Air Quality Monitoring in Sherwood Park
Summer, 1997 (July 3, 11, 15 and 30)

Alberta Environmental Protection conducted an air quality monitoring study in Sherwood Park beginning in the summer of 1996 and ending in the fall of 1997. The objective of this study was to determine air quality parameter concentrations in Sherwood Park relative to air quality guidelines and to other small urban locations in the province. The following report is a summary of mobile air quality monitoring activities in Sherwood Park during the summer of 1997 (July 3, 11, 15 and 30).

Air quality was measured using a mobile monitoring unit at five locations in northwest (Sioux Road), southwest (Victoria Way), central (Festival Place), northcentral (RCMP Headquarters) and east (Heritage Hills) Sherwood Park. Air quality parameters monitored at these locations included carbon monoxide (CO), ozone (O_3), total hydrocarbons (THC), reactive hydrocarbons (RHC), methane (CH_4), total oxides of nitrogen (NO_x), nitrogen dioxide (NO_2), nitric oxide (NO), hydrogen sulphide (H_2S), and sulphur dioxide (SO_2).

Major Findings

- Concentrations of air quality parameters monitored in Sherwood Park were below the air quality guidelines. Maximum 1-hour average concentrations were:
  - < 5% of the 1-hour guideline for CO;
  - < 52% of the 1-hour guideline for O_3;
  - < 13% of the 1-hour guideline for NO_2;
  - < 20% of the 1-hour guideline for H_2S; and
  - < 19% of the 1-hour guideline for SO_2.

- Concentrations of chemicals from vehicle exhaust emissions (carbon monoxide, oxides of nitrogen and hydrocarbons) were generally highest at the northwest and southwest monitoring sites. Higher levels of these chemicals in the western part of Sherwood Park are likely due to traffic along Baseline Road, Wye Road and transport from Edmonton.

- Hydrogen sulphide and sulphur dioxide levels were generally very low in Sherwood Park during the summer survey period. The only exception to this was on July 3 when slightly elevated sulphur dioxide concentrations were recorded at the northcentral site. These elevated values were likely caused by emissions from the Strathcona industrial area.

Carbon Monoxide (CO)

Max. 1-hour Average	1-hour Guideline
0.6 ppm	13 ppm

Carbon monoxide is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion.

Carbon monoxide concentrations were very low in Sherwood Park on all summer survey days. The highest CO values were recorded on July 3 when 1-hour average concentrations ranged from 0.4 to 0.6 ppm. Average CO values on the July 15 survey day were below the instrument detection limit at all locations in Sherwood Park. Average CO concentrations on all survey days showed little variability between locations in the community (0.2 to 0.3 ppm). The overall average CO value for the entire summer monitoring period (0.3 ppm) was half of that observed in downtown Edmonton (0.6 ppm) for the same time period. Average CO concentrations measured in Sherwood Park were close to those recorded at the Edmonton east, Edmonton northwest, Fort Saskatchewan and Fort McMurray monitoring stations.

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.043 ppm	0.082 ppm

Ozone in the lower atmosphere is produced by: (1) the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight; and (2) transport of O_3 from the upper atmosphere to ground level. Background O_3 concentrations are generally highest in the spring and summer seasons. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide.

With the exception of the July 11 survey day, O_3 values generally reached a peak in the late afternoon. This is the typical daily variation observed at other Alberta locations. O_3 values on July 11 show a decrease in the afternoon likely due to nitric oxide (NO) emissions from traffic in the vicinity of the monitoring locations. The reaction of NO with O_3 can reduce ambient O_3 concentrations. Overall average O_3 values were lowest in the western part of Sherwood Park and highest in eastern sector of the community. Again, lower values at the northwest and

southwest sites were likely caused by the destruction of O_3 by NO from vehicle exhaust emissions along major traffic arteries (Baseline Road and Wye Road) in the western part of the community. The overall average O_3 concentration measured in Sherwood Park (0.27 ppm) was the same as that recorded in Fort Saskatchewan and lower than the average at the Edmonton northwest station (0.30 ppm) for the same time period. The average O_3 concentration at a background monitoring station located 65 km northwest of Hinton was 0.042 ppm for the summer monitoring period.

Hydrocarbons (THC, RHC and CH_4)

Max. 1-hour Average	1-hour Guideline
THC = 2.5 ppm	no guideline
RHC = 0.5 ppm	no guideline
CH_4 = 1.9 ppm	no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH_4), a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Reactive hydrocarbons (RHC) such as alkenes, alkynes and aromatics are important because they can: (1) react with oxides of nitrogen in the presence of sunlight to form ozone; and (2) be toxic to humans, animals or vegetation. Sources of hydrocarbons include vegetation, vehicular emissions, gasoline marketing and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic.

Maximum 1-hour average hydrocarbon values were recorded at the southwest and northwest sites in the morning of July 3. Overall average THC concentrations ranged from 2.0 to 2.1 ppm at Sherwood Park monitoring sites. Reactive hydrocarbons made up about 14% of total hydrocarbons based on average concentrations for the summer survey days. Overall average THC values in Sherwood Park (2.1 ppm) were higher than those recorded at Fort Saskatchewan (1.6 ppm) and Fort McMurray (1.6 ppm) for the same time period. This is likely due to vehicle exhaust emissions from major traffic arteries (Baseline Road and Wye Road) in the community. However, the overall average THC concentration in Sherwood Park was lower than the average at the Edmonton east monitoring station (2.5 ppm) for the summer monitoring period. Normal background THC concentrations are between 1.5 and 2.0 ppm.

Oxides of Nitrogen (NO_2, NO, NO_x)

Max. 1-hour Average	1-hour Guideline
NO_2 = 0.027 ppm	0.210 ppm
NO = 0.022 ppm	no guideline
NO_x = 0.039 ppm	no guideline

Oxides of nitrogen (NO_x) are the sum of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion, as in the burning of natural gas, coal, oil and gasoline, atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless, odourless and has no known toxic effects. Most NO is rapidly oxidized to form NO_2. NO_2 is a reddish-brown gas with a pungent odour.

The highest oxides of nitrogen concentrations were recorded in the early morning hours on July 15 and 30 at the northwest and southwest monitoring sites. Average NO_x concentrations of 0.023 and 0.025 ppm were recorded at the northwest and southwest sites, respectively, compared to a range of 0.017 to 0.018 ppm at the central, northcentral and east monitoring sites. Higher values in the western part of Sherwood Park are likely caused by vehicle traffic along major traffic arteries such as Baseline Road and Wye Road and transport from the city of Edmonton. Overall average oxides of nitrogen concentrations in Sherwood Park during the summer monitoring period were similar to those recorded at the Edmonton east and northwest monitoring stations for the same time period. However, the average concentrations of NO_2, NO and NO_x at Fort Saskatchewan and Fort McMurray were lower than those recorded in Sherwood Park during the summer monitoring period.

Hydrogen Sulphide (H_2S)

Max. 1-hour Average	1-hour Guideline
H_2S = 0.002 ppm	0.010 ppm

Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Industrial sources of H_2S include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants which use the kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

Hourly average H_2S values measured in Sherwood Park were close to the detection limit of the monitoring instrument most of the time on the four summer survey days. The maximum 1-hour average H_2S concentration of 0.002 ppm was measured in the early morning on July 3 at the southwest and northwest sites and again in the afternoon of July 3 at the northwest site. This maximum value is 20% of the 1-hour guideline. H_2S concentrations were also very low at other Alberta monitoring stations on the four survey days.

Sulphur Dioxide (SO_2)

Max. 1-hour Average	1-hour Guideline
SO_2 = 0.032 ppm	0.170 ppm

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, the major sources of SO_2 are natural gas processing plants, oil sands facilities, and power plants. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

The first and second highest 1-hour average SO_2 concentrations were measured in the morning (0.032 ppm) and afternoon (0.010 ppm), respectively, on July 3 at the northcentral monitoring site. The maximum value of 0.032 ppm is 19% of the 1-hour guideline for SO_2. Concentrations were much less on July 11, 15 and 30 with a peak SO_2 value of 0.006 ppm. Elevated SO_2 levels at the northcentral site on July 3 were likely due to emissions from the industrial facilities in the Strathcona industrial area west of Sherwood Park. The overall average SO_2 concentration in Sherwood Park (0.003 ppm) was higher than those recorded at the Edmonton east (0.002 ppm), Fort Saskatchewan (0.001 ppm) and Fort McMurray (0.001 ppm) monitoring stations.

Particulates (TSP, PM_{10} and $PM_{2.5}$)

Max. 1-hour Average	1-hour Guideline
TSP = 12 µg/m^3	no guideline
PM_{10} = 8 µg/m^3	no guideline
$PM_{2.5}$ = 2 µg/m^3	no guideline

Air pollutants are not necessarily in a gaseous form. Tiny particles of solid material or liquid droplets, defined collectively as particulates are also present in the atmosphere. Total suspended particulates (TSP) refers to all particles up to 500 microns in diameter (a human hair is about 100 microns in diameter) and are important primarily from a nuisance perspective. Particles less than 10 microns in diameter (PM_{10}) can be inhaled into the nose and throat while particles less than 2.5 microns in diameter ($PM_{2.5}$) can penetrate into the lungs. Sources of particulates include soil dust, road dust, agricultural dust (e.g. harvest), smoke from forest fires and recreational wood burning, vehicle exhaust emissions, brake and tire ware, and industrial emissions. Smaller particles ($PM_{2.5}$) originate in the atmosphere as a result of condensation and combustion from sources such as vehicle exhaust emissions, industrial emissions and wood burning.

