Air Quality Monitoring in Sherwood Park
Winter, 1996/97 (December 11 and 12, 1996; January 13, February 6 and 13, 1997)

Alberta Environmental Protection is currently conducting an air quality monitoring program in Strathcona County. The objectives of this program are to: (1) determine air quality parameter concentrations in the community of Sherwood Park relative to air quality guidelines and to other small urban locations in the province; and (2) determine the concentrations of specific chemical species in the Strathcona industrial area and at upwind and downwind locations from the industrial area. The program began in the summer of 1996 and is expected to be completed in November of 1997.

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).

The following is a summary of the results of the mobile air quality monitoring activities in Sherwood Park during the winter of 1996 and 1997 (December 11 and 12, 1996, and January 13, February 6 and February 13, 1997). Additional chemicals monitored using integrated techniques (volatile organic compounds and polycyclic aromatic hydrocarbons collected as a 24-hour sample) will be reported after the monitoring program is complete.

Major Findings

- Concentrations of all air quality parameters monitored in Sherwood Park were below the air quality guidelines. Maximum 1-hour average concentrations were:
  - < 25% of the 1-hour guideline for CO;
  - < 48% of the 1-hour guideline for O_3;
  - < 24% of the 1-hour guideline for NO_2;
  - < 30% of the 1-hour guideline for H_2S; and
  - < 5% of the 1-hour guideline for SO_2.

- The highest concentration of pollutants emitted by vehicles (carbon monoxide, oxides of nitrogen and hydrocarbons) were recorded in the late afternoon and early evening on December 11 and 12. Higher values on these survey days were associated with very light winds. Concentrations of these chemicals were lower than those recorded at other small urban centres in Alberta.

- Hydrogen sulphide and sulphur dioxide concentrations were very low at all monitoring sites in Sherwood Park.

Carbon Monoxide (CO)

Max. 1-hour Average	1-hour Guideline
3.2 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.

The highest CO concentrations were measured at the central, northcentral and east sites in the late afternoon and early evening on December 11 and 12. Higher CO values on the December survey days were likely caused by local traffic in Sherwood Park, commuter traffic between Edmonton and Sherwood Park combined with very light winds. Overall average CO levels on all survey days were below those recorded in downtown Edmonton, east Edmonton and Fort Saskatchewan for the same time period. The overall average CO concentration was the same as that recorded in Fort McMurray (0.7 ppm). CO values are typically highest in the winter and fall due a higher frequency of stagnant weather conditions (strong temperature inversions and light winds).

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.039 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 winter and fall seasons. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide.

O_3 values were highest in the late morning to mid-afternoon and lowest in the early morning and late evening on all survey days. This daily trend is typically observed at all monitoring stations in Alberta. The maximum 1-hour average O_3 concentration was measured in the early afternoon on February 6 at the

east monitoring site. Overall average O_3 values showed little variation between the monitoring locations in Sherwood Park (0.017 to 0.019 ppm). Average O_3 levels measured in Sherwood Park were higher than other small urban monitoring stations (Fort Saskatchewan and Fort McMurray) and lower than the rural station of Royal Park (located 10 km northwest of Vegreville). Concentrations of O_3 are generally lower in the downtown cores of urban centres due to the destruction of natural background O_3 by nitric oxide emitted by motor vehicles. O_3 values are also lowest in the fall and early winter due to limited sunlight and transport of O_3 from the upper atmosphere.

Hydrocarbons (THC, RHC and CH_4)

Max. 1-hour Average	1-hour Guideline
THC = 3.2 ppm	no guideline
RHC = 0.7 ppm	no guideline
CH_4 = 2.5 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.

The highest THC and RHC values were recorded on December 11 and 12. The 1-hour maximum THC value was measured between 7:15 and 8:15 p.m. at the east site while the highest RHC concentration was recorded between 7:00 and 8:00 p.m. on December 12 at the east site. Average hydrocarbon concentrations showed little variation between monitoring sites in Sherwood Park (THC ranged from 2.3 to 2.5 ppm). RHC, which are primarily emitted by vehicles, made up about 13% of THC based on average concentrations. Overall average THC values were slightly lower than those measured at other small urban locations in Alberta for the same time period. Normal background THC concentrations range from 1.5 and 2.0 ppm.

Oxides of Nitrogen (NO_2, NO, NO_x)

Max. 1-hour Average	1-hour Guideline
NO_2 = 0.051 ppm	0.210 ppm
NO = 0.183 ppm	no guideline
NO_x = 0.221 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 NO_2 concentration was recorded between 5:45 and 7:05 p.m. on February 13 at the central monitoring site. NO_x and NO concentrations were highest between 7:00 and 8:00 p.m. on December 12 at the east monitoring site. Overall average oxide of nitrogen values were highest at the central site. Higher values at this location were likely due to transport of vehicle exhaust from major traffic arteries in Sherwood Park (e.g. Sherwood Dr. and Broadmoor Blvd.). Average oxides of nitrogen values in Sherwood Park were lower than those at Edmonton, Fort Saskatchewan and Fort McMurray monitoring stations.

Hydrogen Sulphide (H_2S)

Max. 1-hour Average	1-hour Guideline
H_2S = 0.003 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.

The highest average H_2S concentration (0.003 ppm) was recorded in the evening of December 12 at the central and east sites. This peak 1-hour value is 30% of the 1-hour guideline. Winds during the time of maximum H_2S values were very light and from the west direction. The major source of H_2S is likely industrial sources in east Edmonton.

Sulphur Dioxide (SO_2)

Max. 1-hour Average	1-hour Guideline
SO_2 = 0.008 ppm	0.170 ppm

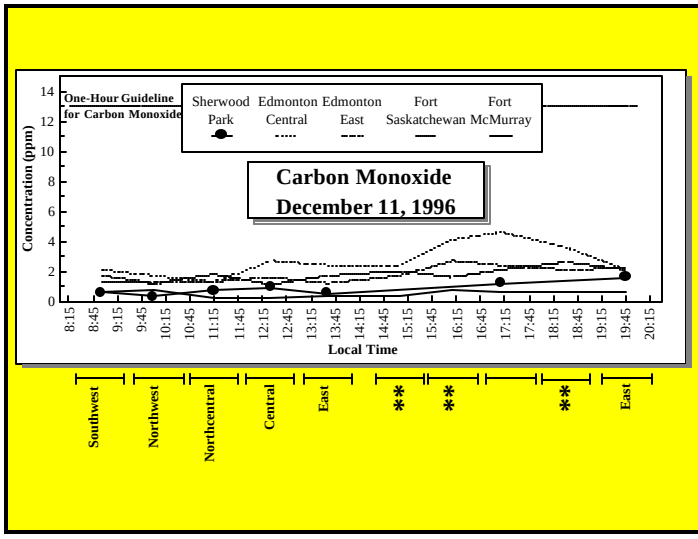
Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, the major sources of SO_2 are natural gas processing plants, oil sands facilities, and power plants. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

