

Air Quality Monitoring in Sherwood Park

Spring, 1997 (March 26, April 18, 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 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 (O₃), total hydrocarbons (THC), reactive hydrocarbons (RHC), methane (CH₄), total oxides of nitrogen (NO_x), nitrogen dioxide (NO₂), nitric oxide (NO), hydrogen sulphide (H₂S), and sulphur dioxide (SO₂).

The following is a summary of the results of the mobile air quality monitoring activities in Sherwood Park during the spring of 1997 (March 26, April 18, 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

- L Concentrations of all air quality parameters monitored in Sherwood Park were below the air quality guidelines. Maximum 1-hour average concentrations were:
 - < 15% of the 1-hour guideline for CO;
 - < 63% of the 1-hour guideline for O₃;
 - < 14% of the 1-hour guideline for NO₂;
 - < 30% of the 1-hour guideline for H₂S; and
 - < 16% of the 1-hour guideline for SO₂.
- L The highest concentration of pollutants emitted by vehicles (carbon monoxide, oxides of nitrogen and hydrocarbons) were recorded during the morning traffic rush hours at the northwest and southwest monitoring sites. Higher values at these locations were due to vehicle exhaust emissions from local traffic and commuter traffic between Sherwood Park and Edmonton.

- L Hydrogen sulphide and sulphur dioxide concentrations were very low relative to the air quality guidelines. However, elevated values of these parameters recorded at the southwest, northwest and central sites were likely due to transport from industries in east Edmonton.

Carbon Monoxide (CO)

Max. 1-hour Average	1-hour Guideline
1.9 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 concentration was measured at the northcentral site between 3:30 and 4:30 p.m. on April 18. Winds on the afternoon of April 18 were light and from the north and north-northwest directions. The peak CO value recorded at this time was likely due to local traffic or transport from Yellowhead Trail. Average CO values showed little variation between monitoring sites in Sherwood Park (0.4 to 0.6 ppm). Overall average CO levels on all survey days in Sherwood Park were close to those recorded at the Fort Saskatchewan, Fort McMurray, Edmonton east and Edmonton northwest monitoring stations for the same time period. The average CO concentration of the Edmonton central station (0.8 ppm) was higher than the average in Sherwood Park (0.5 ppm) on the spring survey days. CO values are usually lower in the spring and summer due to a lower frequency of stagnant weather conditions (strong temperature inversions and light winds).

Ozone (O₃)

Max. 1-hour Average	1-hour Guideline
0.052 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 O₃ from the upper atmosphere to ground level. Background O₃ concentrations are generally highest in the spring and summer seasons. O₃ concentrations are generally lower in urban centres due to the destruction of O₃ by nitric oxide.

O₃ concentrations followed the same daily variation that is observed at other monitoring stations in Alberta.

Values were lowest in the morning and highest between noon and 6 p.m. at all on all spring survey days. The highest 1-hour average O₃ concentration was recorded on May 28 between 4 and 5 p.m. at the northcentral monitoring site. Average O₃ concentrations were generally highest at the east, central and northcentral sites. This is likely because monitoring at these locations was conducted later in the day when background O₃ values are higher. Overall average O₃ values recorded in Sherwood Park were higher than downtown Edmonton and east Edmonton and close to the same as values measured in northwest Edmonton and Fort Saskatchewan. Lower O₃ concentrations in downtown and east Edmonton were due to the destruction of background ozone by nitric oxide emitted in vehicle exhaust. The average O₃ concentration in Sherwood Park (0.038 ppm) was lower than the average at the rural station Royal Park (0.046 ppm), located 10 km northwest of Vegreville, for the same time period.

Hydrocarbons (THC, RHC and CH₄)

Max. 1-hour Average	1-hour Guideline
THC = 2.4 ppm	no guideline
RHC = 0.7 ppm	no guideline
CH ₄ = 2.1 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 THC and RHC values were recorded in the early morning on May 30 at the southwest monitoring site. Peak hydrocarbon concentrations recorded at this time were likely due to vehicle exhaust emissions from morning rush hour traffic on Wye Road. A slightly elevated THC concentration of 2.3 ppm was also recorded at the southwest site during the morning rush hour on May 28. Average THC, RHC and CH₄ concentrations showed little variation between monitoring sites in Sherwood Park (THC ranged from 1.9 to 2.0 ppm). RHC, which are primarily emitted by vehicles, made up about 10% of THC based on average concentrations. The overall average THC value in Sherwood Park (2.0 ppm) was slightly lower than those recorded in downtown (2.2 ppm) and east Edmonton (2.1 ppm) and slightly higher than the average concentration in Fort Saskatchewan (1.8 ppm) for the same time period. 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 = 0.029 ppm	0.210 ppm
NO = 0.045 ppm	no guideline
NO _x = 0.064 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 NO and NO₂ concentrations were recorded in the early morning on May 28 and April 18, respectively. Oxides of nitrogen concentrations were higher during the morning and afternoon traffic rush hours on all spring survey days. Average oxides of nitrogen concentrations were highest at the southwest and northwest monitoring sites. This is because: (1) air quality was monitored at these sites during the morning rush hour; and (2) there is generally more commuter traffic in the western part of Sherwood Park. NO_x, NO₂ and NO concentrations were substantially lower in Sherwood Park than at the Edmonton central, northwest and east monitoring stations. However, oxides of nitrogen values in Sherwood Park were slightly higher than those recorded in Fort Saskatchewan and Fort McMurray for the spring monitoring period.

Hydrogen Sulphide (H₂S)

Max. 1-hour Average	1-hour Guideline
H ₂ S = 0.003 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.

The highest average H₂S concentration (0.003 ppm) was recorded near noon on March 26 at the central site. This peak 1-hour value is 30% of the 1-hour guideline. Winds during this time were from the west-southwest at 20 km/hr. Average H₂S concentrations varied from 0.000 to 0.001 ppm at Sherwood Park monitoring sites for the spring monitoring period. The overall average and maximum H₂S concentrations recorded in Sherwood Park were higher than those recorded at Edmonton, Fort Saskatchewan and Fort McMurray monitoring stations for the same time period.

major source of H₂S in Sherwood Park is fugitive emissions (leakages) from industrial sources in east Edmonton.

Sulphur Dioxide (SO₂)

Max. 1-hour Average	1-hour Guideline
SO ₂ = 0.028 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 in the morning of May 15 at the northwest site. This maximum value is about 16% of the 1-hour guideline. Elevated SO₂ concentrations were also recorded at the southwest site in the morning of April 18 (0.013 ppm), at the northwest site in the afternoon on May 15 (0.013 ppm), and at the central site in the morning of May 30 (0.011 ppm). Average SO₂ concentrations for all spring survey days were highest at the northwest and southwest sites. The average SO₂ value measured in Sherwood Park for all survey days was the same as those measured at the Edmonton East and Fort McMurray monitoring stations.

Particulates (TSP, PM₁₀ and PM_{2.5})

Max. 1-hour Average	1-hour Guideline
TSP = 18 µg/m ³ PM ₁₀ = 15 µg/m ³ PM _{2.5} = 3 µg/m ³	no guideline no guideline no guideline

Air pollutants are not necessarily in a gaseous form. Tiny particles of solid material or liquid droplets, defined collectively as particulates are also present in the atmosphere. Total suspended particulates (TSP) refers to all particles up to 500 microns in diameter (a human hair is about 100 microns in diameter) and are important primarily from a nuisance perspective. Particles less than 10 microns in diameter (PM₁₀) can be inhaled into the nose and throat while particles less than 2.5 microns in diameter (PM_{2.5}) can penetrate into the lungs. Sources of particulates include soil dust, road dust, agricultural dust (e.g. harvest), smoke from forest fires and recreational wood burning, vehicle exhaust emissions, brake and tire wear, and industrial emissions. Smaller particles (PM_{2.5}) originate in the atmosphere as a result of condensation and combustion from sources such as vehicle exhaust emissions, industrial emissions and wood burning.

