

Air Quality Monitoring in Strathcona Industrial Area

Fall, 1997 (October 7 and November 6)

Alberta Environmental Protection conducted an air quality monitoring study in the Strathcona industrial area east of Edmonton beginning in the fall of 1996 and ending in the fall of 1997. 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 following report is a summary of mobile air quality monitoring activities in the Strathcona industrial area during the fall of 1997 (October 7 and November 6).

Air quality was measured using a mobile monitoring unit at seven 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 #1), the off ramp from Hwy. 14X to Baseline Rd. (east site #2), 24 St. and 104 Ave. (central site), near 91 Ave. and 24 St. (south site #1), 92 Ave. and Hwy. 14X (south site #2) 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

- L Concentrations of air quality parameters monitored in the Strathcona industrial area were below the air quality guidelines. Maximum 1-hour average concentrations were:
 - < 33% of the 1-hour guideline for O_3 ;
 - < 12% of the 1-hour guideline for NO_2 ;
 - < 20% of the 1-hour guideline for H_2S ; and
 - < 18% of the 1-hour guideline for SO_2 .

- L The highest oxides of nitrogen and hydrocarbon concentrations were recorded during the morning rush hour traffic. Slight increases in concentrations of these chemicals were also evident during the afternoon rush hour traffic. The major sources of these chemicals are vehicle exhaust emissions from traffic arteries in the industrial area. Industrial sources may have also contributed to hydrocarbon concentrations on the fall survey days.

- L H_2S and SO_2 concentrations were generally very low on both survey days. However, an elevated SO_2 value of 0.031 ppm was recorded on the Hwy 14X off ramp to Baseline Road in the afternoon of October 7.

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.027 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.

The daily variation of O_3 concentrations in the Strathcona industrial area followed the same pattern that is usually observed at Alberta locations (lowest values in the morning and highest values in the afternoon). The highest 1-hour average O_3 values were measured between noon and 3:30 p.m. on November 6. Average O_3 concentrations for the two survey days were highest at the west site (Goldstick Park) likely because of less influence from vehicle exhaust emissions at this location. Average O_3 concentrations on the two fall survey days in the Strathcona industrial area (0.014 ppm) were similar to those recorded in Sherwood Park (0.012 ppm), Fort Saskatchewan (0.013 ppm) and Fort McMurray (0.019 ppm) for the same time period. The average O_3 value measured at a background station located 65 km northwest of Hinton was 0.029 ppm for the two fall survey days. O_3 concentrations are generally the lowest during the fall season.

Total Hydrocarbons (THC)

Max. 1-hour Average	1-hour Guideline
THC = 2.6 ppm	no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane, a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Reactive

hydrocarbons 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 maximum 1-hour average THC value of 2.6 ppm was measured in the morning on November 6 at the south (91 Ave. and 24 St.) and north (Meridian St. and 122 Ave.) sites. Average THC concentrations ranged from 1.8 ppm at the west site (Goldstick Park) to 2.1 ppm at the south site (91 Ave. and 24 St.). Overall average THC concentrations in the Strathcona industrial area (2.0 ppm) were slightly higher than those recorded in Fort Saskatchewan (1.8 ppm) and Fort McMurray (1.8 ppm), and lower than the average values measured at the Edmonton east (2.5 ppm) and Edmonton central (2.2 ppm) stations for the fall survey days. The major sources of hydrocarbons in the industrial area are vehicle exhaust emissions and fugitive emissions from industrial sources. Normal background THC concentrations are between 1.5 and 2.0 ppm.

Oxides of Nitrogen (NO₂, NO, NO_x)

Max. 1-hour Average	1-hour Guideline
NO ₂ = 0.025 ppm	0.210 ppm
NO = 0.033 ppm	no guideline
NO _x = 0.096 ppm	no guideline

Oxides of nitrogen (NO_x) are the sum of nitrogen dioxide (NO₂) 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 NO₂. NO₂ is a reddish-brown gas with a pungent odour.

