

# Air Quality Monitoring in the Strathcona Industrial Area

## Summer, 1997 (July 3, 11, 15 and 30)

Alberta Environmental Protection conducted an air quality monitoring study in the Strathcona industrial area east of Edmonton. The objective of this study was to determine the concentrations of specific chemical species in the Strathcona industrial area and at upwind and downwind locations from the industrial area. The study began in the fall of 1996 and was completed in November of 1997. The following report is a summary of mobile air quality monitoring activities in the Strathcona industrial area during the summer of 1997 (July 3, 11, 15 and 30).

Air quality was measured using a mobile monitoring unit at five locations in the Strathcona industrial area. Monitoring was conducted at Meridian St. and 122 Ave. (north site), the Petro Canada ball diamonds west of Broadmoor Blvd. (east site), 24 St. and 104 Ave. (central site), near 91 Ave. and 24 St. (south site), and Goldstick Park (west site). Air quality parameters monitored at these locations included ozone ( $O_3$ ), total oxides of nitrogen ( $NO_x$ ), nitrogen dioxide ( $NO_2$ ), nitric oxide (NO), total hydrocarbons (THC), hydrogen sulphide ( $H_2S$ ), and sulphur dioxide ( $SO_2$ ). Carbon monoxide (CO), reactive hydrocarbons (RHC) and methane ( $CH_4$ ) were not monitored in the Strathcona industrial area because of space limitations on the monitoring unit. Additional chemicals monitored using integrated techniques (volatile organic compounds and polycyclic aromatic hydrocarbons collected as a 24-hour sample) will be reported in the fall of 1998.

### Major Findings

Concentrations of air quality parameters monitored by the mobile monitoring unit in the Strathcona industrial area were below the air quality guidelines. Maximum 1-hour average concentrations were:

- < 50% of the 1-hour guideline for  $O_3$ ;
- < 11% of the 1-hour guideline for  $NO_2$ ;
- < 30% of the 1-hour guideline for  $H_2S$ , and
- < 10% of the 1-hour guideline for  $SO_2$ .

The highest concentrations of pollutants emitted by vehicles (hydrocarbons and oxides of nitrogen) were recorded near major traffic arteries (Baseline Road, Yellowhead Trail, 17th Street and Meridian Street).

Concentrations of sulphur compounds were low in the Strathcona industrial area. Peak  $H_2S$  and  $SO_2$  values were measured at the south (91 Ave. and 24 St.) and east (Petro Canada ball diamonds) sites, respectively.

### Ozone ( $O_3$ )

Max. 1-hour Average	1-hour Guideline
0.041 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 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,  $O_3$  concentrations were lowest in the early morning and highest in the late afternoon. This is the typical daily variation that is observed at other Alberta locations. Lower values in the afternoon of July 11 were likely due to  $O_3$  destruction by nitric oxide (NO) emissions from vehicles in the vicinity of the monitoring sites. Overall average  $O_3$  values ranged from 0.023 ppm at the south site (91 Ave. and 24 St. ) to 0.029 ppm at the west site (Goldstick Park). Average  $O_3$  values recorded in the Strathcona industrial area (0.025 ppm) were similar to those measured at the Edmonton East (0.024 ppm) and Fort Saskatchewan (0.027 ppm) stations for the same time period. The overall average concentration in the Strathcona industrial area was also close to the average from the Sherwood Park mobile survey (0.027 ppm) which was conducted over the same time period. Background  $O_3$  concentrations for the summer monitoring period are 0.042 ppm based on data collected at the background site of High Tower Ridge located 65 km northwest of Hinton.

### Total Hydrocarbons (THC)

Max. 1-hour Average	1-hour Guideline
THC = 2.9 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.

The highest THC concentration was recorded in the evening on July 11 at the central site (24 St. and 104 Ave.). Average THC concentrations ranged from 1.9 ppm at the north site (Meridian St. and 122 Ave.) to 2.1 ppm at the central (24 St. and 104 Ave.) and south (91 Ave. and 24 St.) sites. Higher THC values were generally observed near major traffic arteries such as 17th Street, Baseline Road and Yellowhead Trail. The overall average THC concentration in the Strathcona industrial area (2.0 ppm) was close to those recorded in Sherwood Park (1.9 ppm) and downtown Edmonton (1.9 ppm) over the same time period. However, the average THC concentration in the Strathcona industrial area was higher than values recorded in Fort Saskatchewan (1.6 ppm) and Fort McMurray (1.6 ppm) for the summer monitoring period. Normal background THC concentrations range from 1.5 and 2.0 ppm.

### Oxides of Nitrogen (NO<sub>2</sub>, NO, NO<sub>x</sub>)

Max. 1-hour Average	1-hour Guideline
NO <sub>2</sub> = 0.024 ppm	0.210 ppm
NO = 0.030 ppm	no guideline
NO <sub>x</sub> = 0.049 ppm	no guideline

Oxides of nitrogen (NO<sub>x</sub>) are the sum of nitrogen dioxide (NO<sub>2</sub>) 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<sub>2</sub>. NO<sub>2</sub> is a reddish-brown gas with a pungent odour.

The maximum NO<sub>2</sub> concentration was recorded in the morning (7 to 8 a.m.) on July 30 at the south site (91 Ave. and 21 St.). NO<sub>x</sub> and NO concentrations were highest between 6:30 and 7:30 p.m. on July 15 at the central site (24 St. and 104 Ave.). Based on the average for the entire summer monitoring period, oxides of nitrogen (NO<sub>2</sub>, NO and NO<sub>x</sub>) concentrations were lowest at the west site (Goldstick Park) and highest at the south (91 Ave. and 24 St.), central (24 St. and 104 Ave.) and north (Meridian St. and 122 Ave.) sites. Higher oxides of nitrogen values at these locations are likely due to vehicle exhaust emissions on the major traffic arteries (Baseline Road, Yellowhead Trail, 17th Street and Meridian Street). Average oxides of nitrogen values for the summer survey days were lower than those measured at the Edmonton central and Edmonton east stations and slightly higher than those recorded in Fort Saskatchewan and Fort McMurray.

### Hydrogen Sulphide (H<sub>2</sub>S)

Max. 1-hour Average	1-hour Guideline
H <sub>2</sub> S = 0.003 ppm	0.010 ppm

Hydrogen sulphide (H<sub>2</sub>S) is a colourless gas with a rotten egg odour. Industrial sources of H<sub>2</sub>S 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<sub>2</sub>S include sulphur hot springs, sloughs, swamps and lakes.

The highest 1-hour average H<sub>2</sub>S concentration (0.003 ppm) recorded by the mobile monitoring unit occurred at the south site (91 Ave. and 24 St.) in the morning of July 11. This peak value is 30% of the 1-hour guideline. H<sub>2</sub>S concentrations showed little variation between monitoring locations in the Strathcona industrial area with average values ranging from 0.000 to 0.001 ppm. Average H<sub>2</sub>S values were also very low at other Alberta monitoring stations for the same time period. However, a 1-hour peak concentration of 0.010 ppm was recorded at the Strathcona Industrial Association (SIA) Beverly station between 5 and 6 p.m. on July 3.