The maximum TSP, PM_{10} and $PM_{2.5}$ concentrations were observed at the northwest site between 8:00 and 9:00 a.m. on July 3. Particulate concentrations showed little variation between monitoring sites in Sherwood Park (average PM_{10} ranged from 1 to 3 µg/m^3). The average $PM_{2.5}$ and PM_{10} concentrations in Sherwood Park were very low relative to other Alberta locations. For example, the average $PM_{2.5}$ value recorded in Sherwood Park was 1 µg/m^3 compared to 7 µg/m^3 at the Fort McMurray station for the same time period. The average PM_{10} concentration in Sherwood Park was 2 µg/m^3 compared to 9 µg/m^3 at the Edmonton northwest monitoring station for the same time period. TSP, PM_{10} and $PM_{2.5}$ are not routinely monitored as a 1-hour average concentrations at other Alberta monitoring stations.

Average Concentrations at Each Monitoring Site in Sherwood Park (ppm)

Monitoring Site	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H_2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**
southwest	0.3	0.023	0.025	0.016	0.009	2.1	1.7	0.4	0.001	0.002	2	2	1
northwest	0.3	0.024	0.023	0.017	0.007	2.1	1.7	0.4	0.001	0.003	4	3	1
northcentral	0.2	0.028	0.017	0.013	0.004	2.1	1.7	0.3	0.001	0.006	2	1	0
central	0.3	0.029	0.018	0.015	0.004	2.1	1.6	0.3	0.001	0.002	2	2	1
east	0.2	0.030	0.017	0.014	0.002	2.0	1.6	0.3	0.000	0.002	2	1	0

Overall Average Concentrations on All Summer Survey Days (ppm)

Location	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H_2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**
Sherwood Park	0.3	0.027	0.020	0.015	0.005	2.1	1.7	0.3	0.001	0.003	2	2	1
Edmonton Central	0.6	0.019	0.035	0.019	0.017	1.9	no data						
Edmonton East	0.2	0.024	0.021	0.012	0.009	2.5	no data		0.001	0.002	no data		
Edmonton Northwest	0.4	0.030	0.027	0.015	0.013	1.8	no data					9	no data
Fort Saskatchewan	0.3	0.027	0.008	0.006	0.002	1.6	no data		0.000	0.001	no data		
Fort McMurray	0.2	0.021	0.008	0.006	0.004	1.6	no data		0.000	0.001	no data		7

Maximum 1-hour Average Concentrations on All Summer Survey Days (ppm)

Location	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H_2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**
Sherwood Park	0.6	0.043	0.039	0.027	0.022	2.5	1.9	0.5	0.002	0.032	12	8	2
Edmonton Central	1.3	0.032	0.068	0.038	0.037	2.3	no data						
Edmonton East	0.8	0.041	0.103	0.030	0.074	3.2	no data		0.002	0.009	no data		
Edmonton Northwest	0.9	0.056	0.095	0.037	0.063	2.4	no data					19	no data
Fort Saskatchewan	0.5	0.042	0.032	0.016	0.016	2.0	no data		0.002	0.004	no data		
Fort McMurray	0.6	0.035	0.088	0.042	0.050	2.0	no data		0.002	0.001	no data		15

** units are in $\mu g/m^3$

Average Concentrations at Each Monitoring Site in Sherwood Park (ppm)

July 03, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H_2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**	Temp.*	Wind dir/spd*	Cloud*
southwest	6:51 to 7:51	0.6	0.009	0.035	0.013	0.022	2.5	1.8	0.5	0.001	0.003	6	4	1	16	W/10	5%
northwest	8:00 to 8:59	0.6	0.013	0.039	0.020	0.019	2.5	1.8	0.5	0.001	0.004	12	8	2	19	W/8	5%
northcentral	9:07 to 10:07	0.5	0.026	0.036	0.020	0.016	2.3	1.7	0.5	0.001	0.032	4	3	1	20	W/9	5%
central	10:15 to 11:15	0.5	0.036	0.023	0.015	0.008	2.2	1.6	0.5	0.001	0.003	4	3	1	22	W/10	5%
east	11:25 to 12:24	0.4	0.035	0.016	0.015	0.002	2.1	1.6	0.4	0.001	0.007	3	2	1	21	W/11	10%
southwest	12:50 to 13:50	0.4	0.039	0.018	0.015	0.003	2.1	1.6	0.4	0.001	0.004	2	2	1	23	W/11	30%
northwest	13:58 to 15:06	0.4	0.039	0.016	0.015	0.001	2.1	1.6	0.4	0.001	0.008	3	2	1	24	W/9	50%
northcentral	15:13 to 16:14	0.3	0.039	0.020	0.017	0.003	2.0	1.6	0.3	0.001	0.010	4	3	1	23	NW/11	40%
central	16:25 to 17:32	0.6	0.025	0.017	0.014	0.002	2.1	1.6	0.4	0.001	0.002	6	4	1	19	NW/9	80%
east	17:41 to 18:44	0.4	0.029	0.012	0.009	0.003	2.0	1.6	0.4	0.001	0.001	1	1	0	14	W/13	100%

July 11, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**	Temp.*	Wind dir/spd*	Cloud*
southwest	7:00 to 7:59	0.3	0.022	0.017	0.012	0.005	2.0	1.6	0.4	0.002	0.001	0	0	0	12	SW/12	0%
northwest	8:07 to 9:10	0.3	0.027	0.013	0.010	0.003	2.0	1.6	0.4	0.002	0.002	9	4	1	12	SW/14	30%
northcentral	9:17 to 10:24	0.2	0.028	0.009	0.008	0.001	2.0	1.6	0.3	0.001	0.002	0	0	0	15	S/19	30%
central	10:33 to 11:37	0.4	0.028	0.017	0.011	0.005	2.0	1.6	0.3	0.001	0.001	1	1	0	17	SW/9	75%
east	11:46 to 12:47	0.3	0.025	0.029	0.022	0.007	2.0	1.6	0.3	0.001	0.002	1	1	0	16	SW/16	90%
southwest	13:16 to 14:15	0.5	0.015	0.034	0.023	0.011	2.0	1.6	0.3	0.001	0.001	1	0	0	12	SW/9	100%
northwest	14:22 to 15:23	0.4	0.012	0.034	0.021	0.013	2.0	1.6	0.4	0.002	0.001	1	1	0	13	SW/8	100%
northcentral	15:31 to 16:31	0.3	0.016	0.022	0.020	0.002	1.9	1.6	0.3	0.001	0.001	0	0	0	15	S/11	100%
central	16:38 to 17:39	0.3	0.019	0.018	0.014	0.004	1.9	1.6	0.3	0.001	0.001	1	0	0	16	S/10	50%
east	17:49 to 18:50	0.3	0.021	0.023	0.022	0.000	2.0	1.6	0.3	0.001	0.002	1	0	0	14	SW/18	90%

July 15, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**	Temp.*	Wind dir/spd*	Cloud*
southwest	7:02 to 8:02	0.0	0.017	0.039	0.019	0.020	2.0	1.6	0.4	0.001	0.002	4	3	1	20	W/16	0%
northwest	8:10 to 9:11	0.0	0.022	0.029	0.024	0.005	2.1	1.6	0.4	0.001	0.002	4	3	1	20	W/18	0%
northcentral	9:18 to 10:20	0.0	0.027	0.008	0.007	0.001	2.1	1.6	0.3	0.001	0.001	1	1	0	20	NW/20	0%
central	10:27 to 11:26	0.0	0.028	0.020	0.017	0.003	2.0	1.6	0.3	0.001	0.006	2	2	1	22	NW12	0%
east	11:42 to 12:45	0.0	0.032	0.012	0.010	0.002	2.0	1.6	0.3	0.000	0.003	1	1	0	23	NW25	0%
southwest	12:55 to 13:55	0.0	0.034	0.014	0.012	0.002	2.0	1.6	0.3	0.000	0.001	2	1	0	24	W/16	0%
northwest	14:05 to 15:06	0.0	0.033	0.014	0.013	0.001	2.0	1.6	0.3	0.001	0.003	1	1	0	25	W/19	10%
northcentral	15:13 to 16:13	0.0	0.035	0.008	0.008	0.000	2.0	1.6	0.3	0.001	0.003	1	1	0	25	W/18	5%
central	16:21 to 17:21	0.0	0.034	0.021	0.018	0.003	2.0	1.6	0.3	0.001	0.002	2	2	1	26	NW/8	5%
east	17:30 to 18:33	0.0	0.030	0.026	0.023	0.002	2.0	1.6	0.3	0.000	0.002	1	1	0	24	NW/13	50%

