

Air Quality Monitoring in the Strathcona Industrial Area

Spring, 1997 (March 26, May 15, May 28, and May 30)

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 six locations in the Strathcona industrial area. Monitoring was conducted at Meridian St. and 122 Ave. (north site #1), Meridian St. and 130 Ave. (north site #2), 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.

The following is a summary of the results of the mobile air quality monitoring activities in the Strathcona industrial area during the spring of 1997 (March 26, May 15, May 28 and May 30). 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 by the mobile monitoring unit in the Strathcona industrial area were below the air quality guidelines. Maximum 1-hour average concentrations were:

- < 62% of the 1-hour guideline for O_3 ;
- < 17% of the 1-hour guideline for NO_2 ;
- < 10% of the 1-hour guideline for H_2S ; and
- < 7% of the 1-hour guideline for SO_2 .

Sulphur compound concentrations (SO_2 and H_2S) were very low on all survey days. Average and maximum concentrations were similar to those

measured at other Alberta monitoring locations for the same time period.

The highest concentrations of pollutants emitted by vehicles (hydrocarbons and oxides of nitrogen) were recorded north of Yellowhead Trail on Meridian St. during traffic rush hours.

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.051 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.

The highest 1-hour average O_3 concentration was recorded in the afternoon on May 28 at the east (Petro Canada ball diamonds) and central (24 St. and 104 Ave.) sites. O_3 values were lowest in the early morning and highest between noon and 6:00 p.m. on all survey days. This observation is consistent with the daily variation observed at other Alberta monitoring stations. Average O_3 concentrations ranged from 0.027 ppm at the north site #2 (Meridian St. and 130 Ave.) to 0.038 ppm at the central site (24 St. and 104 Ave.) and north site #1 (Meridian St. and 122 Ave.). Lower average values at the north site #2 were due to more observations being taken in the morning when O_3 values are at a minimum. Overall average O_3 concentrations in the Strathcona industrial area (0.037 ppm) were similar to those measured in Sherwood Park (0.037 ppm), Fort Saskatchewan (0.035 ppm) and at the east Edmonton station (0.034 ppm) for the same monitoring period. The overall average value was lower than the average at Royal Park (0.045 ppm), located 10 km northwest of Vegreville, and higher than the average in downtown Edmonton (0.029 ppm) for the same time period. O_3 values 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.

Total Hydrocarbons (THC)

Max. 1-hour Average	1-hour Guideline
THC = 2.7 ppm	no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH₄), 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 1-hour average THC concentration was recorded in the early morning on May 28 at the east site (Petro Canada ball diamonds). Winds at this time were very light and from the southwest to south-southwest directions. Higher THC values in the morning on May 28 were likely due to fugitive emissions (leakages) from industries in east Edmonton and vehicle exhaust emissions during the morning traffic rush hour. Average THC concentrations on all spring survey days ranged from 1.6 ppm at the west site (Goldstick Park) to 2.0 ppm at the central site (24 St. and 104 Ave.) and 2.1 ppm at the north site #2 (Meridian St. and 130 Ave.). Again, higher average values at the central site and north site #2 were likely due to fugitive emissions from local industries and vehicle exhaust from commuter traffic. Overall average THC concentrations for the entire monitoring period ranged from 1.8 ppm at the Fort Saskatchewan and Strathcona Industrial Association (SIA) Sherwood Park stations to 2.1 ppm at the Edmonton central and east stations. The average THC value in the Strathcona industrial area was 1.9 ppm. Normal background THC concentrations range from 1.5 and 2.0 ppm.

Oxides of Nitrogen (NO₂, NO, NO_x)

Max. 1-hour Average	1-hour Guideline
NO ₂ = 0.035 ppm	0.210 ppm
NO = 0.059 ppm	no guideline
NO _x = 0.085 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 highest NO₂ concentrations were recorded at the north site #1 (Meridian St. and 122 Ave.) during the late afternoon on March 26 and at the north site #2 (Meridian St. and 130 Ave.) in the morning on May 28. These elevated NO₂

values were likely caused by commuter traffic along Yellowhead Trail and other major traffic arteries in the area. The highest NO concentration was recorded in the early morning on May 28 at the east (Petro Canada ball diamonds) monitoring location. Overall average NO₂ and NO concentrations were highest at the north site #2 (Meridian St. and 130 Ave.). Again, higher oxides of nitrogen values at this location are likely due to traffic along Yellowhead Trail and Meridian Street during the morning rush hour. Overall average NO_x, NO₂ and NO concentrations in the Strathcona industrial area were similar to those recorded in Sherwood Park for the same time period.

Hydrogen Sulphide (H₂S)

Max. 1-hour Average	1-hour Guideline
H ₂ S = 0.001 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 in the Strathcona industrial area on all survey days. The maximum concentration of 0.001 ppm is only 10% of the 1-hour guideline. Average H₂S at all monitoring sites ranged from 0.000 to 0.001 ppm. The overall maximum 1-hour average H₂S concentration recorded in the Strathcona industrial area was lower than those recorded during the mobile survey in Sherwood Park (0.003 ppm) and at the SIA Sherwood Park station (0.002 ppm) for the same time period.

Sulphur Dioxide (SO₂)

Max. 1-hour Average	1-hour Guideline
SO ₂ = 0.012 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.

The highest 1-hour average SO₂ concentration was measured between 11:20 a.m. and 12:20 p.m. on May 28 at the west monitoring site (Goldstick Park). Winds at this time were from west-southwest at 6 km/hr. SO₂ concentrations (1-hour average) were at or below 0.007 ppm for the remaining survey days. The overall average SO₂

value in the Strathcona industrial area (0.003 ppm) was close to those recorded at other Alberta Environmental Protection and SIA stations for the same time period.