The maximum 1-hour average NO₂ concentration was recorded at the central site (24 St. and 104 Ave.) between 7:30 and 8:30 pm on November 6. This maximum value is 12% of the 1-hour guideline for NO₂. NO and NO₂ data are not available for October 7 due to equipment malfunction. The maximum NO_x concentration was measured in the morning on October 7 at the south site (91 Ave. and 24 St.). Average NO₂ concentrations on November 6 ranged from 0.009 ppm at the west site (Goldstick Park) to close to 0.018 ppm at the remaining locations in the Strathcona industrial area. Lower values at the west site are likely due to less vehicles in the vicinity of Goldstick Park. Overall average NO₂ concentrations in the Strathcona industrial area (0.016 ppm) were close to those recorded in Sherwood Park (0.018 ppm), at the Edmonton east station

(0.018 ppm), and at the Strathcona Industrial Association (SIA) Clover Bar station (0.018 ppm). NO₂ concentrations were higher than those recorded in Fort Saskatchewan (0.011 ppm) and Fort McMurray (0.008 ppm) for the same time period.

Hydrogen Sulphide (H₂S)

Max. 1-hour Average	1-hour Guideline
H ₂ S = 0.002 ppm	0.010 ppm

Hydrogen sulphide (H₂S) is a colourless gas with a rotten egg odour. Industrial sources of H₂S 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 H₂S include sulphur hot springs, sloughs, swamps and lakes.

H₂S concentrations were very low at all locations in the Strathcona industrial area on October 7 and November 6. The maximum 1-hour average H₂S concentration was measured at the south (91 Ave. and 24 St.) monitoring site in the morning on November 6. Winds were from the northeast direction when H₂S was detected at this location. Major sources of H₂S in the industrial area are fugitive emissions from industrial sources and/or the sewage treatment plant.

Sulphur Dioxide (SO₂)

Max. 1-hour Average	1-hour Guideline
SO ₂ = 0.031 ppm	0.170 ppm

Sulphur dioxide (SO₂) is a colourless gas with a pungent odour. In Alberta, the major sources of SO₂ 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.

SO₂ concentrations were very low at most monitoring sites on the October 7 and November 6 survey days. The exception to this was on the afternoon of October 7 when a maximum 1-hour average SO₂ concentration of 0.031 ppm was recorded on the Hwy 14X off ramp to Baseline Road. This value is 18% of the 1-hour guideline for SO₂. Winds were from the west-northwest with a speed of 18 km/h during this period. The most probable source of this elevated SO₂ value is stack emissions from the Petro Canada refinery. Elevated SO₂ concentrations were not detected in Sherwood Park during this period. Overall average SO₂ concentrations measured in the Strathcona industrial area (0.004 ppm) were higher than those recorded in Sherwood Park (0.000 ppm), Fort

Saskatchewan (0.002 ppm) and Fort McMurray (0.001 ppm) during the fall survey days.

A Map of location of monitoring sites in the Strathcona industrial area can be viewed at the Special Air Quality Surveys' page: <http://www.gov.ab.ca/env/air/airqual/special.html>

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

Monitoring Site	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂
south (91 Ave& 24 St)	0.011	0.056	0.018	0.018	2.1	0.001	0.003
east (ball diamonds)	0.013	0.019	0.018	0.006	2.0	0.001	0.002
west (Goldstick Park)	0.021	0.008	0.009	0.001	1.8	0.001	0.002
north (Mer St&122 Ave)	0.013	0.024	0.016	0.020	2.0	0.001	0.002
central (24 St&104 Ave)	0.015	0.015	0.018	0.003	1.9	0.001	0.003
south (92 Ave.&Hwy 14X)	0.010	0.007	no data		2.0	0.000	0.001
east (Bsln. Rd.&Hwy 14X)	0.007	0.038	no data		1.9	0.000	0.031

Overall Average Concentrations on All Fall Survey Days (ppm)