### Sulphur Dioxide (SO<sub>2</sub>)

Max. 1-hour Average	1-hour Guideline
SO <sub>2</sub> = 0.017 ppm	0.170 ppm

Sulphur dioxide (SO<sub>2</sub>) is a colourless gas with a pungent odour. In Alberta, the major sources of SO<sub>2</sub> are natural gas processing plant incinerators and flares, oil sands facilities, and power plants. Other sources include oil refineries, pulp and paper mills and fertilizer plants.

The highest 1-hour average SO<sub>2</sub> concentration (0.017 ppm) was measured in the morning (8:20 to 9:20 a.m.) of July 3 at the east site (Petro Canada ball diamonds). This maximum value is 10% of the 1-hour guideline. The overall average SO<sub>2</sub> concentrations for the monitoring period ranged from 0.001 ppm at the west (Goldstick Park) and north (Meridian St. and 122 Ave.) sites to 0.005 ppm at the east (Petro Canada ball diamonds) and central (24 St. and 104 Ave.) sites. Higher values at the east and central sites are likely due to emissions from nearby oil and gas refineries. Overall average SO<sub>2</sub> concentrations measured during mobile monitoring in the Strathcona industrial area (0.003 ppm) were similar to those measured at the SIA Sherwood Park (0.003 ppm), SIA Beverly (0.004 ppm) and Edmonton east (0.003 ppm) stations. These average values are higher than those measured in Fort Saskatchewan (0.001 ppm) and Fort McMurray (0.001 ppm) for the same time period.

**Average Concentrations at Each Monitoring Site  
in the Strathcona Industrial Area (ppm)**

Monitoring Site	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>
south (91 Ave& 24 St)	0.023	0.017	0.008	0.009	2.1	0.001	0.002
east (ball diamonds)	0.025	0.011	0.006	0.005	2.0	0.001	0.005
west (Goldstick Park)	0.029	0.007	0.004	0.004	2.0	0.000	0.001
north (Mer St&122 Ave)	0.024	0.016	0.007	0.009	1.9	0.000	0.001
central (24 St&104 Ave)	0.026	0.016	0.008	0.008	2.1	0.001	0.005

**Overall Average Concentrations on All Summer Survey Days (ppm)**

Location	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>
Strathcona industrial area	0.025	0.013	0.007	0.007	2.0	0.001	0.003
Sherwood Park (mobile#1)	0.027	0.020	0.015	0.005	2.1	0.001	0.003
SIA Sherwood Park	no data				1.9	0.000	0.003
SIA Clover Bar	no data	0.024	0.013	0.012	no data		
SIA Elmjay	no data					0.000	0.002
SIA Gold Bar	no data					0.000	no data
SIA Beverly	no data					0.001	0.004
Edmonton Central	0.019	0.034	0.019	0.016	1.9	no data	
Edmonton East	0.024	0.021	0.012	0.009	2.5	0.001	0.003
Fort Saskatchewan	0.027	0.008	0.006	0.002	1.6	0.000	0.001
Fort McMurray	0.020	0.009	0.006	0.004	1.6	0.000	0.001

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

Location	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>
Strathcona industrial area	0.041	0.049	0.024	0.030	2.9	0.003	0.017
Sherwood Park (mobile#1)	0.043	0.039	0.027	0.022	2.5	0.002	0.032
SIA Sherwood Park	no data				2.2	0.002	0.016
SIA Clover Bar	no data	0.080	0.029	0.057	no data		
SIA Elmjay	no data					0.002	0.005
SIA Gold Bar	no data					0.001	no data
SIA Beverly	no data					0.010	0.023
Edmonton Central	0.032	0.068	0.038	0.037	2.3	no data	
Edmonton East	0.041	0.103	0.030	0.074	3.2	0.002	0.009
Fort Saskatchewan	0.042	0.032	0.016	0.016	2.0	0.002	0.004
Fort McMurray	0.035	0.088	0.042	0.050	2.0	0.002	0.001

## Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)

### July 03, 1997

Monitoring Site	Monitoring Period	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:04 to 08:07	0.006	0.040	0.012	0.028	2.5	0.002	0.003	11	SW/7	0%
east (ball diamonds)	08:19 to 09:20	0.016	0.029	0.014	0.015	2.3	0.002	0.017	14	SW/6	0%
west (Goldstick Park)	09:31 to 10:39	0.032	0.004	0.002	0.002	2.1	0.001	0.000	n/a	W-NW/3	n/a
north (Mer St&122 Ave)	10:52 to 11:52	0.031	0.007	0.004	0.003	1.8	0.002	0.000	19	NW-SW/6	20%
central (24 St&104 Ave)	12:09 to 13:09	0.035	0.007	0.004	0.003	2.0	0.001	0.004	20	W-NW/9	60%
south (91 Ave& 24 St)	13:16 to 14:16	0.039	0.001	0.001	0.001	1.7	0.001	0.003	n/a	NW-NE/8	40%
east (ball diamonds)	14:29 to 15:29	0.036	0.012	0.006	0.007	1.9	0.001	0.008	21	WNW/4	70%
west (Goldstick Park)	15:38 to 16:39	0.038	0.003	0.001	0.002	1.7	0.000	0.000	22	NW/6	70%
north (Mer St&122 Ave)	16:49 to 17:49	0.026	0.002	0.002	0.001	1.7	0.000	0.000	n/a	SW-NW/16	100%
central (24 St&104 Ave)	17:58 to 19:01	0.017	0.008	0.005	0.003	1.8	0.002	0.001	22	SW-SE/7	100%

### July 11, 1997

Monitoring Site	Monitoring Period	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:25 to 08:25	0.021	0.007	0.001	0.008	2.3	0.003	0.002	12	SSW/13	0%
east (ball diamonds)	08:35 to 09:34	0.028	0.000	0.000	0.001	2.0	0.001	0.002	12	SW/9	30%
west (Goldstick Park)	09:45 to 10:46	0.027	0.001	0.000	0.001	1.9	0.001	0.002	13	S/8	30%
north (Mer St&122 Ave)	11:00 to 12:00	0.023	0.009	0.003	0.007	1.7	0.000	0.003	15	SSW/7	60%
central (24 St&104 Ave)	12:12 to 13:13	0.024	0.010	0.002	0.007	2.0	0.001	0.001	16	SW/9	90%
south (91 Ave& 24 St)	13:23 to 14:25	0.013	0.018	0.015	0.003	no data	0.000	0.001	16	SW/10	100%
east (ball diamonds)	14:37 to 15:37	0.014	0.007	0.007	0.000	1.9	0.000	0.001	15	SSW/11	100%
west (Goldstick Park)	15:48 to 16:49	0.016	0.013	0.008	0.006	1.9	0.000	0.003	15	NE-SE/4	90%
north (Mer St&122 Ave)	17:05 to 18:05	0.014	0.024	0.008	0.015	1.9	0.000	0.001	13	S-SW/9	50%
central (24 St&104 Ave)	18:15 to 19:15	0.020	0.014	0.012	0.002	2.9	0.001	0.007	12	WSW/9	100%