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

March 26, 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)	07:59 to 08:59	0.020	0.037	0.030	0.007	1.3	0.000	0.003	n/a	SW/15	n/a
central (24 St & 104 Ave)	09:07 to 10:07	0.033	0.022	0.016	0.005	2.4	0.000	0.004	n/a	SW/18	n/a
east (ball diamonds)	10:23 to 11:25	0.034	0.021	0.014	0.007	2.0	0.000	0.004	n/a	SW/23	n/a
north site#1(Mer St & 122 St)	11:34 to 12:34	0.036	0.019	0.013	0.006	1.9	0.000	0.007	n/a	SW/18	n/a
west (Goldstick Park)	12:47 to 13:45	0.040	0.014	0.011	0.004	1.4	0.000	0.006	n/a	WSW/12	n/a
south (91 Ave & 24 St)	13:55 to 14:55	0.036	0.022	0.015	0.006	1.7	0.000	0.006	n/a	SW/13	n/a
central (24 St & 104 Ave)	15:03 to 16:00	0.040	0.014	0.011	0.003	2.3	0.000	0.001	n/a	SW/14	n/a
east (ball diamonds)	16:23 to 17:23	0.032	0.028	0.020	0.009	1.7	0.000	0.005	n/a	SSW/12	n/a
north site#1(Mer St & 122 St)	17:30 to 18:30	0.016	0.056	0.035	0.021	2.0	0.001	0.005	n/a	SW/9	n/a
west (Goldstick Park)	18:50 to 19:50	0.023	0.032	0.027	0.005	1.9	0.000	0.001	n/a	SW/7	n/a

May 15, 1997

Monitoring Site	Monitoring Period	O ³	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂	Temp.*	Wind dir/spd*	Cloud*
north site#2(Mer St & 130 St)	07:07 to 07:59	0.019	0.029	0.017	0.012	2.2	0.000	0.001	n/a	NE-NW/10	10%
central (24 St & 104 Ave)	08:09 to 09:35	0.036	0.001	0.001	0.001	1.7	0.000	0.000	n/a	NW-WNW/15	10%
west (Goldstick Park)	09:48 to 10:49	0.039	0.002	0.002	0.000	1.6	0.000	0.002	23	WSW/7	0%
east (ball diamonds)	10:57 to 11:57	0.029	0.024	0.013	0.011	1.6	0.000	0.000	23	NW/21	0%
south (91 Ave & 24 St)	12:07 to 13:08	0.040	0.012	0.009	0.002	1.8	0.000	0.007	n/a	NW-WNW/16	90%
north site#1(Mer St & 122 St)	13:15 to 14:15	0.046	0.003	0.003	0.000	1.6	0.000	0.001	n/a	N-NW/19	90%
central (24 St & 104 Ave)	14:26 to 15:25	0.048	0.003	0.002	0.000	1.6	0.000	0.001	n/a	NW-WNW/14	90%
west (Goldstick Park)	15:37 to 16:39	0.045	0.005	0.004	0.001	1.7	0.000	0.005	n/a	SSW-WNW/5	95%
east (ball diamonds)	16:47 to 17:49	0.045	0.006	0.005	0.007	1.7	0.001	0.001	n/a	NW-WNW/15	95%
south (91 Ave & 24 St)	17:58 to 18:58	0.042	0.006	0.006	0.000	1.9	0.000	0.001	n/a	NW/12	95%

May 28, 1997

Monitoring Site	Monitoring Period	O ³	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂	Temp.*	Wind dir/spd*	Cloud*
east (ball diamonds)	07:25 to 08:27	0.002	0.085	0.026	0.059	2.7	0.001	0.003	n/a	SW-SSW/1	fog
north site#2(Mer St & 130 St)	08:40 to 09:42	0.011	0.061	0.034	0.026	2.4	0.001	0.005	n/a	SW-SSW/5	0%
central (24 St & 104 Ave)	09:53 to 11:04	0.031	0.025	0.016	0.009	2.1	0.000	0.002	n/a	SSE-W/3	0%
west (Goldstick Park)	11:20 to 12:22	0.044	0.009	0.006	0.004	1.9	0.000	0.012	n/a	WSW/6	40%
south (91 Ave & 24 St)	12:33 to 13:29	0.050	0.001	0.001	0.000	1.9	0.000	0.003	n/a	SSW-WNW/7	40%
east (ball diamonds)	13:36 to 14:35	0.051	no data			1.8	0.000	0.004	n/a	S-WSW/7	60%
north site#2(Mer St & 130 St)	14:49 to 15:49	0.050	no data			1.9	0.001	0.004	18	SSW-N4	50%
central (24 St & 104 Ave)	15:57 to 17:01	0.051	no data			1.8	0.000	0.002	n/a	SW/4	50%
west (Goldstick Park)	17:15 to 18:15	0.047	no data			2.0	0.000	0.003	n/a	W/2	40%
south (91 Ave & 24 St)	18:27 to 19:27	0.047	no data			1.9	0.000	0.002	n/a	SE-SW/1	20%

May 30, 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)	06:59 to 08:00	0.016	0.029	0.025	0.004	2.0	0.001	0.005	14	N/3	80%
central (24 St & 104 Ave)	08:09 to 09:09	0.025	0.014	0.013	0.001	2.0	0.001	0.003	n/a	N-NNE/4	10%
west (Goldstick Park)	09:20 to 10:20	0.031	0.007	0.006	0.001	2.0	0.001	0.001	n/a	WNW/7	100%
west (Goldstick Park)	10:21 to 10:58	0.037	0.003	0.003	0.000	2.0	0.001	0.000	n/a	WNW/7	100%
north site#1(Mer St & 122 St)	11:13 to 12:15	0.046	no data			2.0	0.000	0.000	n/a	N-WNW/8	50%
east (ball diamonds)	12:28 to 13:28	0.049	0.003	0.003	0.000	2.1	0.001	0.000	n/a	N-WNW/9	20%
south (91 Ave & 24 St)	13:36 to 14:38	0.044	0.004	0.004	0.000	1.8	0.001	0.000	23	N-WNW/6	10%
central (24 St & 104 Ave)	14:48 to 15:49	0.043	0.004	0.004	0.001	1.8	0.000	0.006	22	N-NW/6	10%
west (Goldstick Park)	16:01 to 17:10	0.044	no data			1.9	0.000	0.000	n/a	N-WNW/5	20%
north site#1(Mer St & 122 St)	17:22 to 18:21	0.043	0.007	0.007	0.000	1.7	0.000	0.001	n/a	S-SW/7	5%
east (ball diamonds)	18:31 to 19:31	0.047	0.004	0.004	0.000	1.7	0.000	0.000	n/a	S-SW10	10%