Location	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂
Strathcona industrial area	0.014	0.024	0.016	0.009	2.0	0.001	0.004
Sherwood Park (mobile#1)	0.012	0.031	0.018	0.013	2.2	0.000	0.000
SIA Sherwood Park	no data				2.1	0.001	0.002
SIA Clover Bar	no data	0.038	0.018	0.021	no data		
SIA Elmjay	no data					0.001	0.006
SIA Gold Bar	no data					0.000	no data
SIA Beverly	no data					0.000	0.001
Edmonton Central	0.009	0.071	0.030	0.041	2.2	no data	
Edmonton East	0.010	0.036	0.018	0.019	2.5	0.000	0.001
Fort Saskatchewan	0.013	0.023	0.011	0.012	1.8	0.000	0.002
Fort McMurray	0.019	0.026	0.008	0.019	1.8	0.001	0.001

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

Location	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂
Strathcona industrial area	0.027	0.096	0.025	0.033	2.6	0.002	0.031
Sherwood Park (mobile#1)	0.023	0.073	0.030	0.052	2.8	0.001	0.003
SIA Sherwood Park	no data				2.6	0.002	0.006
SIA Clover Bar	no data	0.117	0.032	0.089	no data		
SIA Elmjay	no data					0.002	0.027
SIA Gold Bar	no data					0.002	no data
SIA Beverly	no data					0.001	0.003
Edmonton Central	0.015	0.103	0.038	0.072	2.4	no data	
Edmonton East	0.022	0.094	0.031	0.067	4.2	0.001	0.006
Fort Saskatchewan	0.026	0.082	0.028	0.058	2.1	0.001	0.006
Fort McMurray	0.026	0.183	0.027	0.157	2.5	0.002	0.002

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

October 07, 1997

Monitoring Site	Monitoring Period	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:07 to 08:07	0.003	0.096	no data		1.8	0.001	0.004	3	NW/10	100%
east (ball diamonds)	08:52 to 09:52	0.010	0.012	no data		1.7	0.000	0.001	3	NW/16	100%
west (Goldstick Park)	10:10 to 11:10	0.010	0.006	no data		1.7	0.000	0.000	3	NW/11	100%
north (Mer St&122 Ave)	11:40 to 12:40	0.012	0.002	no data		1.7	0.000	0.001	3	WNW/16	100%
central (24 St&104 Ave)	12:54 to 13:54	0.010	0.005	no data		2.0	0.001	0.001	3	NW/13	100%
south (92 Ave.&Hwy 14X)	14:06 to 15:06	0.010	0.007	no data		2.0	0.000	0.001	3	SW/23	100%
east (ball diamonds)	15:17 to 16:13	0.009	0.016	no data		1.6	0.000	0.001	3	NNW/18	100%
east (Bsln. Rd.&Hwy 14X)	16:27 to 17:27	0.007	0.038	no data		1.9	0.000	0.031	3	WNW/18	100%

