Air Quality Monitoring in the Strathcona Industrial Area 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 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 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 by the mobile monitoring unit in the Strathcona industrial area were below the air quality guidelines. Maximum 1-hour average concentrations were:

  - 49% of the 1-hour guideline for O_3;
  - 26% of the 1-hour guideline for NO_2;
  - 60% of the 1-hour guideline for H_2S; and
  - 10% of the 1-hour guideline for SO_2.

- However, an exceedance of the 1-hour guideline for hydrogen sulphide was recorded at the Edmonton east monitoring station (17 St. north of Baseline Rd.) in the morning of February 6. This exceedance was likely caused by fugitive emissions from a petroleum storage facility located to the south-southeast the monitoring station.

- The highest concentrations of pollutants emitted by vehicles (hydrocarbons and oxides of nitrogen) were recorded near major traffic arteries (e.g. Yellowhead Tr., Baseline Rd. and Meridian St.).

Ozone (O_3)

Max. 1-hour Average	1-hour Guideline
0.040 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.

The highest 1-hour average O_3 concentrations occurred in the afternoon of February 6 and 7. O_3 values are typically higher in February than in earlier winter months due to increased atmospheric mixing and therefore more transport of O_3 from the upper atmosphere. Overall average O_3 values ranged from 0.011 ppm at the north site #1 (Meridian St. and 122 Ave.) to 0.016 ppm at the east site (Petro Canada ball diamonds). Average O_3 values recorded in the Strathcona industrial area were similar to those measured in Fort Saskatchewan and lower than values measured in Sherwood Park for the same time period. Average O_3 values in the Strathcona industrial area were less than one-half of those recorded at the rural location 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.

Hydrocarbons (THC, RHC and CH_4)

Max. 1-hour Average	1-hour Guideline
THC = 4.6 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 concentrations were recorded in the late afternoon and evening on December 11 and 12. The 1-hour maximum THC value was measured between 7:15 and 8:15 p.m. at the west site (Goldstick Park). Average THC concentrations ranged from 2.2 ppm at the east site (Petro Canada ball diamonds) to 2.9 ppm at the north site #2 (Meridian St. and 130 Ave.). Higher THC values were observed near major traffic arteries (e.g. Meridian St., Yellowhead Tr. and Baseline Rd.). Overall average THC values were the same as those recorded in Sherwood Park for the same time period and slightly lower than those measured at other small urban locations in Alberta (Fort Saskatchewan and Fort McMurray). 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 = 0.054 ppm	0.210 ppm
NO = 0.269 ppm	no guideline
NO_x = 0.316 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 2:50 and 3:50 p.m. on January 13 at the north site #1 (Meridian St. and 122 Ave.). NO_x and NO concentrations were highest between 7:15 and 8:15 p.m. on December 11 at the west monitoring site (Goldstick Park). The overall average oxides of nitrogen concentration was lowest at the east site (Petro Canada ball diamonds) and highest at the north site #1 (Meridian St. and 122 Ave.). Higher oxides of nitrogen values at the north site #1 were likely due to local traffic on Meridian St. (for NO) or transport of vehicle exhaust emissions from major traffic arteries such as Yellowhead Tr. (for NO_2). Average oxides of nitrogen values for the winter survey days were similar to those measured in Fort Saskatchewan and slightly higher than those measured in Sherwood Park and Fort McMurray.

Hydrogen Sulphide (H_2S)

Max. 1-hour Average	1-hour Guideline
H_2S = 0.006 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 1-hour average H_2S concentration (0.006 ppm) recorded by the mobile monitoring unit occurred at the west site (Goldstick Park) in the evening of December 11. This peak value is 60% of the 1-hour guideline. However, a 1-hour average H_2S concentration which was over three times the guideline (0.031 ppm) was recorded in the morning (8:00 to 9:00 a.m.) of February 6 at the Edmonton east permanent monitoring station (17 St. north of Baseline Rd.). Winds during this exceedance were relatively light and from the south-southeast. The cause of this exceedance was likely fugitive emissions from a petroleum storage facility located to the south-southeast of the monitoring station. H_2S concentrations showed little variation between monitoring locations in the Strathcona industrial area based on overall averages.

Sulphur Dioxide (SO_2)

Max. 1-hour Average	1-hour Guideline
SO_2 = 0.017 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 (0.017 ppm) was measured in the morning (9:15 to 10:15 a.m.) of February 13 at the central site (24 St. and 104 Ave.). This maximum value is 10% of the 1-hour guideline. Overall average SO_2 concentrations were also highest at the central site. Higher SO_2 concentrations at the central location are likely due to emissions from near-by oil and gas refineries. Overall average SO_2 concentrations measured in the Strathcona industrial area were similar to those recorded at the Edmonton east and Fort Saskatchewan monitoring stations for the same time period. Average and peak SO_2 values were over twice as high in the Strathcona industrial area than in Sherwood Park for the winter survey monitoring period.

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

December 11, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	08:11 to 09:11	0.002	0.137	0.034	0.093	no data	0.002	0.004	-13	calm	85%
east (ball diamonds)	09:22 to 10:22	0.005	0.045	0.024	0.021	no data	0.001	0.004	-14	calm	90%
north site#2(Mer St&130 Ave)	10:35 to 11:36	0.005	0.101	0.033	0.069	no data	0.002	0.004	-11	SSW/2	90%
central (24 St&104 Ave)	11:58 to 13:00	0.004	0.165	0.039	0.126	no data	0.003	0.006	-9	SSW/2	90%
west (Goldstick Park)	13:10 to 14:14	0.004	0.113	0.042	0.071	no data	0.001	0.008	-7	calm	95%
south (91 Ave& 24 St)	14:30 to 15:30	0.006	0.216	0.048	0.168	2.9	0.004	0.011	-2	calm	95%
east (ball diamonds)	15:41 to 16:42	0.001	0.161	0.041	0.124	2.7	0.003	0.008	-6	calm	95%
north site#1(Mer St&122 Ave)	16:52 to 17:52	0.002	0.228	0.042	0.186	3.1	0.003	0.006	-8	S/2	100%
central (24 St&104 Ave)	18:00 to 18:56	0.003	0.178	0.040	0.137	3.1	0.003	0.007	-8	calm	100%
west (Goldstick Park)	19:16 to 20:16	0.003	0.316	0.047	0.269	4.2	0.006	0.008	-9	calm	no data