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

**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)	0.037	0.016	0.013	0.003	1.8	0.000	0.003
central (24 St&104 Ave)	0.038	0.012	0.009	0.003	2.0	0.000	0.002
east (ball diamonds)	0.036	0.024	0.012	0.013	1.9	0.000	0.002
north site#1	0.038	0.021	0.014	0.007	1.8	0.000	0.003
west (Goldstick Park)	0.035	0.009	0.007	0.002	1.6	0.000	0.003
north site#2	0.027	0.045	0.026	0.019	2.1	0.001	0.003

Overall Average Concentrations on All Spring Survey Days (ppm)

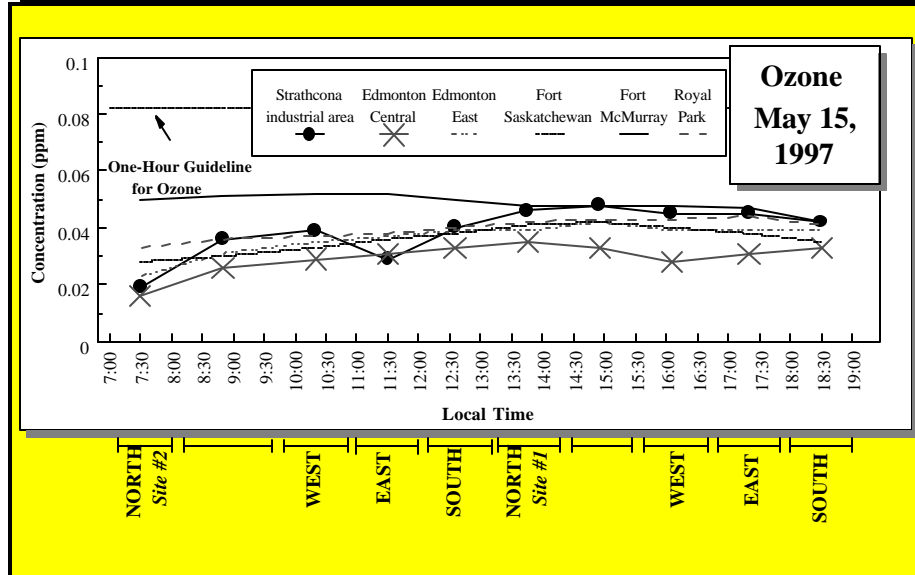
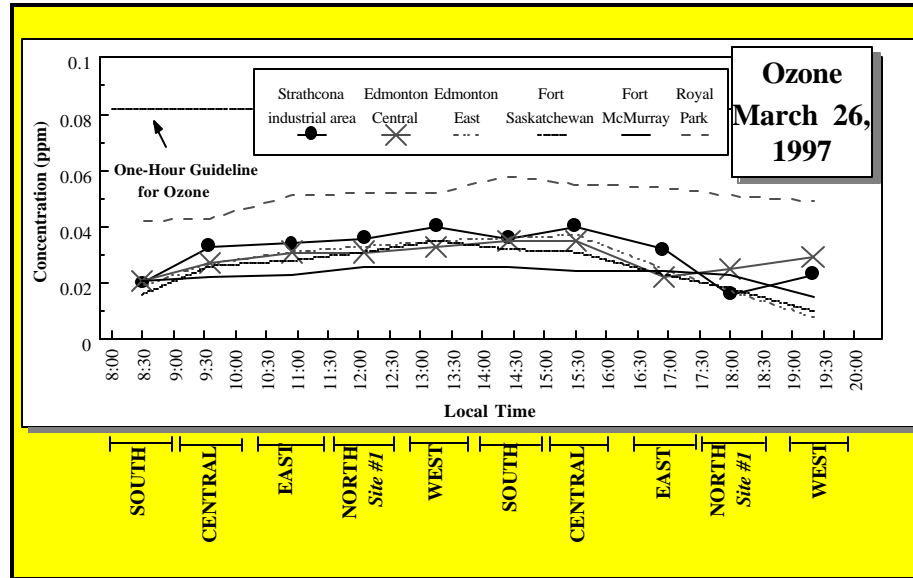
Location	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂
Strathcona industrial area	0.037	0.018	0.012	0.006	1.9	0.000	0.003
Sherwood Park (mobile#1)	0.037	0.017	0.012	0.006	2.0	0.001	0.003
SIA Sherwood Park	no data				1.8	0.000	0.003
SIA Clover Bar	no data	0.036	0.018	0.019	no data	0.000	no data
SIA Elmjay	no data					0.000	0.004
SIA Gold Bar	no data					0.000	no data
SIA Beverly	no data					0.000	0.001
Edmonton Central	0.029	0.039	0.022	0.018	2.1	no data	
Edmonton East	0.034	0.027	0.016	0.011	2.1	0.000	0.003
Fort Saskatchewan	0.035	0.013	0.010	0.003	1.8	0.000	0.003
Fort McMurray	0.029	0.010	0.007	0.004	1.9	0.000	0.004
Royal Park	0.045	0.010	0.003	0.007	no data		