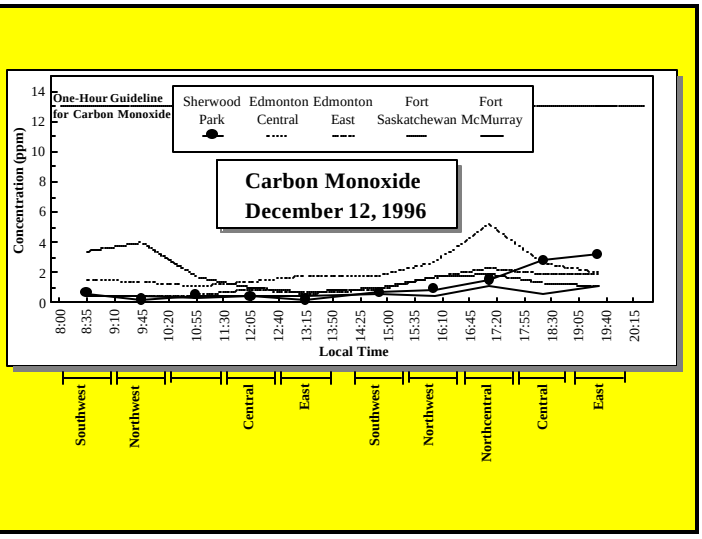
The highest 1-hour average SO_2 concentration was measured in the evening of December 12 at the northcentral and east sites. This maximum value is about 5% of the 1-hour guideline. Average SO_2 concentrations for all winter survey days were generally higher at the central and east sites. The average SO_2 value measured in Sherwood Park

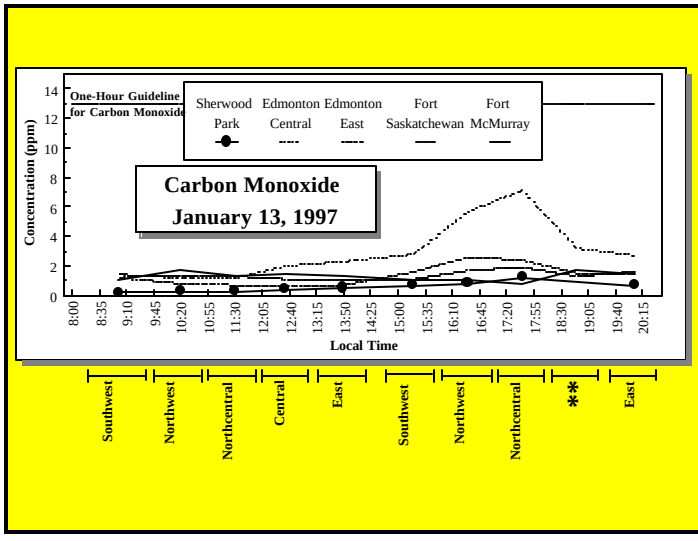
for all survey days was lower than those measured at the Edmonton east, Fort Saskatchewan and Fort McMurray monitoring stations.

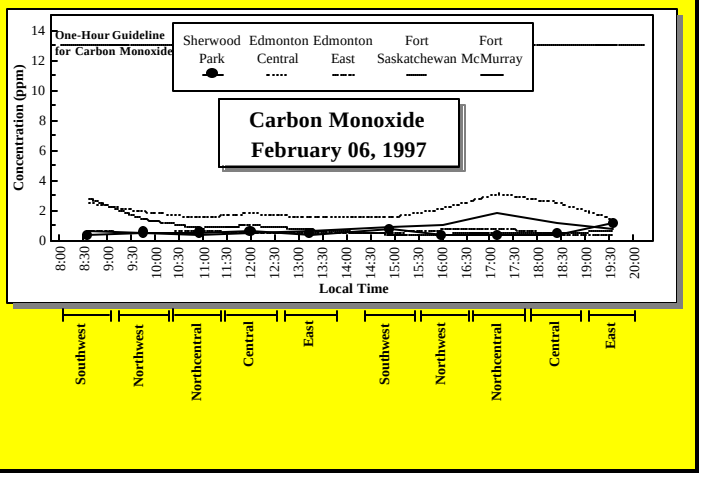
Winter, 1996

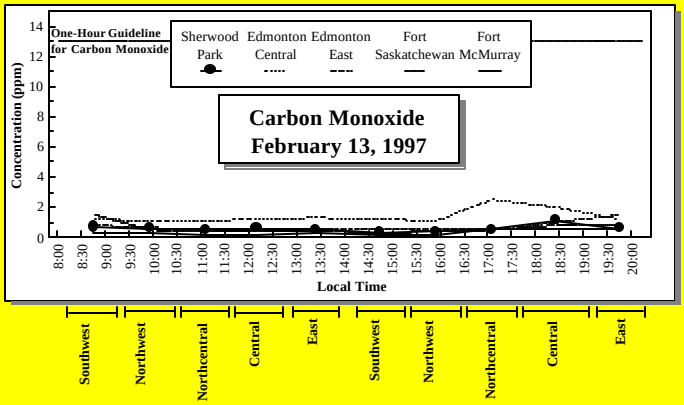
Average Carbon Monoxide Concentrations in Sherwood Park











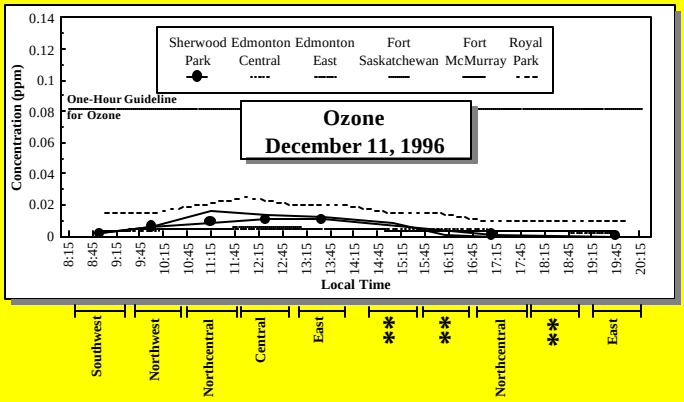
Location of monitoring sites in Sherwood Park

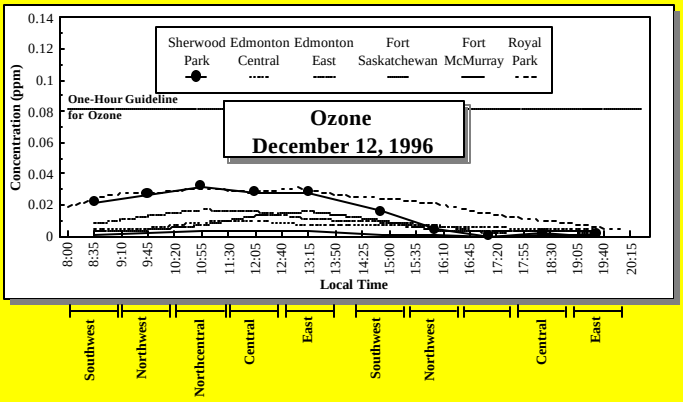
CENTRAL	100 Festival Way
EAST	Heritage Drive 1/4 mile east of Cloverbar Road
NORTHCENTRAL	Bison Road & Sherwood Drive
NORTHWEST	Corner of Sioux Road & Kaska Road
SOUTHWEST	Village Drive @ Village Sports Park

