Air Quality Monitoring:

In the Vicinity of Heavy Oil Cold Flow Tanks Near Bonnyville

Fall 2007 and spring 2008 **Final Report**

1. Introduction

Alberta Environment conducted two air sampling surveys in the vicinity of heavy oil cold flow tanks near Bonnyville, Alberta. The surveys were initiated by public concern with odours and potential health effects. Heavy oil extracted using the cold-flow technique is heated in onsite storage tanks to reduce viscosity. Lowering the viscosity of the oil allows the product to be pumped from the onsite storage to tank-trucks for treating and upgrading. The onsite storage tanks may not have vapour recovery systems installed and water vapour and volatilized hydrocarbons can be released from the thief hatch at the top of the tank. These tanks are 7-10 meters in height.

Air samples were collected at a number of sites in the fall of 2007 and the spring of 2008. Samples collected were analyzed for 150 individual volatile organic compounds and 30 polycyclic aromatic hydrocarbons. The main objective of the study was to examine hydrocarbon concentrations on properties located adjacent to cold flow tank platforms. Samplers were placed at various distances from the cold flow tanks platforms; in addition attempts were made to alter the temperature of the oil within the tanks. Concentrations downwind of the cold flow tanks were compared with odour thresholds (when available) and concentrations measured upwind of the tanks. The current survey is a follow up to a similar survey conducted on March 24th 2006 in the Hamlet of La Corey, Alberta[1].

[1] Off site measurements of Tank Vapours in the La Corey Area (March 2006)

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2. Monitoring method and location

Samples were collected using SilcCO canisters and hi-volume samplers (HiVol) outfitted with polyurethane foam cartridges (PUF). Canisters were used to collect air samples that were later analyzed for 150 individual volatile organic compounds (VOCs). PUF cartridges were analyzed for 30 Polycyclic Aromatic Hydrocarbons (PAHs). The PUF sampling method is designed to simultaneously collect total suspended particulate as well as volatile PAHs. Canisters and PUF samplers were setup downwind of the tanks as shown in Figure 1. The monitoring designed was based on the initial tank vapour study conducted on March 24th, 2006. A canister and HiVol were also set up to simultaneously sample upwind from the tanks (reference sample). The reference samples were taken about 35 meters upwind from the nearest tank. In this study the Mobile Air Monitoring Laboratory (MAML) was largely used as a staging platform and meteorological station. Generators were used as power supply and were located downwind from the sample site. Figure A1 in the appendix illustrates a cold flow tank platform. There were two sample sessions, one in the fall 2007 and one in the spring of 2008. The fall samples on November 15 and 16, 2007 were collected in the vicinity of CNRL platform 2C Bonnyville (LSD 2-15-61-5 W4M) located east of Bonnyville and off Hwy 659. The spring samples on March 11 and 12, 2008 were collected in the vicinity of CNRL 3-28-63-08 located west of Iron River off Hwy 55. Figure 2 presents the location of these two sample sites. During the fall sample, canisters and PUFs collected one-hour integrated samples, providing one-hour average for VOCs and PAHs concentrations at the sample sites. Concentrations for a number of PAHs from these samples were below analytical detection limit. Thus, PUF sample time for the spring survey was extended to three hours, in order to collect more mass on the sampling medium. The VOC sampling interval for the spring survey remained one-hour.

Attempts were made to change the oil temperature for both sample periods, as this was assumed to influence hydrocarbons emitted from tanks. However, the response time was much greater than anticipated and thus the exercise was not very successful. Table 1 presents temperature settings and actual oil temperature. Oil temperature during these surveys ranged from 40 to 55°C. This was an ambitious sampling setup using equipment that could not readily be moved. Efforts were made to collect at least seven simultaneous samples for each sample day. The sample sites were set using initial conditions at the start of the sample day; a change in

the wind direction during the day would have affected the relative location of the downwind samples.