July 30, 1997

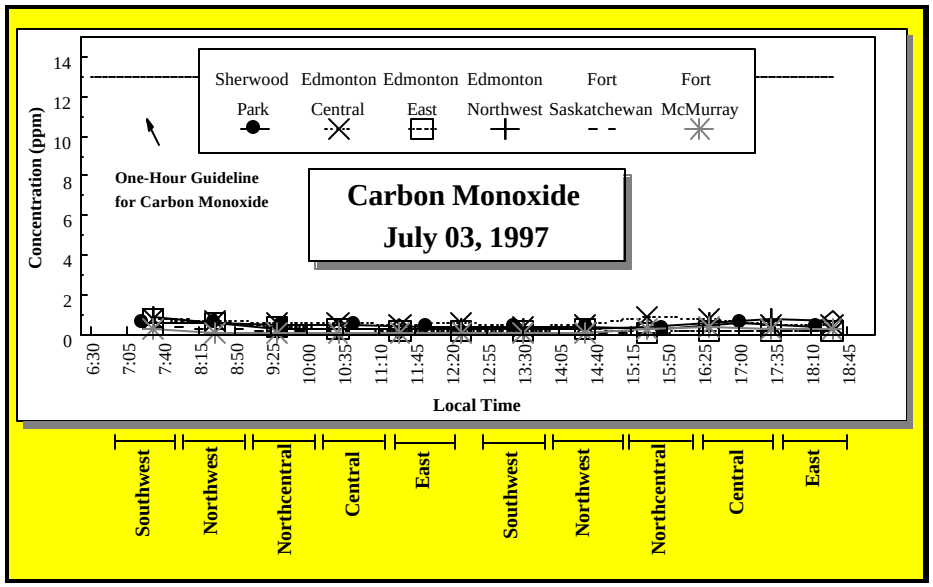
Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**	Temp.*	Wind dir/spd*	Cloud*
southwest	7:02 to 8:02	0.5	0.012	0.032	0.027	0.005	2.1	1.8	0.3	0.000	0.000	2	1	1	20	SE/9	100%
northwest	8:11 to 9:11	0.5	0.004	0.033	0.024	0.008	2.2	1.9	0.3	0.000	0.000	2	2	1	20	SE/4	100%
northcentral	9:18 to 10:19	0.4	0.009	0.029	0.020	0.009	2.1	1.8	0.2	0.000	0.000	1	1	0	20	SE/9	100%
central	10:25 to 11:25	0.4	0.016	0.020	0.019	0.002	2.2	1.9	0.2	0.000	0.002	1	1	1	21	SE/15	100%
east	11:34 to 12:38	0.2	0.032	0.003	0.003	0.000	2.1	1.8	0.2	0.000	0.001	2	1	1	25	SW/18	80%
southwest	12:49 to 13:50	0.3	0.040	0.007	0.006	0.000	2.0	1.7	0.2	0.000	0.001	1	1	1	26	SW/18	90%
northwest	13:58 to 14:58	0.4	0.041	0.009	0.007	0.002	2.0	1.7	0.2	0.000	0.000	3	2	1	27	SE/18	100%
northcentral	15:06 to 16:06	0.3	0.041	0.004	0.004	0.000	2.0	1.7	0.2	0.000	0.000	2	1	1	27	SE/18	90%
central	16:12 to 17:13	0.5	0.043	0.009	0.008	0.001	2.0	1.8	0.1	0.000	0.000	2	1	1	29	S/12	20%
east	17:21 to 18:22	0.4	0.038	0.011	0.011	0.000	2.0	1.8	0.2	0.000	0.000	2	2	0	26	SW/19	60%

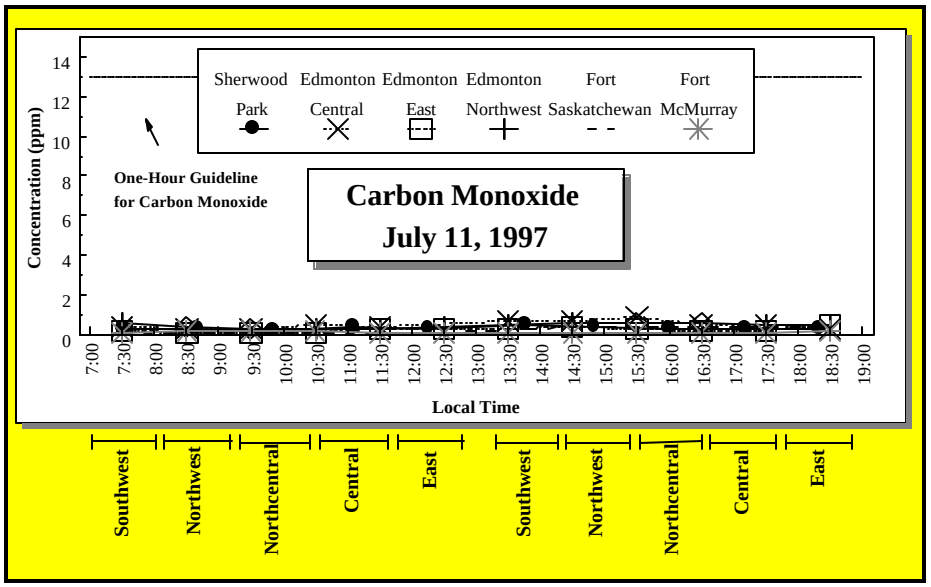
* Weather conditions are based on observations at the monitoring site. Units are temperature [^{o}C], wind speed [km/h] and cloud cover [% of sky coverage].