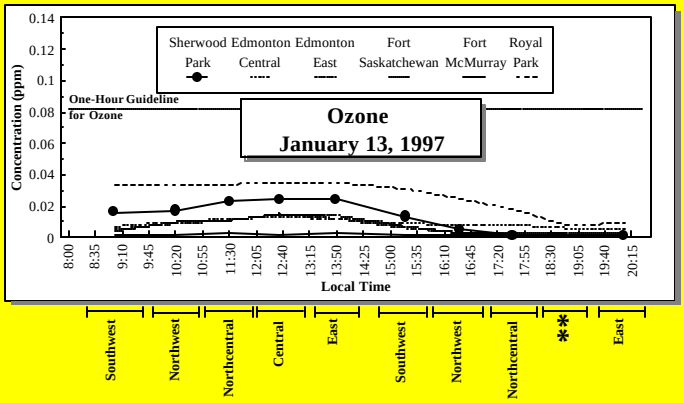
** Less than 75% data available

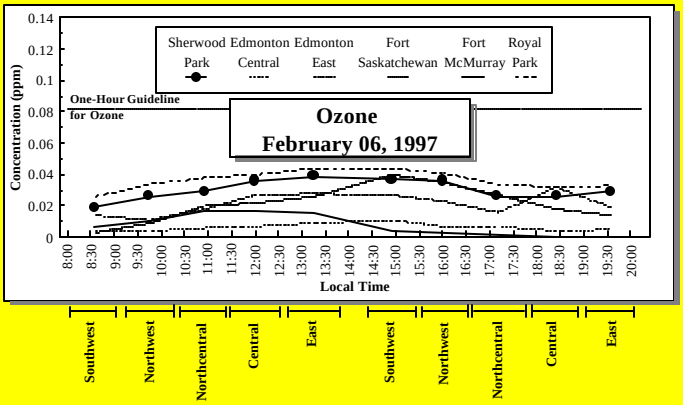
Winter, 1996

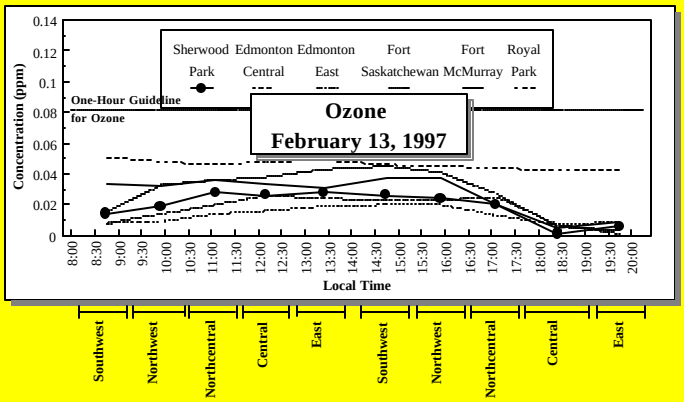
Average Ozone Concentrations in Sherwood Park











Location of monitoring sites in Sherwood Park

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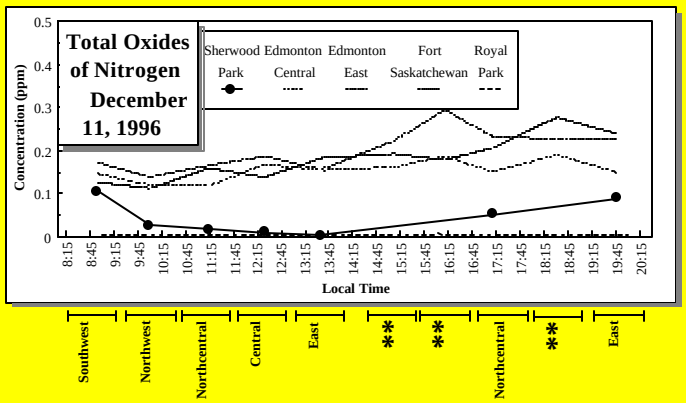
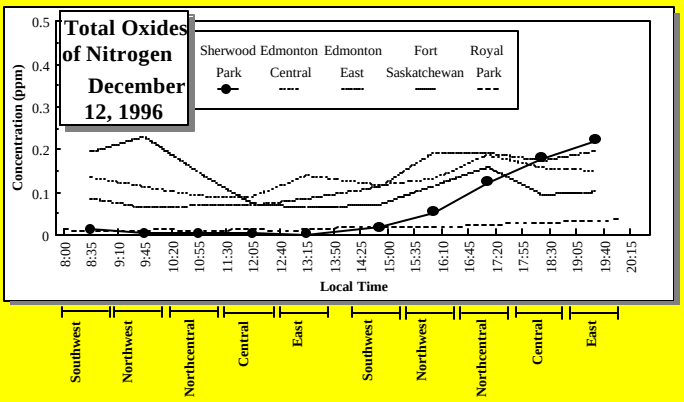
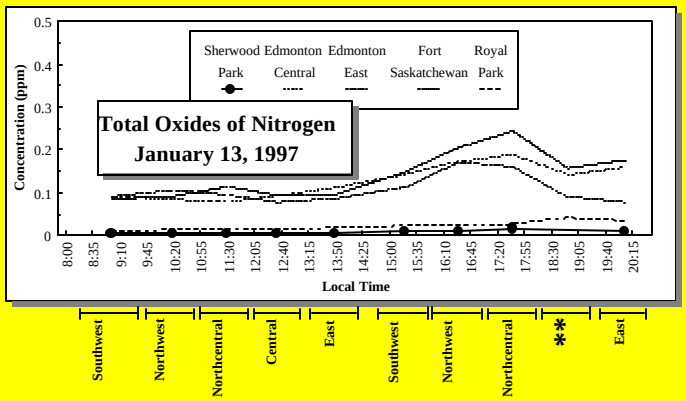
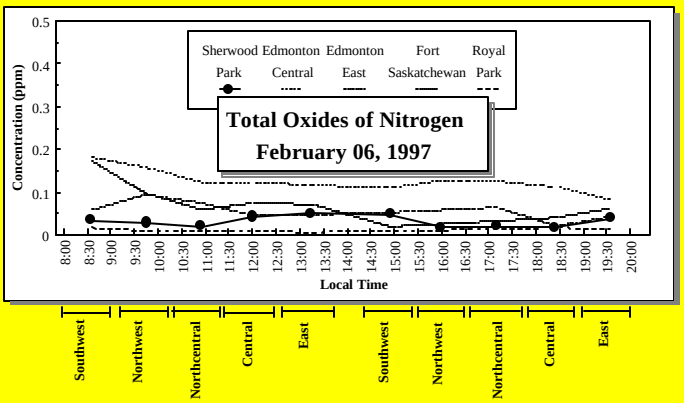
Winter, 1996