### July 15, 1997

Monitoring Site	Monitoring Period	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:16 to 08:16	0.020	0.017	0.007	0.010	1.9	0.000	0.002	19	NW/14	0%
east (ball diamonds)	08:27 to 09:28	0.025	0.009	0.004	0.005	2.1	0.000	0.008	20	NW-SE/7	0%
west (Goldstick Park)	09:39 to 10:41	0.031	0.001	0.000	0.001	1.9	0.000	0.000	20	WNW-NE/12	0%
north (Mer St&122 Ave)	10:57 to 11:58	0.028	0.022	0.004	0.018	2.0	0.000	0.001	21	W/16	0%
central (24 St&104 Ave)	12:08 to 13:12	0.033	0.009	0.004	0.006	2.2	0.001	0.008	22	NW-SW/15	0%
south (91 Ave& 24 St)	13:21 to 14:21	0.035	0.003	0.001	0.002	1.9	0.000	0.001	23	NW-NE/15	0%
east (ball diamonds)	14:31 to 15:31	0.034	0.009	0.006	0.003	1.9	0.000	0.006	24	SW-NW/13	10%
west (Goldstick Park)	15:43 to 16:50	0.036	0.002	0.001	0.002	1.9	0.000	0.001	25	NW/10	10%
north (Mer St&122 Ave)	17:03 to 18:03	0.029	0.016	0.007	0.009	1.9	0.000	0.001	24	NNW-E/9	50%
central (24 St&104 Ave)	18:28 to 19:28	0.020	0.049	0.019	0.030	1.9	0.000	0.002	24	NW-SW/8	30%

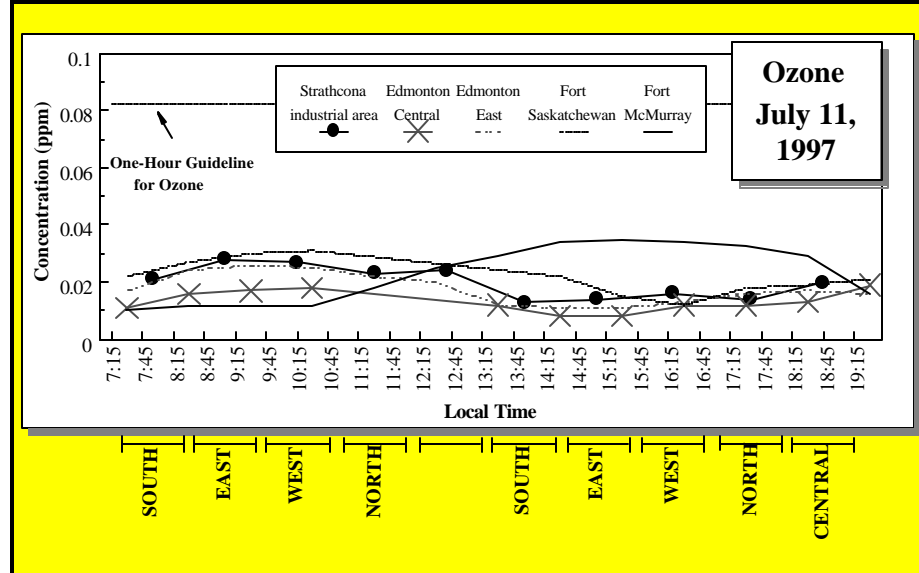
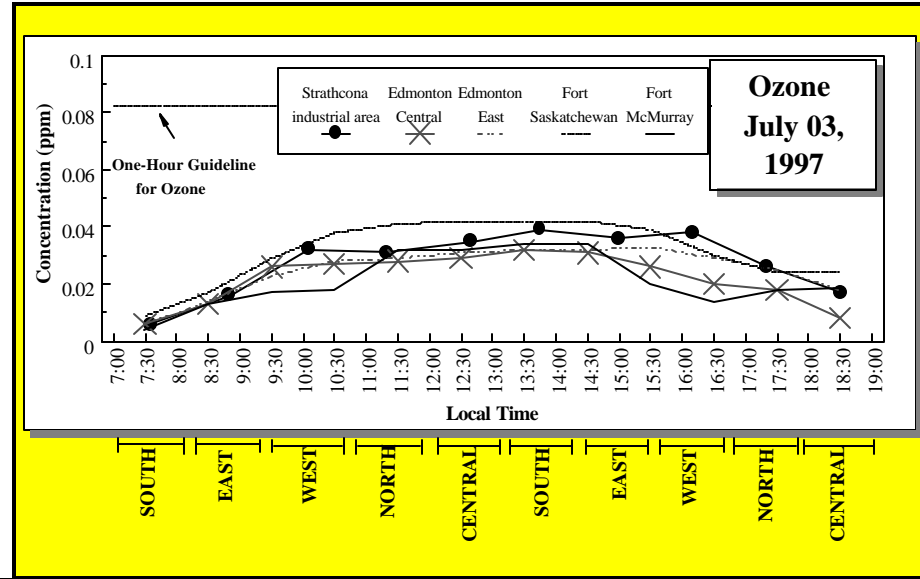
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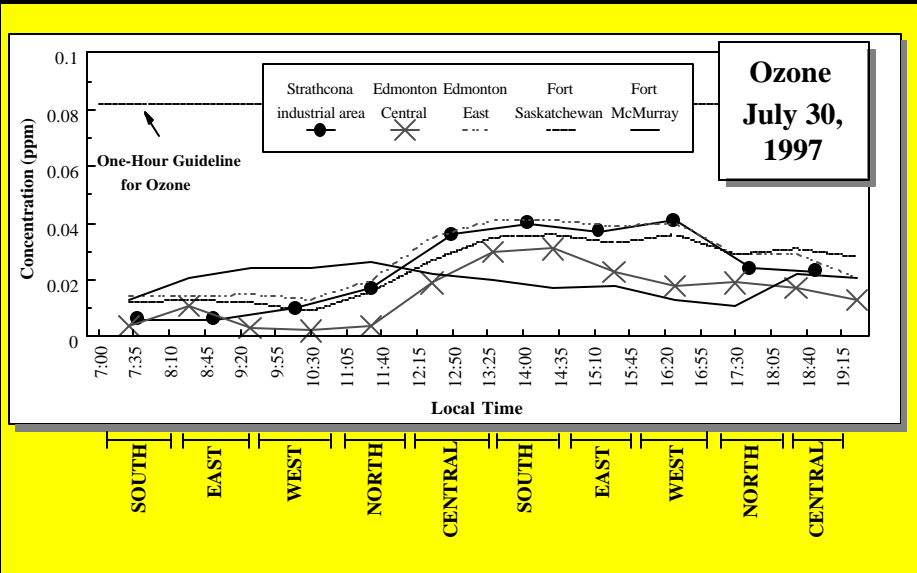
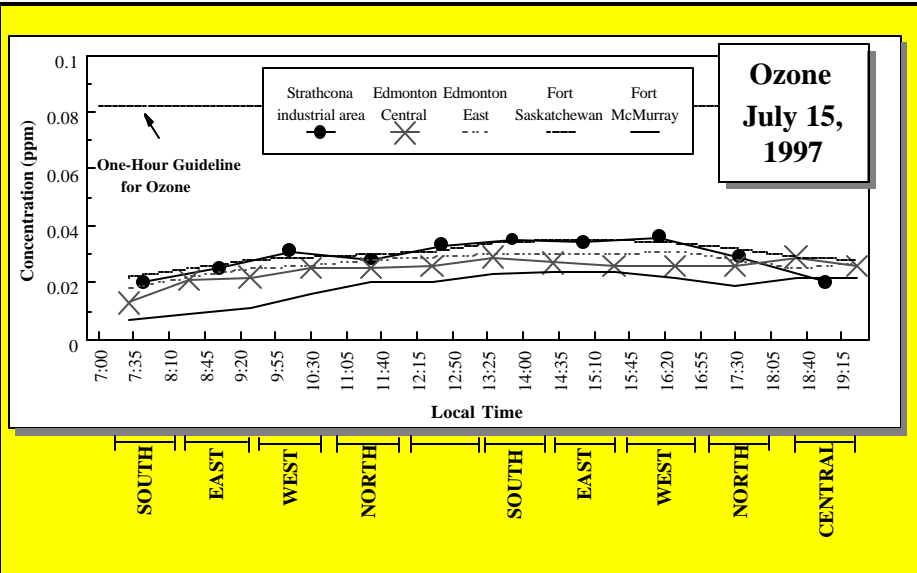
Monitoring Site	Monitoring Period	O <sub>3</sub>	NO <sub>x</sub>	NO <sub>2</sub>	NO	THC	H <sub>2</sub> S	SO <sub>2</sub>	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:08 to 08:11	0.006	0.041	0.024	0.017	2.4	0.001	0.001	18	SSE-SSW/2	100%
east (ball diamonds)	08:23 to 09:28	0.006	0.017	0.011	0.006	2.1	0.000	0.000	20	NE/2	100%
west (Goldstick Park)	09:39 to 10:49	0.010	0.028	0.016	0.012	2.6	0.001	0.004	20	ENE-ESE/6	100%
north (Mer St&122 Ave)	11:02 to 12:02	0.017	0.015	0.006	0.008	2.1	0.000	0.002	20	SSE/12	100%
central (24 St&104 Ave)	12:12 to 13:26	0.036	0.010	0.006	0.004	2.2	0.001	0.002	23	SE/15	70%
south (91 Ave& 24 St)	13:34 to 14:34	0.040	0.007	0.004	0.003	1.9	0.000	0.002	24	SE/17	90%
east (ball diamonds)	14:46 to 15:46	0.037	0.003	0.002	0.001	1.9	0.000	0.001	25	SE/14	100%
west (Goldstick Park)	15:56 to 17:01	0.041	0.006	0.004	0.002	2.2	0.000	0.001	25	SE/10	50%
north (Mer St&122 Ave)	17:14 to 18:16	0.024	0.031	0.020	0.011	2.1	0.000	0.002	27	SW/10	80%
central (24 St&104 Ave)	18:26 to 19:15	0.023	0.020	0.012	0.007	2.1	0.002	0.015	25	N/11	100%