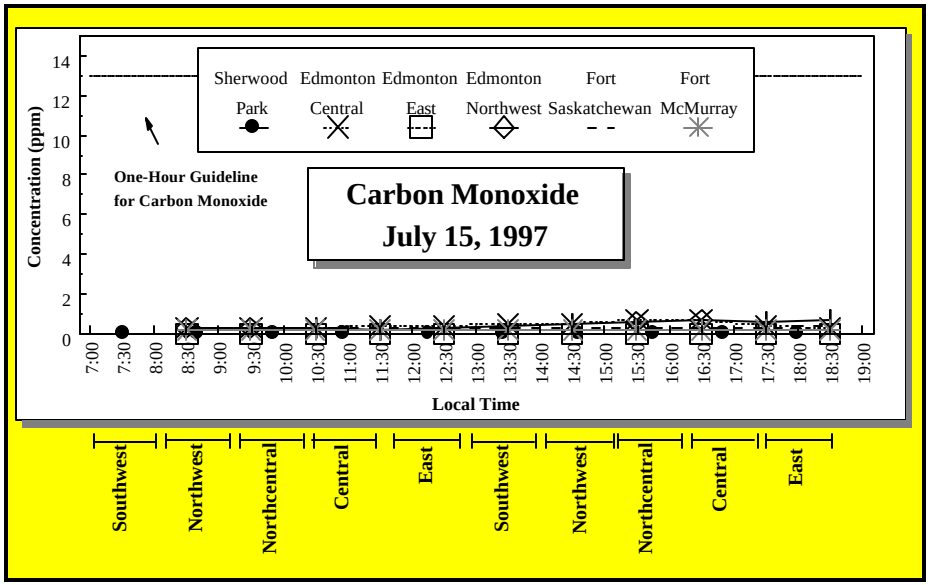
** units are in $\mu g/m^3$

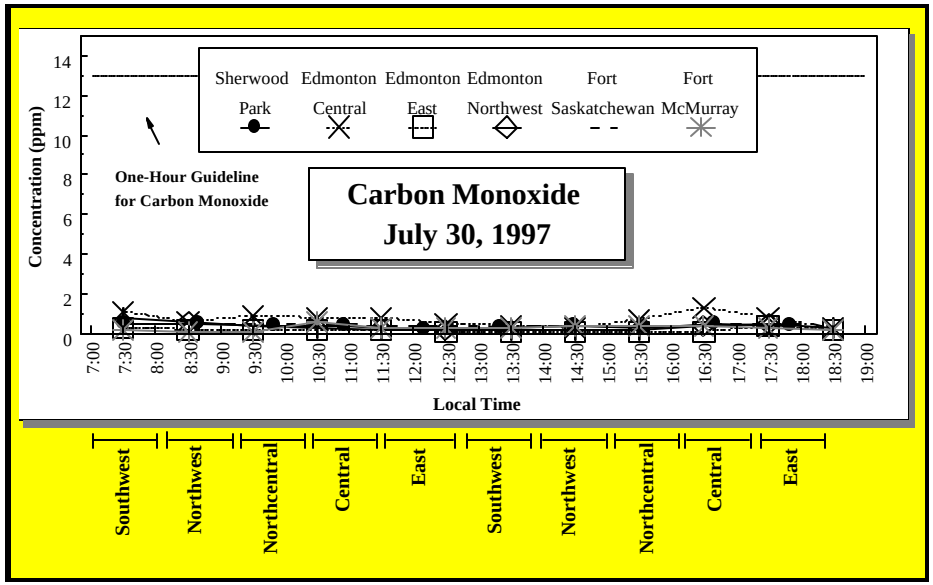
Summer, 1997

Average Carbon Monoxide Concentrations in Sherwood Park



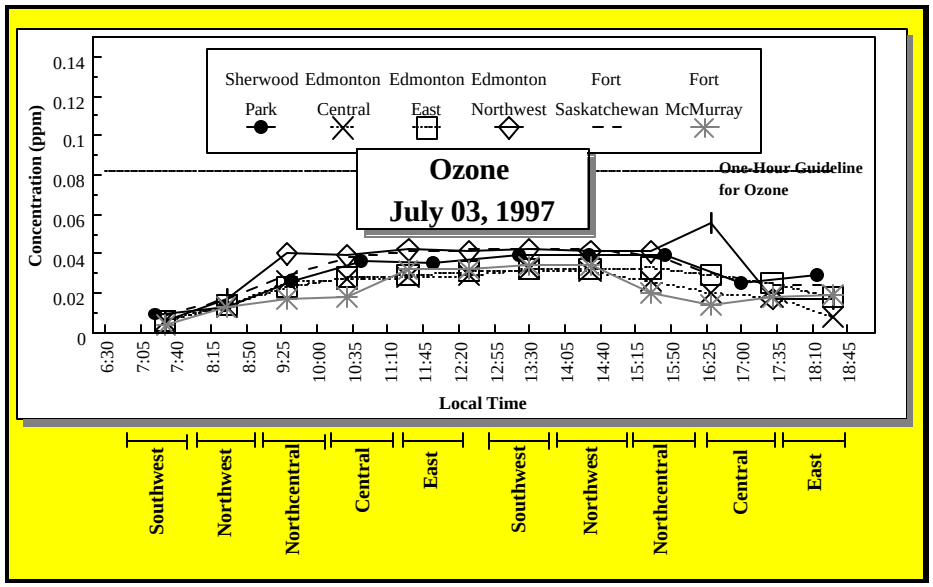


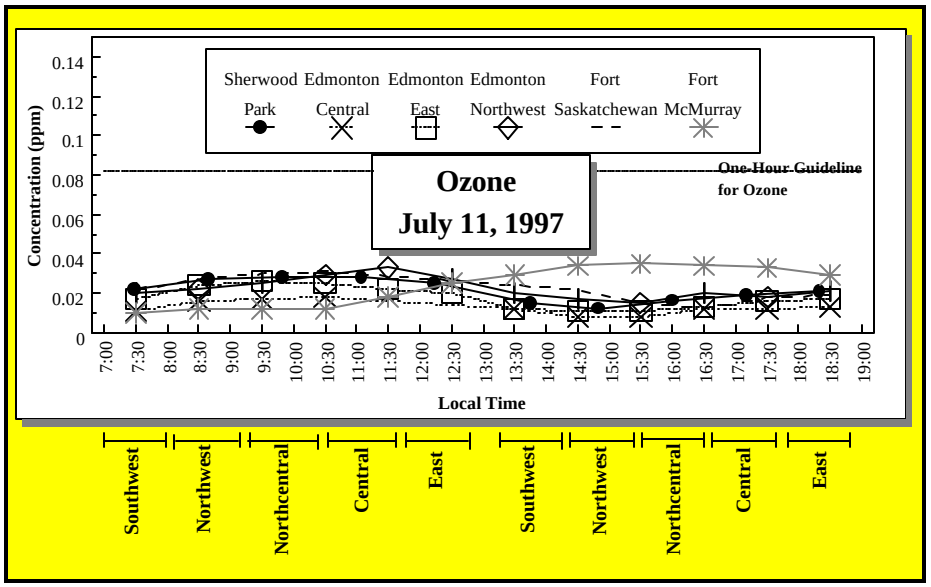


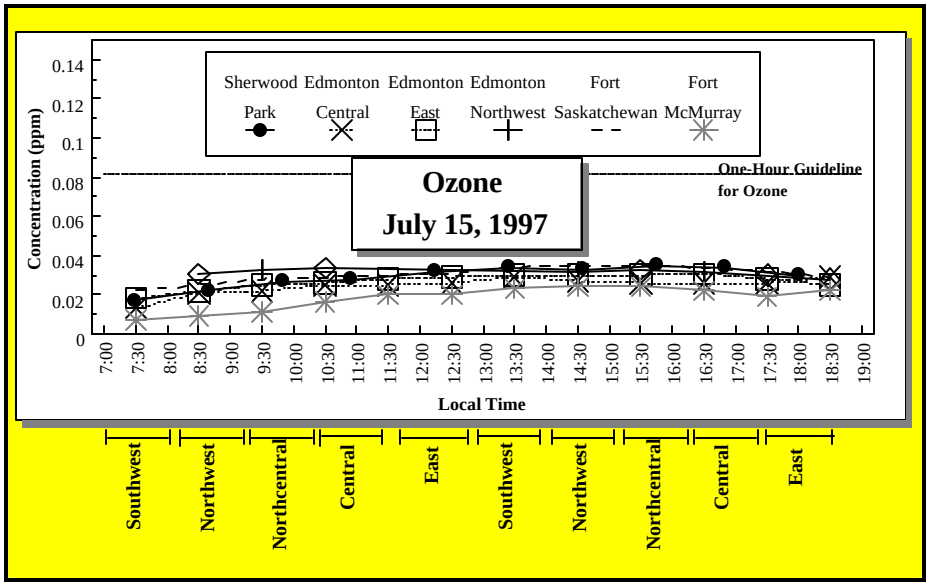


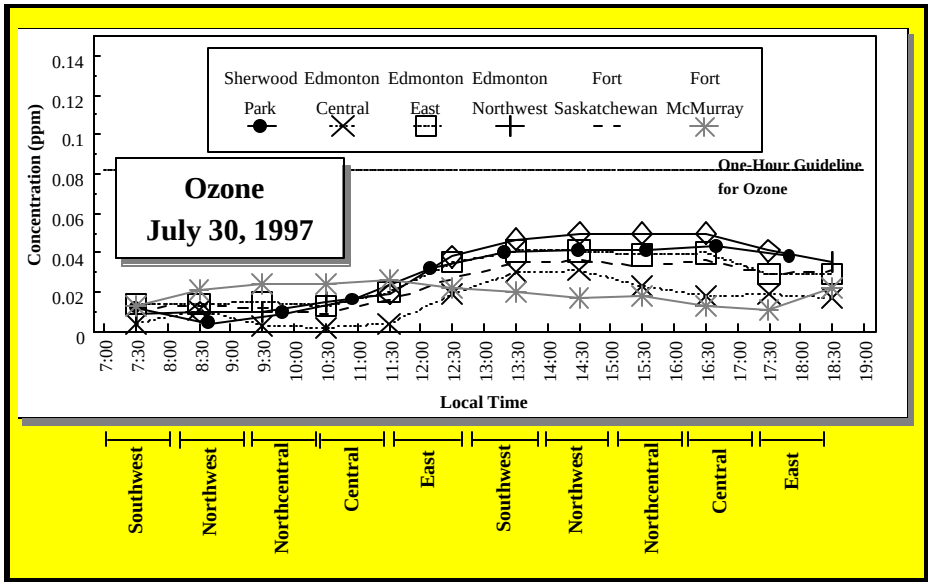
Summer, 1997

Average Ozone Concentrations in Sherwood Park