December 12, 1996

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	07:46 to 08:47	0.015	0.038	0.030	0.008	3.0	0.000	0.002	-13	SSW/2	40%
east (ball diamonds)	08:57 to 09:58	0.028	0.015	0.013	0.002	2.6	0.000	0.003	-11	SSW/1-2	40%
north site#2(Mer St&130 Ave)	10:09 to 11:09	0.019	0.051	0.031	0.020	2.3	0.001	0.010	-8	SSW/2-3	40%
central (24 St&104 Ave)	11:24 to 12:24	0.020	0.066	0.031	0.035	2.3	0.001	0.003	-10	SW/1-2	45%
west (Goldstick Park)	12:38 to 13:38	0.019	0.053	0.035	0.018	2.5	0.001	0.003	-11	S/2-3	75%
south (91 Ave& 24 St)	13:51 to 14:57	0.014	0.080	0.042	0.038	2.3	0.002	0.004	-9	S/0-1	90%
east (ball diamonds)	15:07 to 15:58	0.011	0.067	0.038	0.029	2.3	0.001	0.004	-11	S/1-2	95%
north site#1(Mer St&122 Ave)	16:08 to 17:08	0.006	0.167	0.049	0.118	2.2	0.002	0.004	-11	W/1-2	no data
central (24 St&104 Ave)	17:19 to 18:20	0.006	0.159	0.046	0.113	2.8	0.003	0.010	-9	W/0-1	no data
west (Goldstick Park)	18:42 to 19:44	0.006	0.187	0.045	0.142	3.2	0.003	0.006	-8	calm	no data

January 13, 1997

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
north site#2(Mer St&130 Ave)	08:17 to 09:29	0.007	0.076	0.046	0.030	2.5	0.002	0.005	-14	calm	20%
central (24 St&104 Ave)	09:45 to 10:50	0.012	0.099	0.044	0.055	2.3	0.000	0.005	-14	SW/0-1	20%
west (Goldstick Park)	11:02 to 12:06	0.015	0.094	0.042	0.052	2.4	0.000	0.003	-11	SW/0-2	10%
east (ball diamonds)	12:18 to 13:23	0.026	0.033	0.022	0.011	2.0	0.000	0.003	-10	SW/2-4	5%
south (91 Ave& 24 St)	13:34 to 14:35	0.016	0.082	0.035	0.047	2.2	0.000	0.005	-7	SW/2-3	5%
north site#1(Mer St&122 Ave)	14:49 to 15:50	0.009	0.204	0.054	0.150	2.1	0.002	0.007	-7	calm	5%
central (24 St&104 Ave)	16:03 to 17:06	0.007	0.146	0.050	0.096	2.0	0.001	0.005	-4	SW/0-2	10%
west (Goldstick Park)	17:18 to 18:19	0.009	0.226	0.052	0.174	2.9	0.003	0.005	-7	SW/2-3	5%
east (ball diamonds)	18:32 to 19:35	0.005	0.073	0.042	0.031	1.9	0.000	0.005	-7	calm	no data
south (91 Ave& 24 St)	19:50 to 20:51	0.006	0.106	0.046	0.060	2.1	0.001	0.004	-11	SW/0-1	no data

February 06, 1997

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
east (ball diamonds)	08:04 to 09:07	0.017	0.023	0.022	0.001	2.3	0.001	0.001	-9	SE/0-1	5%
north site#2(Mer St&130 Ave)	09:22 to 10:25	0.006	0.157	0.053	0.104	4.6	0.005	0.003	-8	SE/0-1	5%
central (24 St&104 Ave)	10:41 to 11:53	0.022	0.039	0.017	0.023	2.0	0.001	0.003	-8	S/2-4	2%
west (Goldstick Park)	12:04 to 13:08	0.028	0.036	0.023	0.013	2.5	0.001	0.002	-6	SSW/2-3	2%
south (91 Ave& 24 St)	13:20 to 14:29	0.031	0.024	0.016	0.008	2.2	0.001	0.002	-6	SW/2-3	2%
east (ball diamonds)	14:43 to 15:46	0.040	0.013	0.009	0.004	2.0	0.001	0.004	-2	SW/2-3	2%
north site#2(Mer St&130 Ave)	15:59 to 17:00	0.028	0.026	0.022	0.004	2.2	0.001	0.003	-4	SW/2-4	2%
central (24 St&104 Ave)	17:15 to 18:23	0.019	0.035	0.032	0.004	2.0	0.000	0.005	-5	SSW/2-4	1%
west (Goldstick Park)	18:43 to 19:45	0.023	0.027	0.026	0.001	2.2	0.001	0.006	-7	S/2-4	clear
south (91 Ave& 24 St)	19:57 to 20:58	0.021	0.037	0.029	0.007	1.9	0.002	0.005	-7	S/2-4	no data

February 13, 1997

Monitoring Site	Monitoring Period	O_3	NO_x	NO_2	NO	THC	H_2S	SO_2	Temp.*	Wind dir/spd*	Cloud*
south (91 Ave& 24 St)	8:02 to 9:05	0.003	0.077	0.041	0.035	2.0	0.002	0.000	-6	calm	90%
central (24 St&104 Ave)	09:11 to 10:15	0.020	0.034	0.027	0.006	2.2	0.000	0.017	-4	NNW/0-1	90%
west (Goldstick Park)	10:25 to 11:28	0.025	0.033	0.022	0.011	1.8	0.001	0.002	-3	NW/0-3	85%
north site#1(Mer St&122 Ave)	11:42 to 12:56	0.035	0.009	0.007	0.002	1.9	0.000	0.000	-3	NW/0-3	85%
east (ball diamonds)	13:05 to 14:05	0.026	0.032	0.022	0.009	1.9	0.001	0.003	-2	NW/0-3	85%
south (91 Ave& 24 St)	14:15 to 15:16	0.029	0.015	0.011	0.004	1.9	0.000	0.002	-3	calm	90%
central (24 St&104 Ave)	15:23 to 16:26	0.021	0.042	0.025	0.017	2.3	0.001	0.008	-3	NW/0-2	95%
west (Goldstick Park)	16:36 to 17:37	0.021	0.021	0.021	0.000	2.0	0.001	0.002	-4	NW/0-2	80%
north site#1(Mer St&122 Ave)	17:51 to 18:52	0.001	0.075	0.043	0.032	2.0	0.001	0.004	-5	W/0-1	85%
east (ball diamonds)	19:13 to 20:15	0.004	0.052	0.038	0.014	1.8	0.001	0.004	-5	NW/0-1	no data