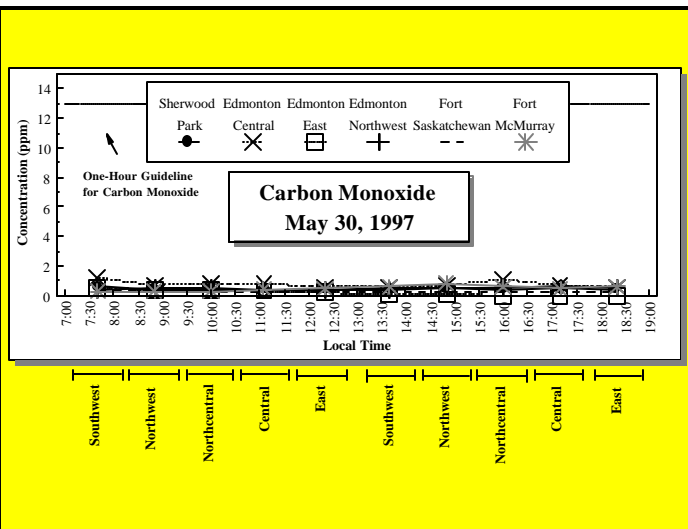
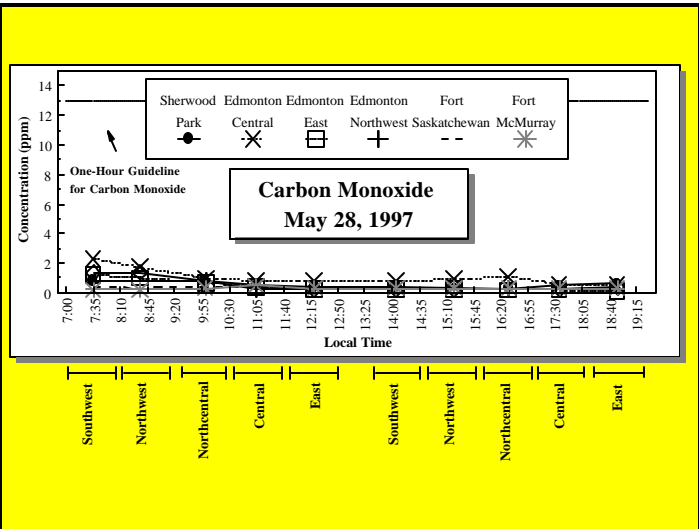
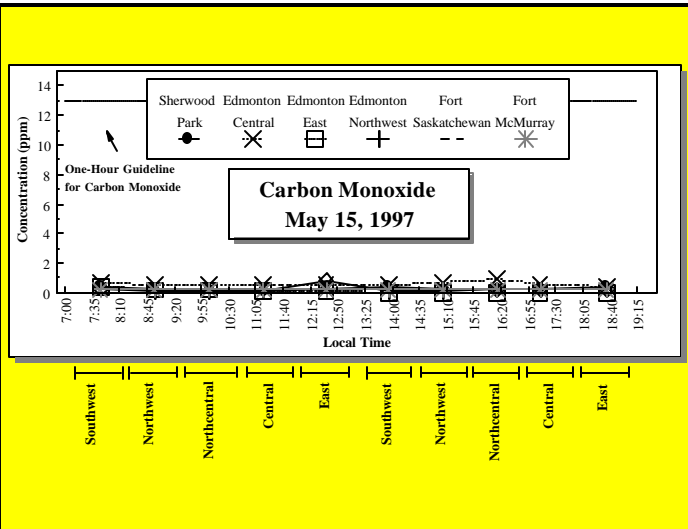
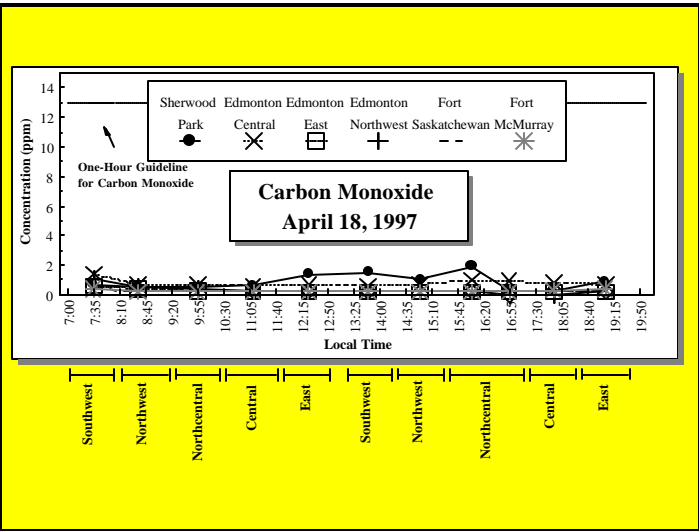
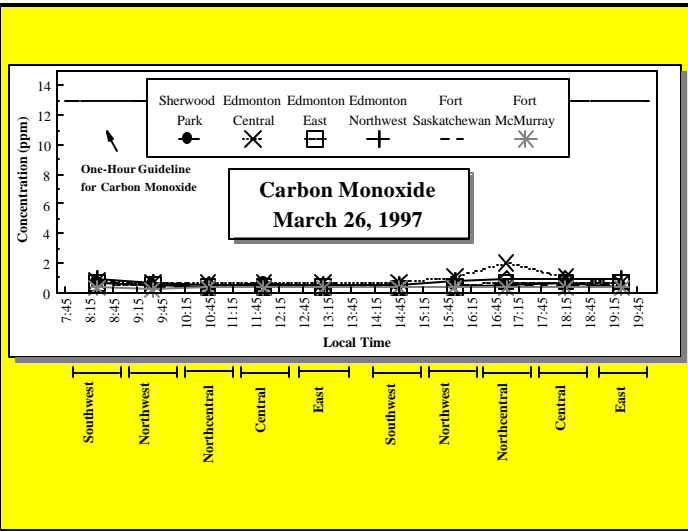
Particulate concentrations were measured on March 26, May 15, May 28 and May 30 in Sherwood Park. The maximum TSP, PM₁₀ and PM_{2.5} concentrations were observed at the central site between 5:40 and 6:40 p.m. on March 26. The next highest particulate concentrations were recorded at the northwest site between 8:15 and 9:15 a.m. on May 28. Particulate concentrations showed little variation between monitoring sites in Sherwood Park (average PM₁₀ ranged from 5 to 7 µg/m³). The average PM₁₀ concentration in Sherwood Park (6 µg/m³) was much lower than the average value in northwest Edmonton (16 µg/m³). The average PM_{2.5} concentration in Sherwood Park (1 µg/m³) was also very low relative to other locations (e.g. 7 µg/m³ in Fort McMurray) for the same time period. TSP, PM₁₀ and PM_{2.5} are not routinely monitored as a 1-hour average concentrations at other Alberta monitoring stations.