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

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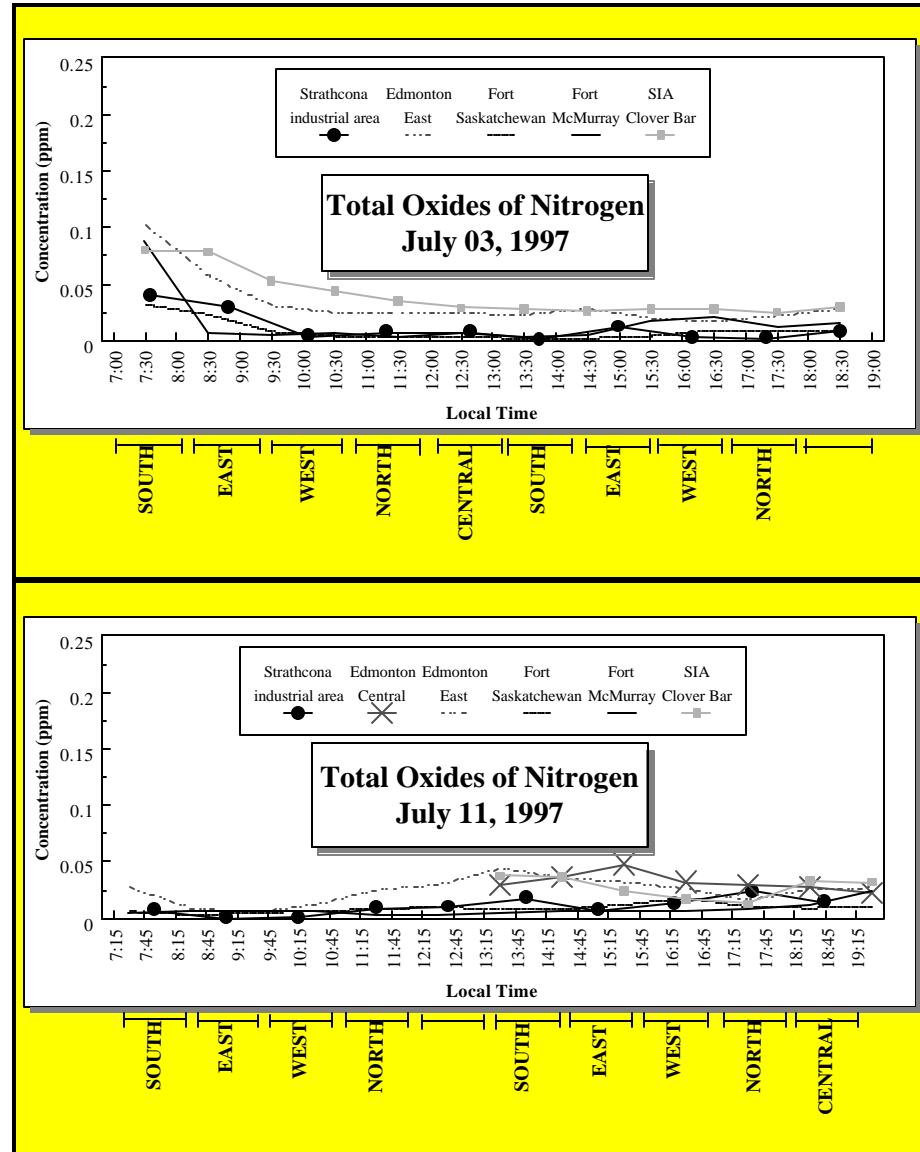
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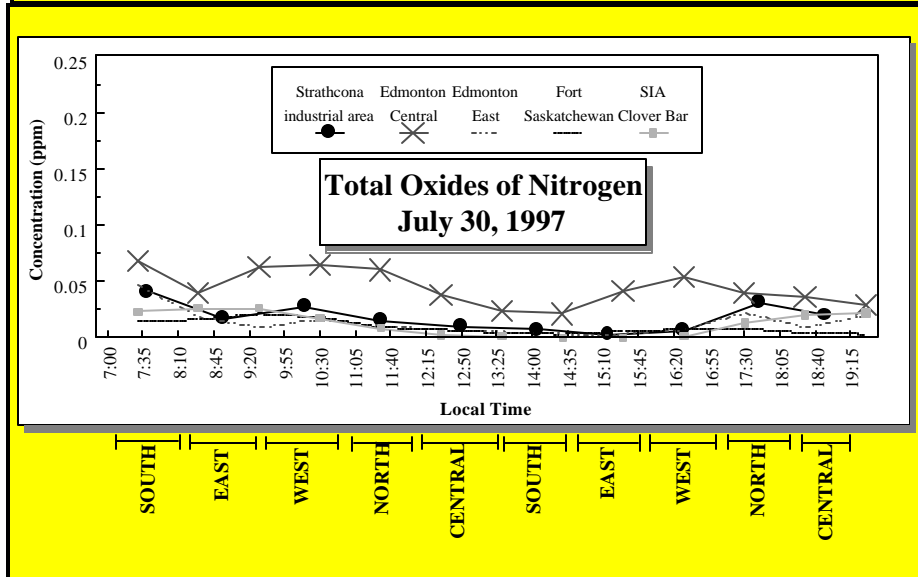
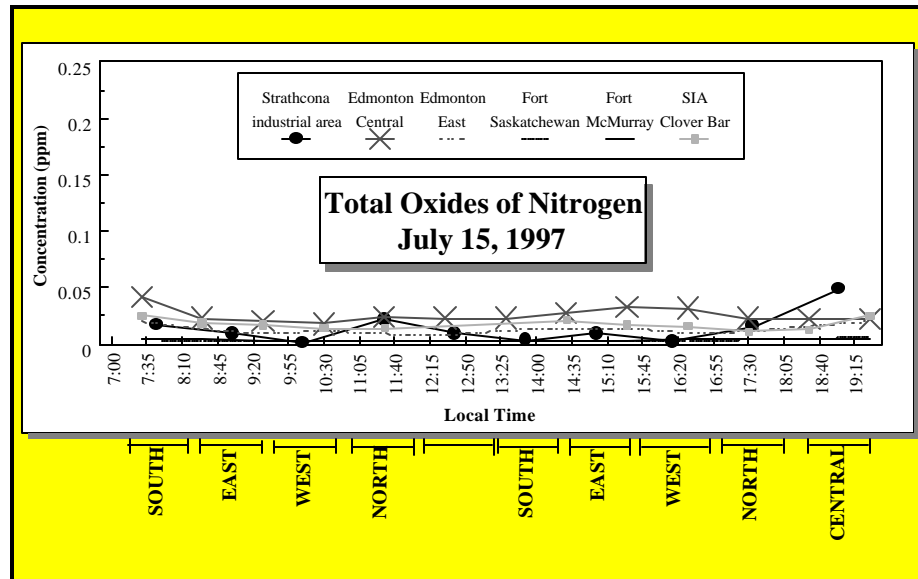