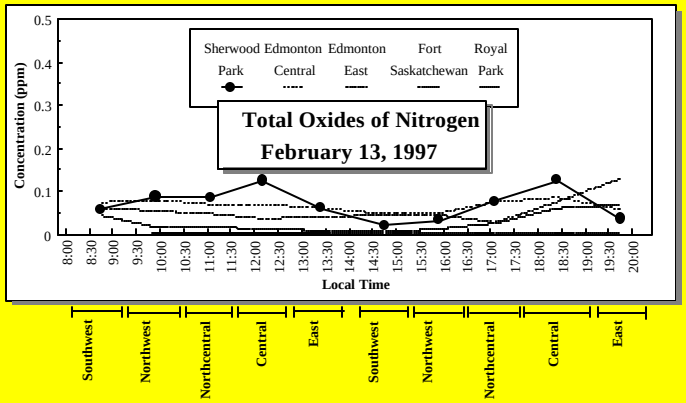
Average Total Oxides of Nitrogen Concentrations in Sherwood Park











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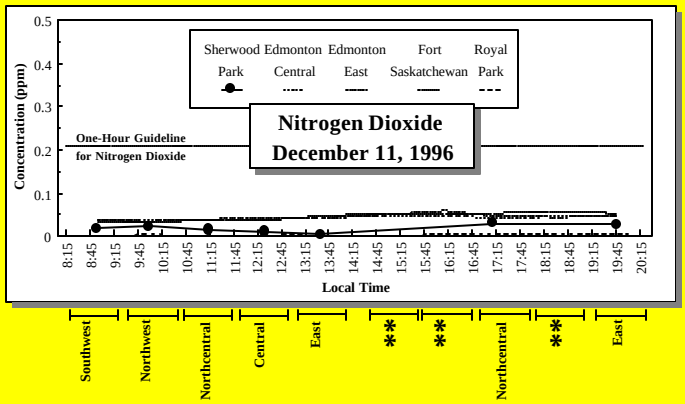
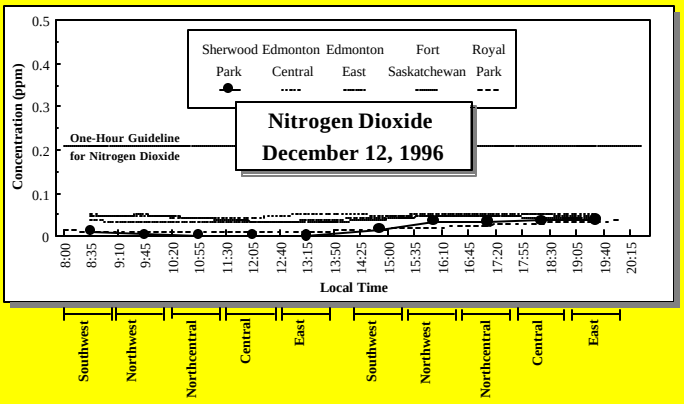
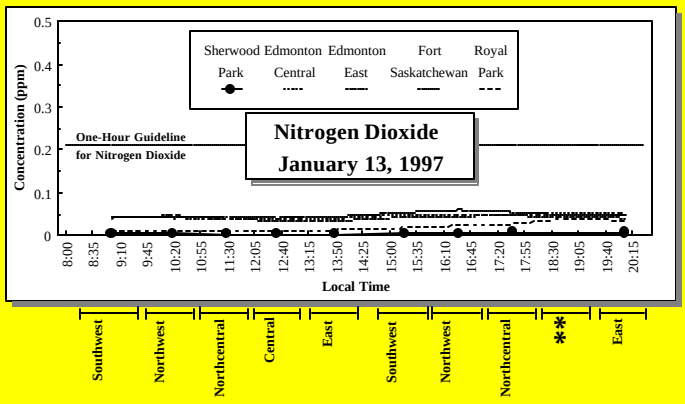
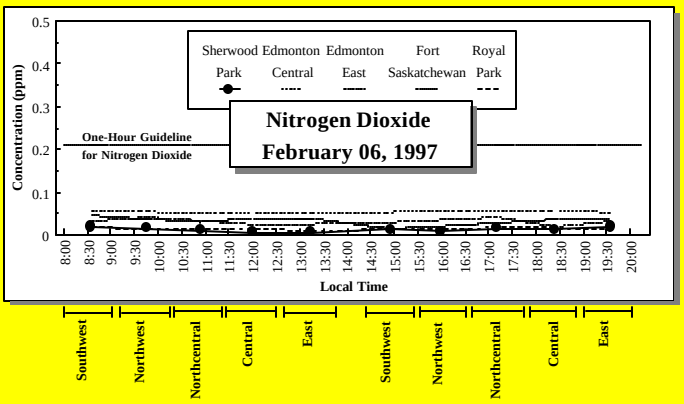
Winter, 1996

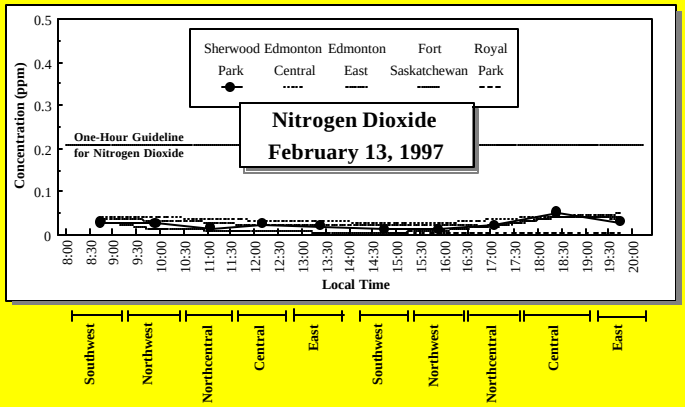
Average Nitrogen Dioxide Concentrations in Sherwood Park