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 ₂ S	SO ₂	TSP**	PM ₁₀ **	PM _{2.5} *
southwest	0.6	0.029	0.025	0.013	0.012	1.9	1.6	0.2	0.001	0.004	7	6	1
northwest	0.5	0.034	0.022	0.015	0.007	2.0	1.7	0.2	0.001	0.006	9	7	2
northcentral	0.5	0.040	0.017	0.012	0.005	2.0	1.8	0.1	0.000	0.002	6	5	1
central	0.4	0.042	0.014	0.011	0.003	1.9	1.7	0.1	0.001	0.003	7	6	1
east	0.5	0.043	0.015	0.010	0.004	1.9	1.7	0.1	0.001	0.001	6	5	1
Overall Average Concentrations on All Spring Survey Days (ppm)													
Location	CO	O ₃	NO _x	NO ₂	NO	THC	CH ₄	RHC	H ₂ S	SO ₂	TSP*	PM ₁₀ *	PM _{2.5} *
Sherwood Park	0.5	0.038	0.019	0.012	0.007	2.0	1.7	0.1	0.001	0.003	7	6	1
Edmonton Central	0.8	0.028	0.041	0.023	0.019	2.2	no data			no data			
Edmonton East	0.3	0.035	0.026	0.016	0.011	2.1	no data		0.000	0.003	no data		
Edmonton Northwest	0.4	0.038	0.034	0.021	0.014	1.4	no data			no data	16	no data	
Fort Saskatchewan	0.3	0.037	0.012	0.009	0.003	1.8	no data		0.000	0.002	no data		
Fort McMurray	0.3	0.032	0.009	0.006	0.004	2.0	no data		0.000	0.003	no data	7	
Royal Park	no data	0.046	0.007	0.003	0.005	no data							
Maximum 1-hour Average Concentrations on All Spring Survey Days (ppm)													
Location	CO	O ₃	NO _x	NO ₂	NO	THC	CH ₄	RHC	H ₂ S	SO ₂	TSP*	PM ₁₀ *	PM _{2.5} *
Sherwood Park	1.9	0.052	0.064	0.029	0.045	2.4	2.1	0.7	0.003	0.028	18	15	3
Edmonton Central	2.3	0.040	0.191	0.051	0.154	2.9	no data			no data			
Edmonton East	1.2	0.047	0.117	0.044	0.091	2.6	no data		0.001	0.008	no data		
Edmonton Northwest	1.4	0.064	0.065	0.041	0.028	1.9	no data			no data	43	no data	
Fort Saskatchewan	0.8	0.053	0.049	0.036	0.018	2.2	no data		0.000	0.009	no data		
Fort McMurray	0.8	0.052	0.042	0.020	0.022	2.2	no data		0.001	0.037	no data	13	
Royal Park	no data	0.061	0.013	0.005	0.008	no data							

*units are µg/m³

Spring, 1997

Average Carbon Monoxide Concentrations in Sherwood Park



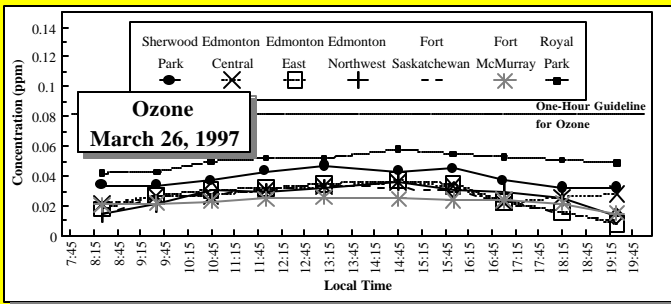
Location of monitoring sites in Sherwood Park

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

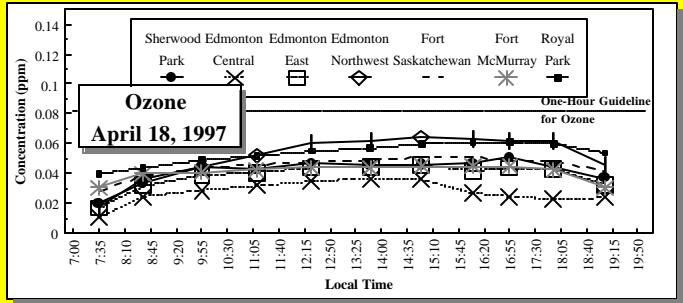
** Less than 75% data available

Spring, 1997

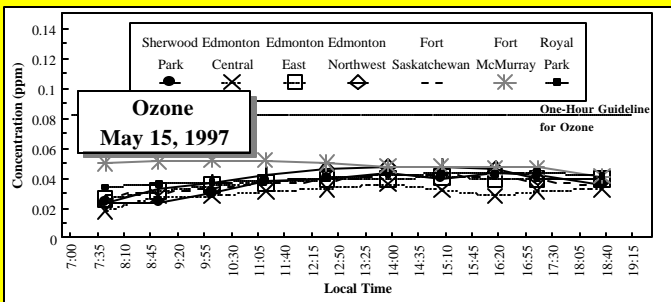
Average Ozone Concentrations in Sherwood Park