# Summer, 1997

## Average Total Oxides of Nitrogen Concentrations in Strathcona Industrial Area

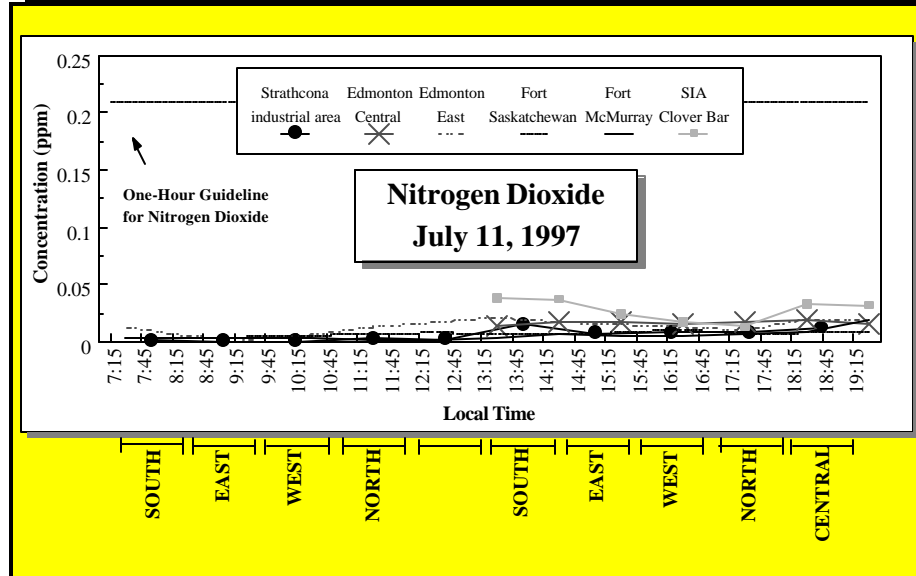
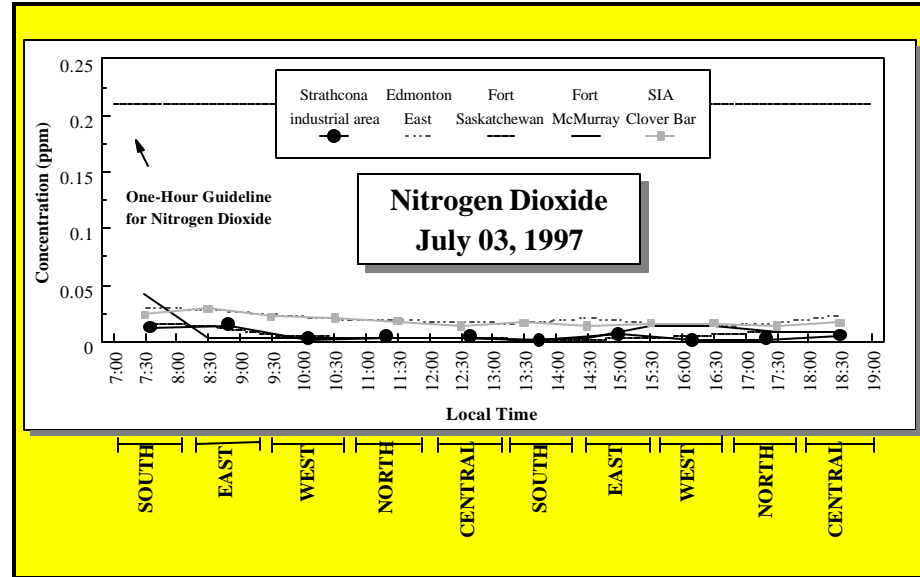


