Air Quality Monitoring in Sherwood Park
Fall, 1997 (October 7 and November 6)

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 fall of 1997 (October 7 and November 6).

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:

  - < 4% of the 1-hour guideline for CO;
  - < 28% of the 1-hour guideline for O_3;
  - < 14% of the 1-hour guideline for NO_2;
  - < 10% of the 1-hour guideline for H_2S; and
  - < 2% of the 1-hour guideline for SO_2.

- Concentrations of particulates and carbon monoxide were very low in Sherwood Park compared to other Alberta locations. However, oxides of nitrogen and hydrocarbon levels were slightly higher in Sherwood Park than at other small urban locations. The highest concentrations of these chemicals were in the western part of the community. The major sources of carbon monoxide, oxides of nitrogen, hydrocarbons and particulates in Sherwood Park are emissions from vehicles along major traffic arteries (Baseline Road and Wye Road).

- Overall average H_2S and SO_2 concentrations were very low at all monitoring sites in Sherwood Park during the two fall survey days.

Carbon Monoxide (CO)

Max. 1-hour Average	1-hour Guideline
0.5 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 on both fall survey days. The highest 1-hour average CO concentration, recorded at the southwest and northcentral sites in the morning on November 6, was only 4% of the guideline. CO showed little variability between monitoring locations with average concentrations ranging from 0.1 to 0.2 ppm. The overall average CO value in Sherwood Park was lower than the average concentration for the same monitoring period at the Edmonton east, Fort Saskatchewan and Fort McMurray monitoring stations.

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.023 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. Transport of O_3 from the upper atmosphere accounts for most of the background O_3 during the fall season. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide.

O_3 values on November 6 followed the typical daily variation observed at other Alberta locations with maximum values in the afternoon and lowest values in the early morning. Concentrations were low all day on October 7 because of the influence of vehicle exhaust emissions in the vicinity of the monitoring sites. Nitric oxide (NO) from vehicle exhaust will react with O_3 generated by natural sources and result in lower O_3 concentrations in urban locations. Overall average O_3 values were lower at the northwest and southwest sites (0.009 ppm) and highest at the northcentral, central and east sites (0.014 to 0.015 ppm). Again, lower values in the western part of Sherwood Park are likely due to vehicle exhaust emissions from major traffic arteries such as Baseline Road and Wye

Road. Overall average O_3 levels in Sherwood Park were close to those recorded at the Edmonton east, Edmonton northwest and Fort Saskatchewan stations for the same time period. O_3 concentrations are generally the lowest during the fall season.

Hydrocarbons (THC, RHC and CH_4)

Max. 1-hour Average	1-hour Guideline
THC = 2.8 ppm	no guideline
RHC = 0.6 ppm	no guideline
CH_4 = 2.1 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 THC and RHC values were recorded at the southwest site in the morning of November 6. Hydrocarbon concentrations were generally higher at the northwest and southwest sites. The major source of hydrocarbons at these locations is vehicle exhaust emissions. RHC made up about 14% of THC based on average concentrations. Overall average THC values in Sherwood Park (2.2 ppm) were higher than those recorded in Fort Saskatchewan and Fort McMurray (1.8 ppm) and lower than the average at the Edmonton east station (2.5 ppm) for the same time period. Slightly higher THC values in Sherwood Park were likely due to vehicle exhaust emissions from major traffic arteries such as Baseline Road and Wye Road. 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 = 0.030 ppm	0.210 ppm
NO = 0.052 ppm	no guideline
NO_x = 0.073 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 maximum 1-hour average NO_2 values were measured in the early afternoon on November 6 at the east monitoring site. Maximum NO and NO_x concentrations were recorded at the southwest site in the morning of November 6. Higher NO values were observed at the northwest and southwest sites while NO_2 concentrations were highest at the southwest and east sites based on averages for both survey days. Higher NO concentrations in the western part of Sherwood Park were likely due to vehicle exhaust emissions from major traffic arteries in Sherwood Park. The overall average NO_2 concentration in Sherwood Park (0.018 ppm) was lower than those recorded at the Edmonton central (0.023 ppm) and northwest (0.022 ppm) monitoring sites and higher than those measured in Fort Saskatchewan (0.011 ppm) and Fort McMurray (0.008 ppm) for the same time period.

Hydrogen Sulphide (H_2S)

Max. 1-hour Average	1-hour Guideline
H_2S = 0.001 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.

Based on 1-hour average concentrations, H_2S values were at or below the detection limit of the monitoring instrument most of the time on both survey days. The highest 1-hour average H_2S values were recorded at the northwest and southwest sites in the morning on November 6. The maximum 1-hour average concentration of 0.001 ppm is 10% of the 1-hour guideline. H_2S concentrations were also very low at other Alberta stations on the two fall survey days.

Sulphur Dioxide (SO_2)

Max. 1-hour Average	1-hour Guideline
SO_2 = 0.003 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.

SO_2 concentrations were very low on the fall survey days. The maximum 1-hour average SO_2 concentration was measured at the southwest site in the early morning on

November 6 (0.003 ppm). This value is only 2% of the 1-hour guideline for SO_2. Average SO_2 concentrations were also very low at other Alberta Environmental Protection monitoring stations on October 7 and November 6.

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

Max. 1-hour Average	1-hour Guideline
TSP = 4 µg/m^3	no guideline
PM_{10} = 3 µg/m^3	no guideline
$PM_{2.5}$ = 1 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.

Particulate concentrations in Sherwood Park were very low on October 7 and November 6. The maximum TSP, PM_{10} and $PM_{2.5}$ concentrations were observed at the central site near noon on October 7. The next highest particulate concentrations were recorded at the southwest and northwest sites in the morning on November 6. 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_{10} concentration in Sherwood Park (1 µg/m^3) was much lower than the average value in northwest Edmonton (9 µg/m^3). The average $PM_{2.5}$ concentration in Sherwood Park (0 µg/m^3) was also very low relative to other locations (e.g. 5 µg/m^3 in Fort McMurray) 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	0.2	0.009	0.040	0.021	0.019	2.3	1.9	0.4	0.000	0.001	2	1	0
northwest	0.1	0.009	0.041	0.017	0.024	2.2	1.8	0.4	0.000	0.001	2	2	0
northcentral	0.2	0.015	0.019	0.014	0.006	2.1	1.8	0.3	0.000	0.000	1	1	0
central	0.2	0.014	0.028	0.018	0.011	2.1	1.8	0.3	0.000	0.000	2	1	0
east	0.1	0.015	0.022	0.020	0.002	2.1	1.8	0.3	0.000	0.000	0	0	0

