2004, none of the samples collected from the Provincially operated sites or the company operated sites exceeded the Provincial guideline for lead.

Discussion of the heavy metals As, Cd, Cu, and Zn (Tables 3a and 3c, 5a and 5c, 7a and 7c) will not be included in this report. For the aforementioned heavy metals, where there is a listing for exceedences of the 24-hr MAL, the exceedences were based on the Ontario Guidelines (Ontario, 2005) for these heavy metals. The Ontario Guidelines were adopted by Manitoba as of July 2005. Other provincial reports specifically relating to heavy metals in Flin Flon are available (Bezak, D. 1991 and Manitoba Environment 1989). Quarterly reports detailing particulate matter (PM_{10}) levels and selected heavy metals levels in dust are produced by Manitoba Conservation and distributed to interested groups and individuals in the Flin Flon area.

D. THOMPSON AIR QUALITY

SO_2 monitoring in Thompson was conducted only by the local nickel smelting company, located south of the town, and the yearly results are shown in Tables 2, 4 and 6. Reported SO_2 emissions from this complex were 191 kilotonnes in 2003, 192 kilotonnes in 2004 and 180 kilotonnes in 2005. There was one exceedence of the Provincial 1-hour MAL of 0.34 ppm for SO_2 in 2003, none in 2004 and two in 2005. Yearly trends are shown in Figures 101 and 102.

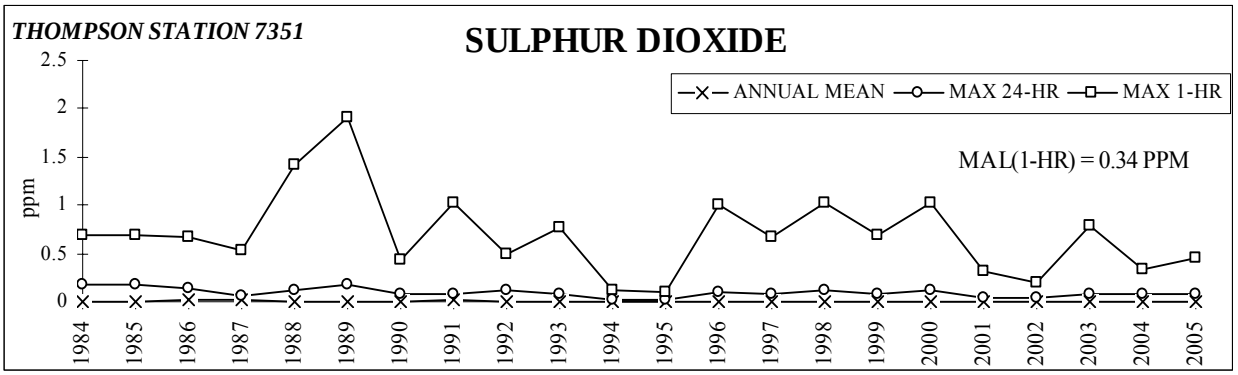

Figure 101. Annual mean, 24-Hr and 1-Hr maximum sulphur dioxide levels calculated and observed for the company operated Thompson monitoring site from 1984 through 2005.

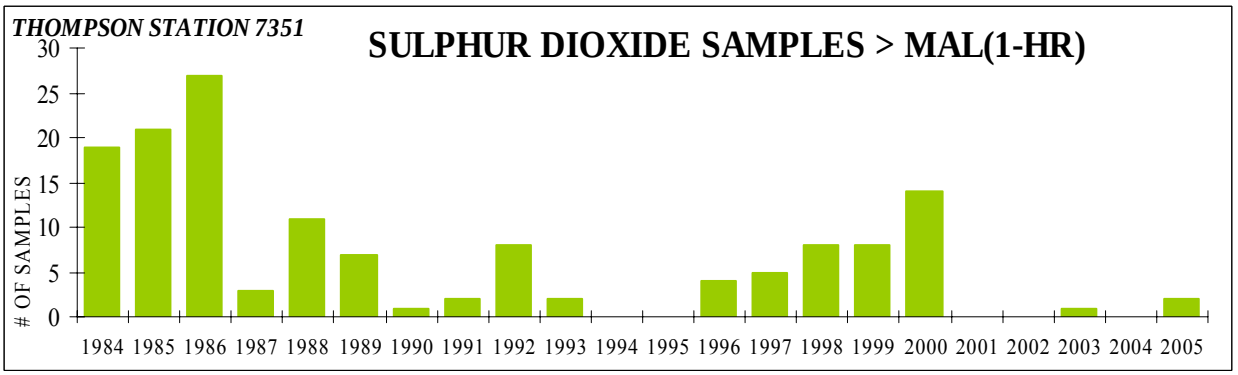

Figure 102. Number of exceedences of the 1-hour MAL for SO_2 annual recorded at the company operated monitoring site in Thompson from 1984 through 2005.

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