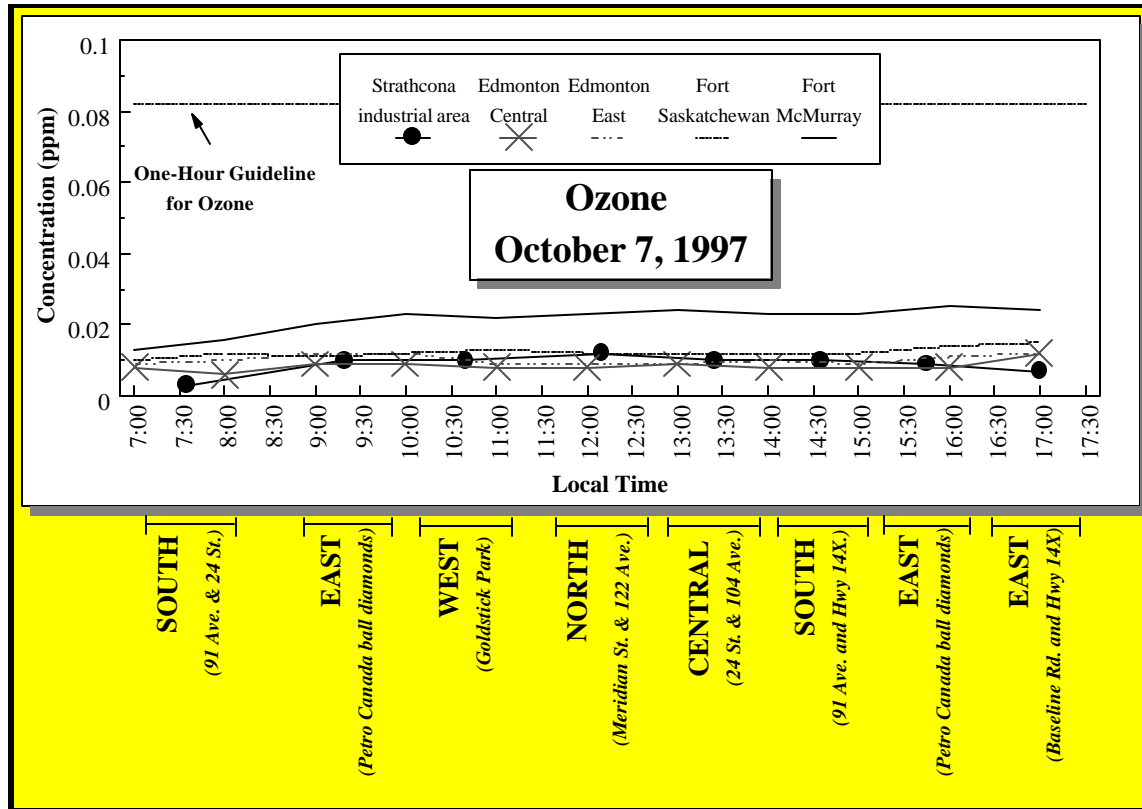
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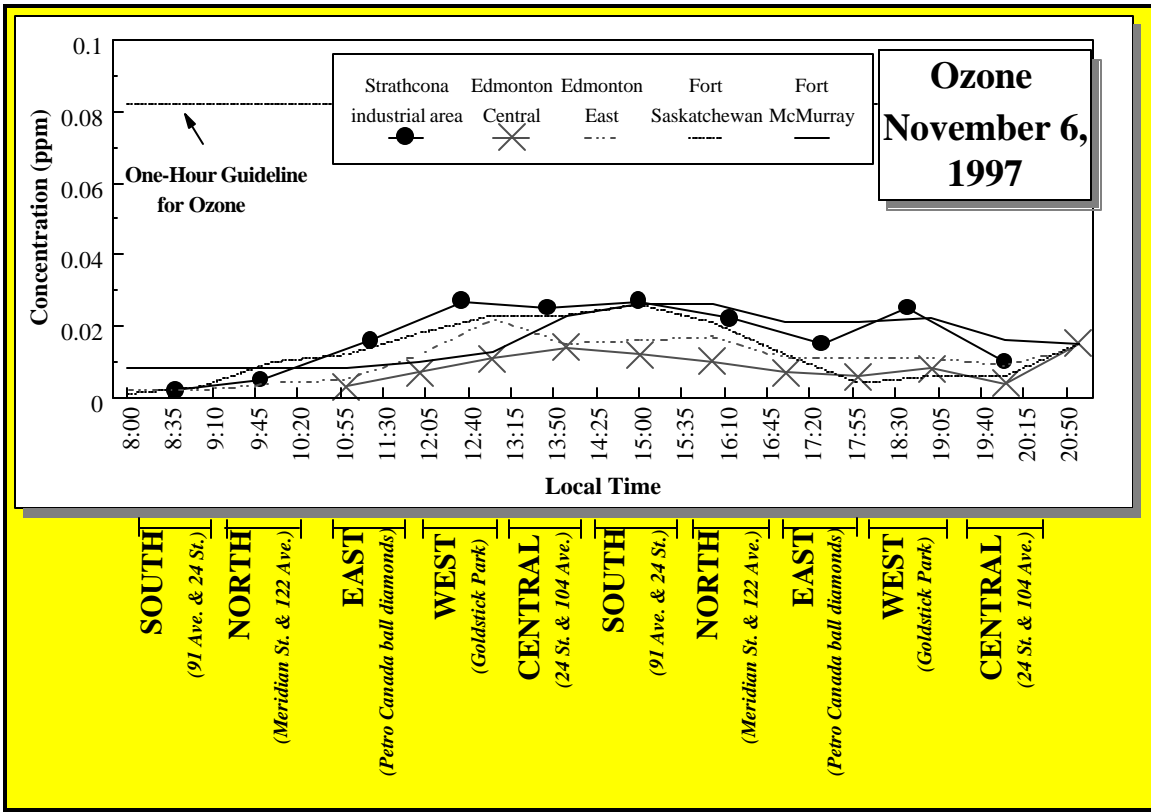
Monitoring Site	Monitoring Period	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	08:09 to 09:09	0.002	0.057	0.024	0.033	2.6	0.002	0.003	6	NE/5	70%
north (Mer St&122 Ave)	09:22 to 10:22	0.005	0.049	0.019	0.030	2.6	0.001	0.000	6	NE/1	70%
east (ball diamonds)	10:49 to 11:49	0.016	0.021	0.014	0.007	2.2	0.001	0.001	6	E/12	90%
west (Goldstick Park)	12:03 to 13:03	0.027	0.009	0.007	0.002	1.9	0.001	0.001	6	SE/10	85%
central (24 St&104 Ave)	13:13 to 14:13	0.025	0.016	0.011	0.005	1.7	0.001	0.002	6	NW/13	90%
south (91 Ave& 24 St)	14:23 to 15:31	0.027	0.014	0.012	0.002	1.9	0.000	0.002	6	SE/13	95%
north (Mer St&122 Ave)	15:45 to 16:46	0.022	0.020	0.012	0.009	1.7	0.001	0.004	6	SE/5	100%
east (ball diamonds)	16:57 to 17:58	0.015	0.027	0.022	0.005	2.3	0.001	0.005	6	E/7	100%
west (Goldstick Park)	18:08 to 19:12	0.025	0.010	0.011	0.000	1.8	0.001	0.004	6	NW/4	100%
central (24 St&104 Ave)	19:30 to 20:31	0.010	0.025	0.025	0.001	2.1	0.001	0.007	6	NW/2	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].