Overall Average Concentrations on All Fall 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	0.2	0.012	0.031	0.018	0.013	2.2	1.8	0.3	0.000	0.000	1	1	0
Edmonton Central	0.2	0.009	0.056	0.023	0.033	2.2	no data						
Edmonton East	0.4	0.011	0.037	0.018	0.020	2.5	no data		0.000	0.001	no data		
Edmonton Northwest	0.5	0.011	0.053	0.022	0.033	2.0	no data				9	no data	
Fort Saskatchewan	0.4	0.013	0.023	0.011	0.012	1.8	no data		0.000	0.002	no data		
Fort McMurray	0.4	0.019	0.027	0.008	0.020	1.8	no data		0.001	0.000	no data		5

Maximum 1-hour Average Concentrations on All Fall 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	0.5	0.023	0.073	0.030	0.052	2.8	2.1	0.6	0.001	0.003	4	3	1
Edmonton Central	0.9	0.014	0.103	0.038	0.072	2.4	no data						
Edmonton East	0.8	0.022	0.094	0.031	0.067	4.2	no data		0.001	0.006	no data		
Edmonton Northwest	1.2	0.026	0.129	0.041	0.092	2.4	no data				17	no data	
Fort Saskatchewan	1.1	0.026	0.082	0.028	0.058	2.1	no data		0.001	0.006	no data		
Fort McMurray	2.9	0.026	0.183	0.027	0.157	2.5	no data		0.002	0.002	no data		16

** units are in µg/m^3

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

October 07, 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	6:57 to 7:59	0.1	0.006	0.034	0.020	0.014	2.1	1.8	0.3	0.000	0.000	1	1	0	3	NW/10	100%
northwest	8:46 to 9:47	0.0	0.006	0.039	0.010	0.029	2.2	1.8	0.3	0.000	0.001	2	2	1	4	NW/10	100%
northcentral	9:54 to 10:58	0.0	0.011	0.007	0.006	0.000	2.1	1.9	0.2	0.000	0.000	1	1	0	4	NW/15	100%
central	11:05 to 12:06	0.0	0.006	0.028	0.013	0.015	2.1	1.9	0.2	0.000	0.000	4	3	1	4	NW/15	100%
east	12:14 to 13:15	0.0	0.010	0.008	0.003	0.005	2.1	1.9	0.2	0.000	0.000	0	0	0	3	NW/15	100%
southwest	13:25 to 14:24	0.0	0.007	0.024	0.019	0.006	2.1	1.8	0.2	0.000	0.001	1	1	0	3	NW/15	100%
northwest	14:31 to 15:32	0.0	0.006	0.034	0.011	0.023	2.2	1.8	0.3	0.000	0.000	1	1	0	2	NW/15	100%
northcentral	15:38 to 16:39	0.0	0.013	0.008	0.004	0.004	2.0	1.8	0.2	0.000	0.000	1	1	0	1	NW/15	100%
central	16:45 to 17:47	0.0	0.013	0.016	0.013	0.003	2.0	1.8	0.2	0.000	0.000	1	1	0	1	NW/15	100%

November 06, 1997

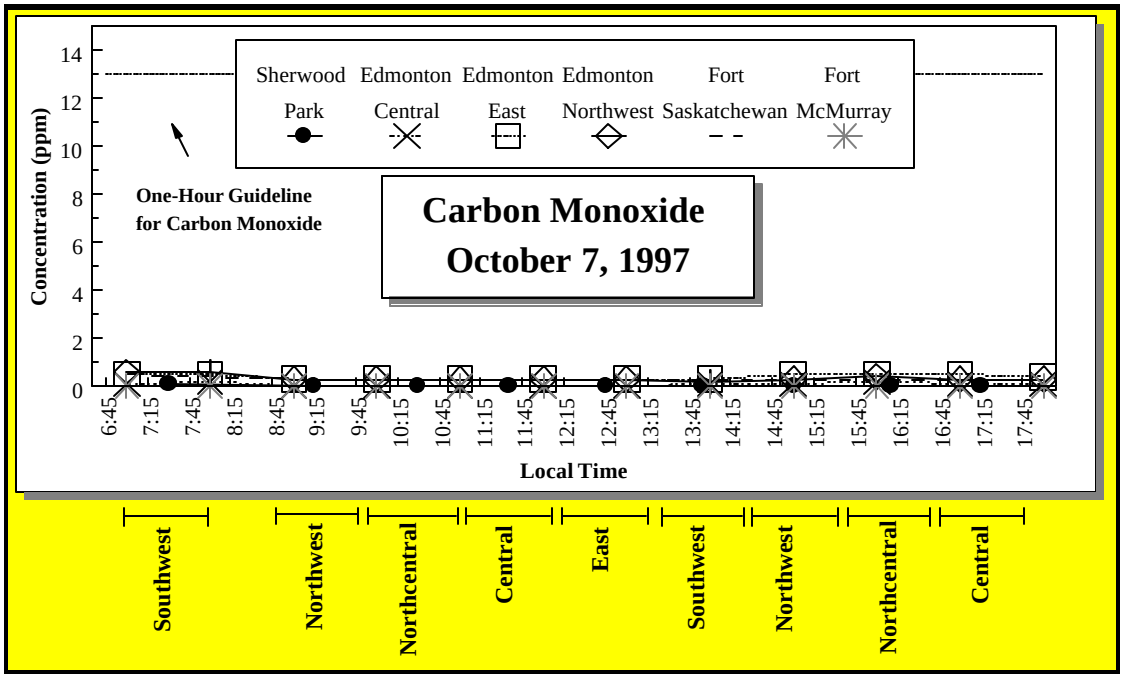
Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	TSP**	PM_{10}**	$PM_{2.5}$**	Temp.*	Wind dir/spd*	Cloud*
southwest	8:16 to 9:17	0.5	0.001	0.073	0.020	0.052	2.8	2.1	0.6	0.001	0.003	3	3	1	5	N/8	70%
northwest	9:26 to 10:28	0.3	0.003	0.061	0.021	0.039	2.4	1.9	0.5	0.001	0.001	3	3	1	6	N/4	70%
northcentral	10:35 to 11:46	0.5	0.014	0.032	0.021	0.011	2.2	1.8	0.4	0.000	0.001	1	1	0	8	NE/4	90%
central	11:54 to 12:57	0.4	0.022	0.026	0.021	0.005	2.2	1.8	0.4	0.000	0.000	2	1	0	9	NNE/3	85%
east	13:05 to 14:05	0.1	0.020	0.031	0.030	0.002	2.1	1.8	0.3	0.000	0.001	0	0	0	8	N/5	90%
southwest	14:15 to 15:14	0.2	0.022	0.028	0.025	0.003	2.1	1.8	0.3	0.000	0.000	1	1	0	8	N/4	95%
northwest	15:22 to 16:22	0.2	0.019	0.030	0.025	0.005	2.1	1.7	0.4	0.000	0.000	1	1	0	6	N/6	100%
northcentral	16:29 to 17:29	0.3	0.023	0.031	0.024	0.007	2.1	1.7	0.4	0.000	0.000	1	1	0	5	N/3	100%
central	17:38 to 18:39	0.4	0.014	0.044	0.024	0.020	2.1	1.7	0.4	0.000	0.000	1	1	0	5	N/2	100%
east	18:49 to 19:48	0.2	0.016	0.029	0.028	0.001	2.1	1.7	0.4	0.000	0.000	0	0	0	3	NW/5	100%