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

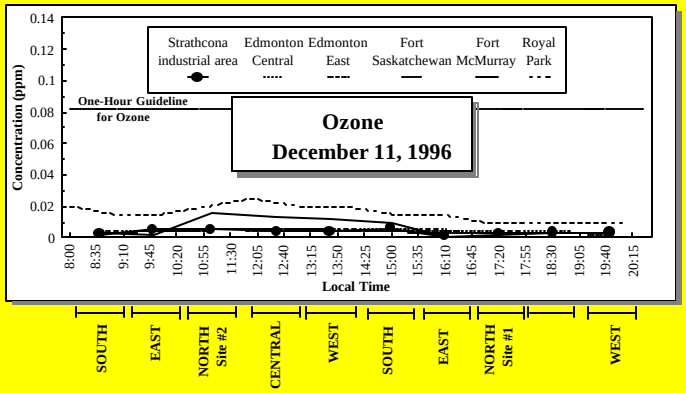
Average Concentrations at Each Monitoring Site in the Strathcona Industrial Area (ppm)							
Monitoring Site	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
south (91 Ave& 24 St)	0.014	0.081	0.033	0.047	2.3	0.001	0.004
east (ball diamonds)	0.016	0.051	0.027	0.025	2.2	0.001	0.004
north site#2	0.013	0.082	0.037	0.045	2.9	0.002	0.005
north site#1	0.011	0.137	0.039	0.098	2.3	0.002	0.004
central (24 St&104 Ave)	0.013	0.096	0.035	0.061	2.3	0.001	0.007
west (Goldstick Park)	0.015	0.111	0.036	0.075	2.6	0.002	0.004

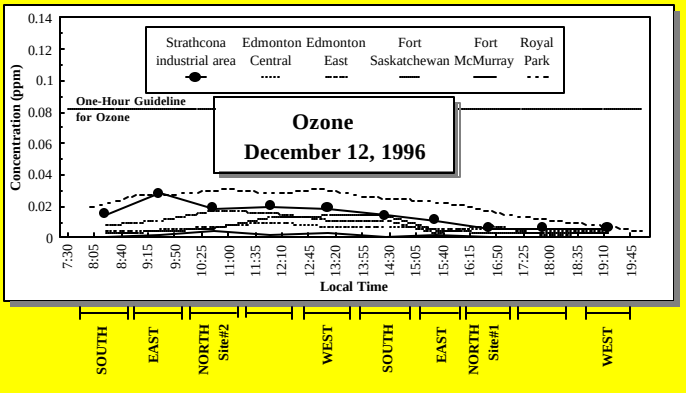
verall Average Concentrations on All Winter Survey Days (pp							
Location	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
Strathcona industrial area	0.014	0.090	0.034	0.056	2.4	0.001	0.005
Sherwood Park (mobile#1)	0.018	0.044	0.016	0.028	2.4	0.000	0.002
SIA Sherwood Park	no data				2.2	0.000	0.003
SIA Clover Bar	no data	0.063	0.027	0.038	no data	0.001	no data
SIA Elmjay	no data					0.001	0.004
SIA Gold Bar	no data					0.002	no data
SIA Beverly	no data					0.002	0.006
Edmonton Central	0.008	0.121	0.045	0.076	2.9	no data	
Edmonton East	0.011	0.108	0.038	0.071	2.6	0.002	0.006
Fort Saskatchewan	0.014	0.107	0.038	0.070	2.6	0.001	0.006
Fort McMurray	0.009	0.052	0.019	0.034	2.5	0.001	0.003
Royal Park	0.029	0.013	0.012	0.003	no data		

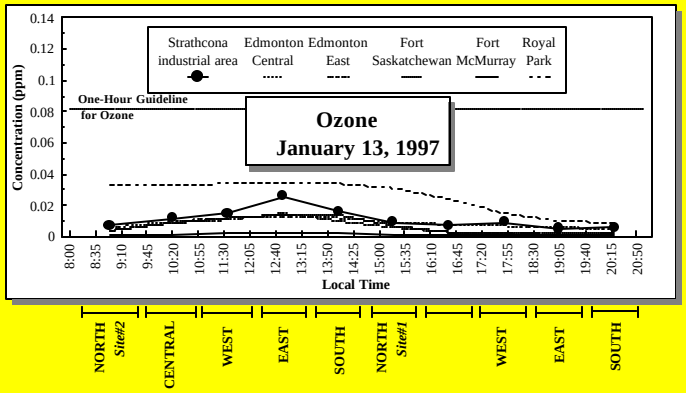
Maximum 1-hour Average Concentrations on All Winter Survey Days (ppm							
Location	**O_3**	**NO_x**	**NO_2**	**NO**	**THC**	**H_2S**	**SO_2**
Strathcona industrial area	0.040	0.316	0.054	0.269	4.6	0.006	0.017
Sherwood Park (mobile#1)	0.039	0.221	0.051	0.183	3.2	0.003	0.008
SIA Sherwood Park	no data				3.1	0.001	0.009
SIA Clover Bar	no data	0.186	0.045	0.148	no data	0.003	no data
SIA Elmjay	no data					0.001	0.008
SIA Gold Bar	no data					0.004	no data
SIA Beverly	no data					0.008	0.016
Edmonton Central	0.020	0.191	0.062	0.147	3.5	no data	
Edmonton East	0.028	0.295	0.059	0.237	4.8	0.031	0.013
Fort Saskatchewan	0.045	0.277	0.061	0.220	4.4	0.005	0.012
Fort McMurray	0.038	0.141	0.036	0.106	2.9	0.001	0.031
Royal Park	0.051	0.037	0.036	0.006	no data		