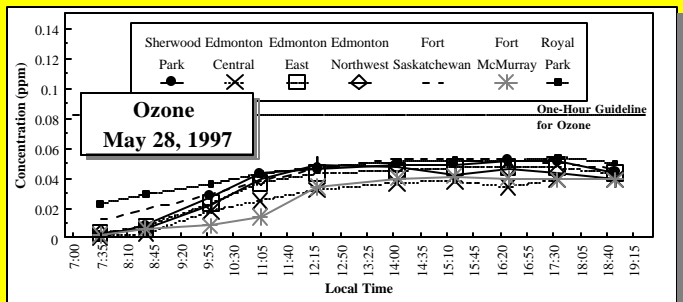
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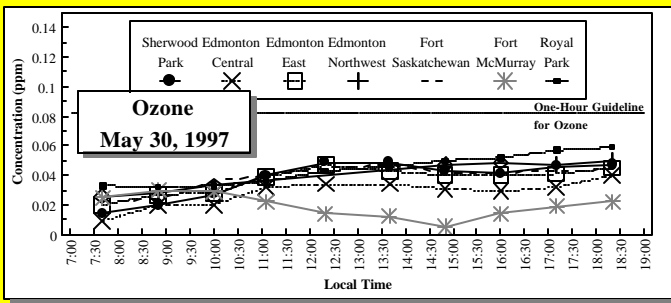
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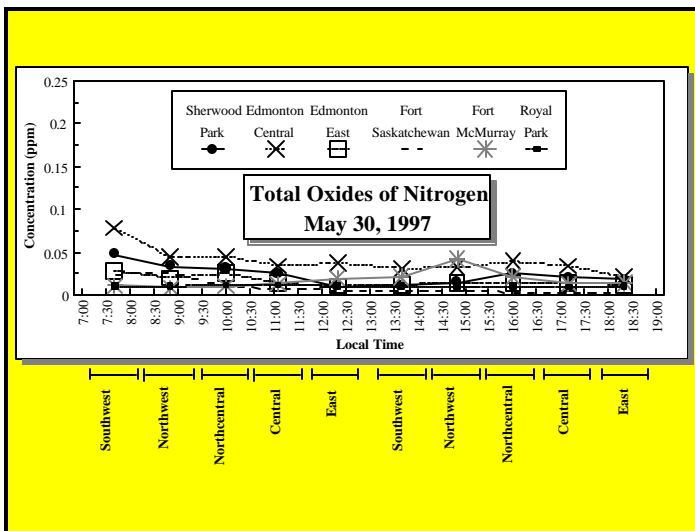
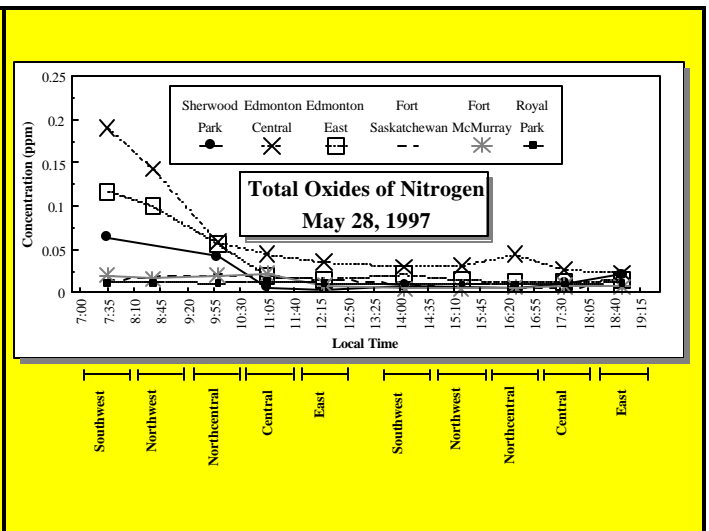
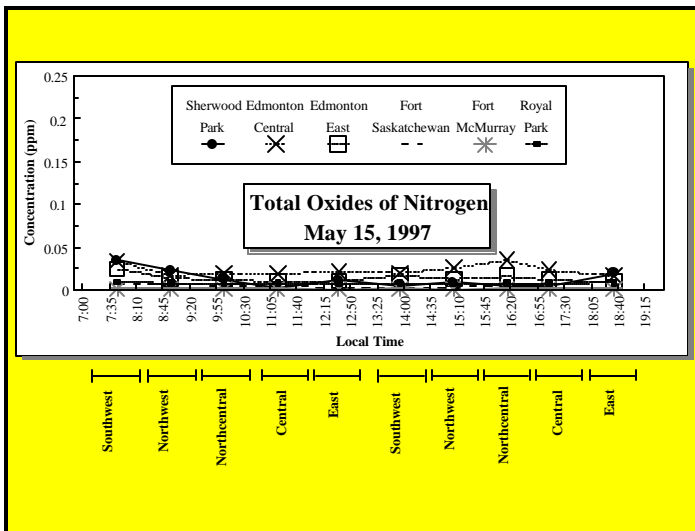
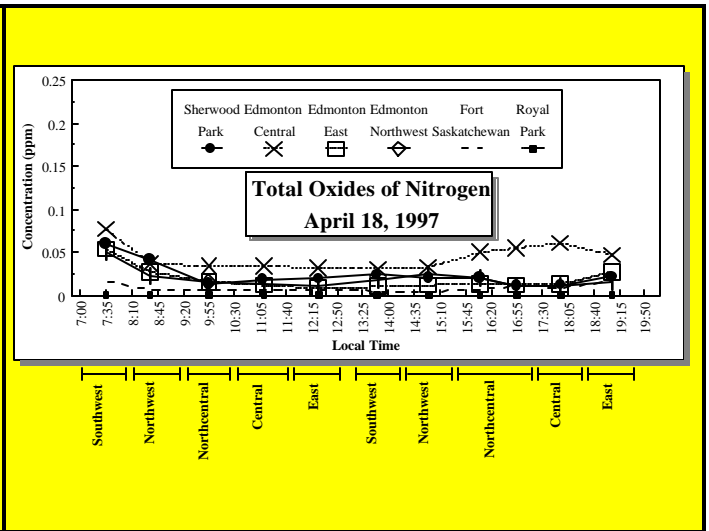
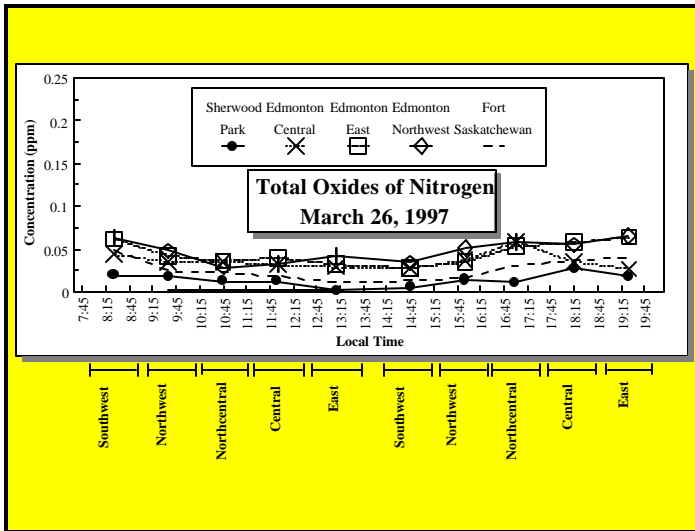
Location of monitoring sites in Sherwood Park

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

Spring, 1997

Average Total Oxides of Nitrogen Concentrations in Sherwood Park



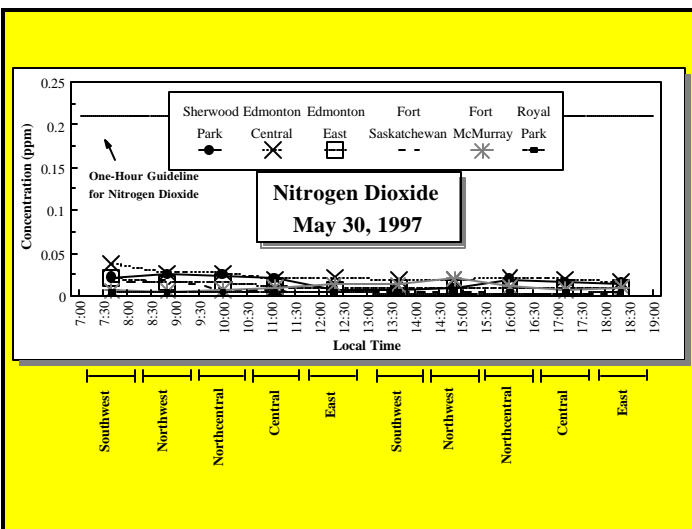
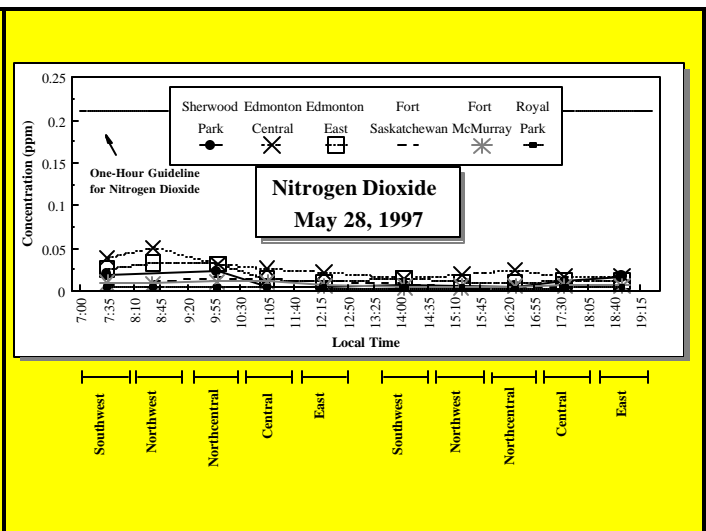
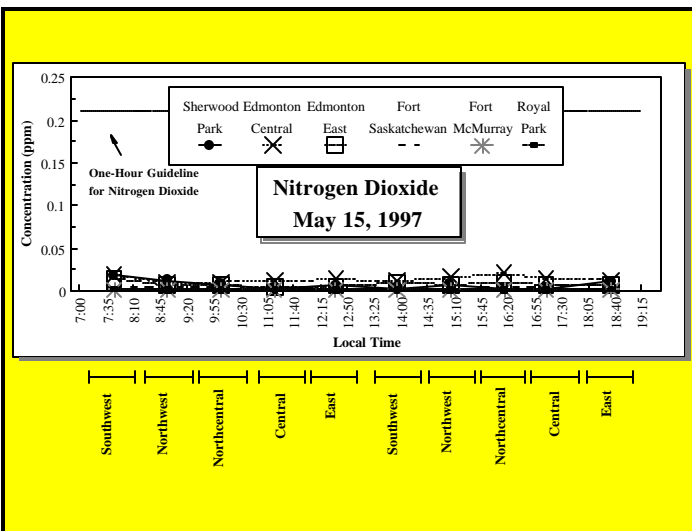
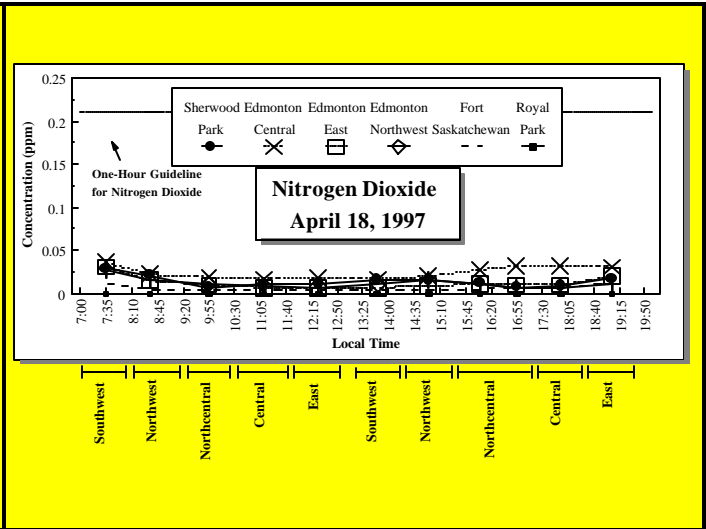
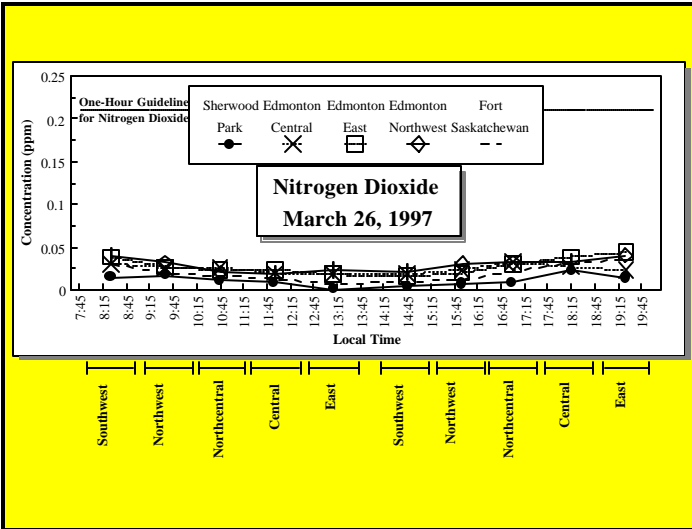
Location of monitoring sites in Sherwood Park