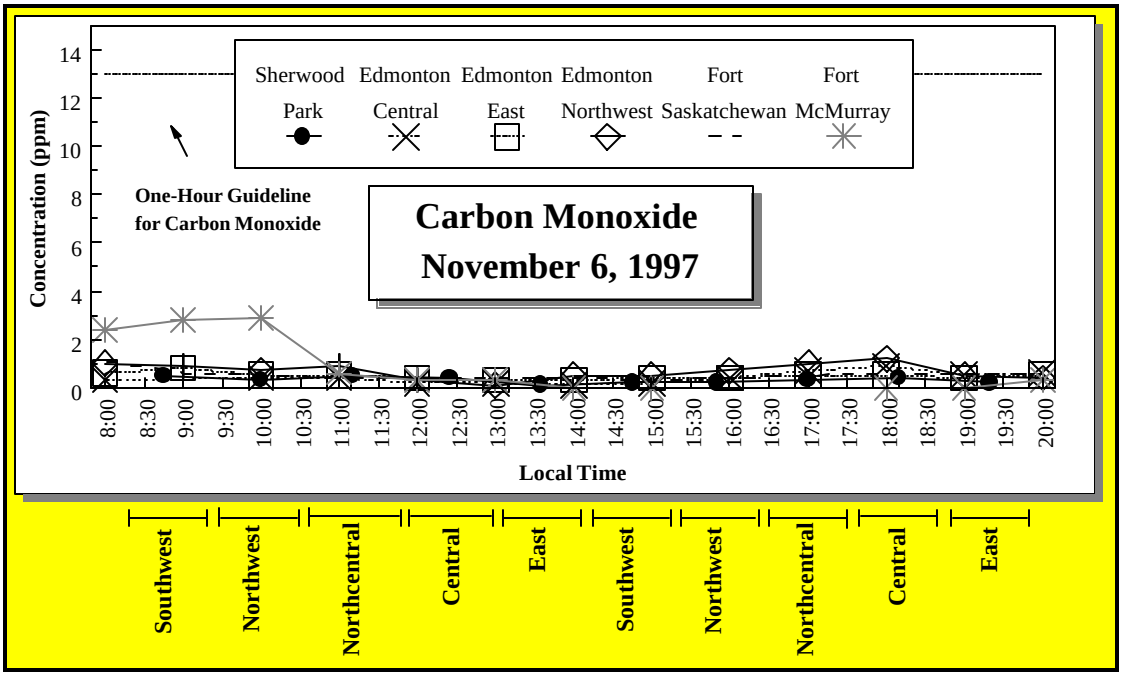
* Weather conditions are based on observations at the monitoring site. Units are temperature [^oC], wind speed [km/h] and cloud cover [% of sky coverage].

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

Fall, 1997

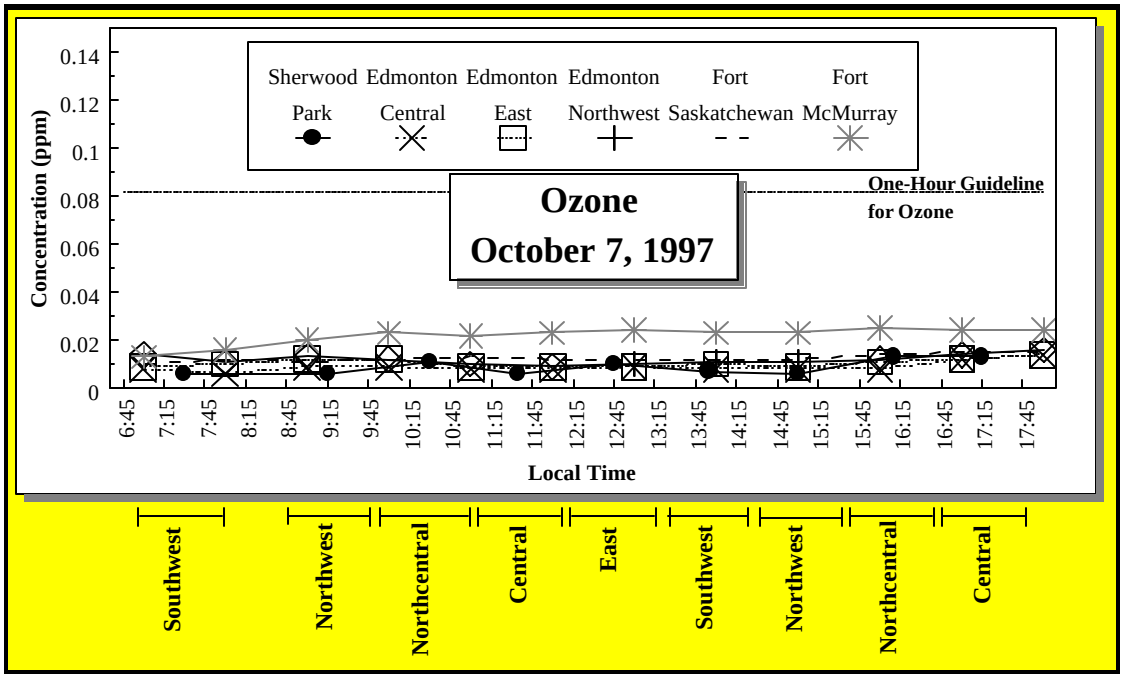
Average Carbon Monoxide Concentrations in Sherwood Park