Fall, 1997

Average Ozone Concentrations in Strathcona Industrial Area





SOUTH
(91 Ave. & 24 St.)

NORTH
(Meridian St. & 122 Ave.)

EAST
(Petro Canada ball diamonds)

WEST
(Goldstick Park)

CENTRAL
(24 St. & 104 Ave.)

SOUTH
(91 Ave. & 24 St.)

NORTH
(Meridian St. & 122 Ave.)

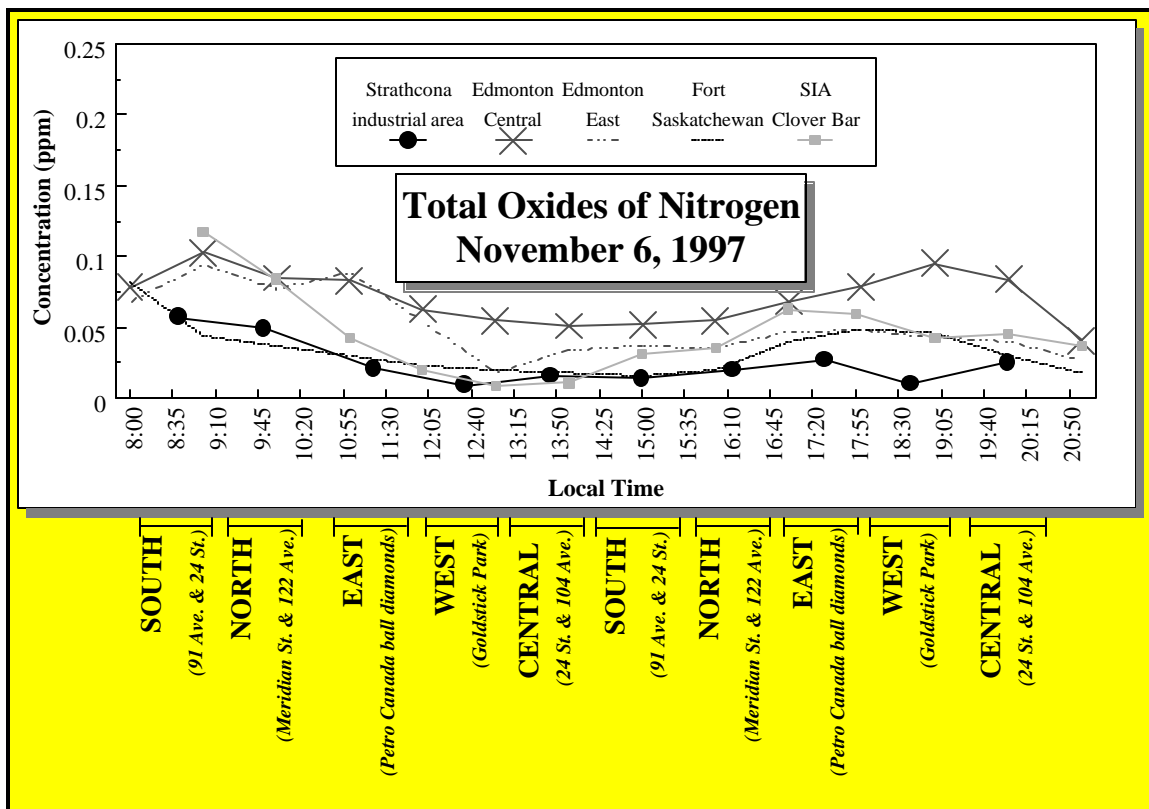
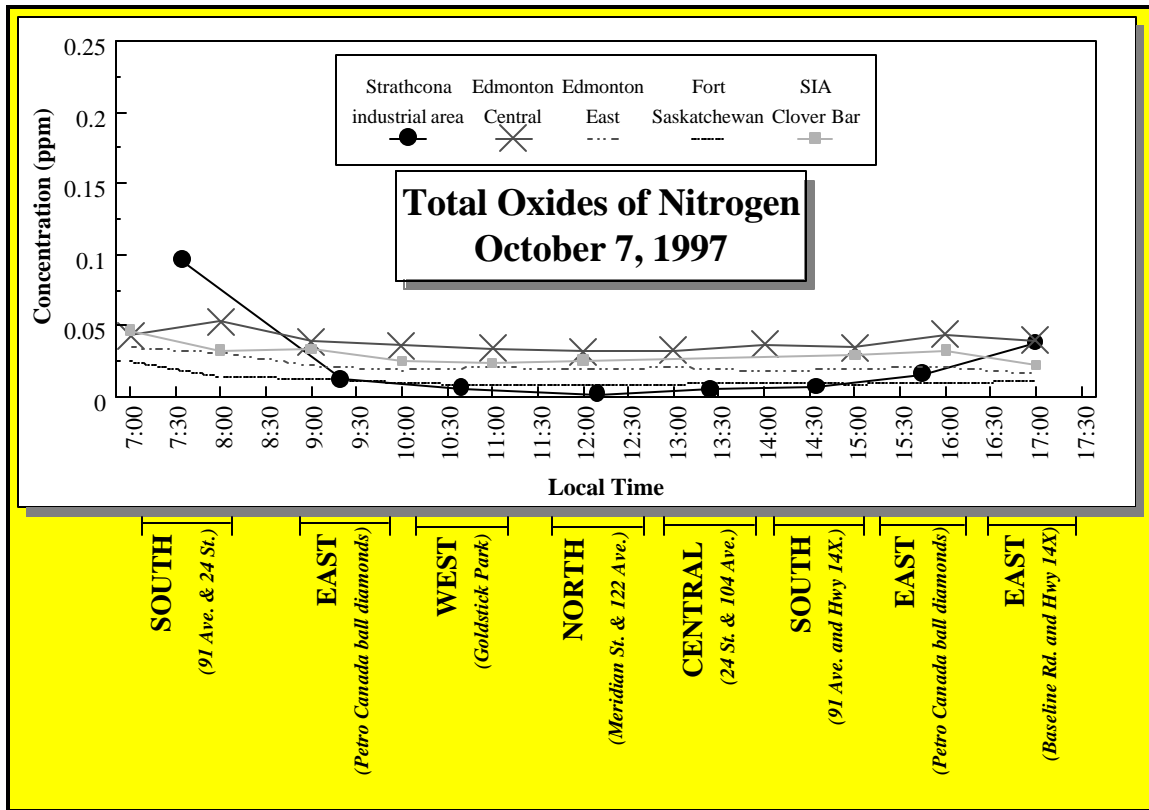
EAST
(Petro Canada ball diamonds)