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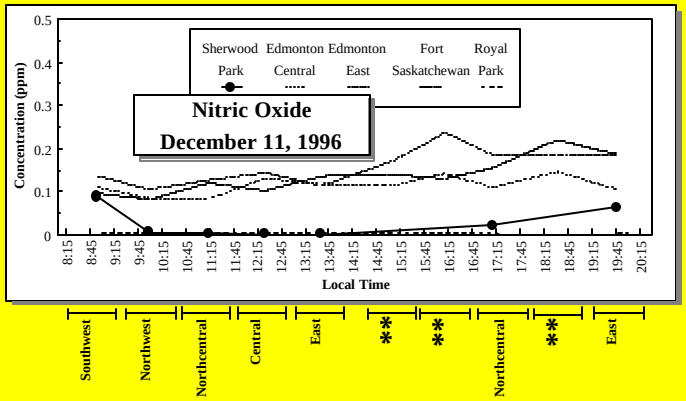
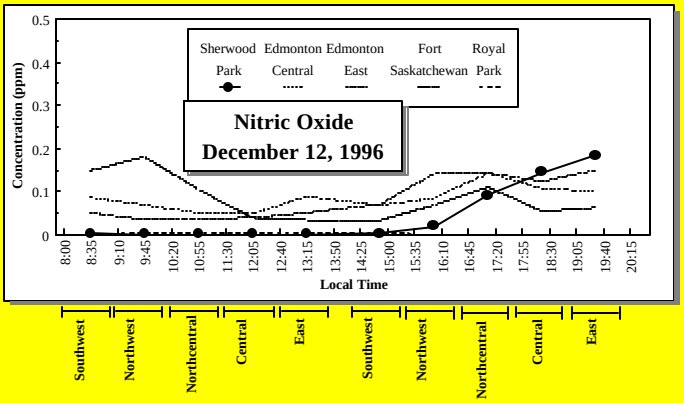
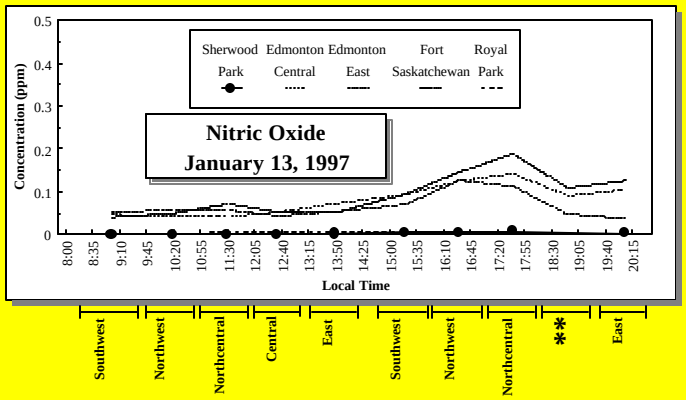
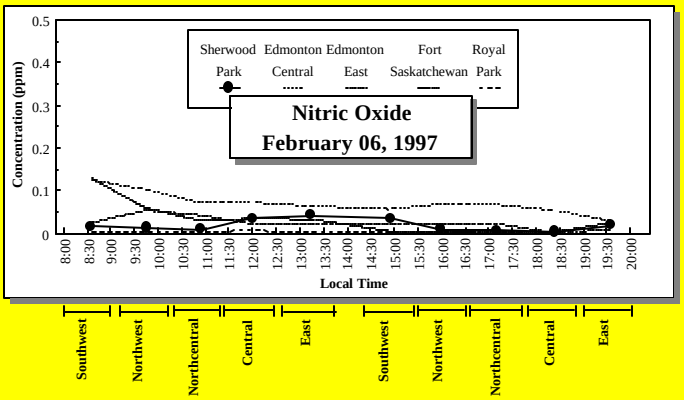
Winter, 1996

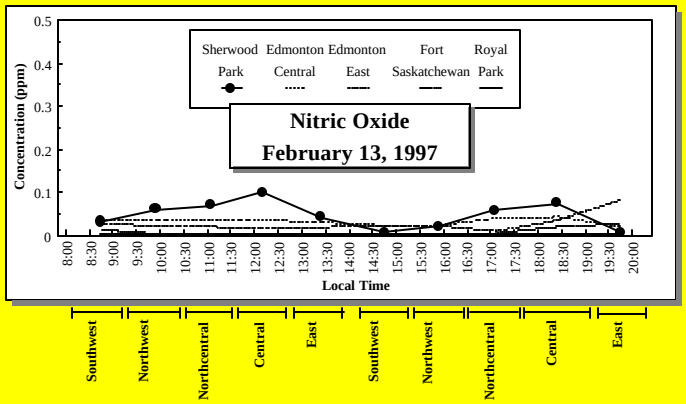
Average Nitric Oxide Concentrations in Sherwood Park











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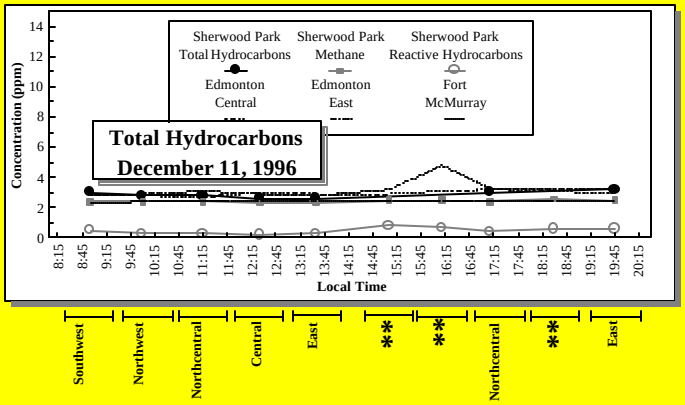
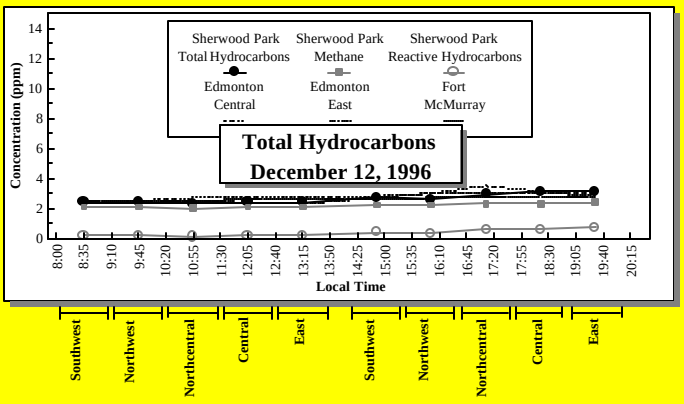
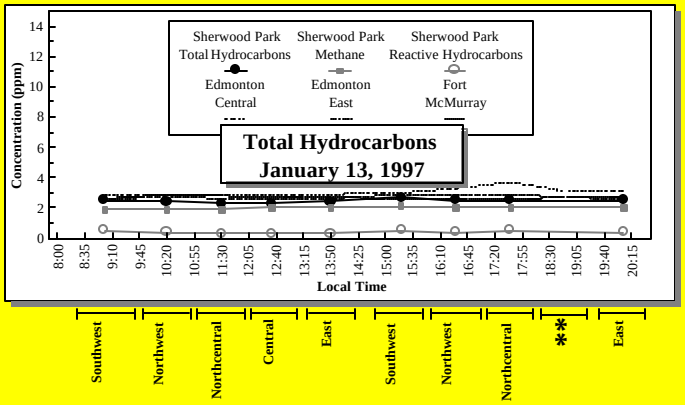
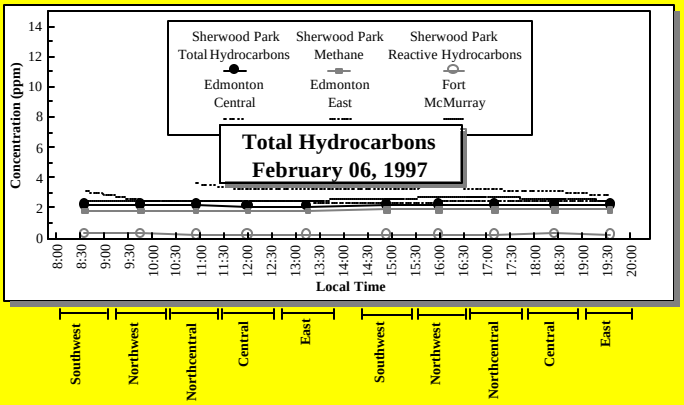
Winter, 1996