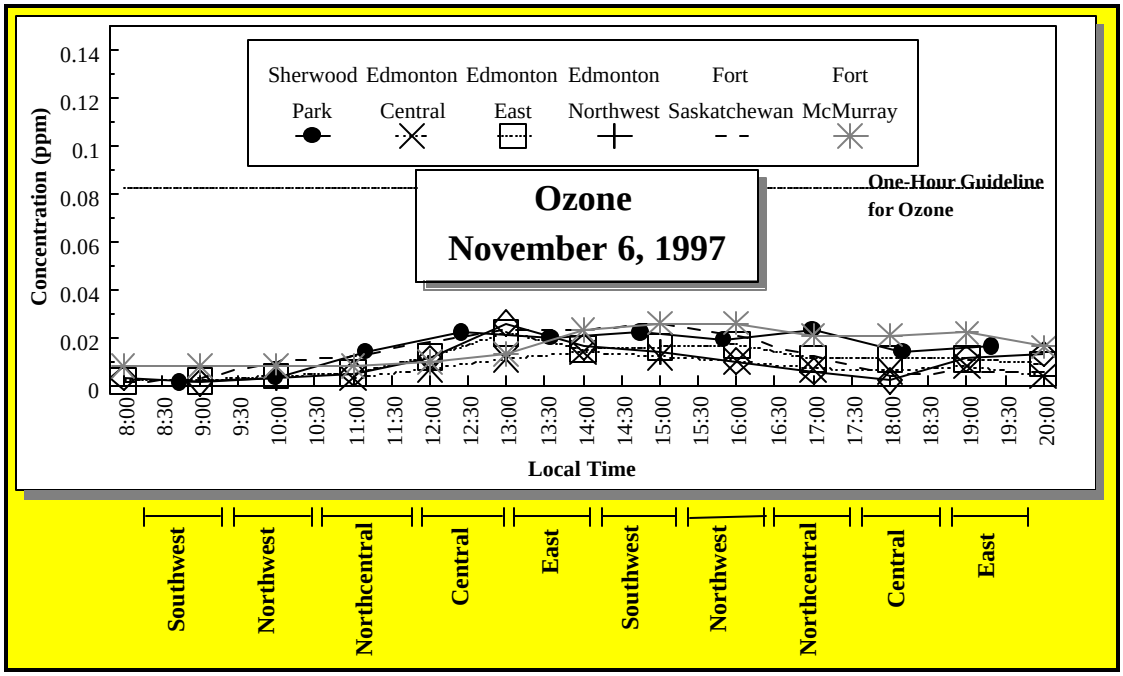




Fall, 1997

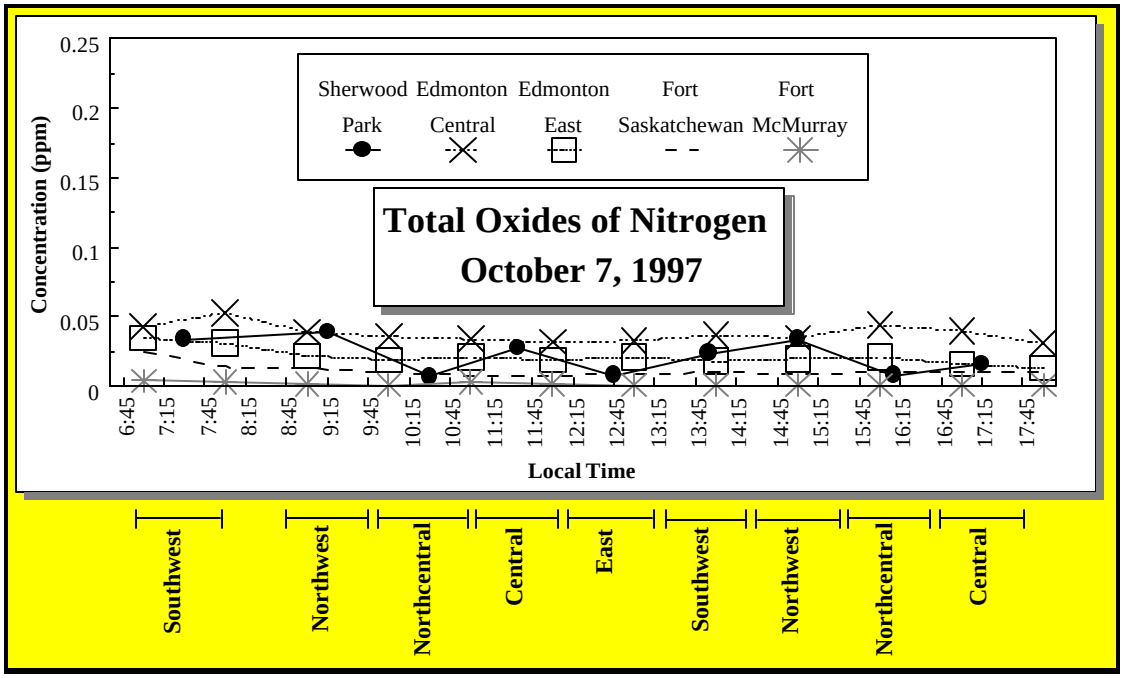
Average Ozone Concentrations in Sherwood Park