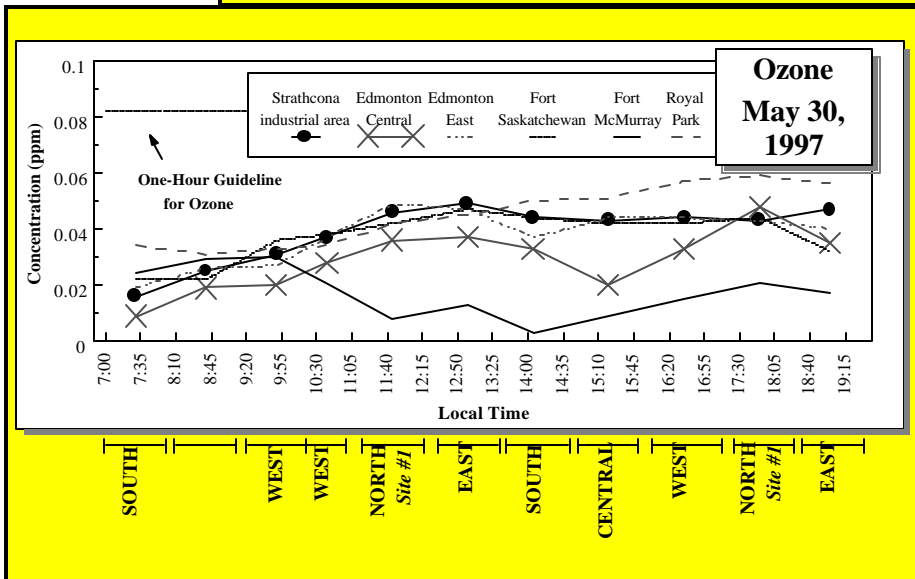
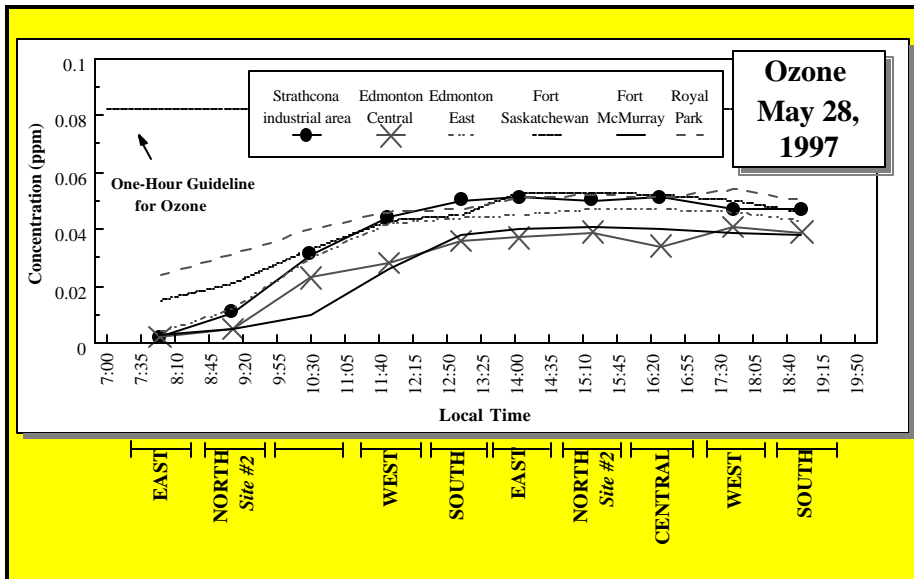
Maximum 1-hour Average Concentrations on All Spring Survey Days (ppm)

Location	O ₃	NO _x	NO ₂	NO	THC	H ₂ S	SO ₂
Strathcona industrial area	0.051	0.085	0.035	0.059	2.7	0.001	0.012
Sherwood Park (mobile#1)	0.052	0.064	0.025	0.045	2.4	0.003	0.028
SIA Sherwood Park	no data				2.4	0.002	0.022
SIA Clover Bar	no data	0.131	0.044	0.100	no data	0.002	no data
SIA Elmjay	no data					0.000	0.012
SIA Gold Bar	no data					0.001	no data
SIA Beverly	no data					0.001	0.007
Edmonton Central	0.048	0.208	0.057	0.157	2.8	no data	
Edmonton East	0.049	0.116	0.044	0.088	2.5	0.001	0.007
Fort Saskatchewan	0.053	0.045	0.036	0.016	2.2	0.000	0.009
Fort McMurray	0.052	0.055	0.024	0.032	2.2	0.001	0.039
Royal Park	0.059	0.013	0.005	0.008	no data		

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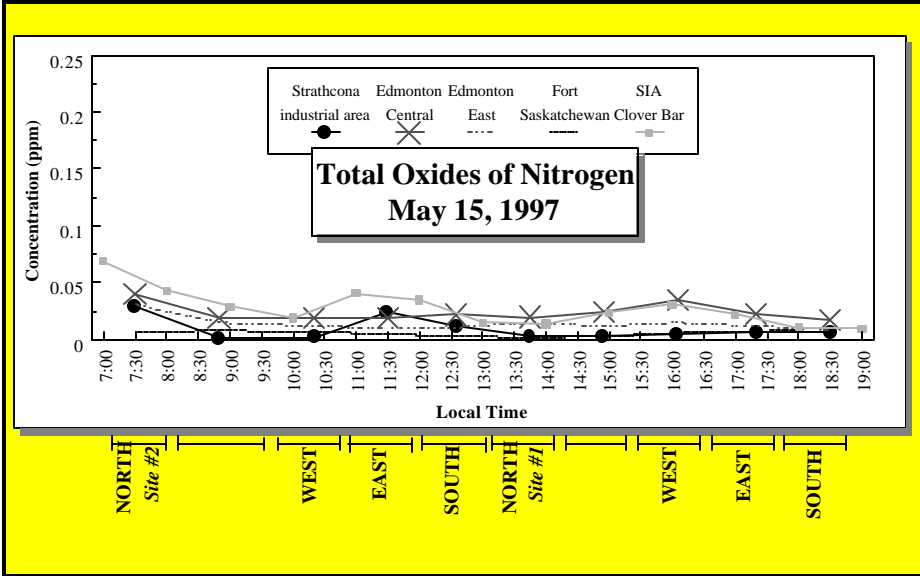
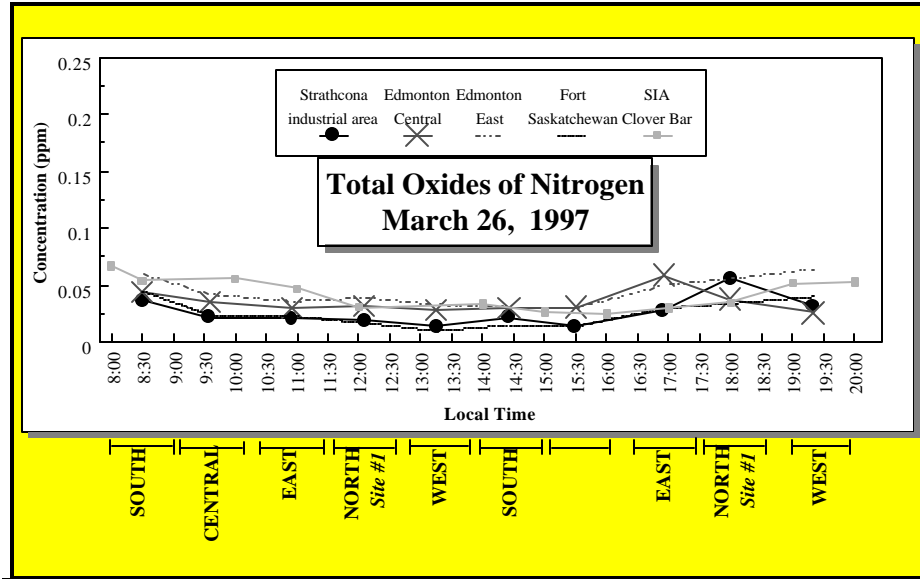
Average Ozone Concentrations in Strathcona Industrial Area