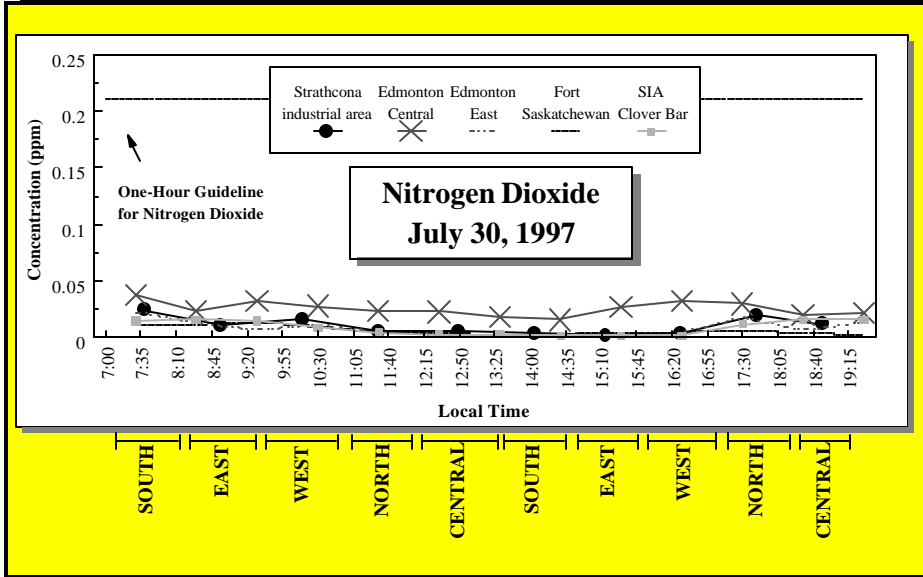
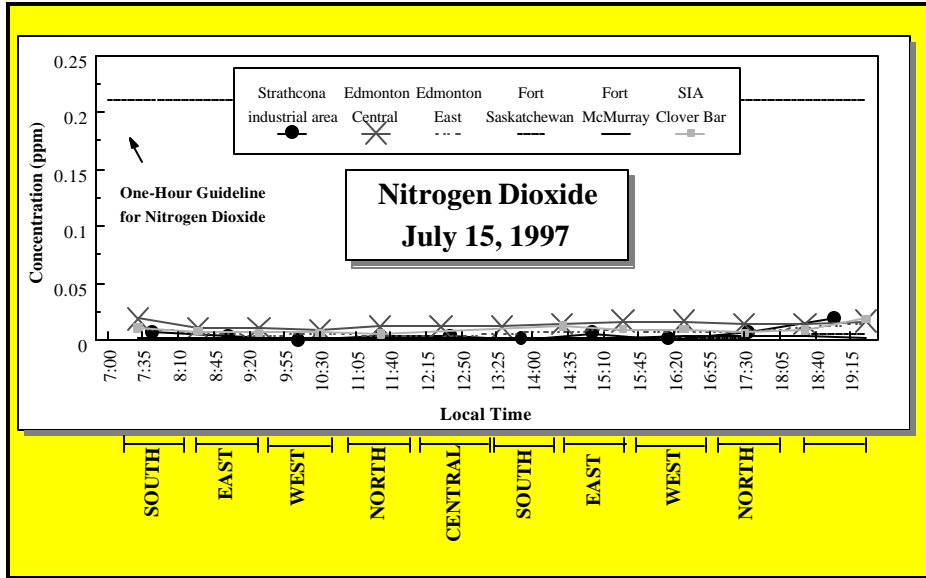




# Summer, 1997

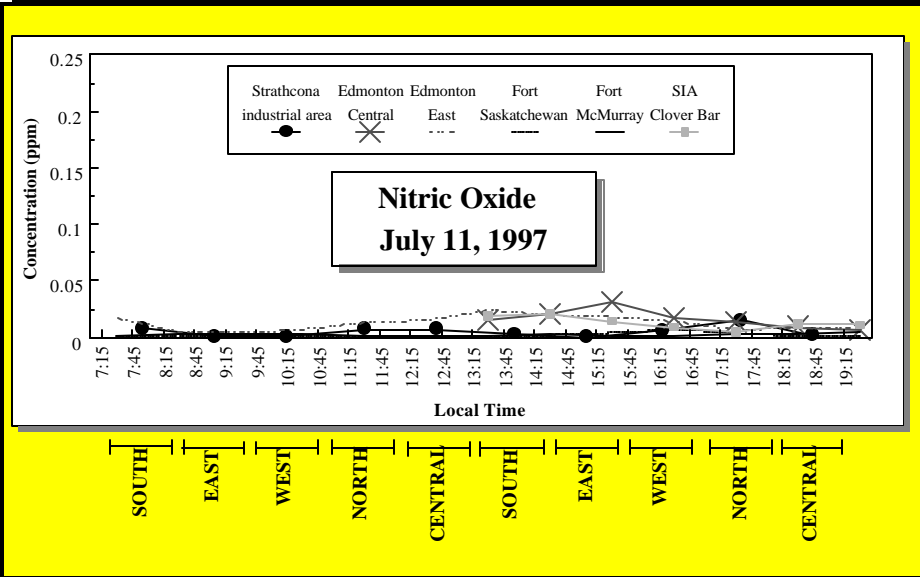
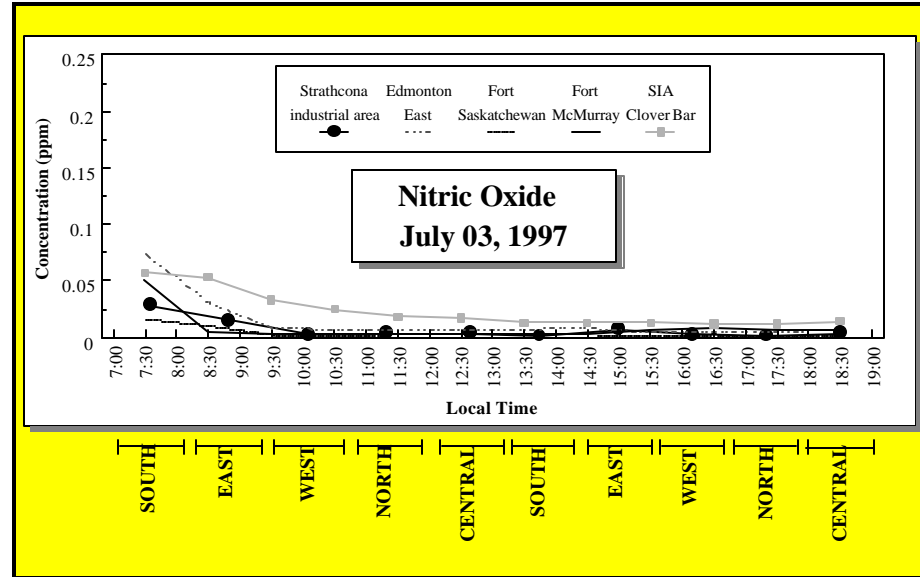
## Average Nitrogen Dioxide Concentrations in Strathcona Industrial Area