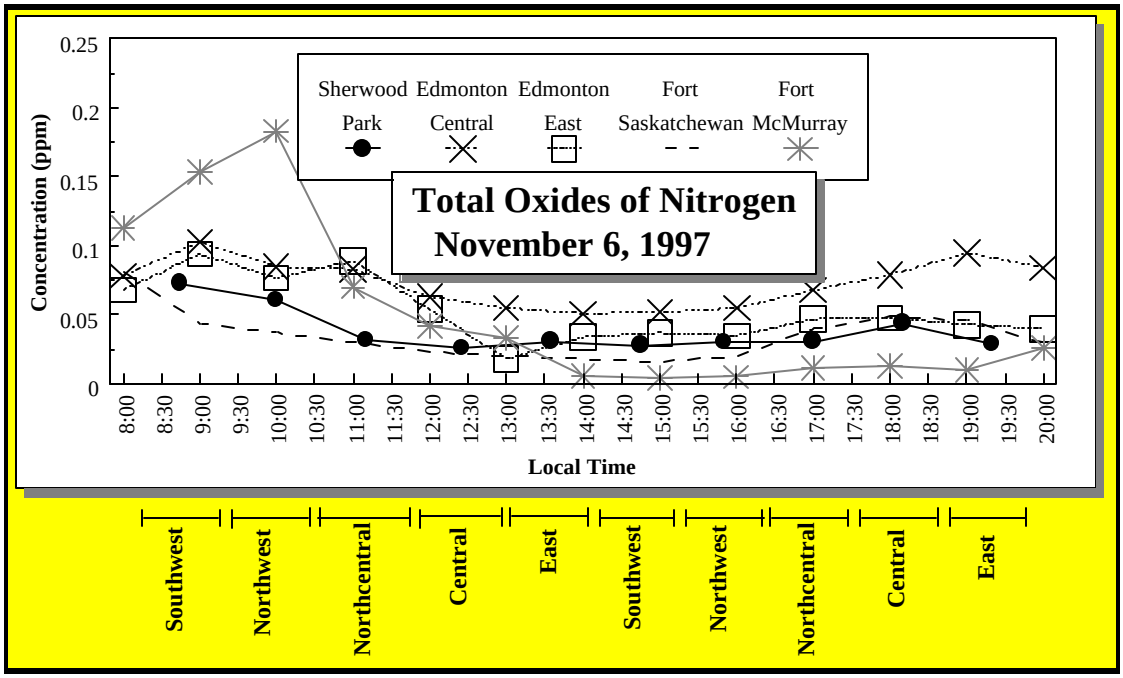




Fall, 1997

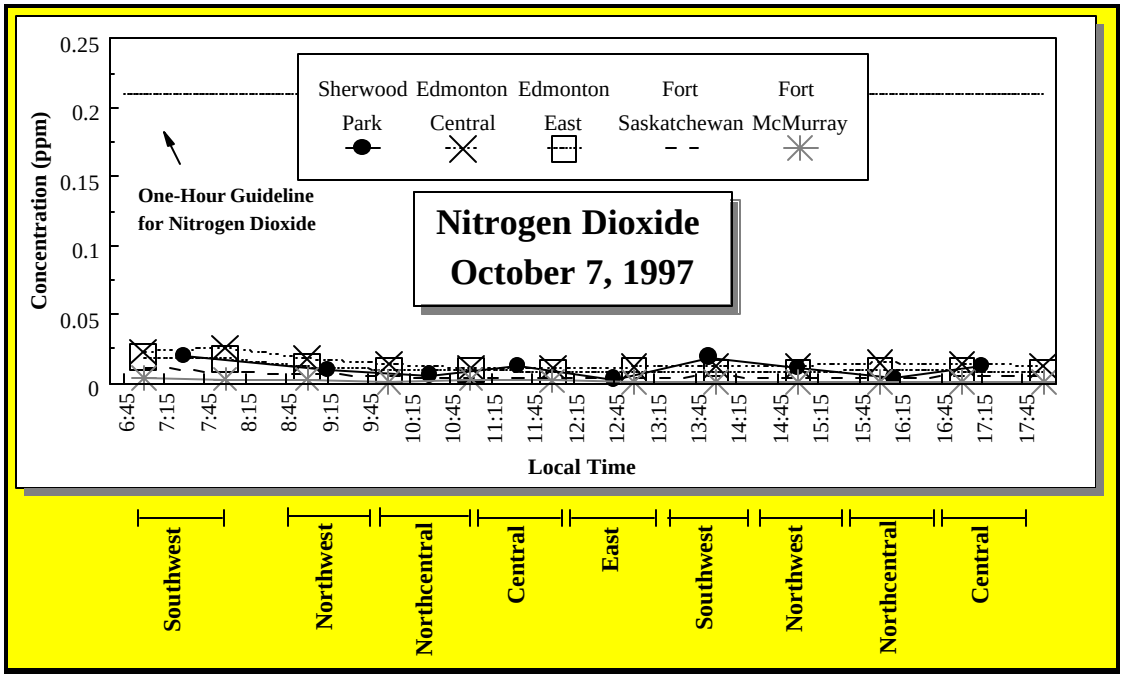
Average Total Oxides of Nitrogen Concentrations in Sherwood Park