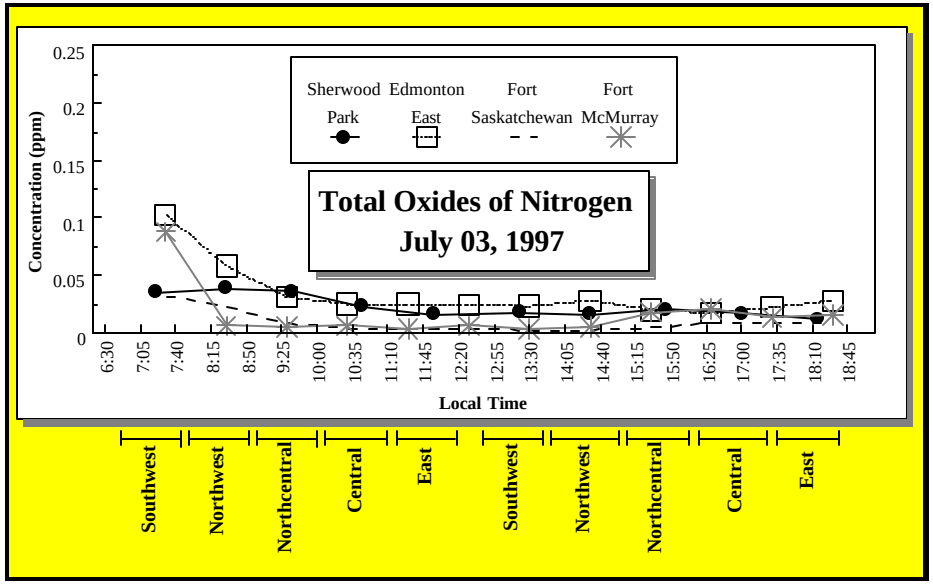


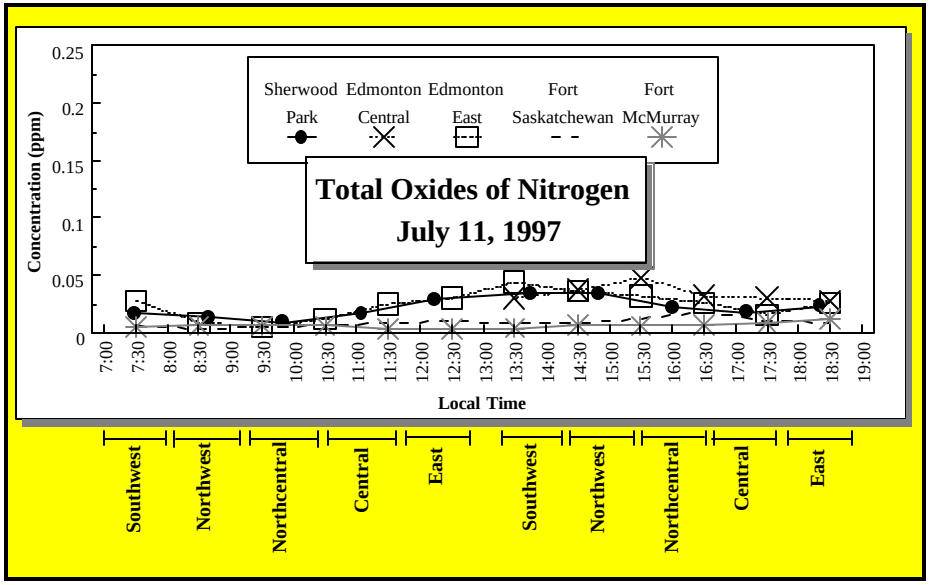


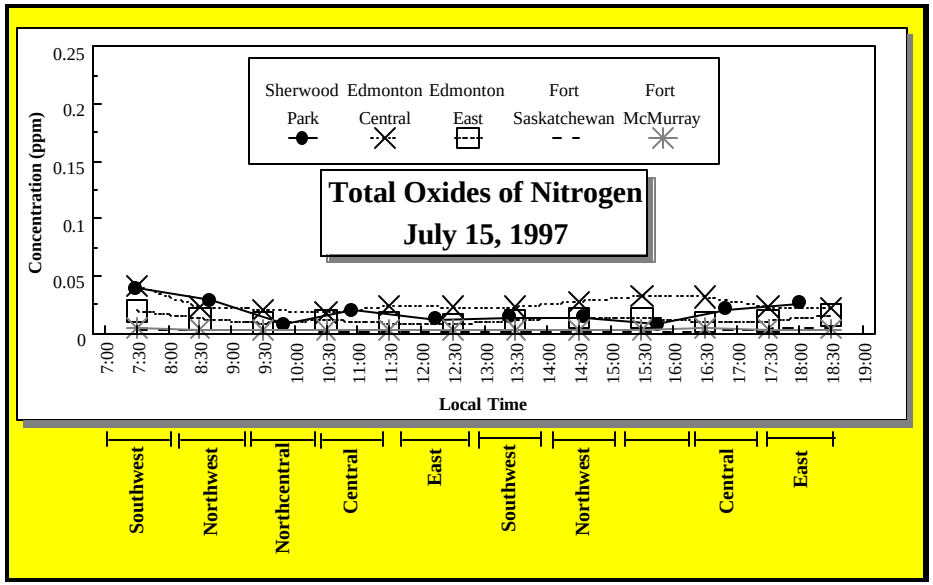


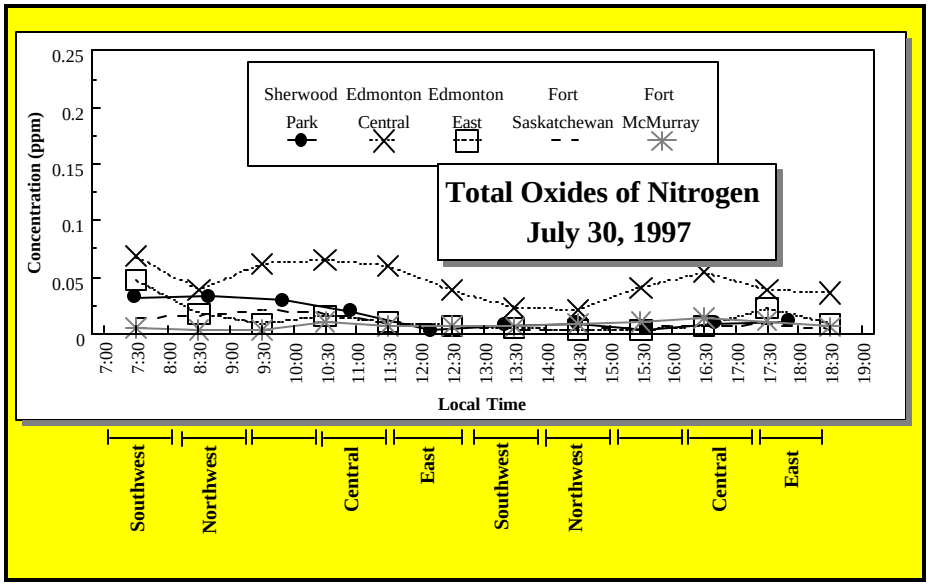
Summer, 1997

Average Total Oxides of Nitrogen Concentrations in Sherwood Park



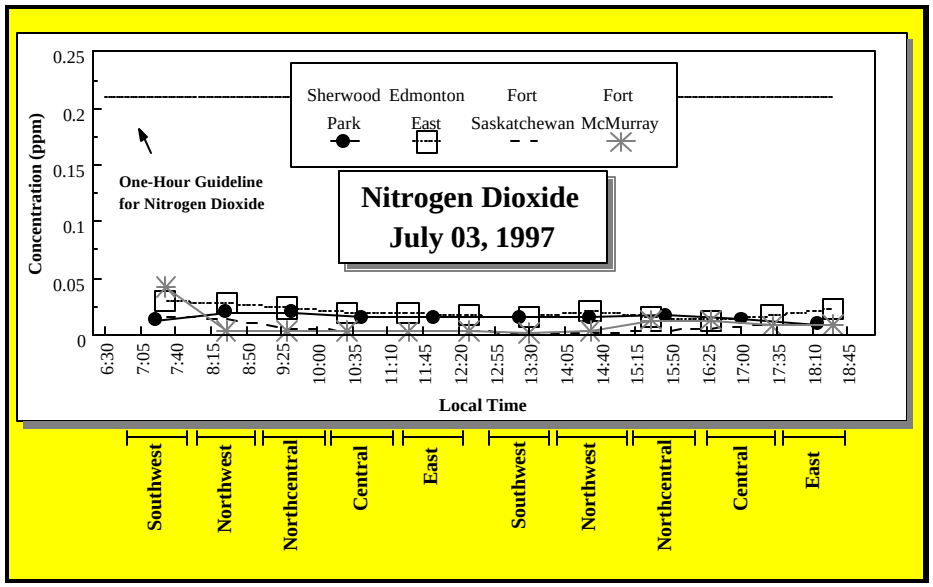


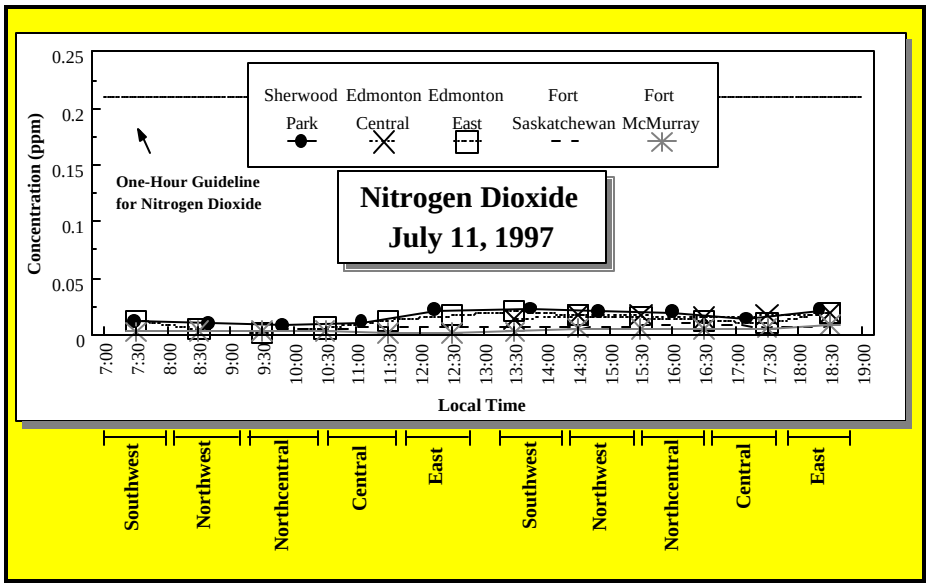


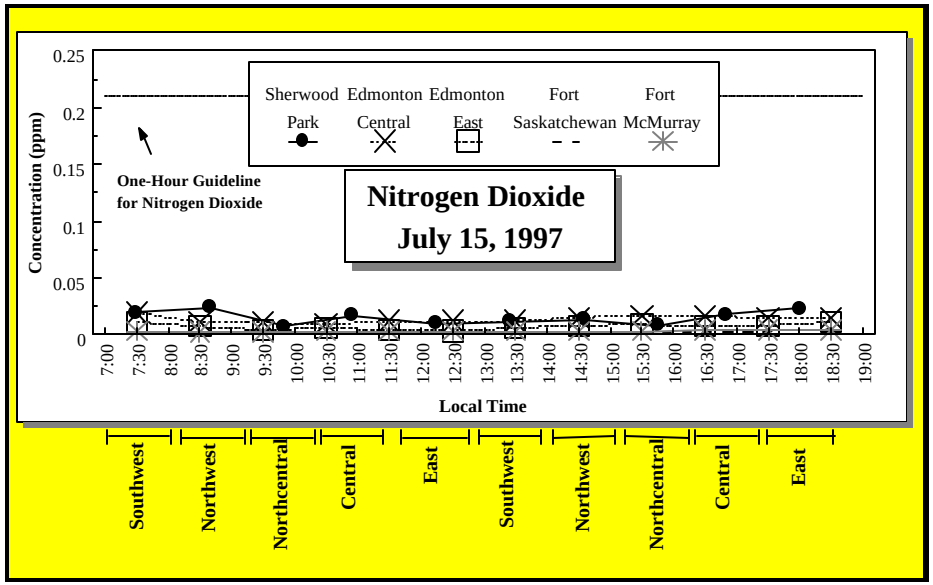


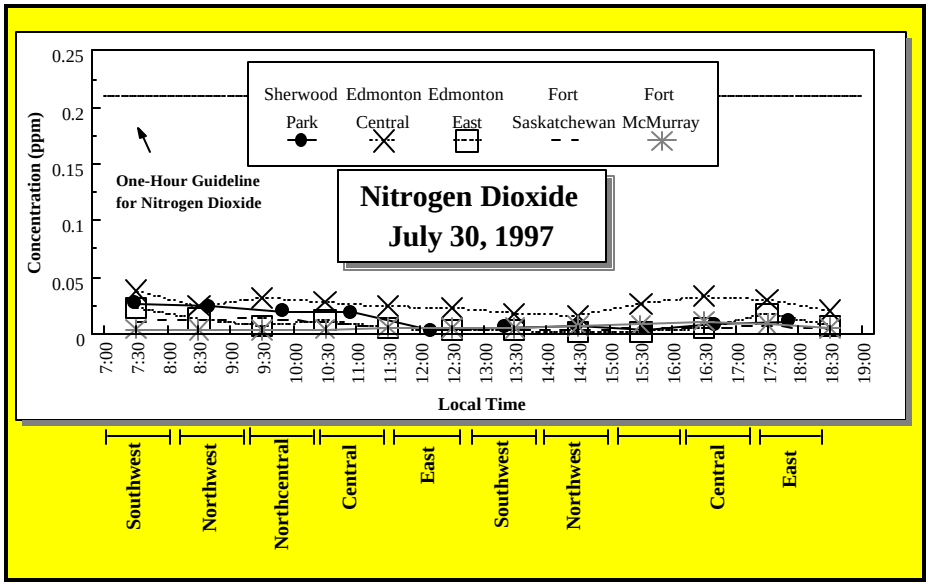