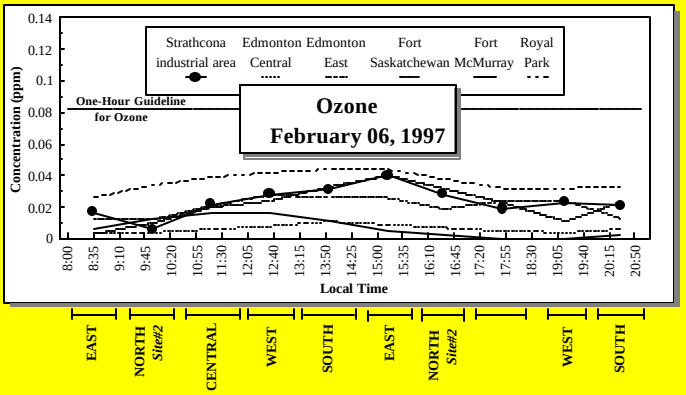
Winter, 1996

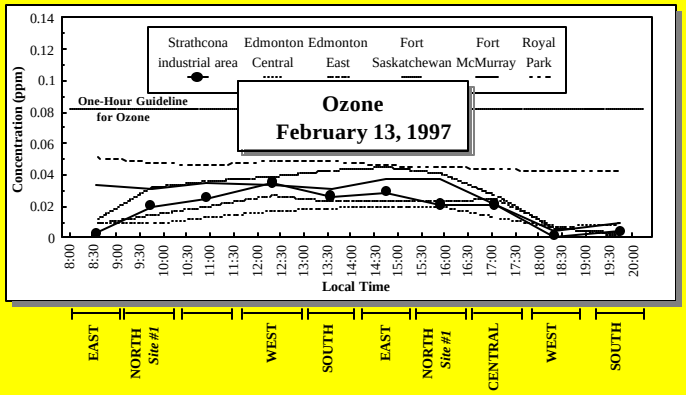
Average Ozone Concentrations in Strathcona Industrial Area









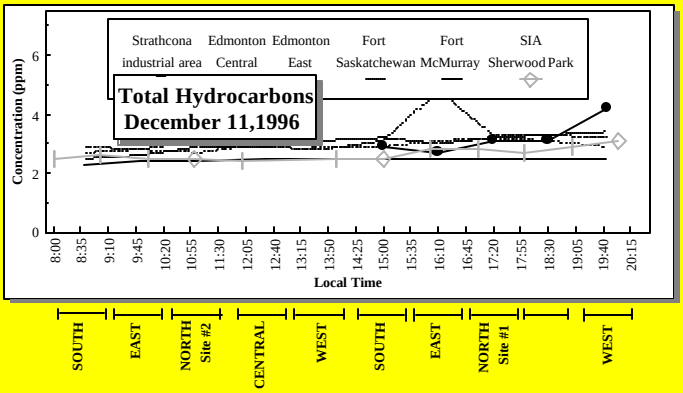


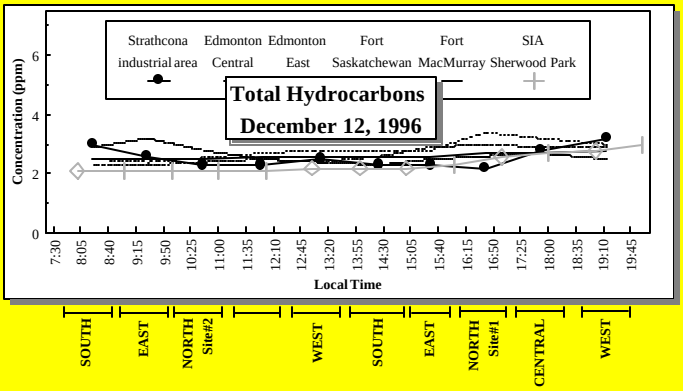
Location of monitoring sites in Strathcona industrial area

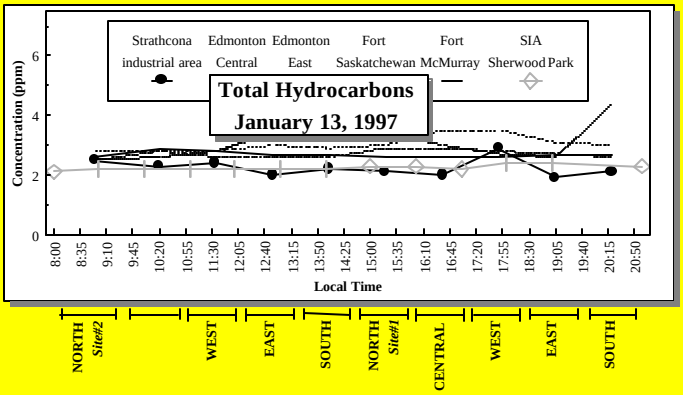
SOUTH	91 avenue & 24 street
EAST	Petro-Canada Ball Diamonds
NORTH site#1	Meridian street & 122 avenue
NORTH site#2	Meridian street & 130 avenue
CENTRAL	24 street & 104 avenue
WEST	Goldstick Park

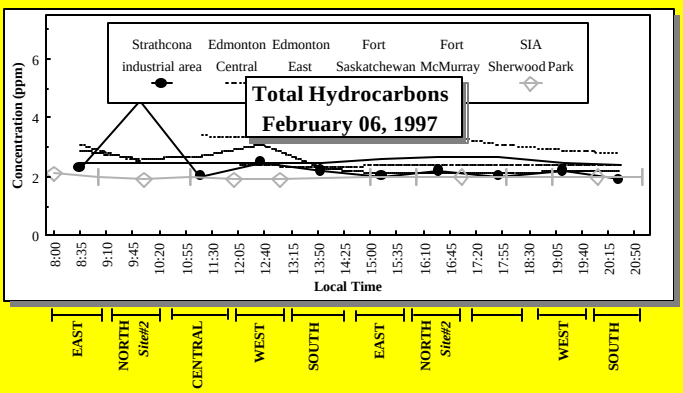
Winter, 1996

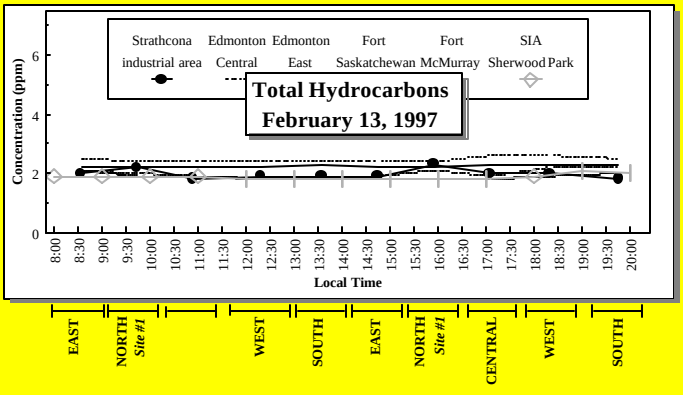
Average Total Hydrocarbon Concentrations in Strathcona Industrial Area