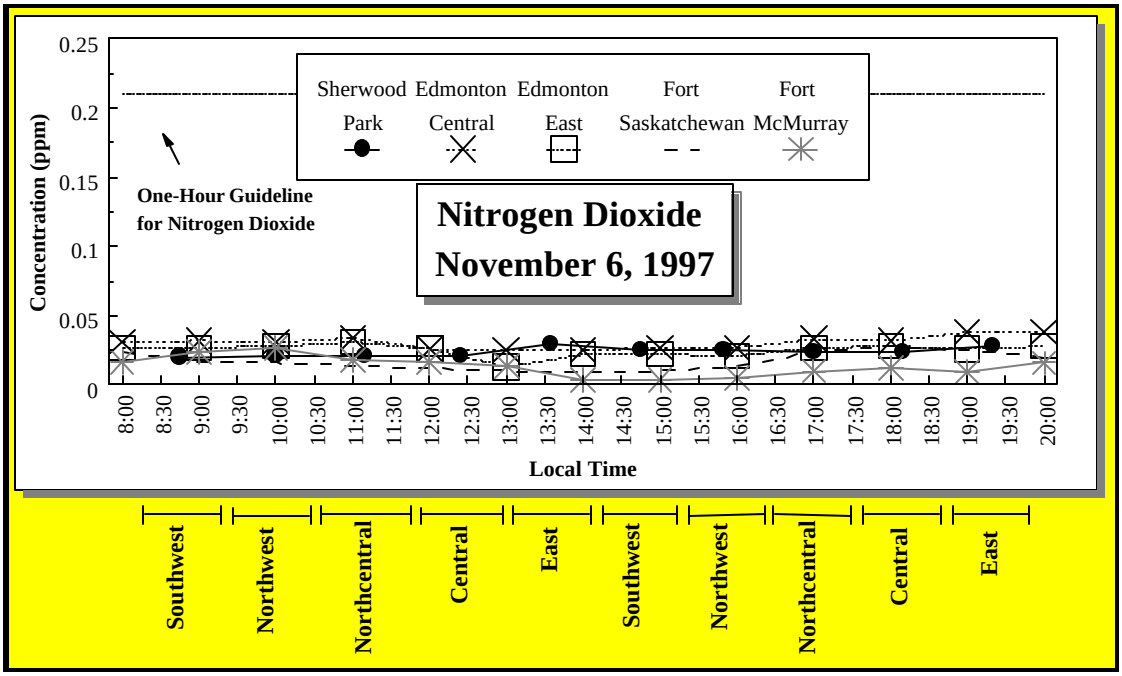




Fall, 1997

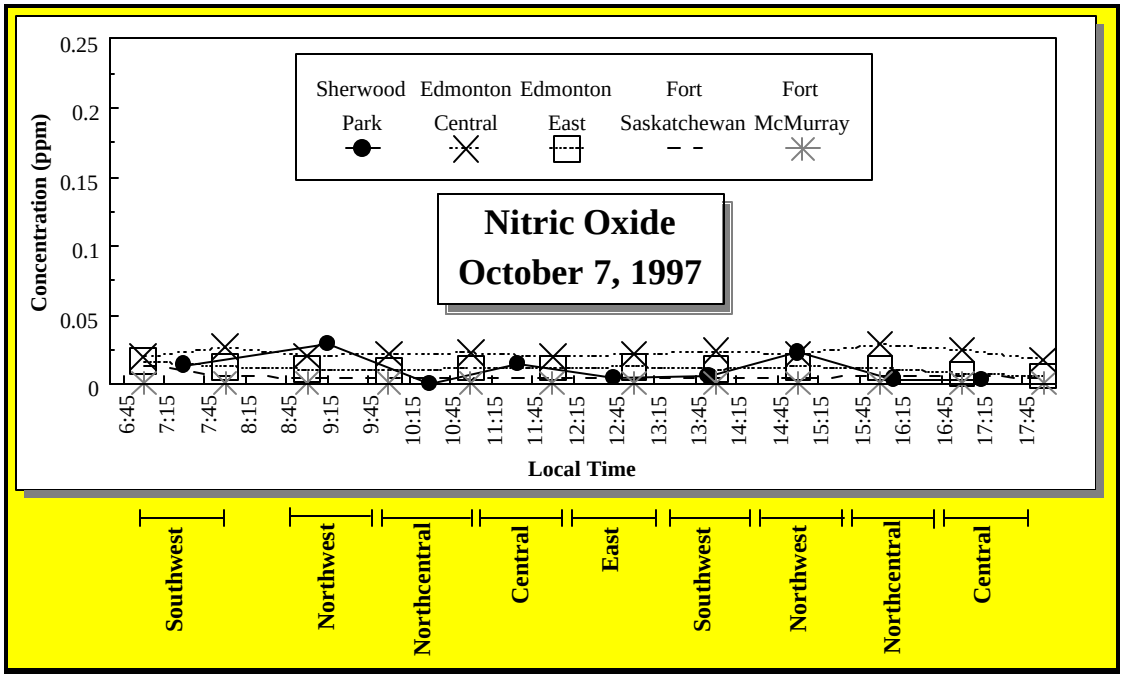
Average Nitrogen Dioxide Concentrations in Sherwood Park

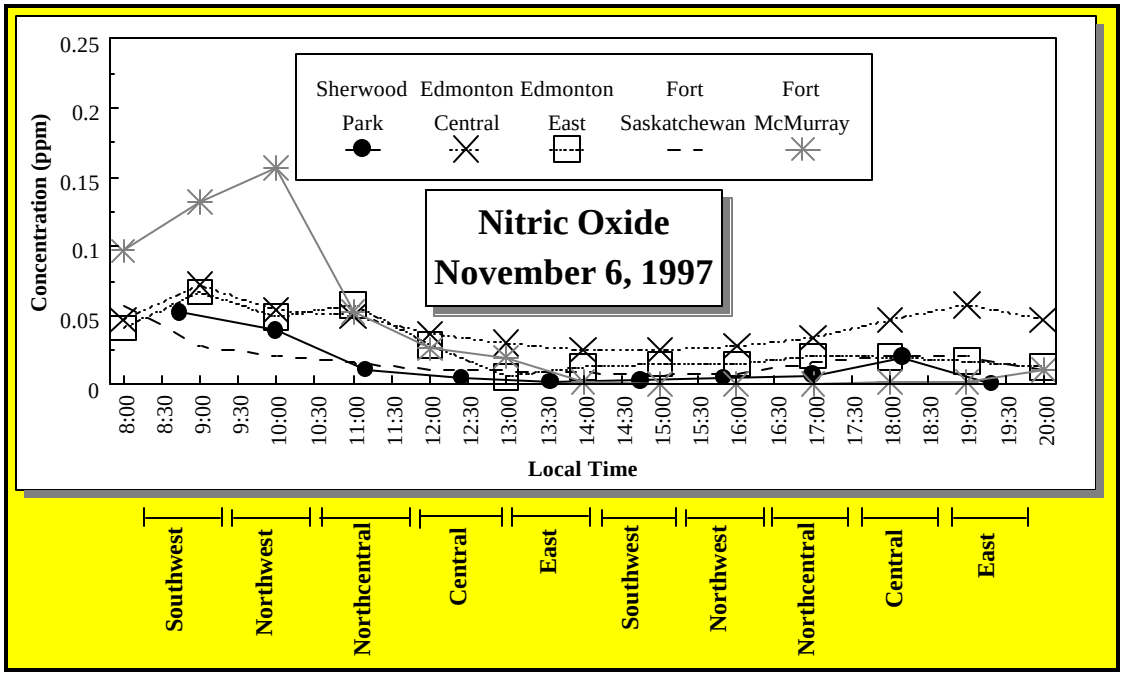




Fall, 1997

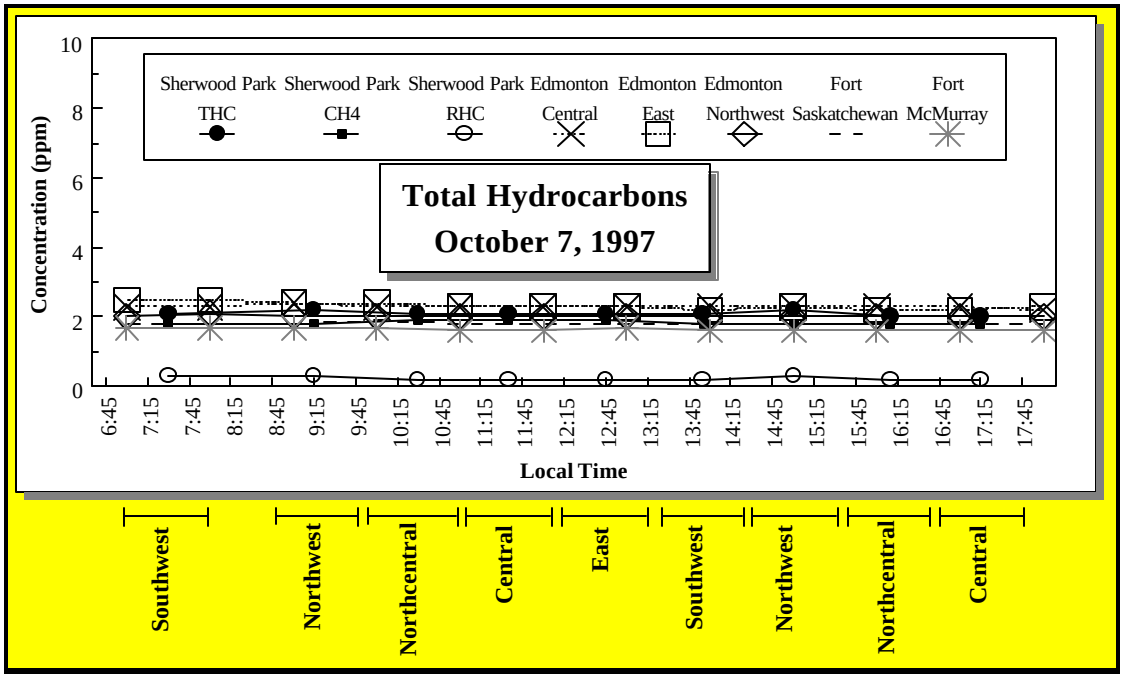
Average Nitric Oxide Concentrations in Sherwood Park