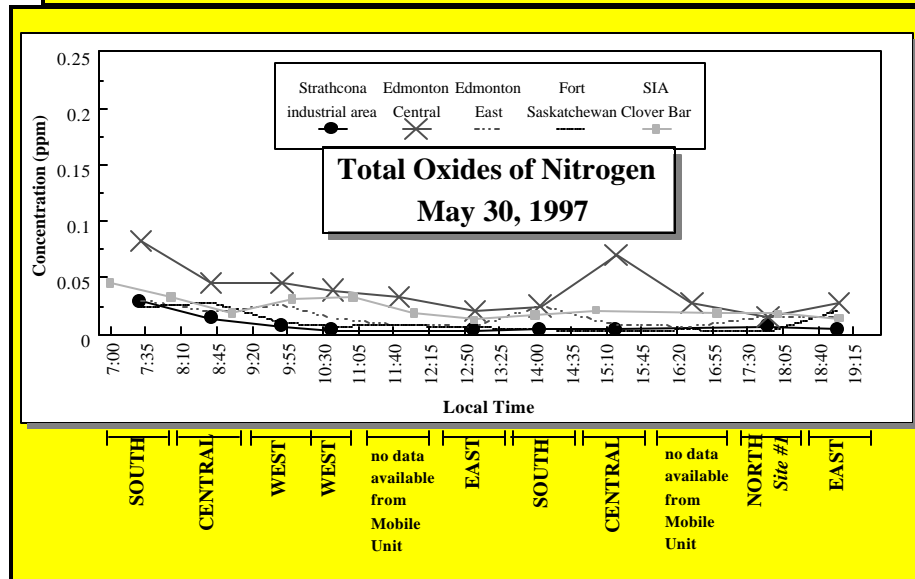
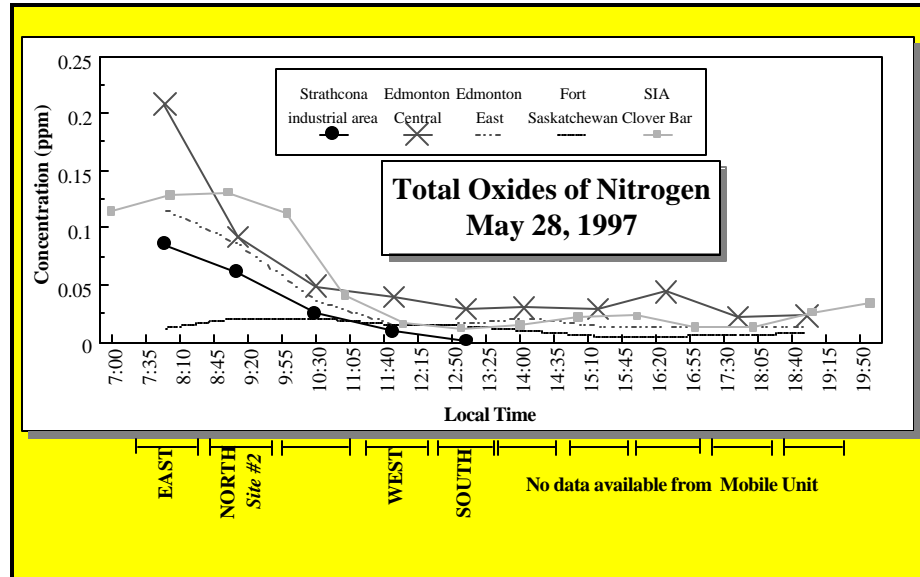


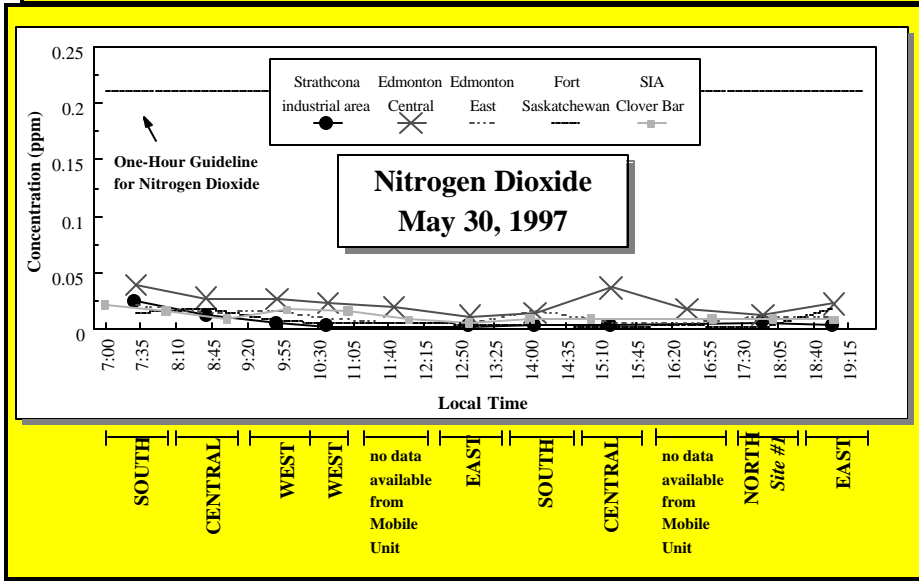
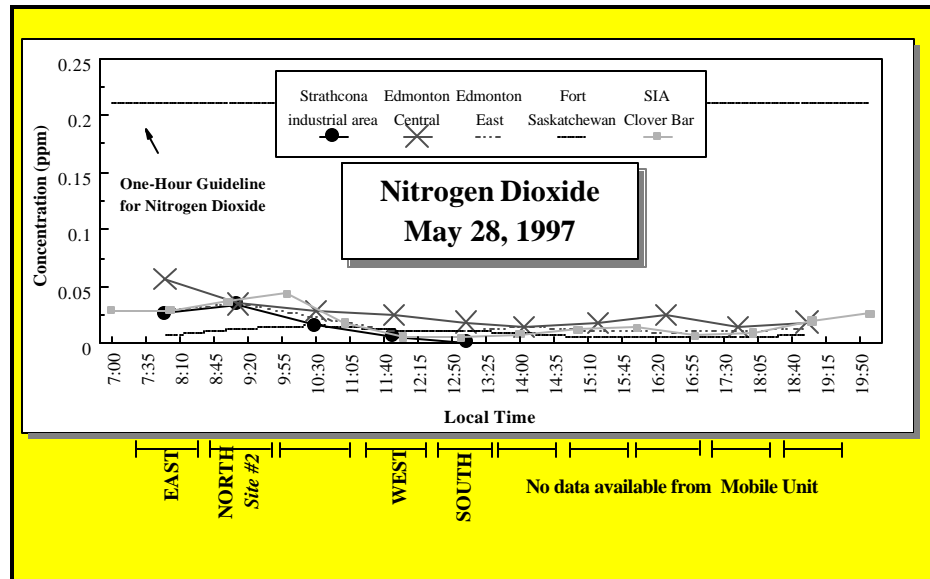