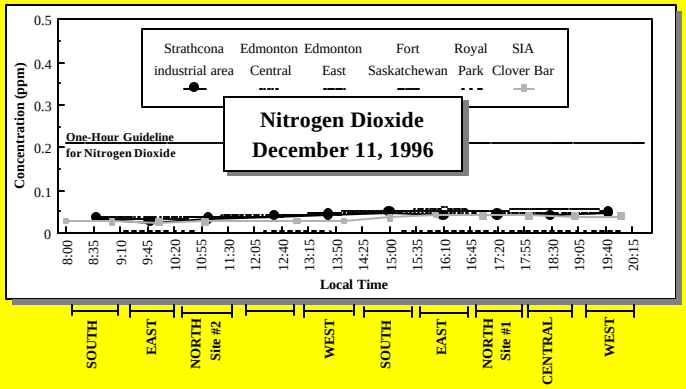


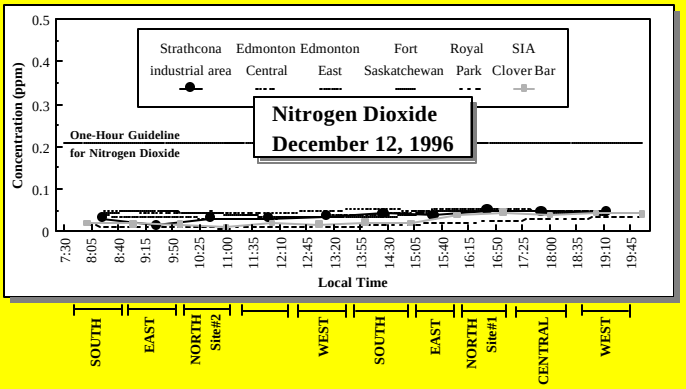
Location of monitoring sites in Strathcona industrial area

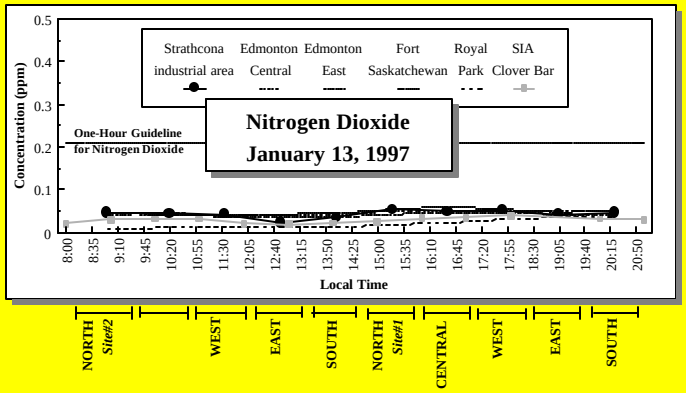
SOUTH	91 avenue & 24 street
EAST	Petro-Canada Ball Diamonds
NORTH site#1	Meridian street & 122 avenue
NORTH site#2	Meridian street & 130 avenue
CENTRAL	24 street & 104 avenue
WEST	Goldstick Park

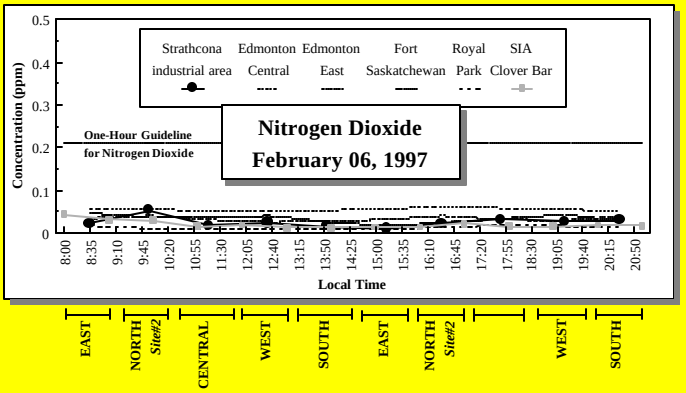
Winter, 1996

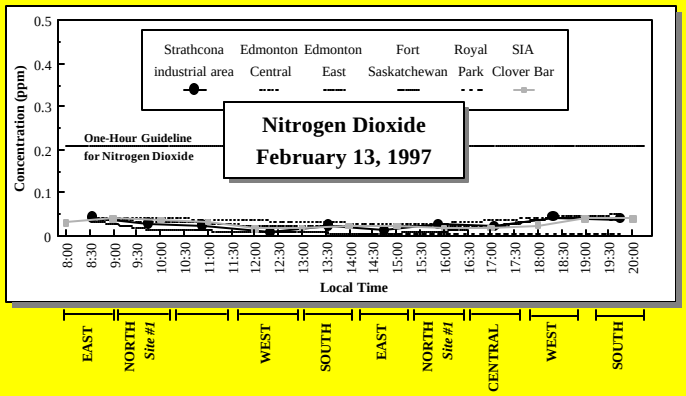
Average Nitrogen Dioxide Concentrations in Strathcona Industrial Area