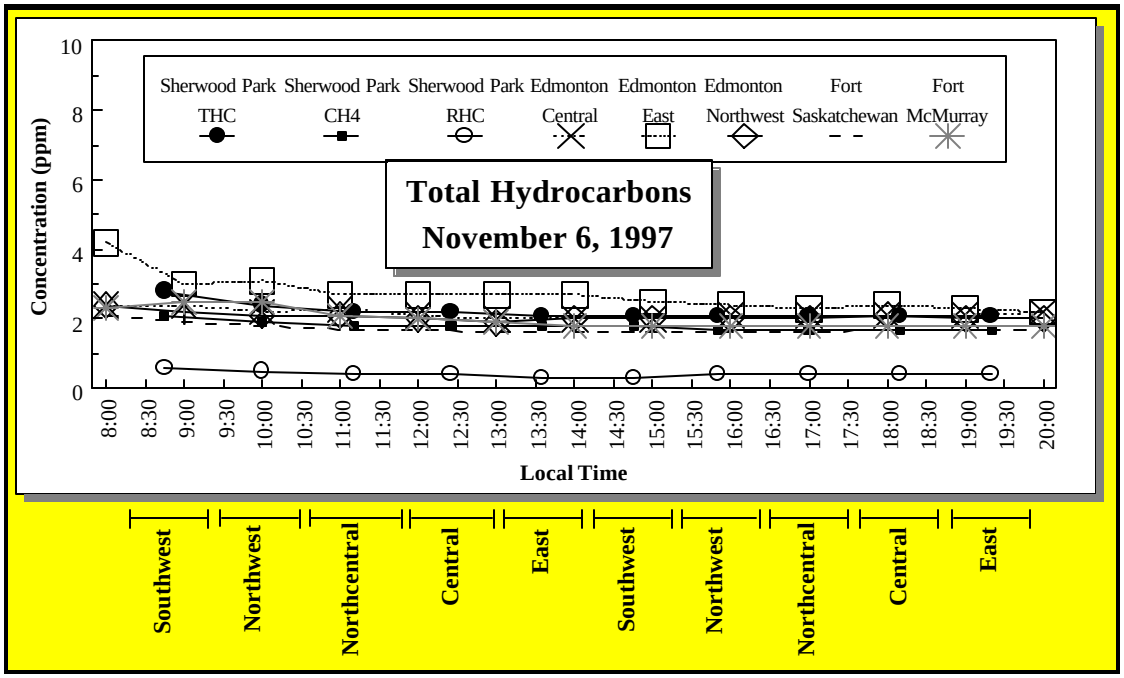




Fall, 1997

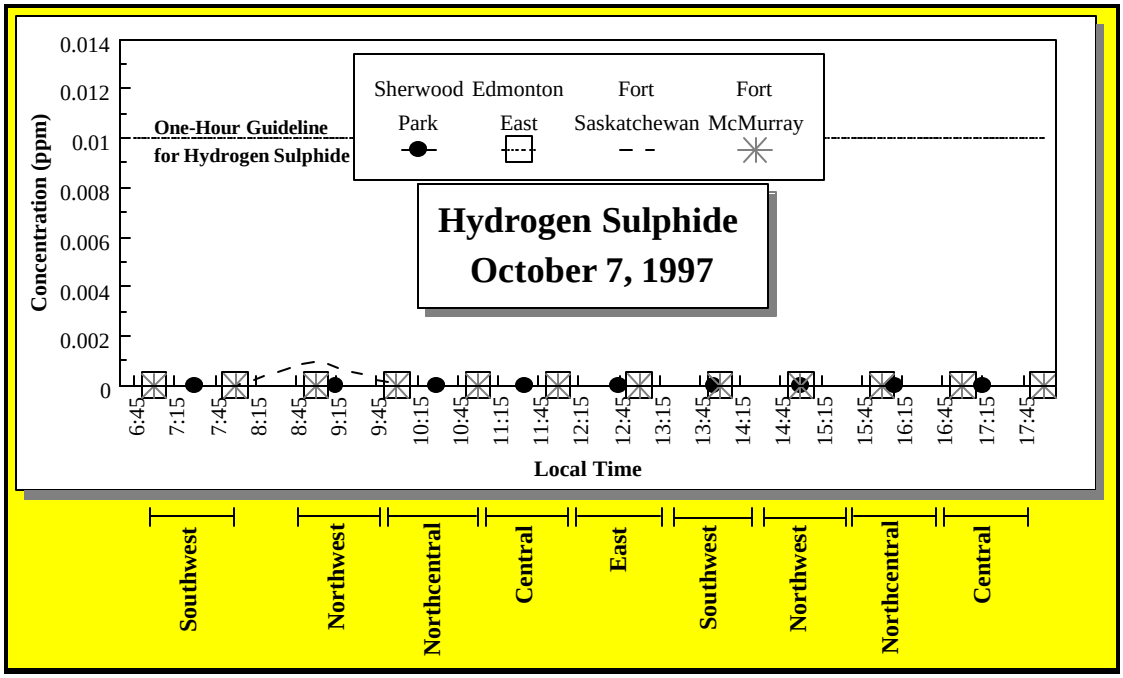
Average Total Hydrocarbon Concentrations in Sherwood Park