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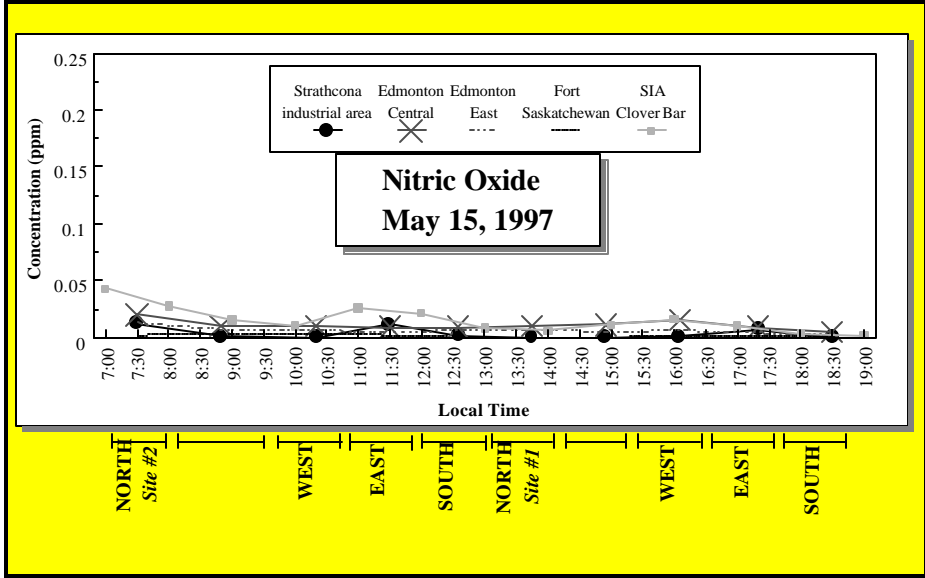
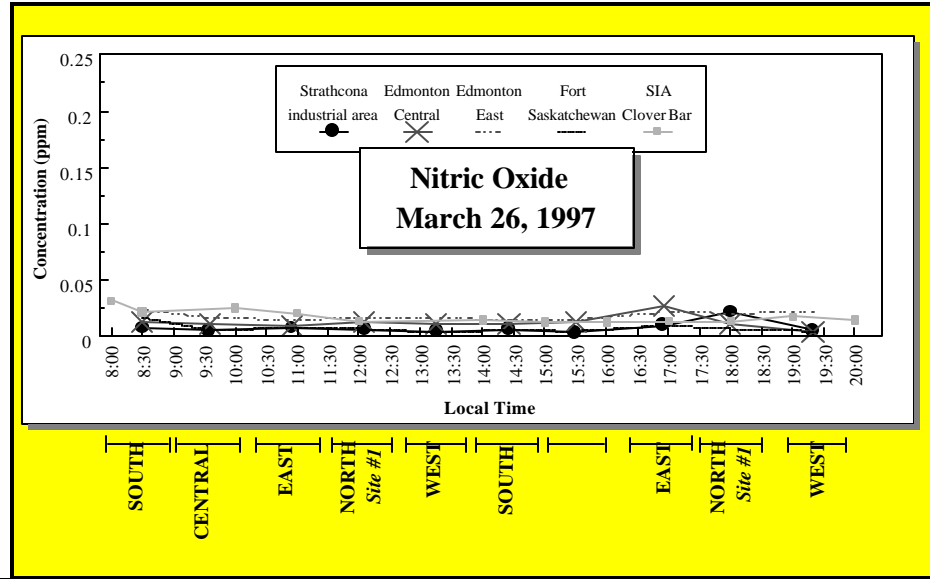
Average Total Oxides of Nitrogen Concentrations in Strathcona Industrial Area

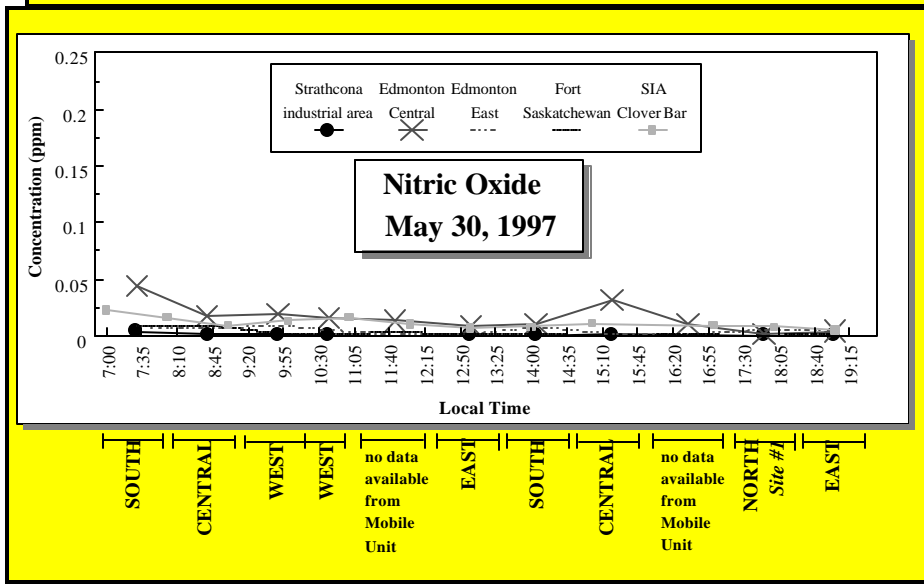
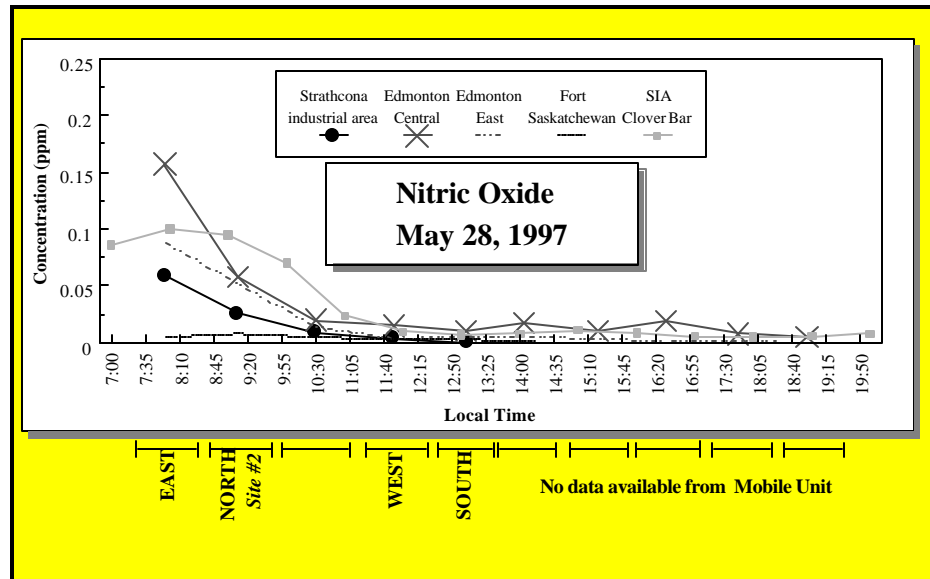