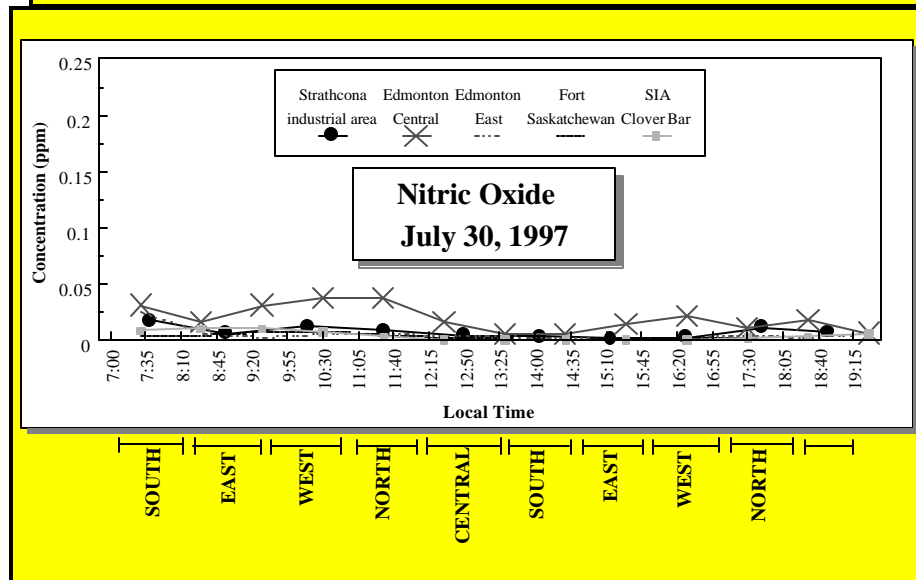
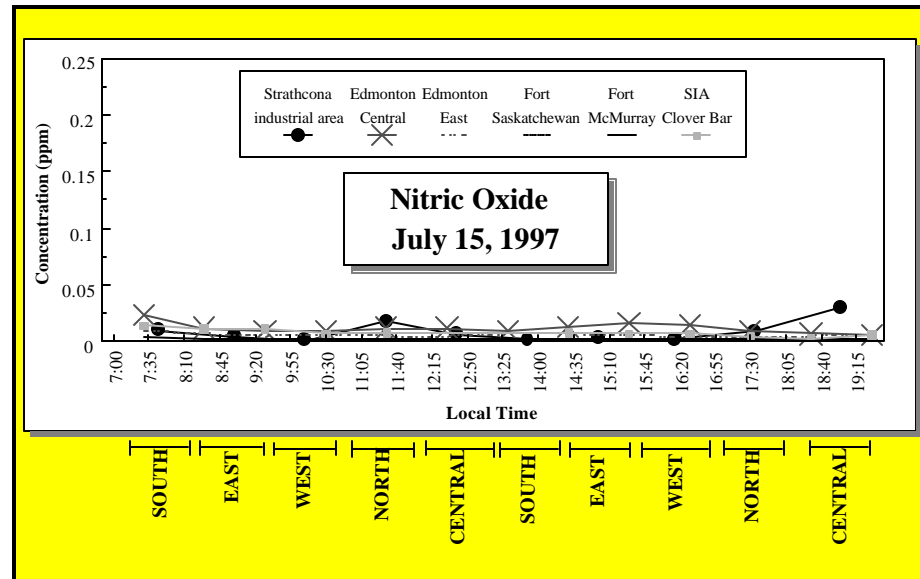




# Summer, 1997

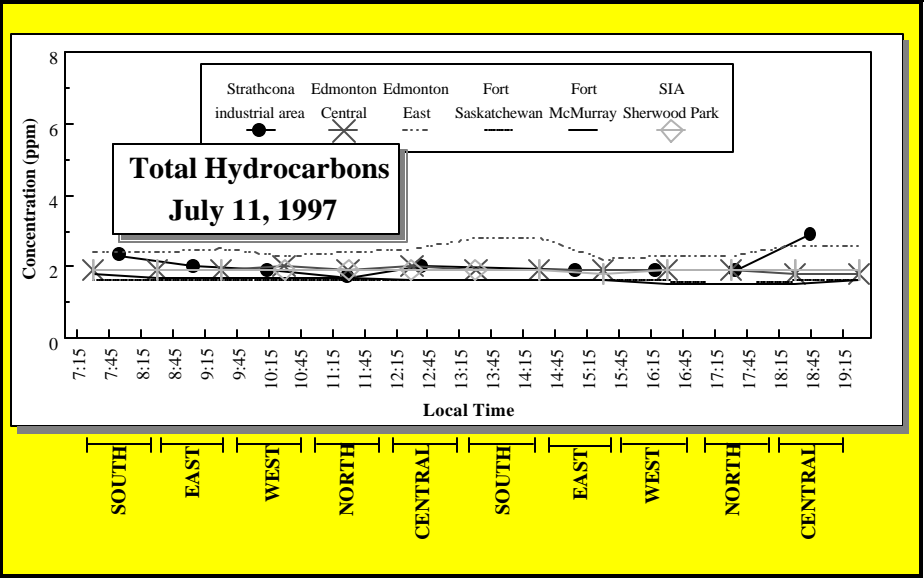
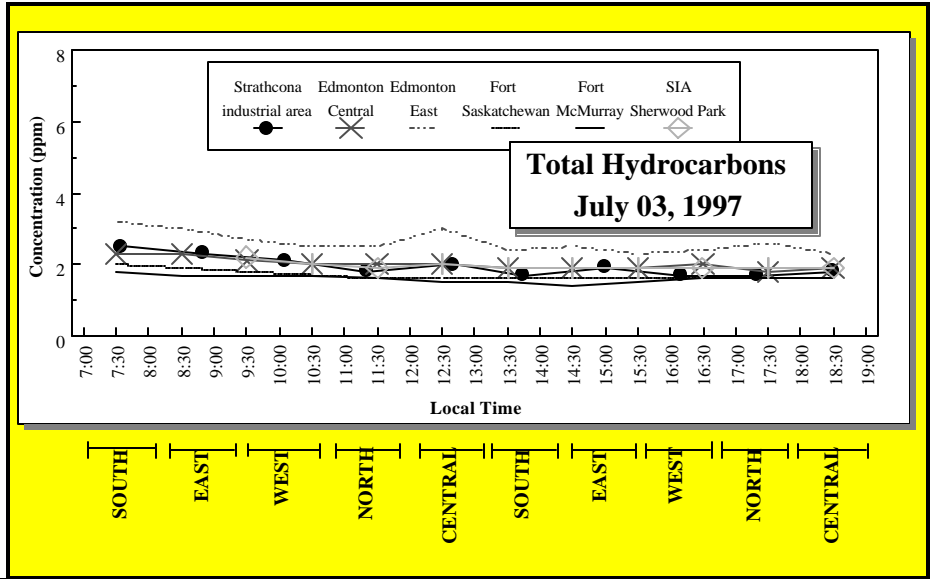
## Average Nitric Oxide Concentrations in Strathcona Industrial Area