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Spring, 1997

Average Nitrogen Dioxide Concentrations in Sherwood Park



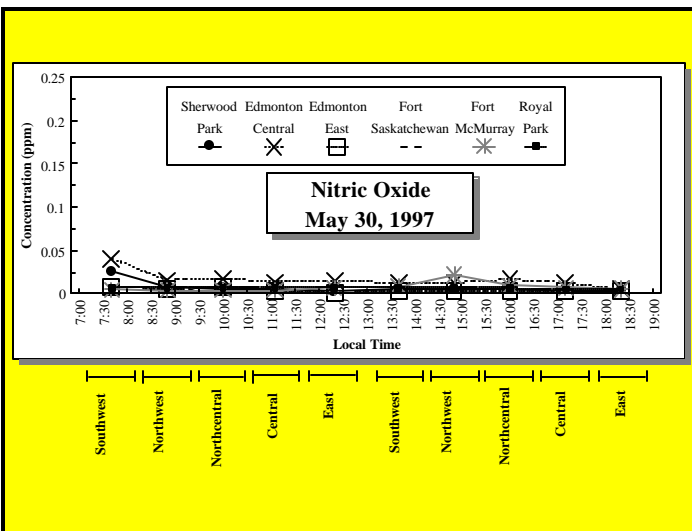
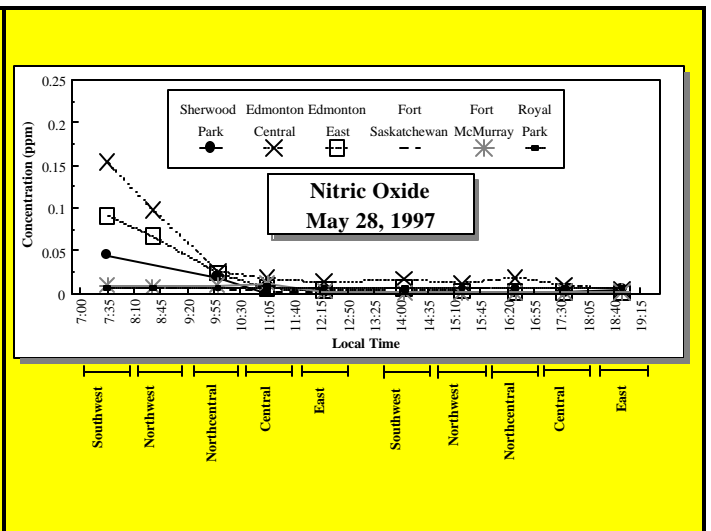
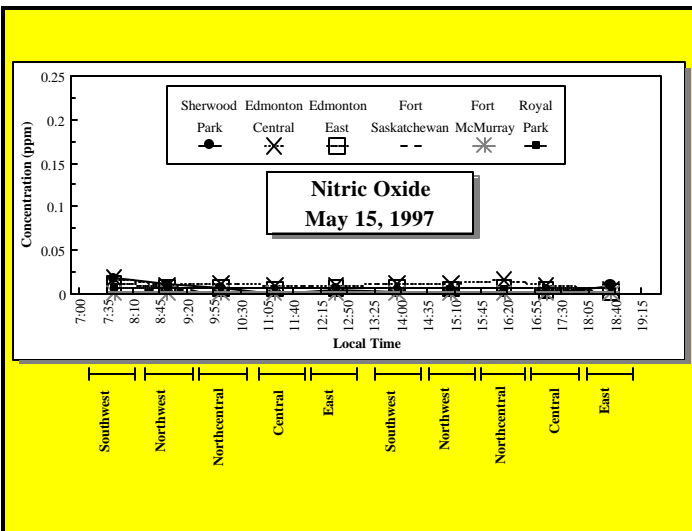
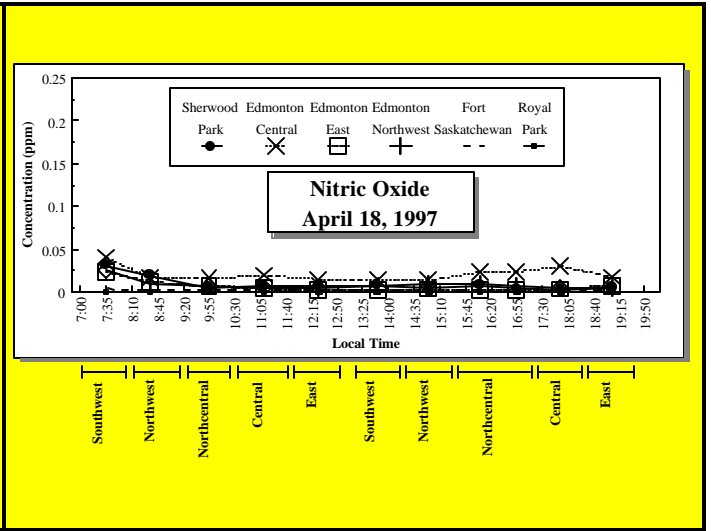
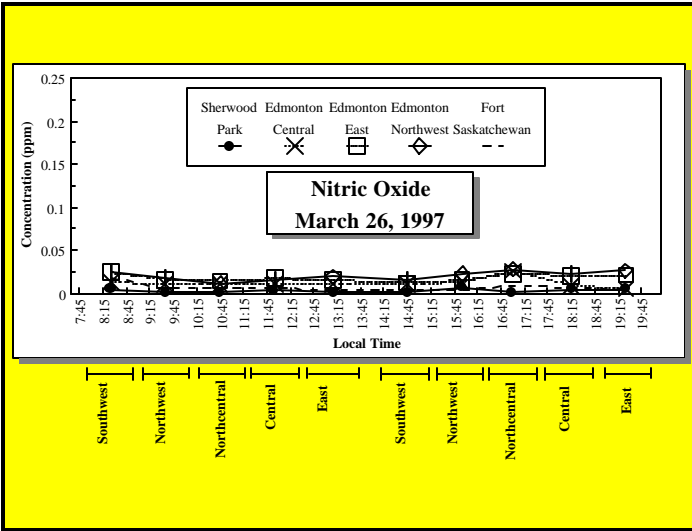
Location of monitoring sites in Sherwood Park