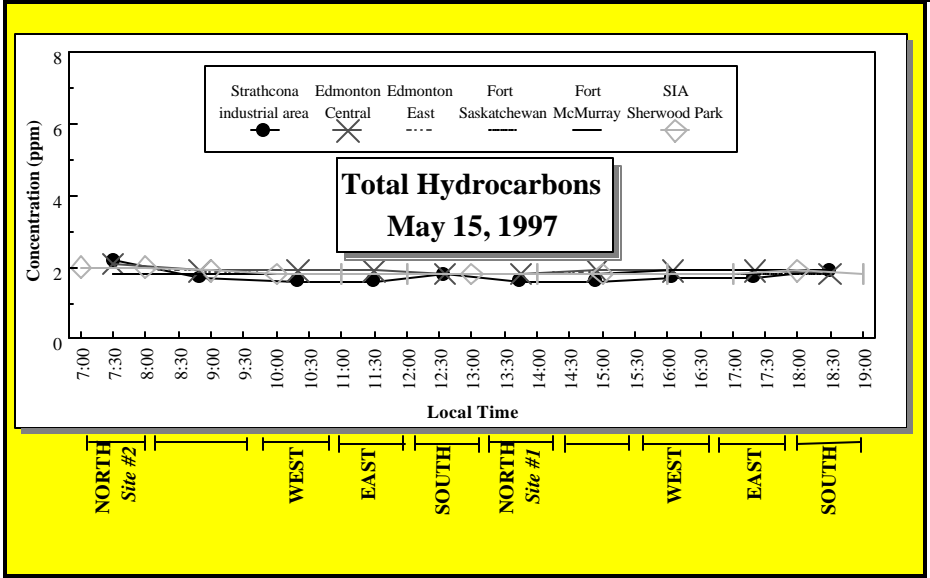
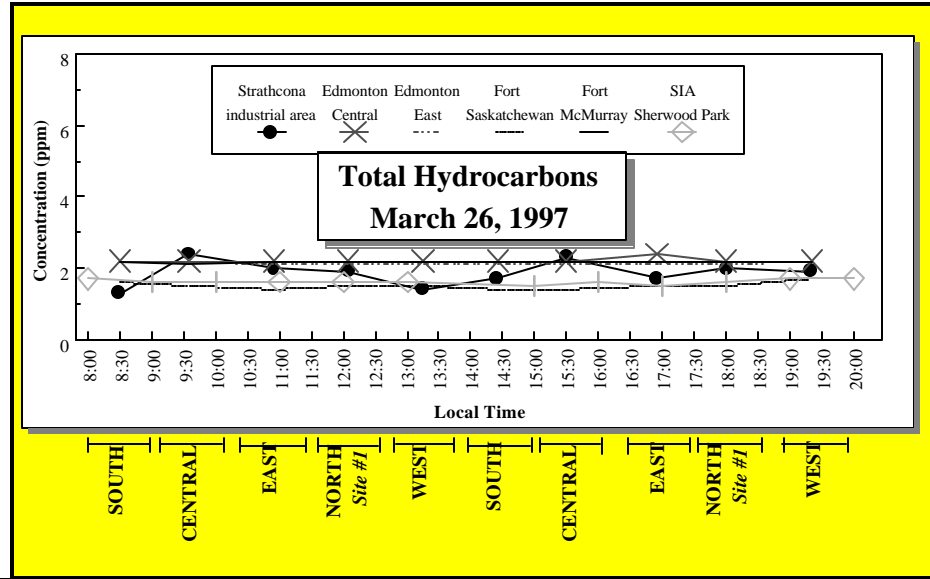
Spring, 1997
Average Nitric Oxide Concentrations in Strathcona Industrial Area