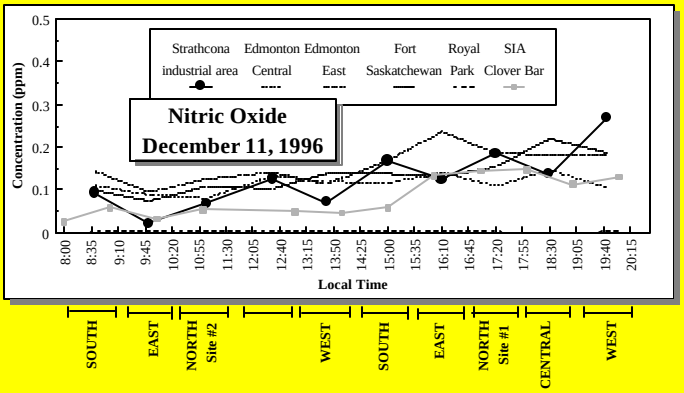


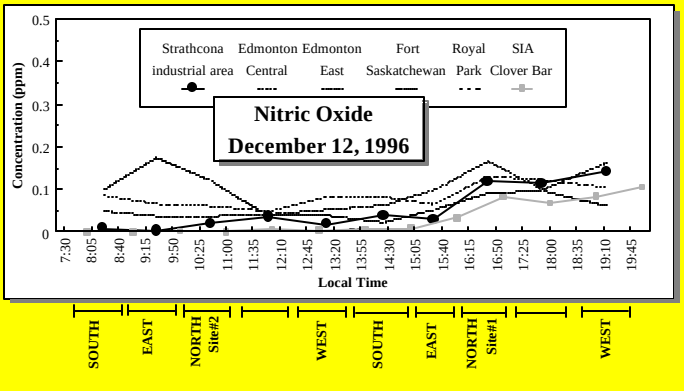
Location of monitoring sites in Strathcona industrial area

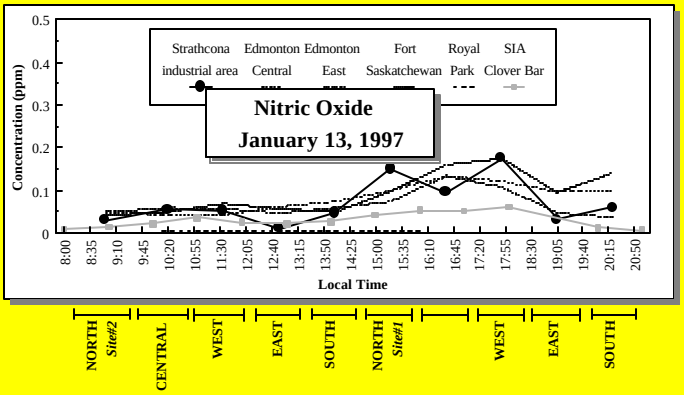
SOUTH	91 avenue & 24 street
EAST	Petro-Canada Ball Diamonds
NORTH site#1	Meridian street & 122 avenue
NORTH site#2	Meridian street & 130 avenue
CENTRAL	24 street & 104 avenue
WEST	Goldstick Park

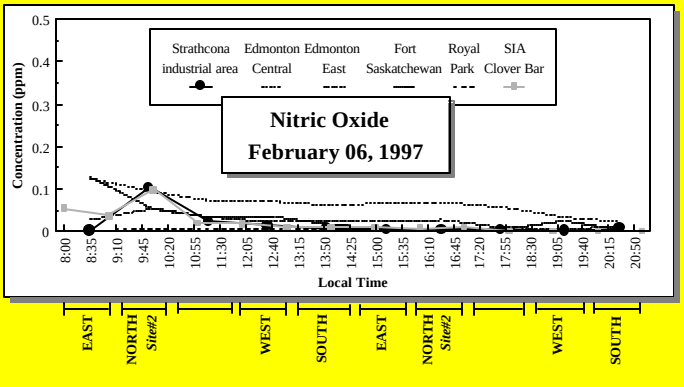
Winter, 1996

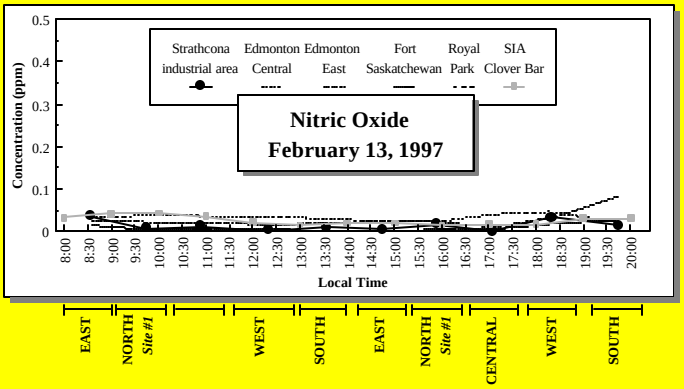
Average Nitric Oxide Concentrations in Strathcona Industrial Area