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Spring, 1997

Average Nitric Oxide Concentrations in Sherwood Park



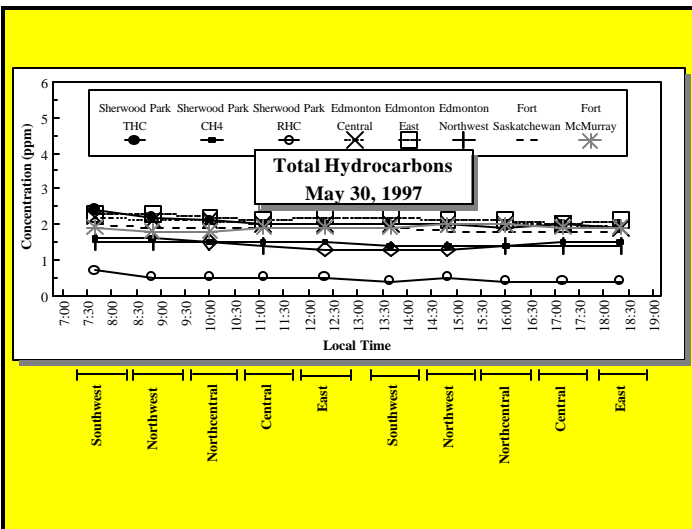
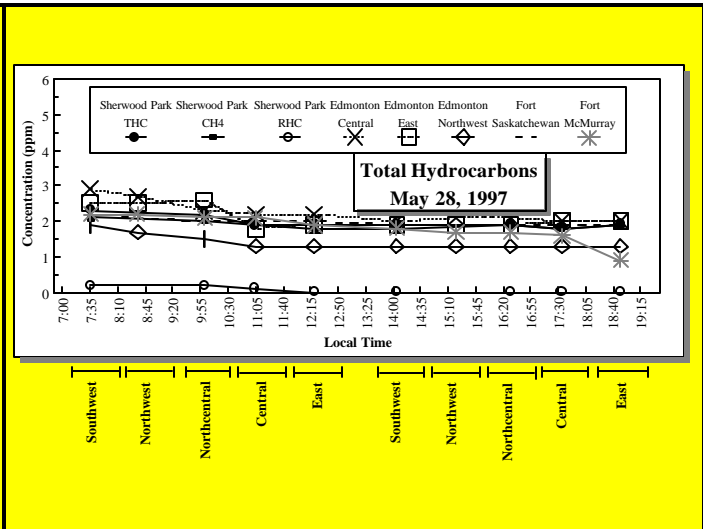
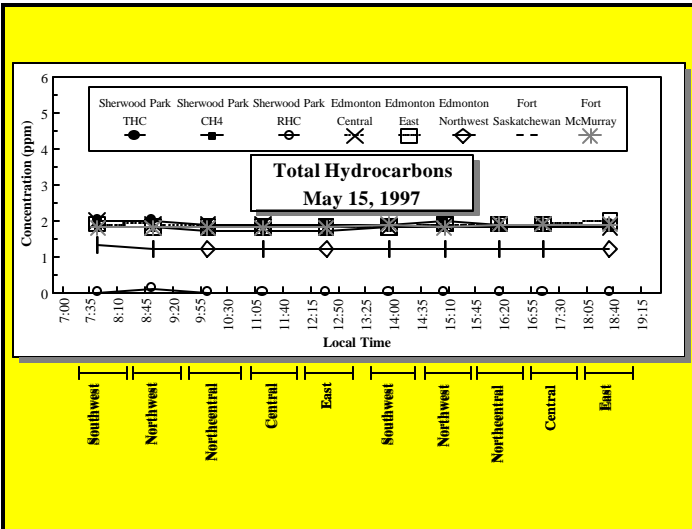
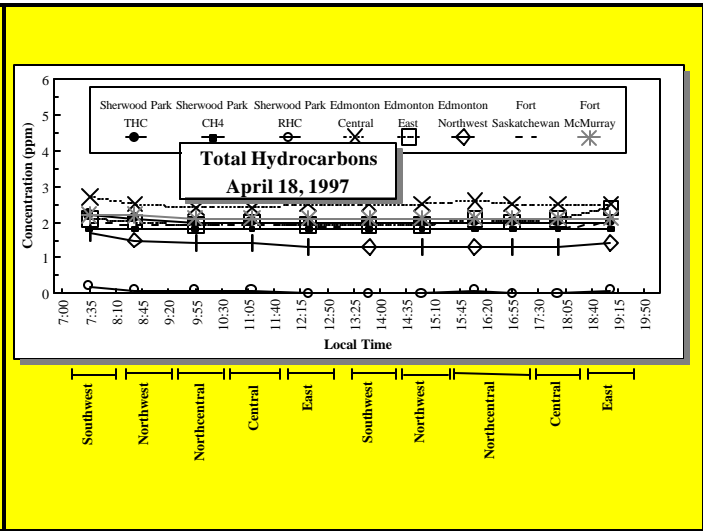
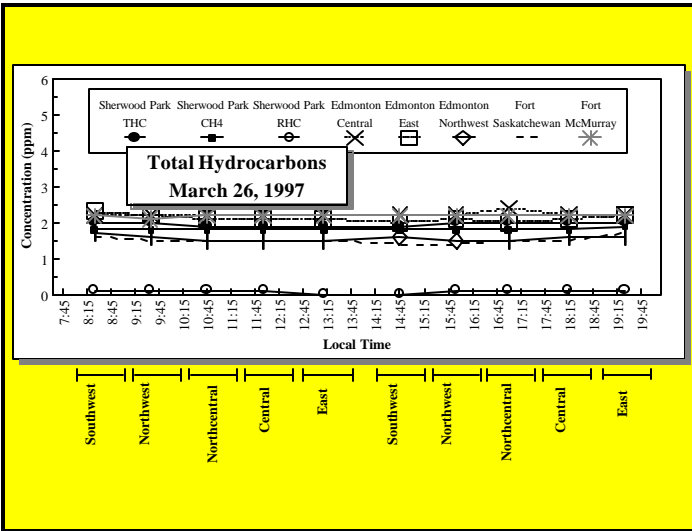
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Spring, 1997