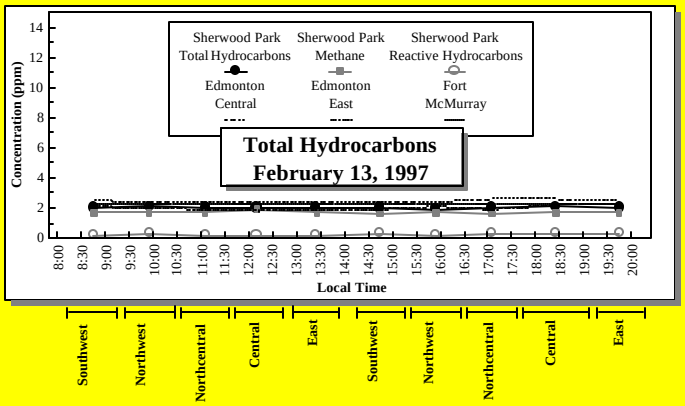
Average Total Hydrocarbon Concentrations in Sherwood Park











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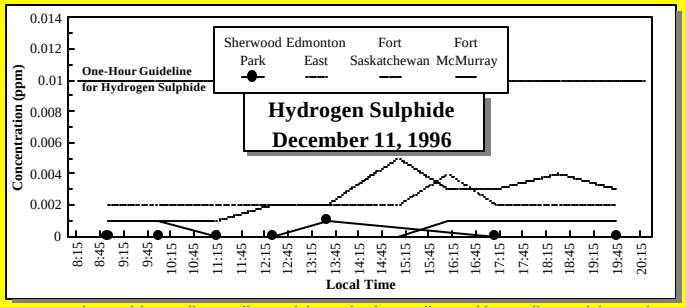
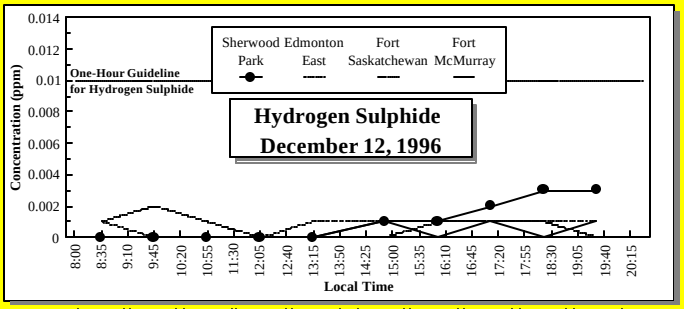
Winter, 1996

Average Hydrogen Sulphide Concentrations in Sherwood Park



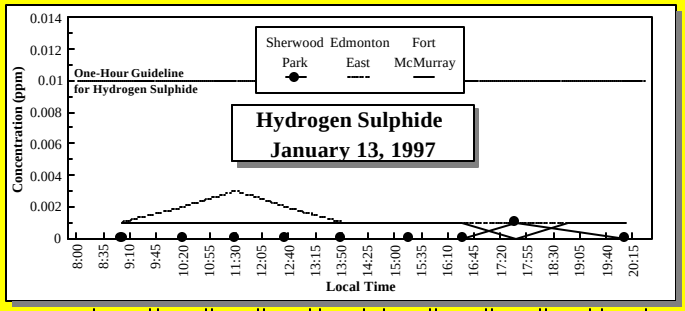
Hydrogen Sulphide December 11, 1996

Southwest | Northwest | Northcentral | Central | East | ** | ** | Northcentral | ** | East



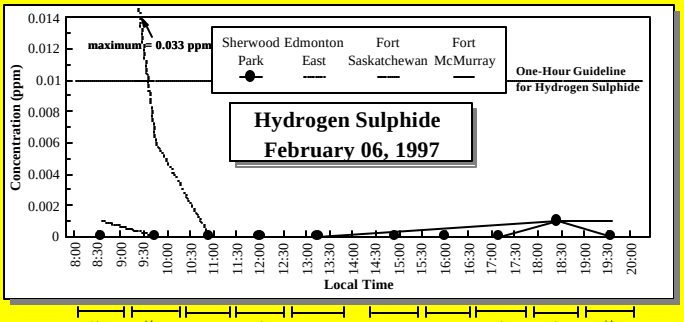
Hydrogen Sulphide December 12, 1996

Southwest | Northwest | Northcentral | Central | East | Southwest | Northwest | Northcentral | Central | East



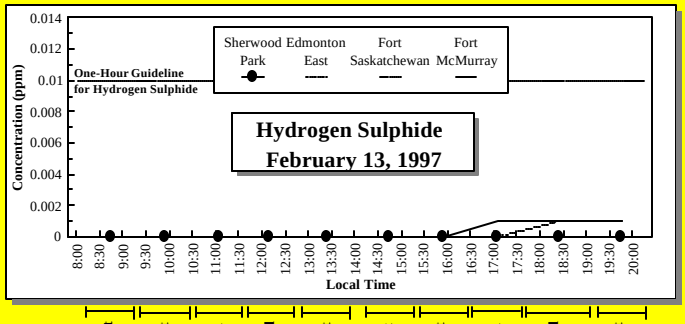
Hydrogen Sulphide January 13, 1997

Southwest | Northwest | Northcentral | Central | East | Southwest | Northwest | Northcentral | ** | East



Hydrogen Sulphide February 06, 1997

Southwest | Northwest | Northcentral | Central | East | Southwest | Northwest | Northcentral | Central | East



Hydrogen Sulphide February 13, 1997

Southwest | Northwest | Northcentral | Central | East | Southwest | Northwest | Northcentral | Central | East