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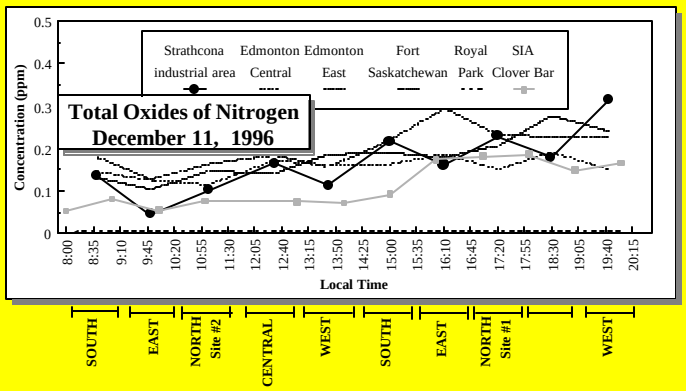
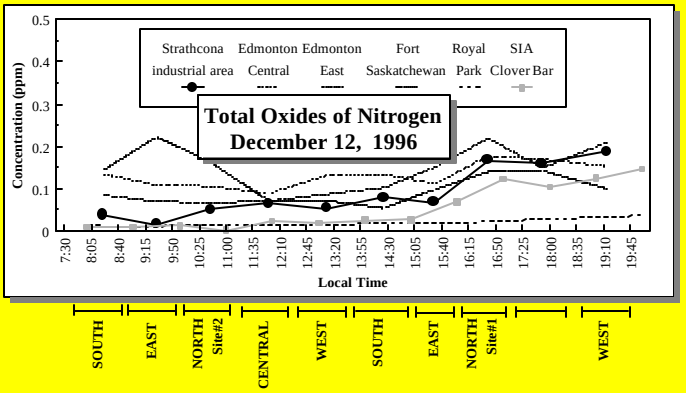
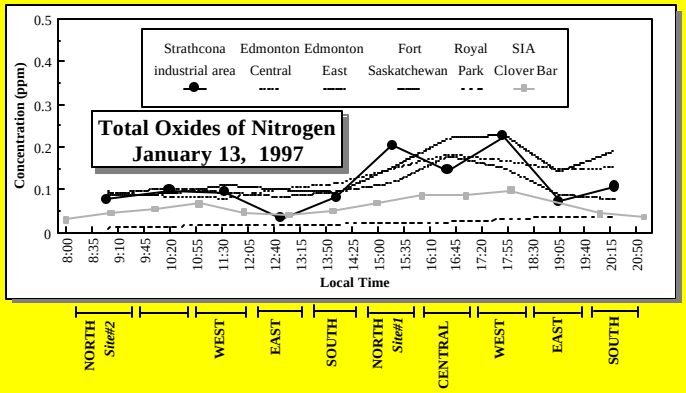
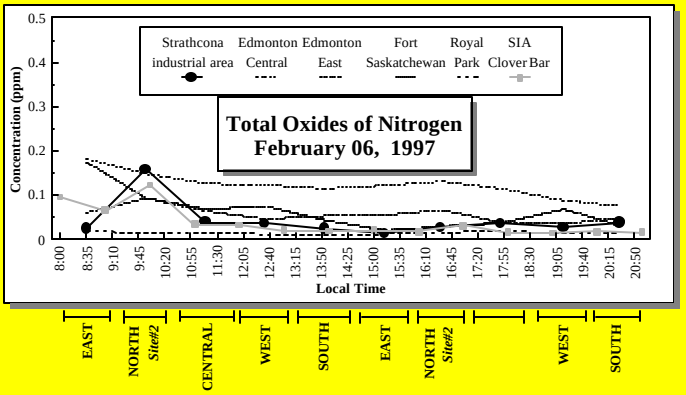
Winter, 1996

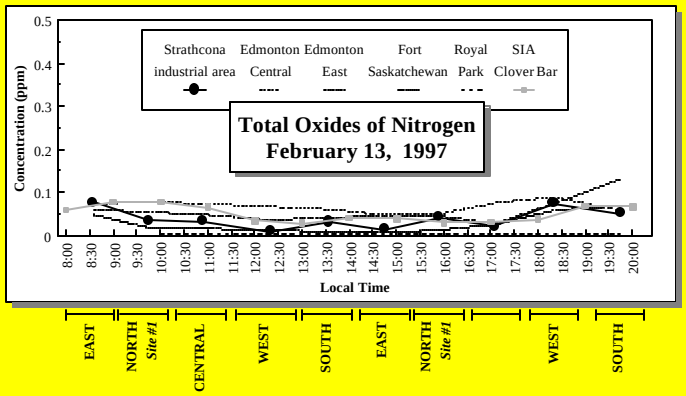
Average Total Oxides of Nitrogen Concentrations in Strathcona Industrial Area











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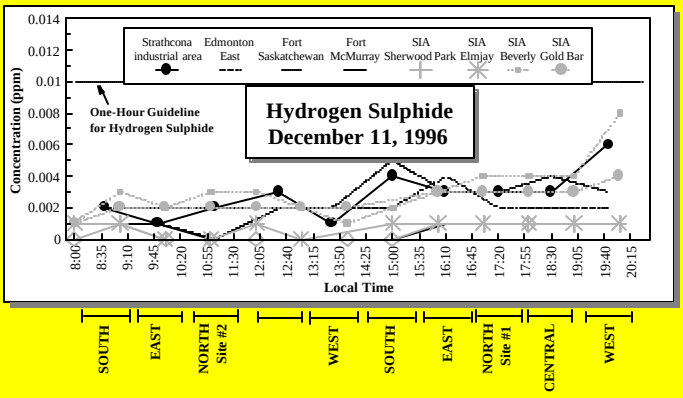
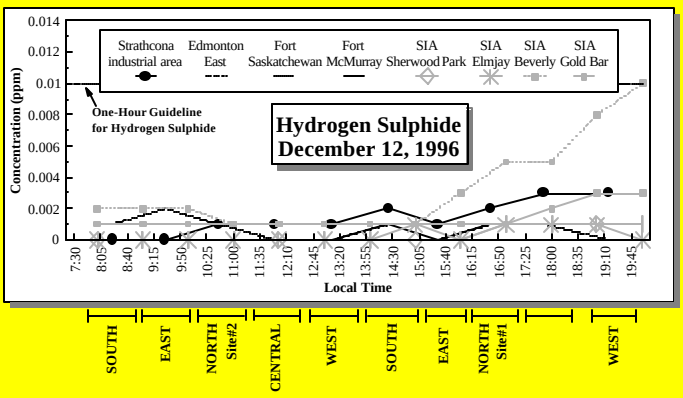
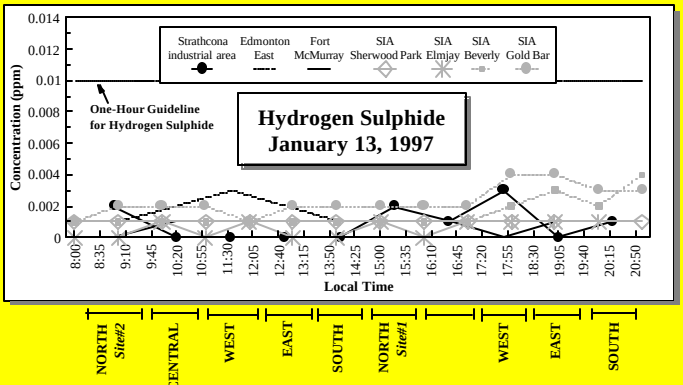
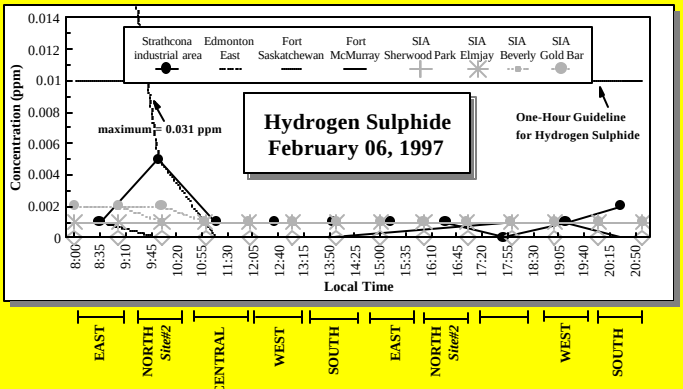
Winter, 1996