Average Total Hydrocarbon Concentrations in Sherwood Park



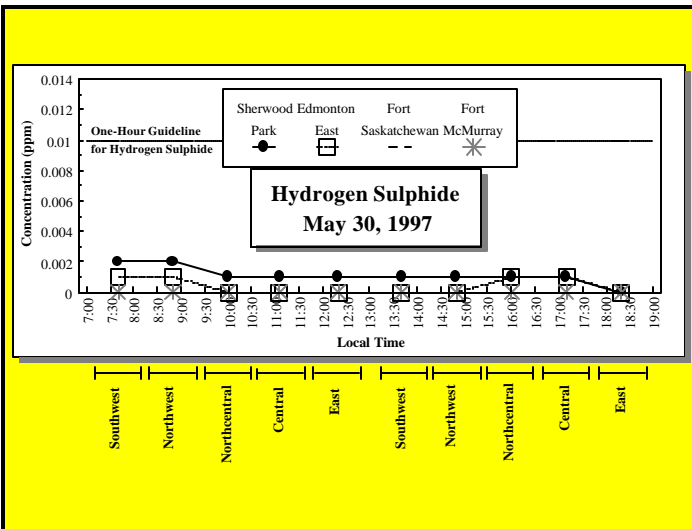
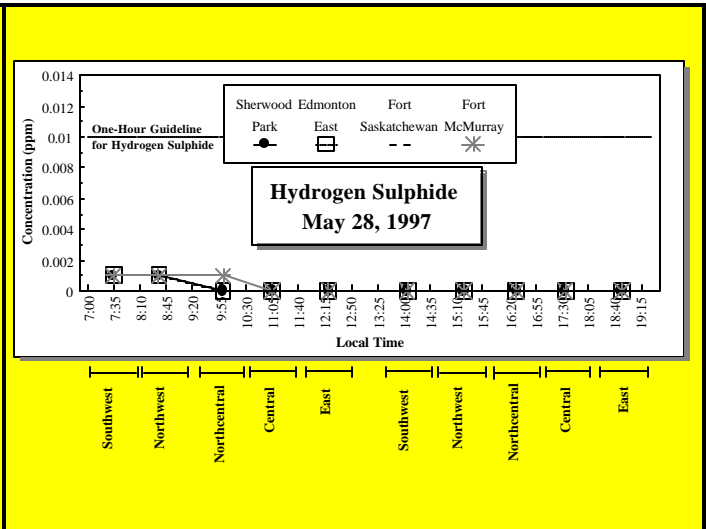
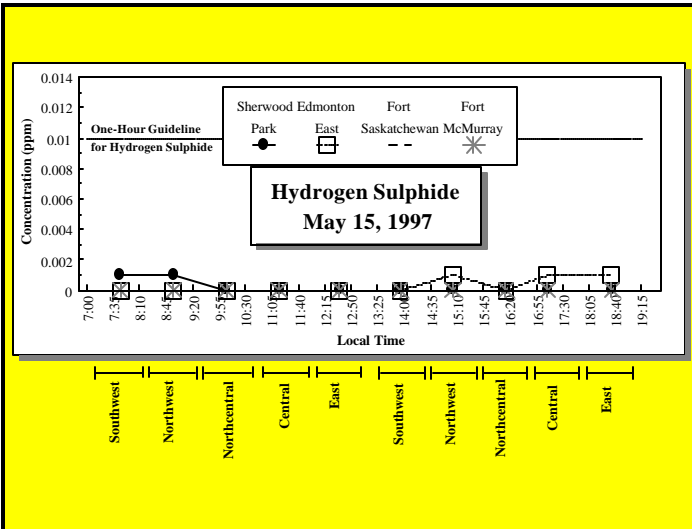
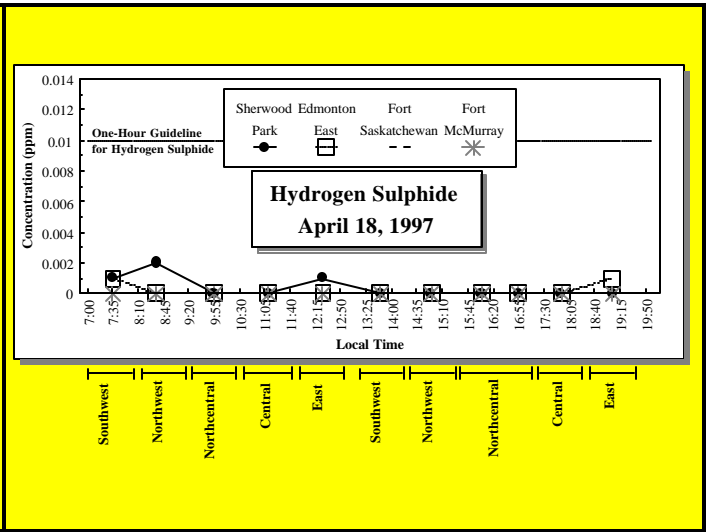
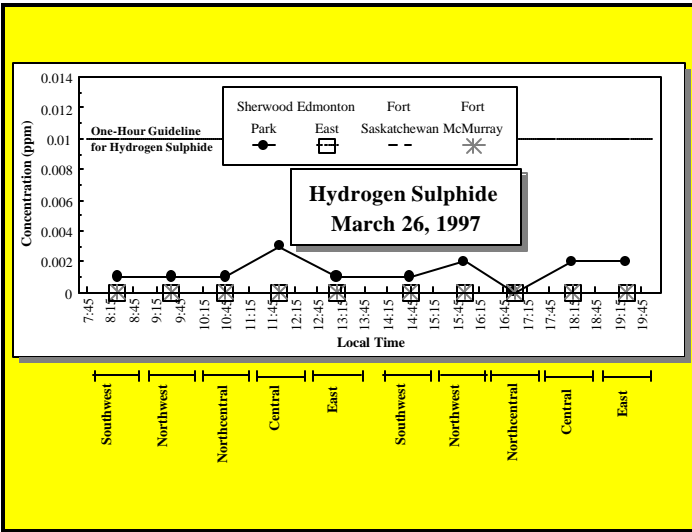
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Average Hydrogen Sulphide Concentrations in Sherwood Park



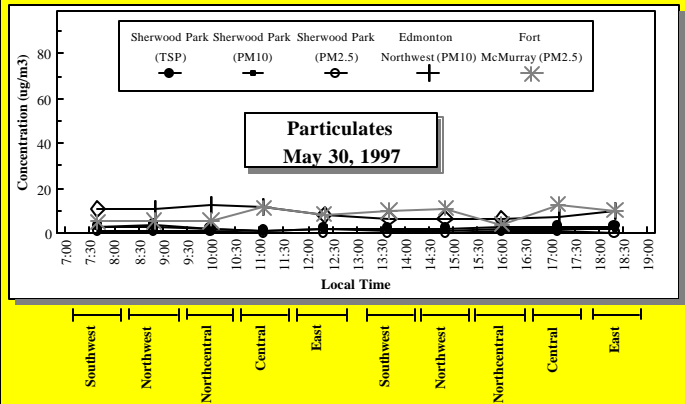
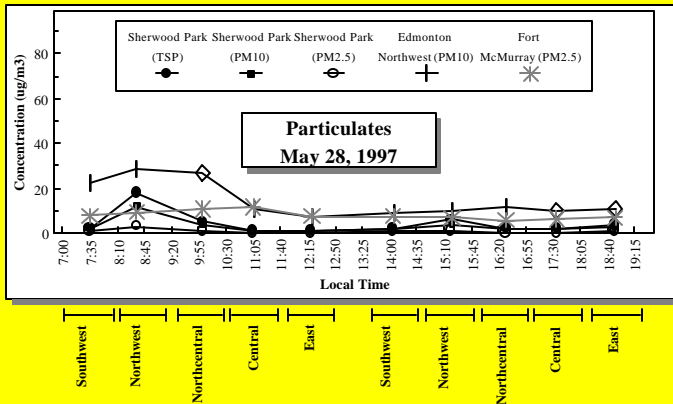
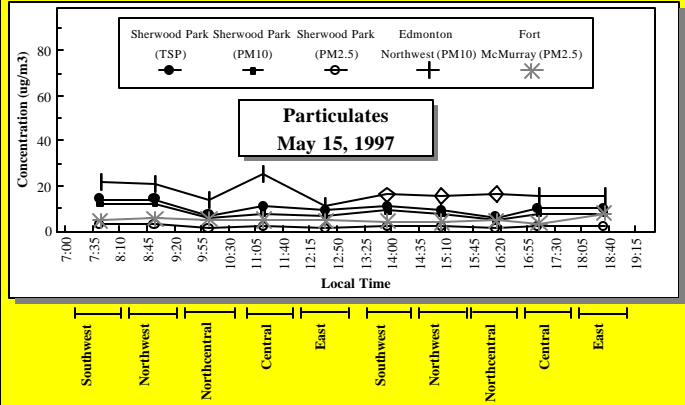
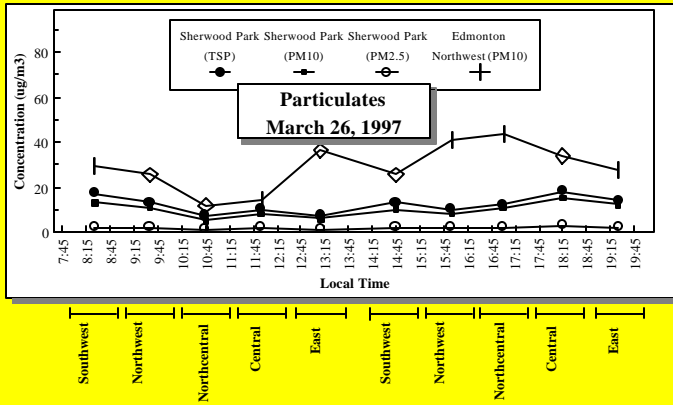
Location of monitoring sites in Sherwood Park