Location of monitoring sites in Sherwood Park

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EAST	Heritage Drive 1/4 mile east of Cloverbar Road
NORTHCENTRAL	Bison Road & Sherwood Drive
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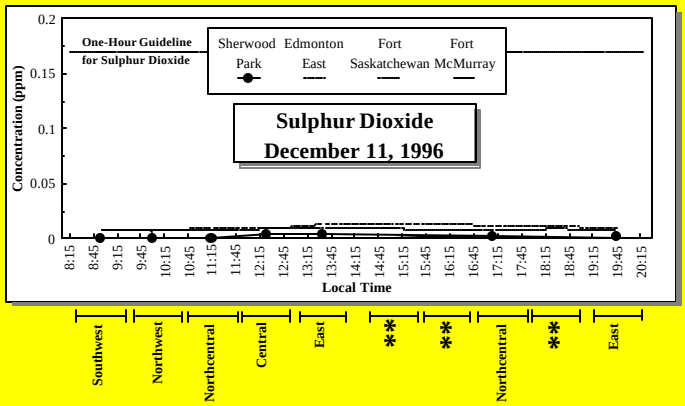
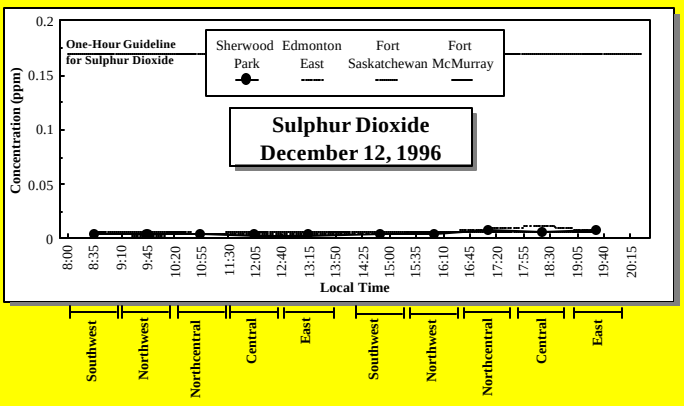
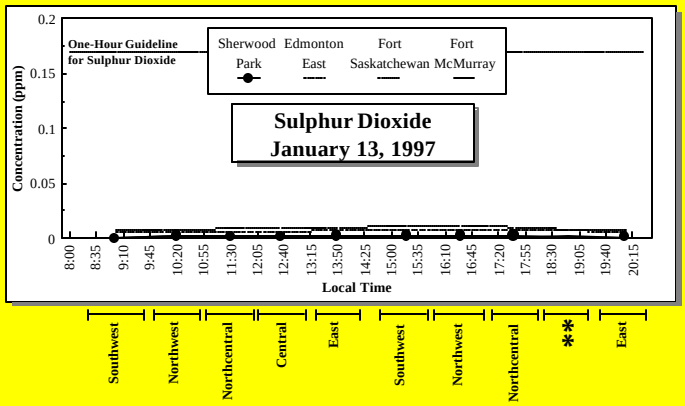
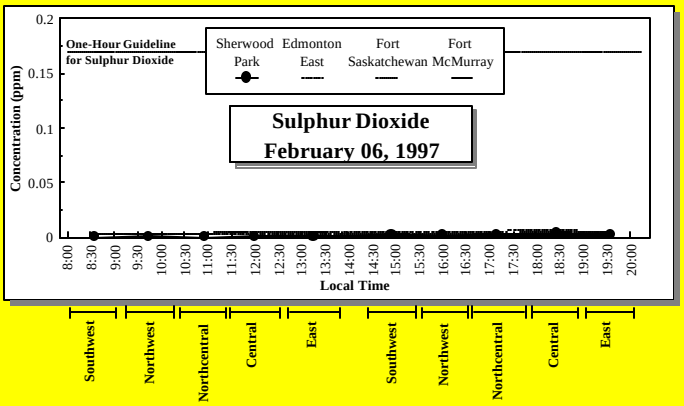
Winter, 1996

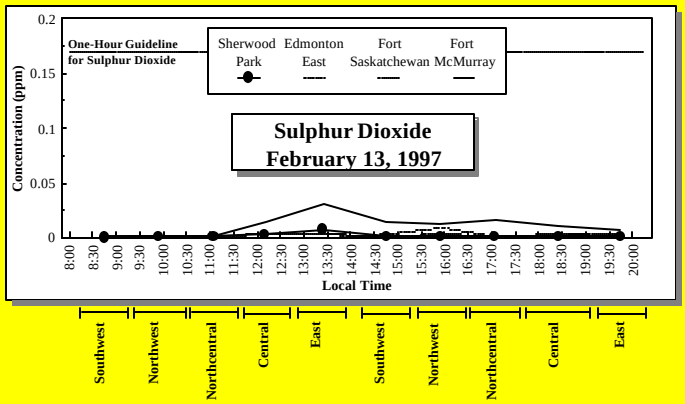
Average Sulphur Dioxide Concentrations in Sherwood Park











Location of monitoring sites in Sherwood Park

CENTRAL	100 Festival Way
EAST	Heritage Drive 1/4 mile east of Cloverbar Road
NORTHCENTRAL	Bison Road & Sherwood Drive
NORTHWEST	Corner of Sioux Road & Kaska Road
SOUTHWEST	Village Drive @ Village Sports Park

** Less than 75% data available

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

December 11, 1996

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
southwest	08:24 to 09:24	0.6	0.002	0.106	0.018	0.088	3.0	2.4	0.5	0.000	0.000	-13	calm	85%
northwest	09:36 to 10:38	0.3	0.006	0.027	0.022	0.005	2.8	2.4	0.3	0.000	0.000	-14	calm	90%
northcentral	10:44 to 11:46	0.7	0.009	0.017	0.014	0.003	2.8	2.4	0.3	0.000	0.000	-11	SSW/7	90%
central	11:53 to 12:53	0.9	0.011	0.010	0.010	0.000	2.6	2.3	0.2	0.000	0.004	-9	SSW/7	90%
east	13:06 to 14:05	0.5	0.011	0.004	0.004	0.000	2.6	2.3	0.3	0.001	0.004	-7	calm	95%
southwest	14:34 to 15:35**	no data										-2	calm	95%
northwest	15:41 to 16:42**	no data										-6	calm	95%
northcentral	16:51 to 17:52	1.2	0.001	0.052	0.030	0.022	3.0	2.4	0.4	0.000	0.002	-8	S/7	100%
central	17:59 to 19:01**	no data										-8	calm	100%
east	19:15 to 20:17	1.6	0.000	0.090	0.027	0.063	3.2	2.5	0.6	0.000	0.001	-9	calm	no data

December 12, 1996

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
southwest	08:04 to 09:06	0.6	0.022	0.013	0.011	0.002	2.4	2.1	0.2	0.000	0.004	-13	SSW/7	40%
northwest	09:12 to 10:14	0.2	0.027	0.005	0.004	0.001	2.4	2.1	0.2	0.000	0.004	-11	SSW/4-7	40%
northcentral	10:23 to 11:26	0.5	0.032	0.004	0.003	0.001	2.3	2.0	0.1	0.000	0.004	-8	SSW/7-11	40%
central	11:33 to 12:36	0.4	0.028	0.004	0.003	0.001	2.4	2.1	0.2	0.000	0.003	-10	SSW/4-7	45%
east	12:45 to 13:48	0.2	0.028	0.003	0.001	0.001	2.4	2.1	0.2	0.000	0.003	-11	S/7-11	75%
southwest	14:18 to 15:19	0.7	0.016	0.019	0.017	0.002	2.7	2.2	0.4	0.001	0.004	-9	S/0-4	90%
northwest	15:27 to 16:28	0.9	0.004	0.053	0.034	0.019	2.6	2.2	0.3	0.001	0.004	-11	S/4-7	95%
northcentral	16:38 to 17:39	1.5	0.000	0.123	0.033	0.090	2.9	2.3	0.6	0.002	0.008	-11	W/4-7	no data
central	17:49 to 18:49	2.8	0.001	0.180	0.036	0.144	3.1	2.3	0.6	0.003	0.006	-9	W/0-4	no data
east	19:00 to 20:02	3.2	0.001	0.221	0.038	0.183	3.1	2.4	0.7	0.003	0.008	-8	calm	no data