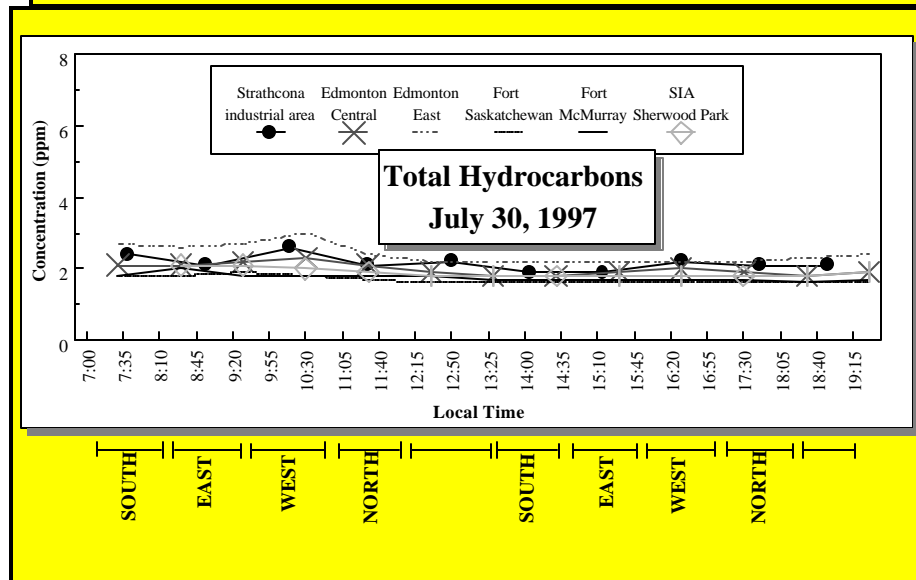
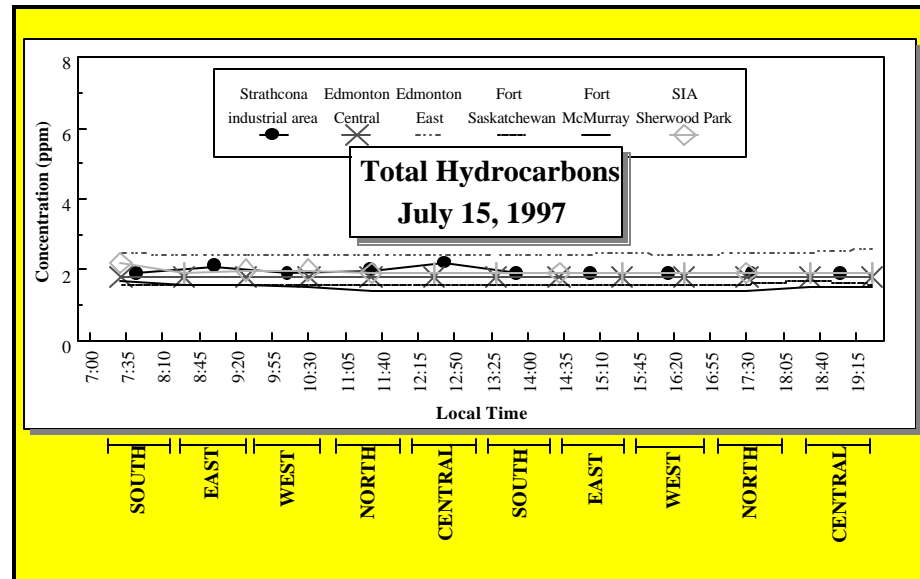




## Summer, 1997

Average Total Hydrocarbon Concentrations in Strathcona Industrial Area

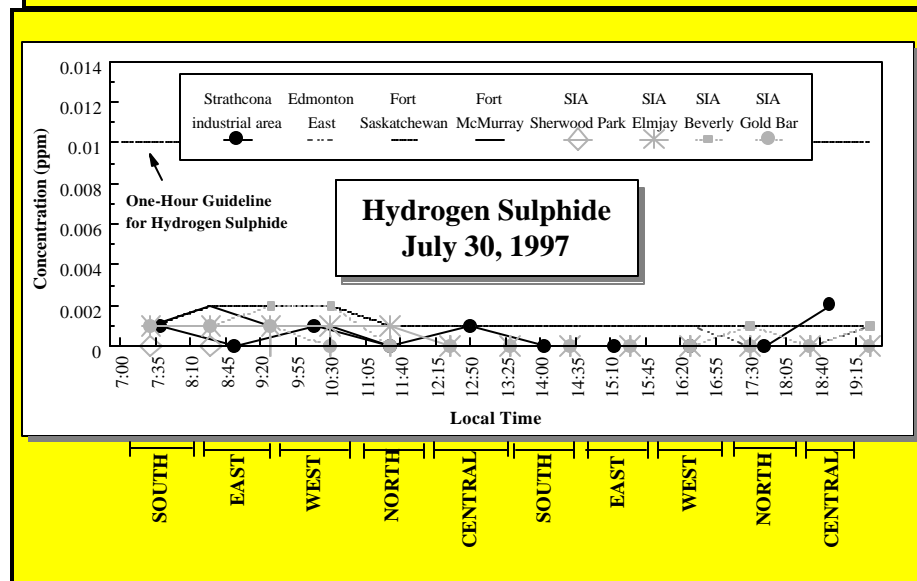
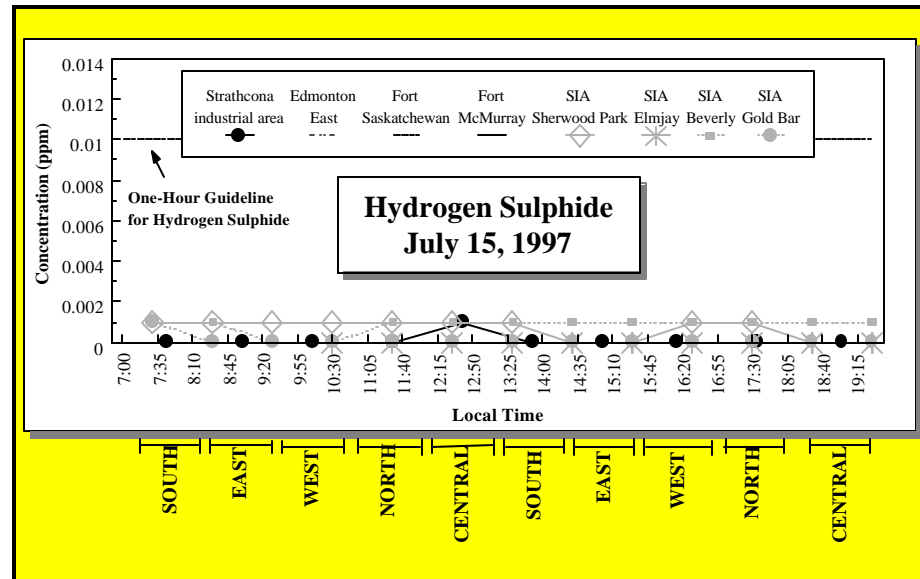




## Summer, 1997

Average Hydrogen Sulphide Concentrations in Strathcona Industrial Area





**Summer, 1997**

**Average Sulphur Dioxide Concentrations in Strathcona Industrial Area**