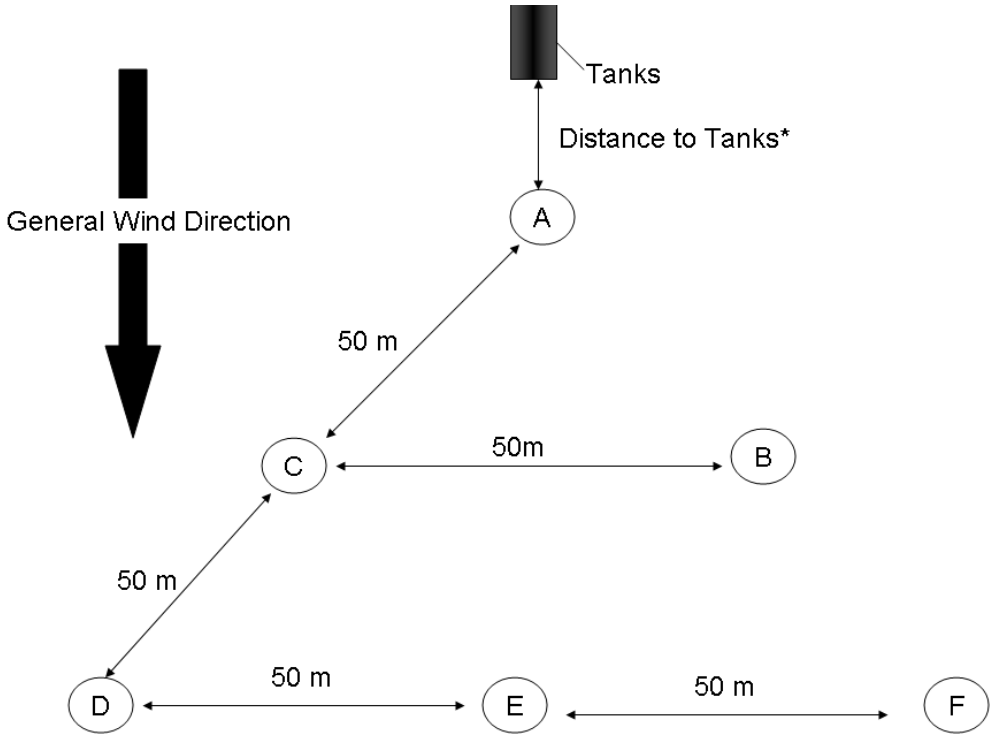

Figure 1: Schematics of sample sites. *Distance to tanks was 76 meters for the November samples and 50 meters for the March samples.