Summer, 1997

Average Nitrogen Dioxide Concentrations in Sherwood Park



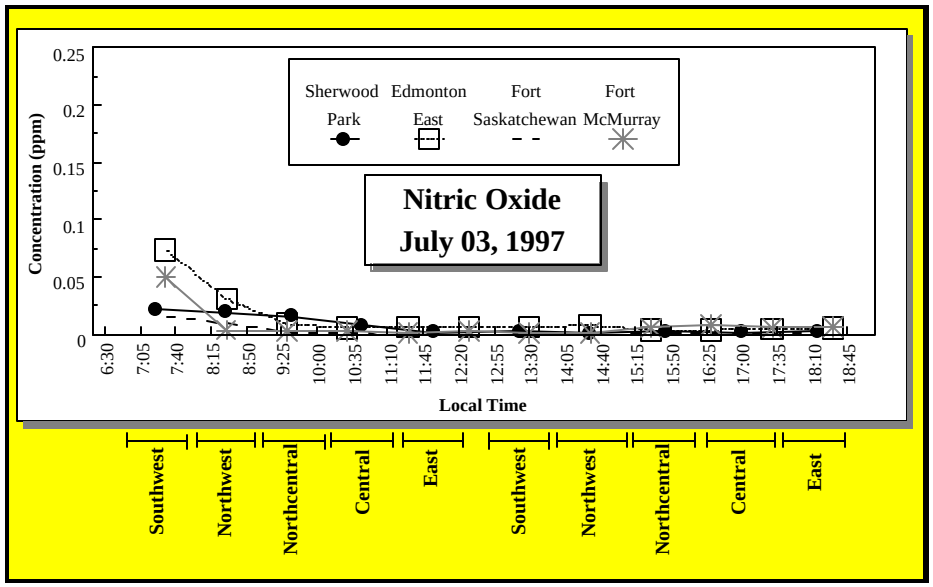


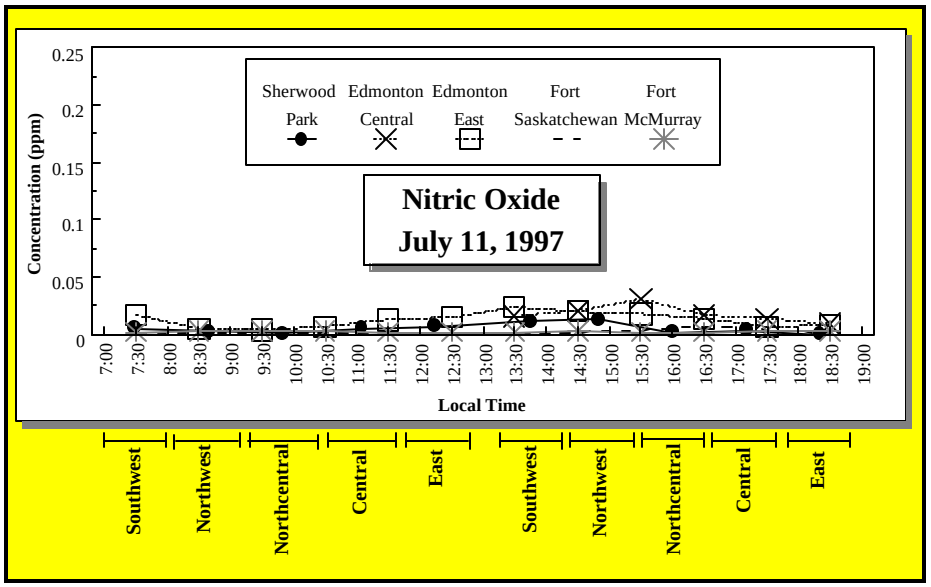


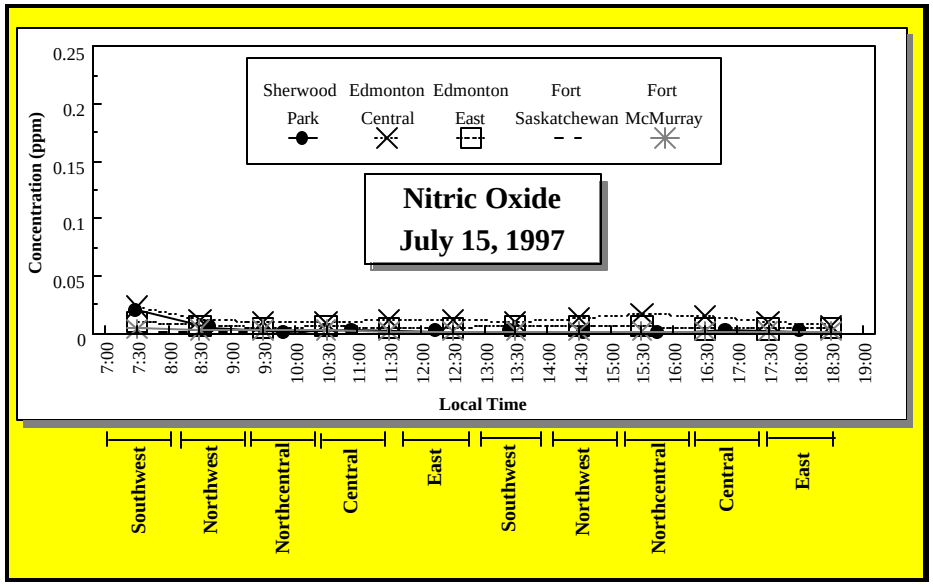


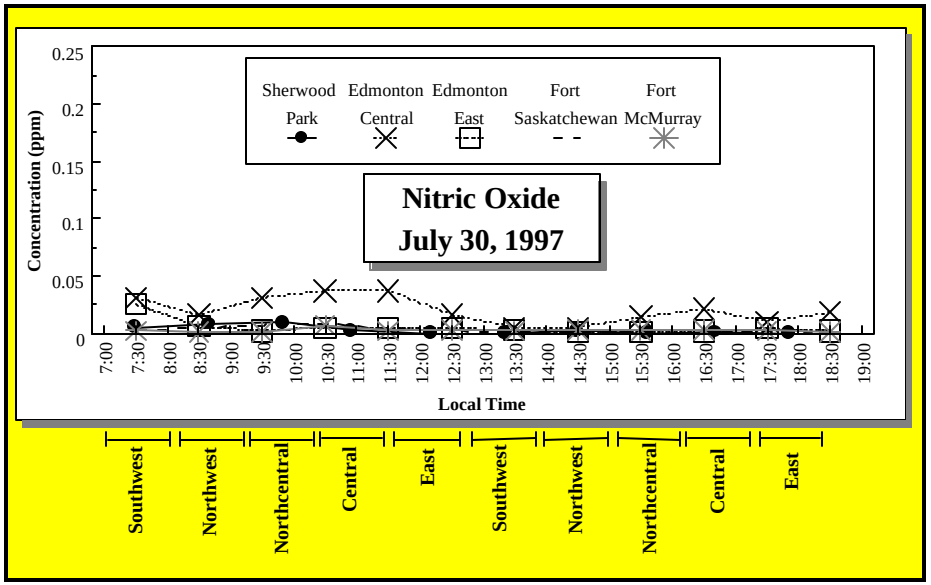
Summer, 1997

Average Nitric Oxide Concentrations in Sherwood Park



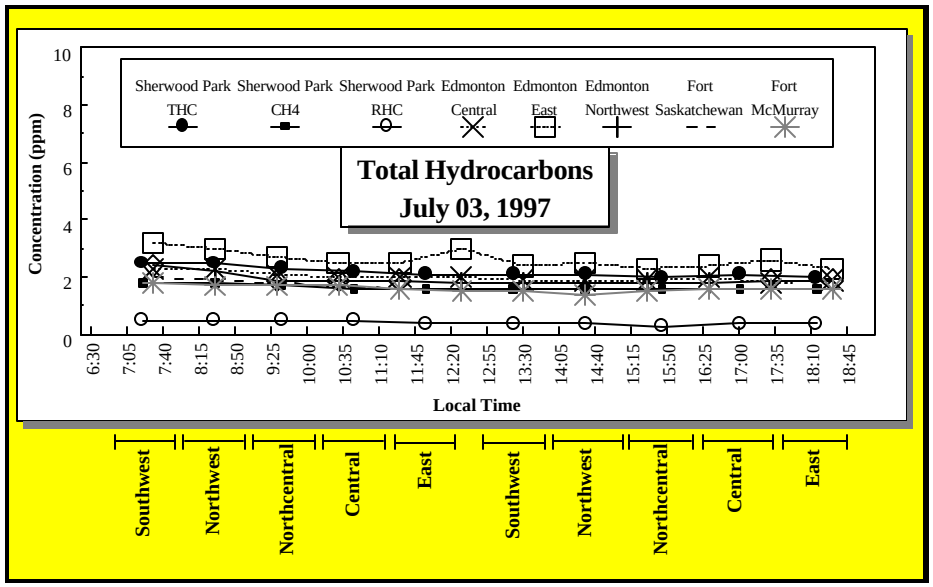


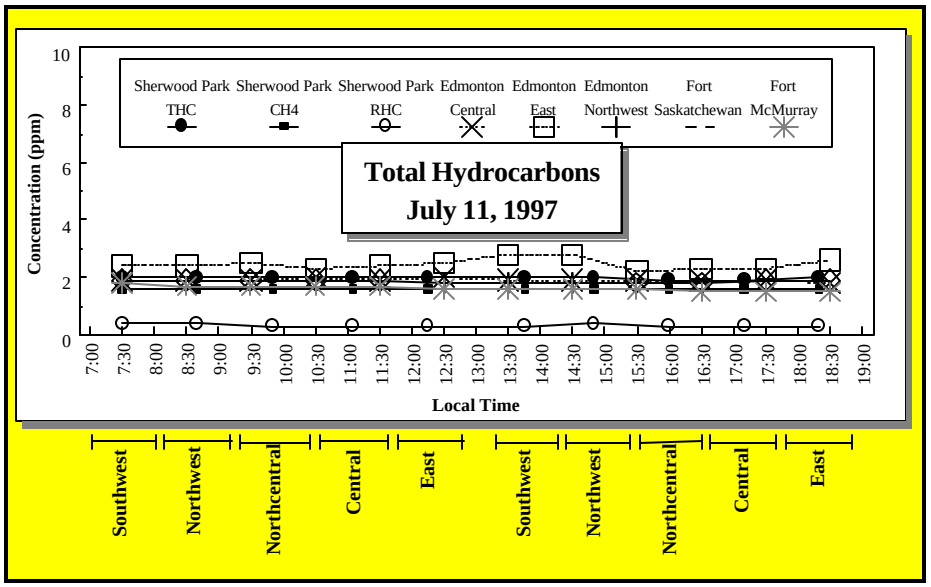


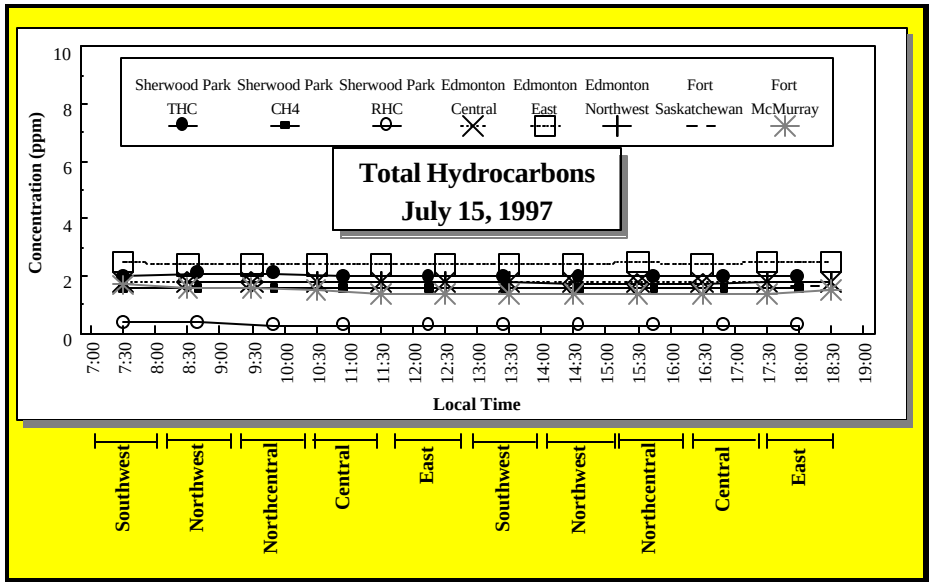