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

Spring, 1997

Average Particulate Concentrations in Sherwood Park



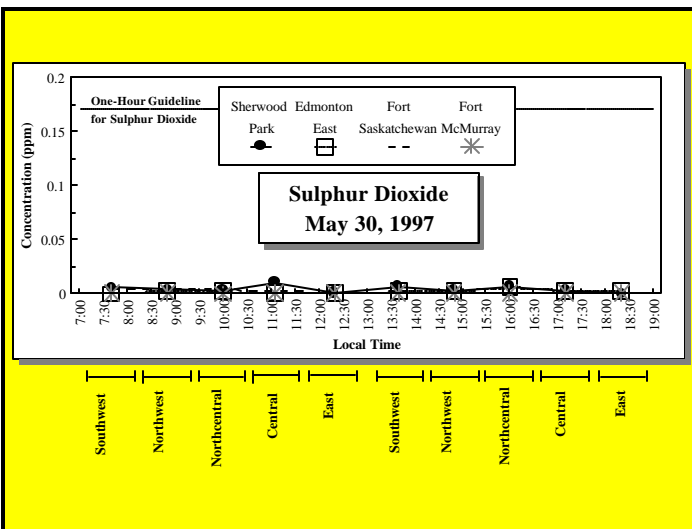
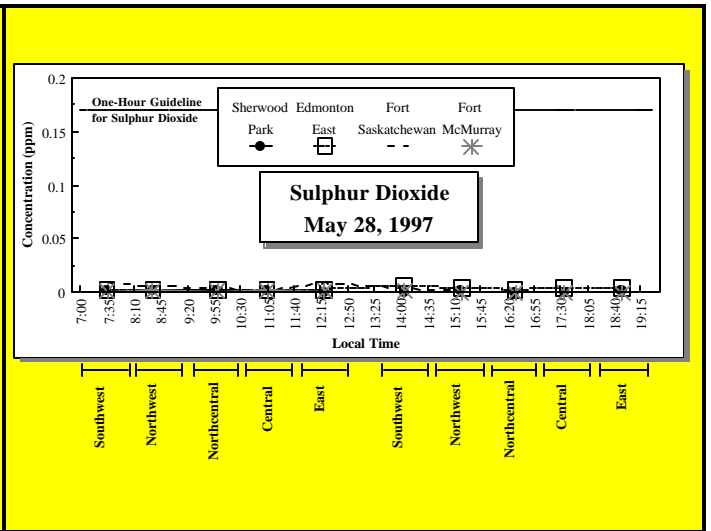
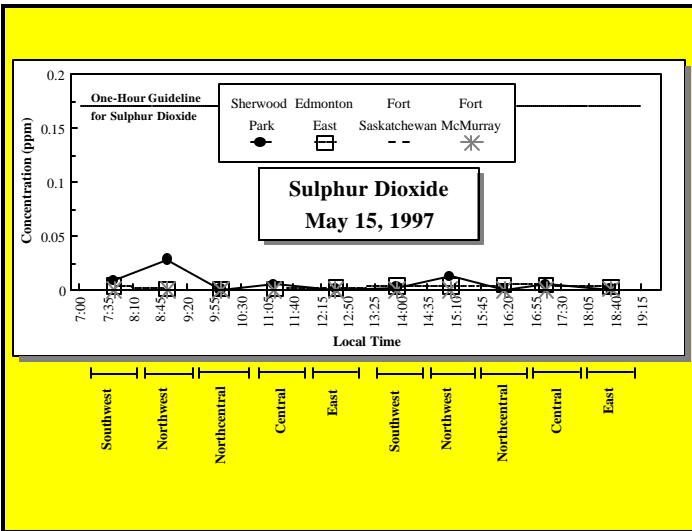
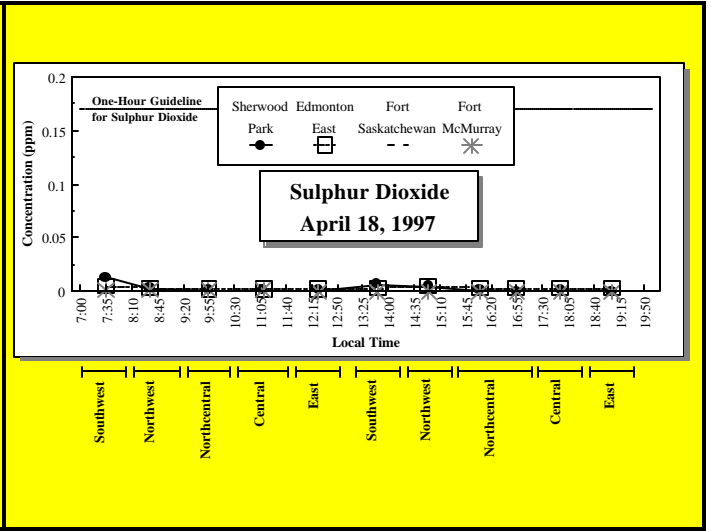
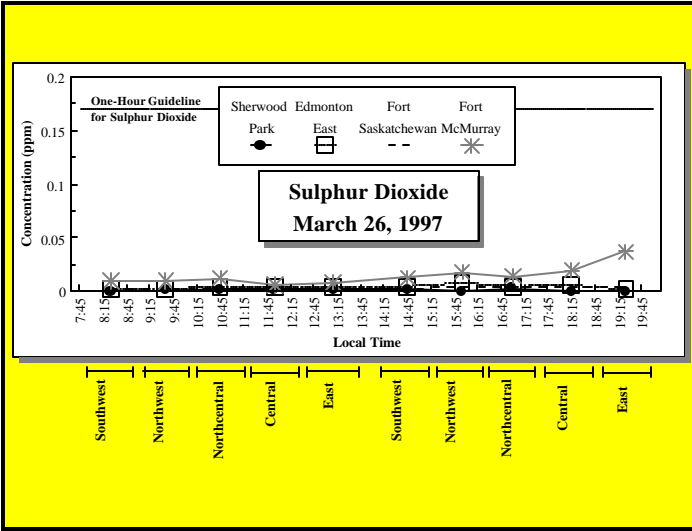
Location of monitoring sites in Sherwood Park

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

Spring, 1997

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