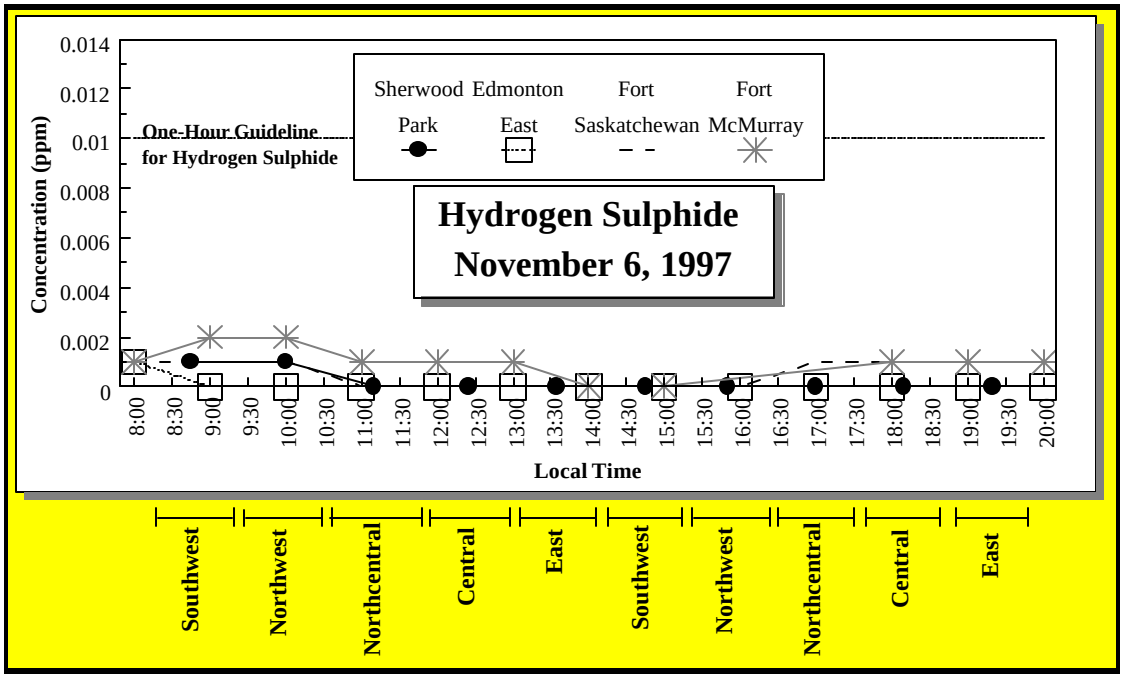




Fall, 1997

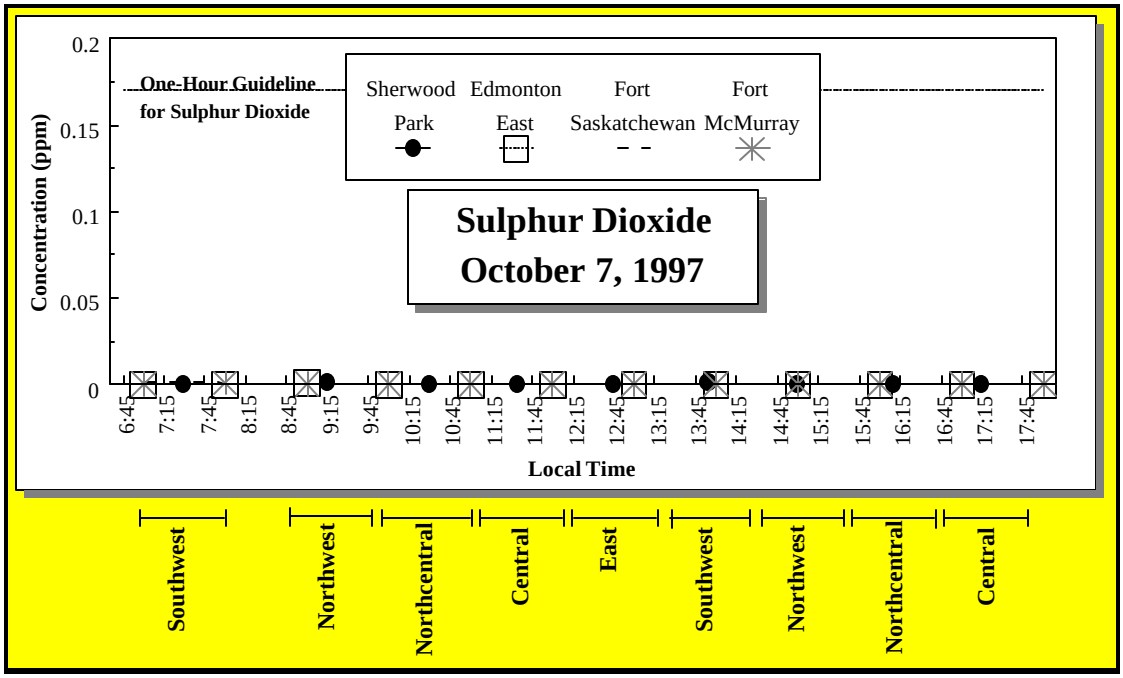
Average Hydrogen Sulphide Concentrations in Sherwood Park

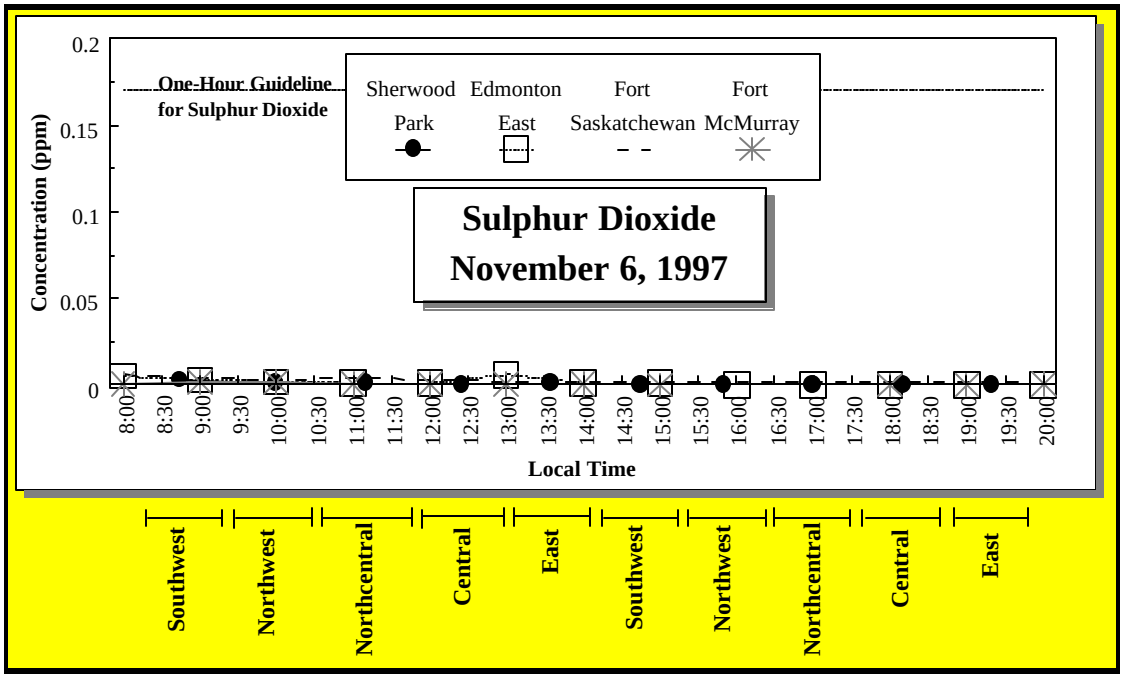




Fall, 1997

Average Sulphur Dioxide Concentrations in Sherwood Park





Fall, 1997

Average Particulate Concentrations in Sherwood Park