January 13, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
southwest	08:23 to 09:39	0.2	0.016	0.005	0.004	0.001	2.5	1.9	0.5	0.000	0.000	-14	calm	20%
northwest	09:48 to 10:50	0.3	0.017	0.005	0.004	0.001	2.4	1.9	0.4	0.000	0.002	-14	SW/0-4	20%
northcentral	10:58 to 12:00	0.3	0.023	0.004	0.003	0.001	2.3	1.9	0.3	0.000	0.001	-11	SW/0-7	10%
central	12:06 to 13:07	0.4	0.024	0.004	0.003	0.001	2.3	2.0	0.3	0.000	0.001	-10	SW/7-14	5%
east	13:20 to 14:20	0.5	0.024	0.005	0.003	0.002	2.4	2.0	0.3	0.000	0.002	-7	SW/2-3	5%
southwest	14:46 to 15:47	0.7	0.013	0.010	0.005	0.005	2.7	2.1	0.5	0.000	0.002	-7	calm	5%
northwest	15:56 to 17:01	0.8	0.005	0.010	0.005	0.005	2.5	2.0	0.4	0.000	0.002	-4	SW/0-7	10%
northcentral	17:09 to 18:10	1.2	0.001	0.015	0.007	0.008	2.5	2.0	0.5	0.001	0.002	-7	SW/7-11	5%
central	18:18 to 19:17**	no data										-7	calm	no data
east	19:32 to 20:33	0.7	0.001	0.009	0.006	0.003	2.5	2.0	0.4	0.000	0.001	-11	SW/0-4	no data

February 06, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
southwest	08:03 to 09:03	0.3	0.019	0.034	0.019	0.015	2.2	1.8	0.3	0.000	0.000	-9	SE/0-4	5%
northwest	09:14 to 10:17	0.5	0.026	0.028	0.015	0.013	2.2	1.8	0.3	0.000	0.000	-8	SE/0-4	5%
northcentral	10:23 to 11:23	0.5	0.029	0.020	0.011	0.009	2.2	1.8	0.2	0.000	0.000	-8	S/7-14	2%
central	11:29 to 12:32	0.6	0.036	0.042	0.006	0.035	2.1	1.8	0.2	0.000	0.000	-6	SSW/7-11	2%
east	12:42 to 13:49	0.4	0.039	0.050	0.007	0.043	2.1	1.8	0.2	0.000	0.000	-6	SW/7-11	2%
southwest	14:23 to 15:25	0.7	0.037	0.048	0.013	0.035	2.2	1.9	0.2	0.000	0.003	-2	SW/7-11	2%
northwest	15:33 to 16:32	0.3	0.036	0.018	0.008	0.010	2.2	1.9	0.2	0.000	0.002	-4	SW/7-14	2%
northcentral	16:39 to 17:45	0.3	0.026	0.021	0.015	0.006	2.2	1.9	0.2	0.000	0.003	-5	SSW/7-14	1%
central	17:53 to 18:53	0.4	0.026	0.018	0.014	0.003	2.2	1.9	0.3	0.001	0.004	-7	S/7-14	clear
east	19:04 to 20:04	1.1	0.029	0.039	0.019	0.019	2.2	1.9	0.2	0.000	0.003	-7	S/7-14	no data

February 13, 1997

Monitoring Site	Monitoring Period	CO	O_3	NO_x	NO_2	NO	THC	CH_4	RHC	H2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
southwest	08:13 to 09:15	0.7	0.014	0.058	0.028	0.031	2.0	1.7	0.2	0.000	0.000	-6	calm	90%
northwest	09:23 to 10:29	0.6	0.019	0.087	0.026	0.061	2.1	1.7	0.3	0.000	0.001	-4	NNW/0-4	90%
northcentral	10:35 to 11:35	0.5	0.028	0.086	0.016	0.070	2.0	1.7	0.2	0.000	0.001	-3	NW/0-11	85%
central	11:42 to 12:42	0.6	0.026	0.124	0.025	0.099	2.0	1.9	0.2	0.000	0.003	-3	NW/0-11	85%
east	12:53 to 13:54	0.5	0.028	0.061	0.020	0.041	2.0	1.7	0.2	0.000	0.007	-2	NW/0-11	85%
southwest	14:15 to 15:16	0.3	0.026	0.020	0.013	0.007	2.0	1.6	0.3	0.000	0.001	-3	calm	90%
northwest	15:24 to 16:26	0.4	0.024	0.032	0.012	0.021	1.9	1.7	0.2	0.000	0.001	-3	NW/0-7	95%
northcentral	16:34 to 17:36	0.5	0.020	0.077	0.021	0.057	2.0	1.6	0.3	0.000	0.001	-4	NW/0-7	80%
central	17:43 to 19:06	1.1	0.001	0.126	0.051	0.075	2.1	1.7	0.3	0.000	0.001	-5	W/0-4	85%
east	19:17 to 20:16	0.6	0.006	0.036	0.029	0.007	2.0	1.7	0.3	0.000	0.001	-5	NW/0-4	no data

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

** Less than 75% data available.

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**
southwest	0.5	0.018	0.035	0.014	0.021	2.4	2.0	0.4	0.000	0.001
northwest	0.5	0.018	0.030	0.014	0.015	2.3	2.0	0.3	0.000	0.002
northcentral	0.7	0.017	0.042	0.015	0.027	2.4	2.0	0.3	0.000	0.002
central	0.9	0.019	0.063	0.019	0.045	2.4	2.0	0.3	0.001	0.003
east	0.9	0.017	0.052	0.016	0.036	2.5	2.0	0.3	0.001	0.003

Overall Average Concentrations on All Winter Survey Days (ppm)										
Location	**CO**	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**CH_4**	**RHC**	**H_2S**	**SO_2**
Sherwood Park	0.7	0.018	0.044	0.016	0.028	2.4	2.0	0.3	0.000	0.002
Edmonton Central	2.2	0.008	0.122	0.045	0.077	2.9	no data			
Edmonton East	1.1	0.012	0.110	0.038	0.072	2.6	no data		0.002	0.006
Fort Saskatchewan	1.3	0.014	0.108	0.038	0.071	2.6	no data		0.001	0.006
Fort McMurray	0.7	0.009	0.051	0.019	0.034	2.5	no data		0.001	0.003
Royal Park	no data	0.029	0.012	0.011	0.002	no data				

Maximum 1-hour Average Concentrations on All Winter Survey Days (ppm)										
Location	**CO**	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**CH_4**	**RHC**	**H_2**	**SO_2**
Sherwood Park	3.2	0.039	0.221	0.051	0.183	3.2	2.5	0.7	0.003	0.008
Edmonton Central	7.1	0.020	0.191	0.059	0.147	3.7	no data			
Edmonton East	2.7	0.032	0.295	0.059	0.237	4.8	no data		0.033	0.013
Fort Saskatchewan	4.0	0.045	0.277	0.060	0.220	3.8	no data		0.005	0.012
Fort McMurray	1.8	0.038	0.146	0.036	0.111	2.9	no data		0.001	0.031
Royal Park	no data	0.051	0.042	0.040	0.006	no data				