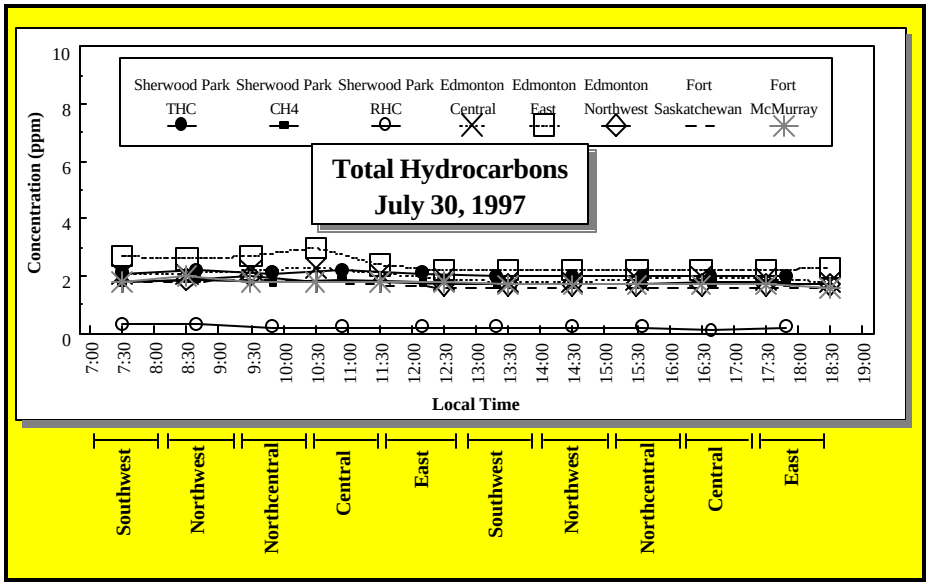
Summer, 1997

Average Total Hydrocarbon Concentrations in Sherwood Park









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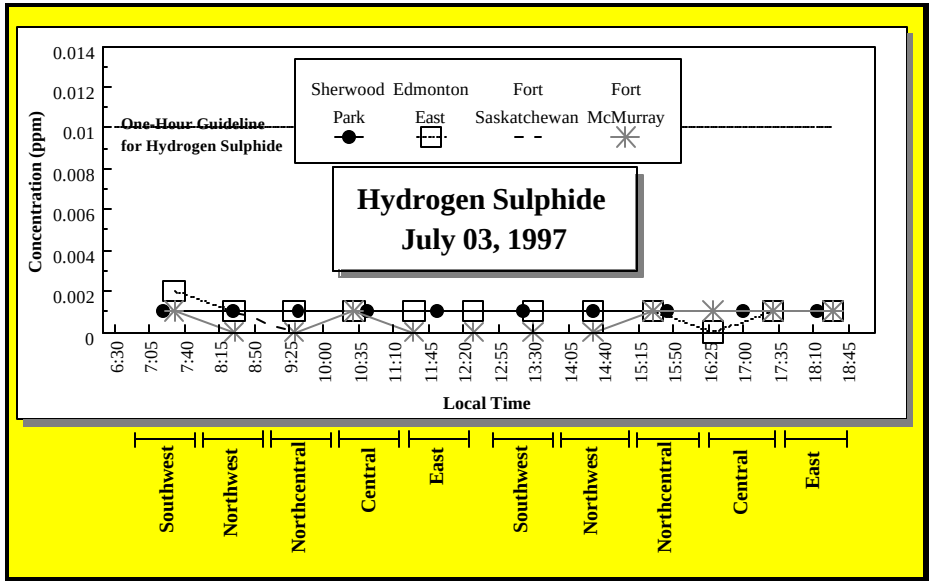
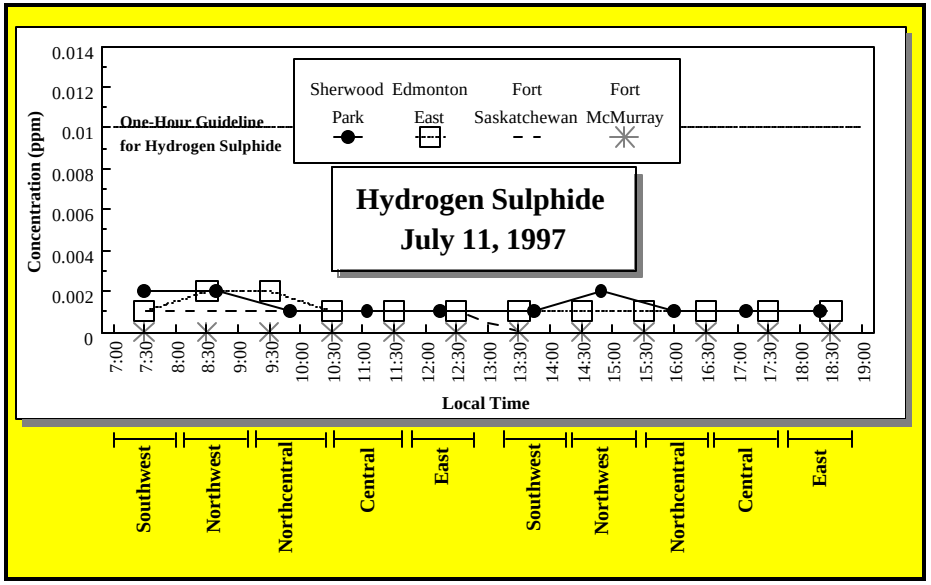
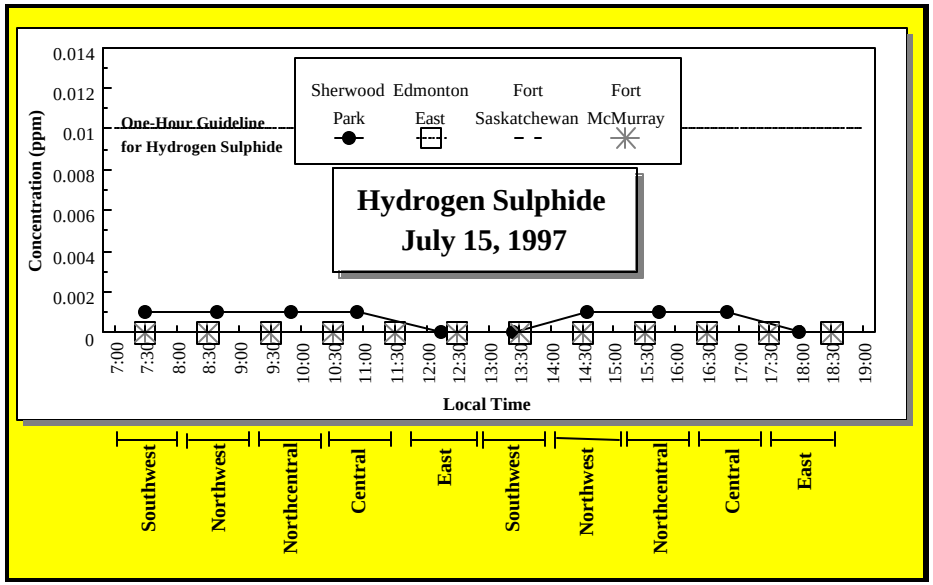
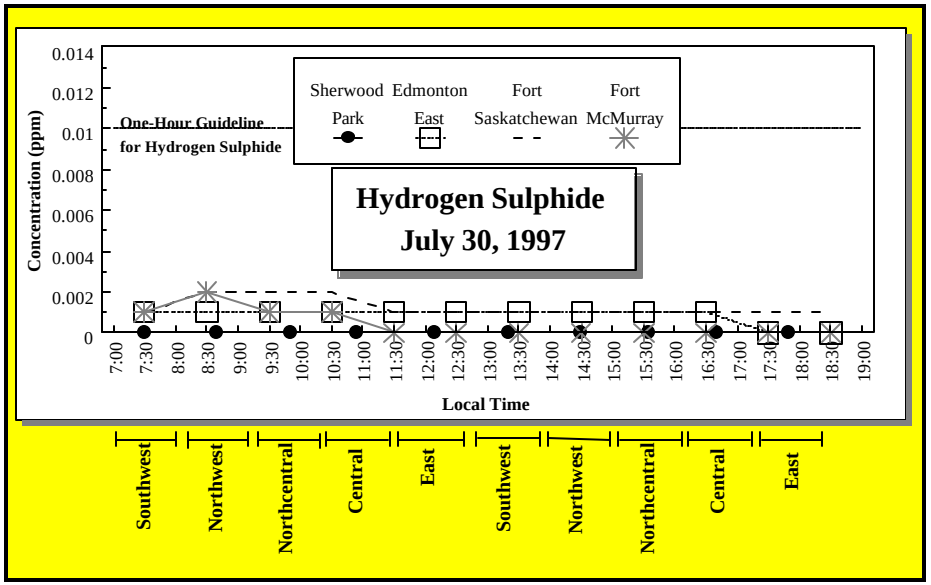
Average Hydrogen Sulphide Concentrations in Sherwood Park