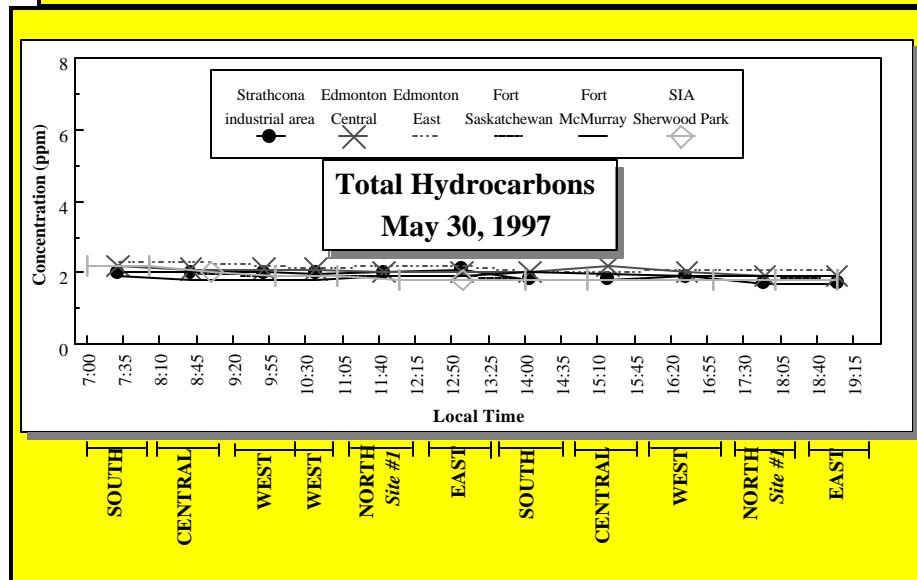
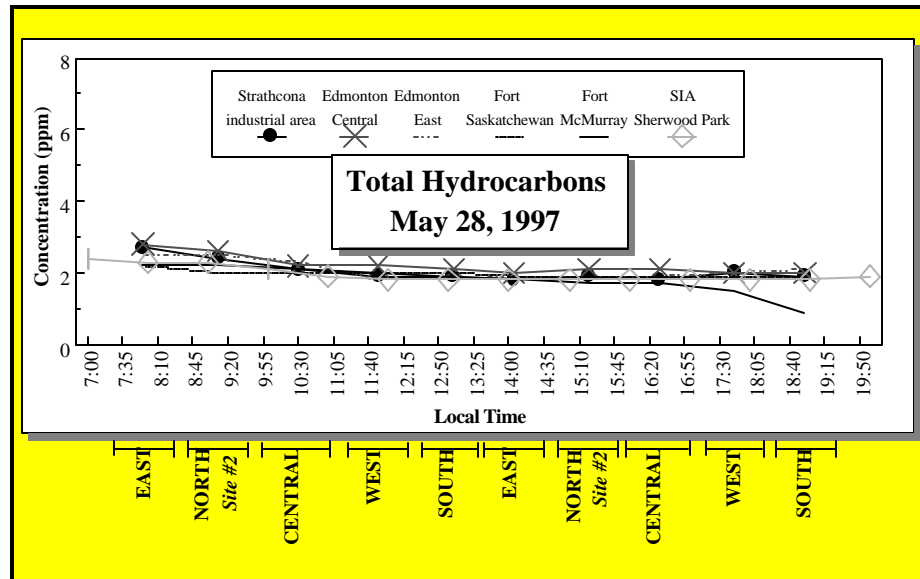




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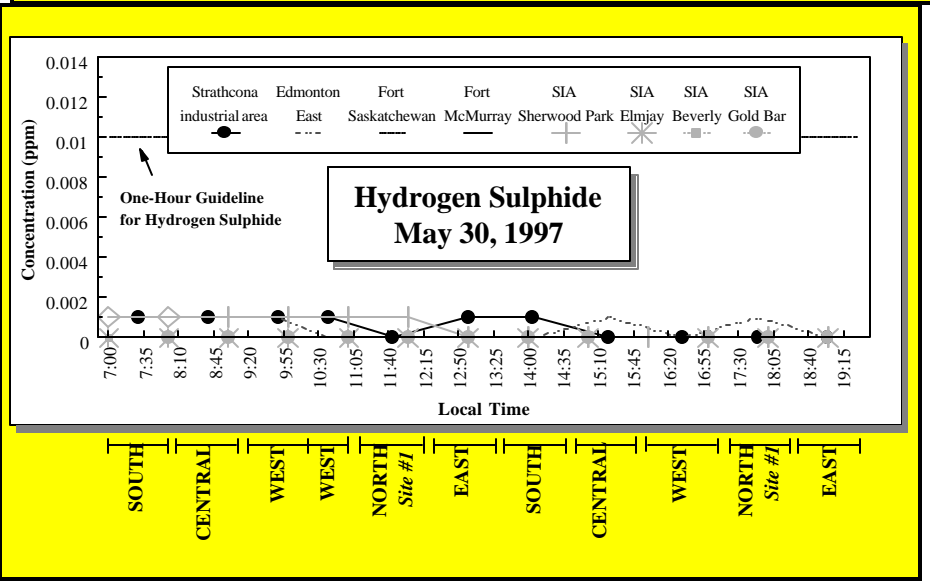
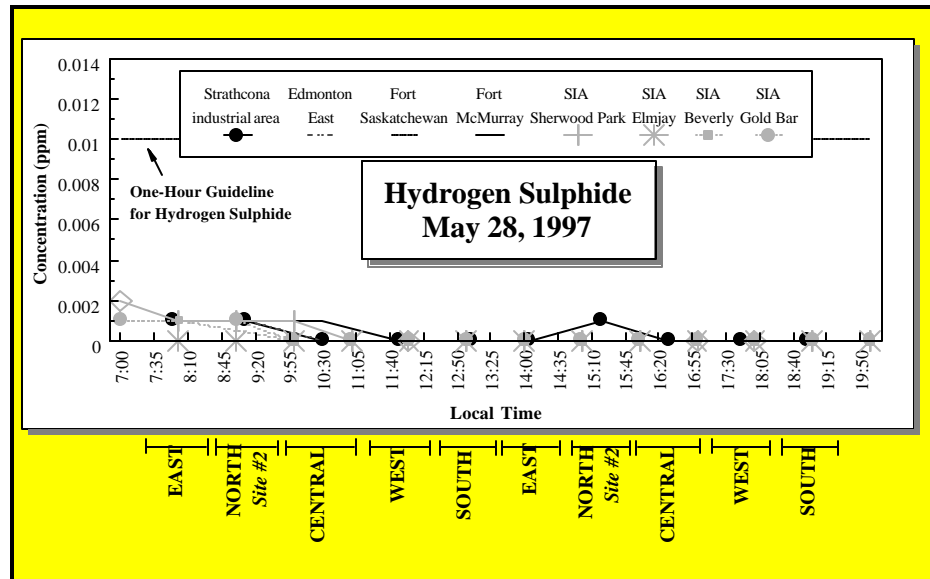
Average Total Hydrocarbon Concentrations in Strathcona Industrial Area





Spring, 1997

Average Hydrogen Sulphide Concentrations in Strathcona Industrial Area



Spring, 1997

Average Sulphur Dioxide Concentrations in Strathcona Industrial Area