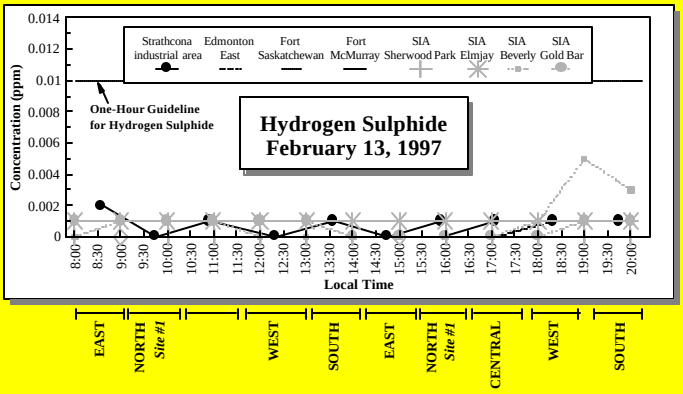
Average Hydrogen Sulphide Concentrations in Strathcona Industrial Area











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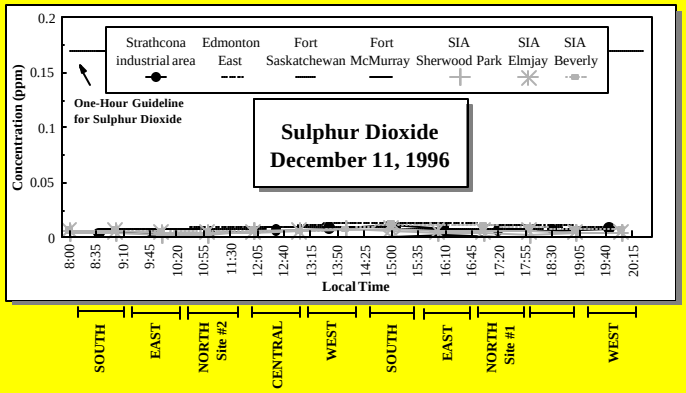
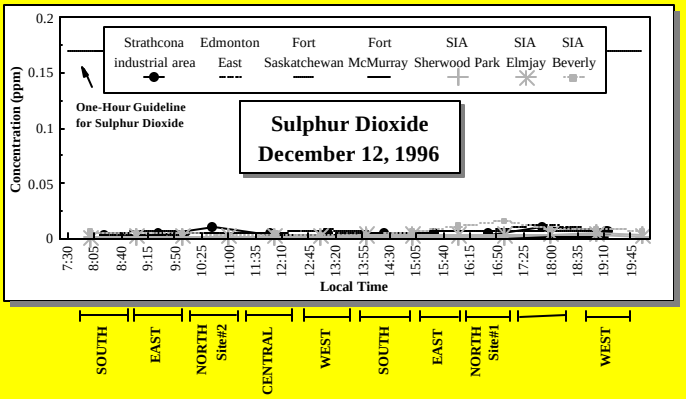
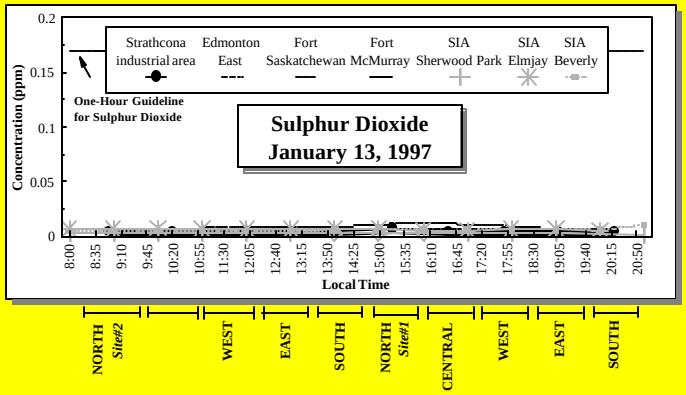
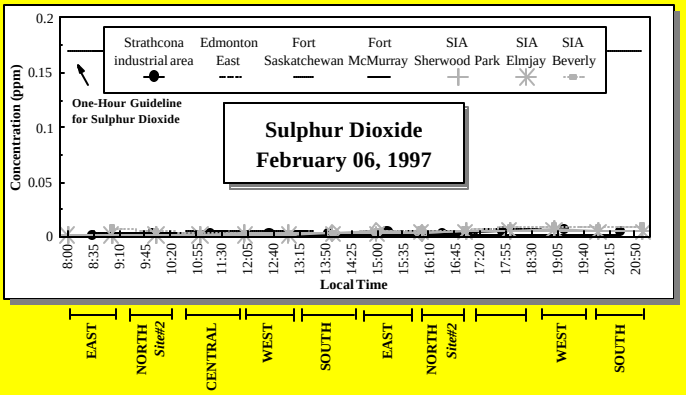
Winter, 1996

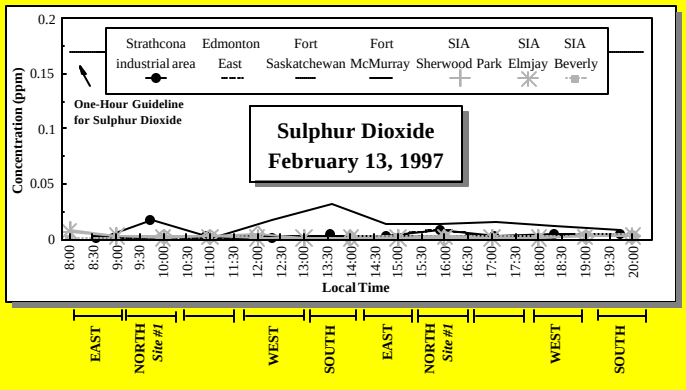
Average Sulphur Dioxide Concentrations in Strathcona Industrial Area











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