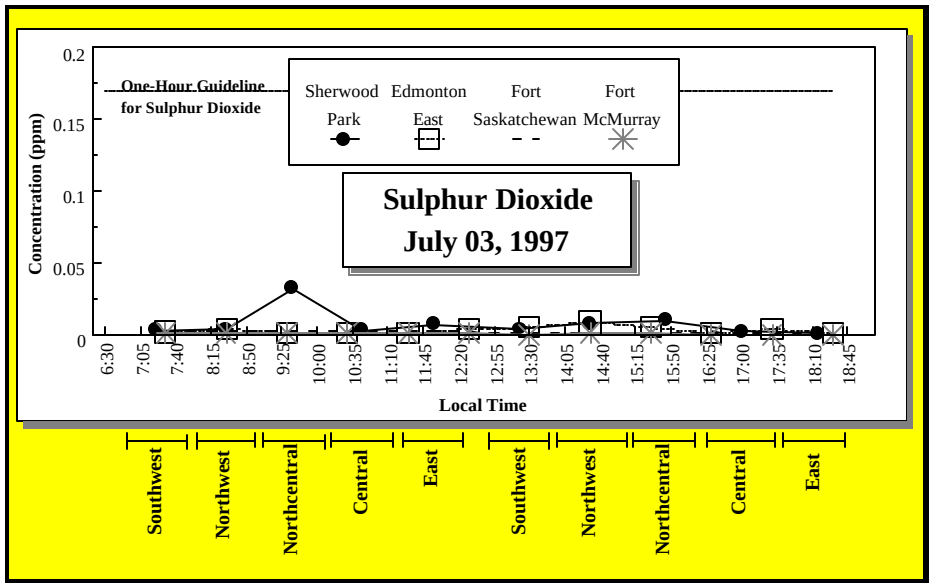


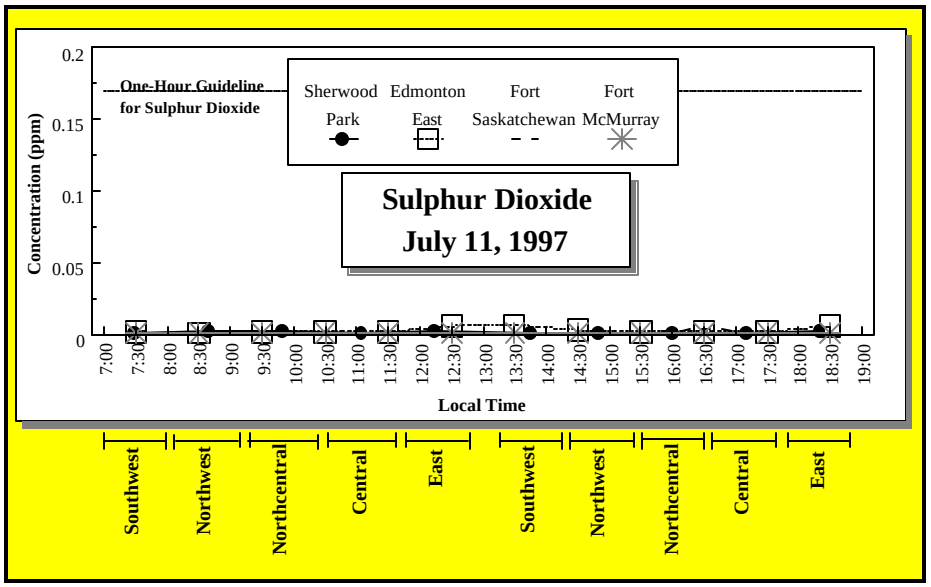


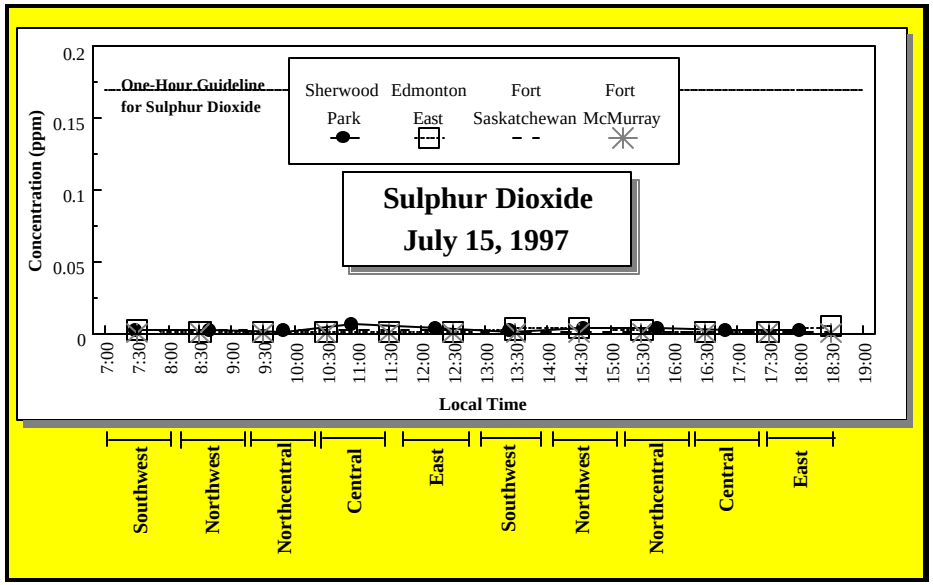


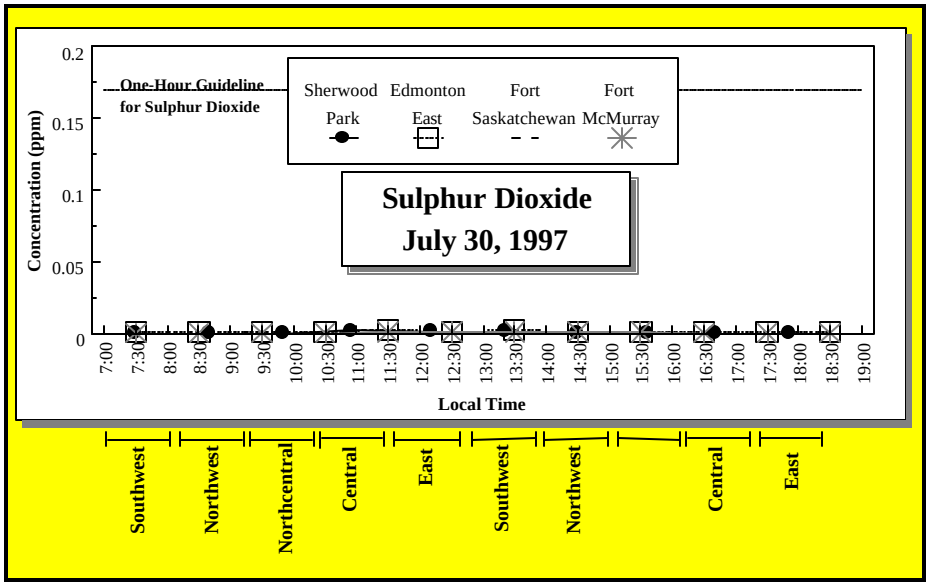
Summer, 1997

Average Sulphur Dioxide Concentrations in Sherwood Park









Summer, 1997

Average Particulate Concentrations in Sherwood Park