WEST
(Goldstick Park)

CENTRAL
(24 St. & 104 Ave.)

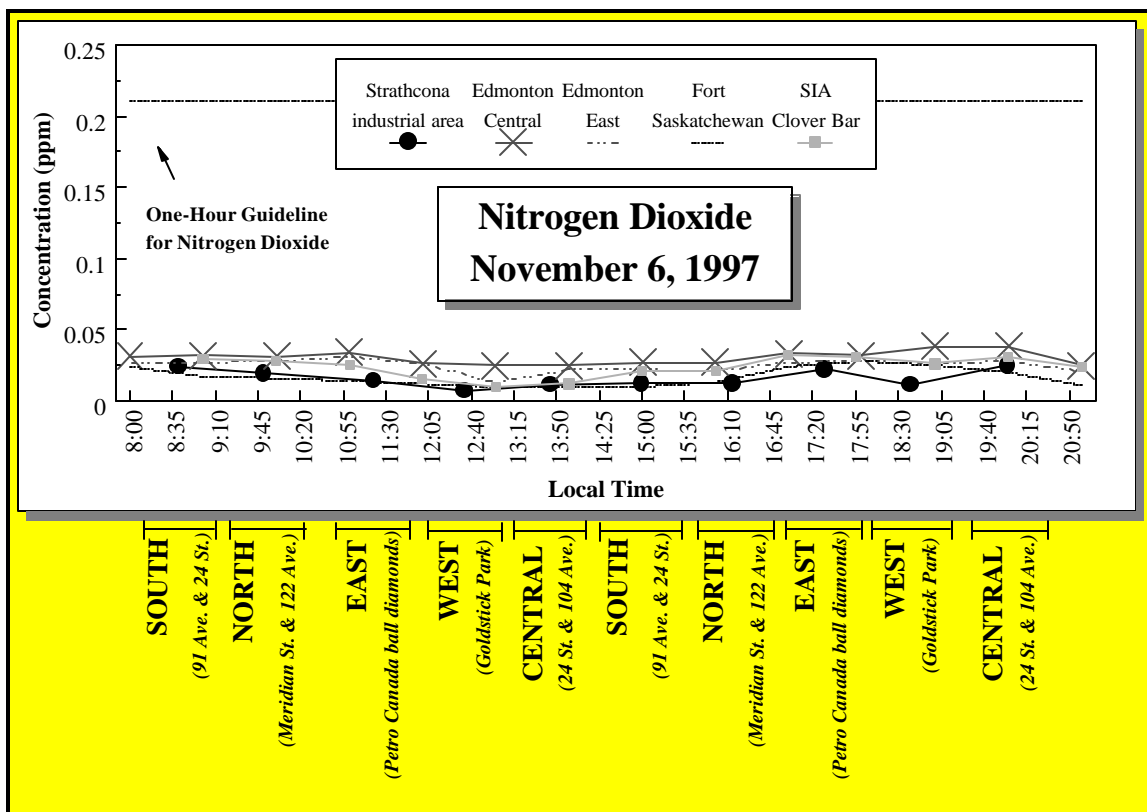
Fall, 1997

Average Total Oxides of Nitrogen Concentrations in Strathcona Industrial Area



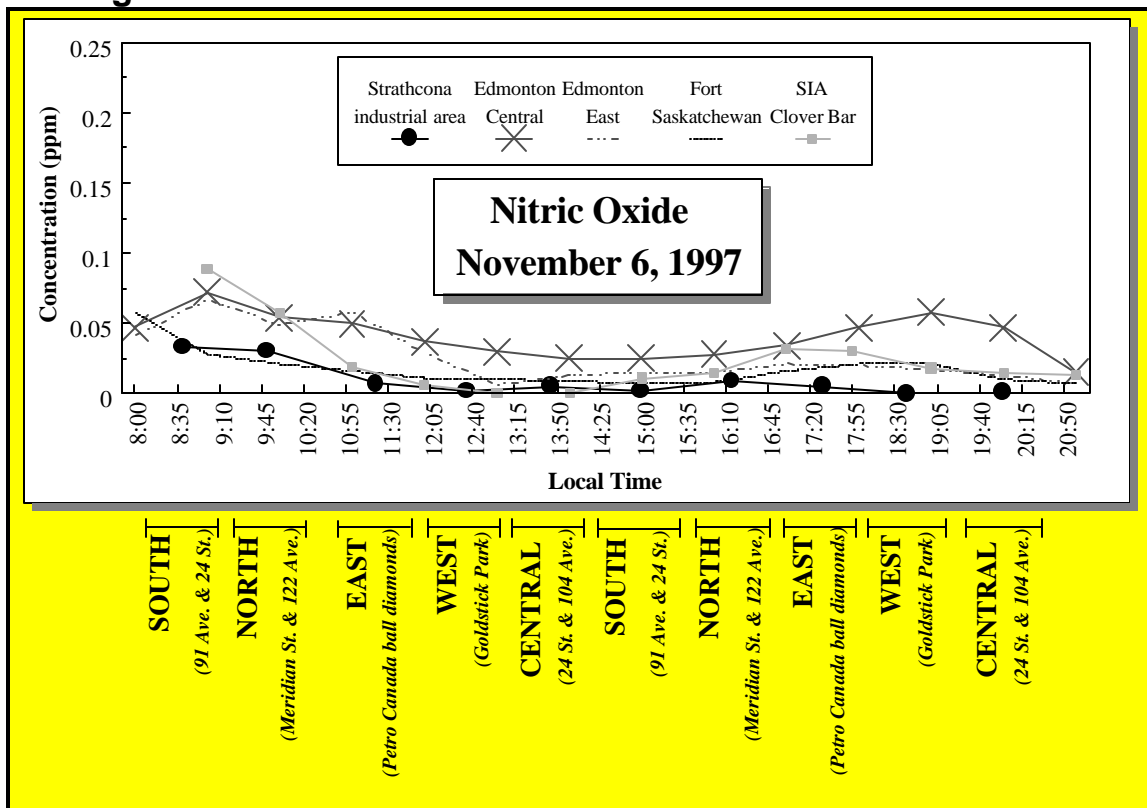
Fall, 1997

Average Nitrogen Dioxide Concentrations in Strathcona Industrial Area



Fall, 1997

Average Nitric Oxide Concentrations in Strathcona Industrial Area



Fall, 1997

Average Total Hydrocarbon Concentrations in Strathcona Industrial Area