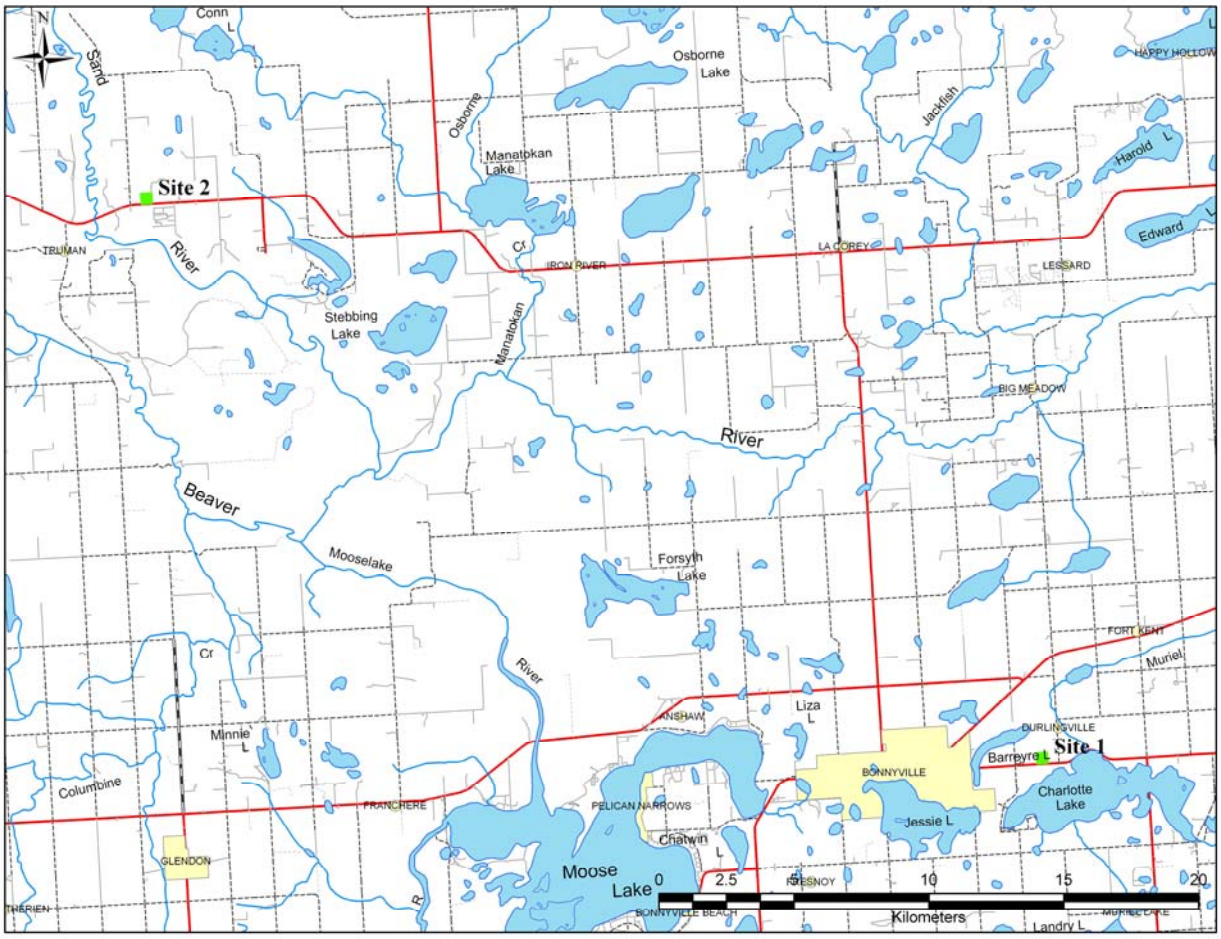

Figure 2: Map of monitoring locations. Sample collection in the fall of 2007 was conducted at Site 1 and collection in the Spring of 2008 was conducted at Site 2.

Table 1: Oil temperature and burner setting for the various sample dates

Sample Date	*Oil surface temperature*[2]	*Oil temperature at 9 ft*	*Burner setting*
November 15, 2007	49°C	70°C	61°C
November 16, 2007	54°C	70°C	80°C
March 11, 2008	55°C	--	86°C
March 12, 2008	40°C	--	88°C

Note: °C – Degrees centigrade
-- temperature not monitored

[2] Average of two measurements

3. Results

Wind speed and wind direction for the sample period are presented in Figure A 2. For the most part wind directions remain primarily from a single prominent direction. The most widespread elevated concentration for both PAHs and VOCs was observed on November 16. The wind direction was least variable during this day.

3.1. Polycyclic aromatic hydrocarbons

Polycyclic aromatic hydrocarbons are organic compound consisting of two or more benzene rings and are formed through incomplete combustion. PAHs in the atmosphere are typically associated with vehicle exhaust, wood smoke and forest fires. This study monitored hydrocarbon concentrations including PAHs near heavy oil tanks. PAHs occur as complex mixtures and can be found as a gas or condensed onto particles. The phase of PAHs is dependant on ambient conditions such as temperature and the molecular structure of the compound. Larger PAHs (containing more benzene rings) tend to be found in the condensed phase (bound onto particles), while smaller PAHs are more volatile and tend to be found in the gas phase. The PAHs included in the analysis are listed in Table A1. Here after total PAHs refers to the total concentration of the listed species when above detection limit.

The samples were analyzed for 30 PAHs. The *number* of PAHs that were above detection limit varied from 11 to 22. The total PAH concentrations ranged from 11.3 to 47.9 nano grams per cubic meter (ng/m^3) for one-hour samples (fall) and 2.0 to 72.5 ng/m^3 for three hour samples (spring). The lower range concentrations were measured at an upwind reference site. The variability in the measured concentrations at the downwind sites illustrates the heterogeneous nature of the air near these tanks. Limited mixing and dispersion may have accounted for observed elevated concentrations in both fall and spring.

Napthalene was the most prevalent PAH; its concentration was on average 70% of the total. Naphthalene it is also the smallest PAH in the analysis list. Smaller PAHs are more volatile, all other variables being equal, these PAHs would be more abundant in air near cold flow tanks. The maximum measured concentration of Napthalene is 70.25 ng/m^3 (3-hour average). Concentrations of the top seven PAHs most commonly observed are listed in Table 3 (all with three or less benzene rings). The sampling method collected both gas and particle phase

PAHs the results indicate limited mass contribution from the larger PAHs that would have been sample in the particle phase.

Table 2: PAHs summary, indicating the number of PAHs above detection limit and their total mass concentration (ng/m^3). Individual PAHs are listed in Table A1.

Site	15-Nov✦		16-Nov✦		11-Mar*		12-Mar*	
	Number	*Total Conc*	*Number*	*Total Conc*	*Number*	*Total Conc*	*Number*	*Total Conc*
Upwind	--	--	*11*	*11.3*	*21*	*18.6*	*12*	*2.0*
A	20	16.7	12	40.7	16	7.7	10	5.7
B	19	18.4	11	47.9	15	6.9	10	3.2
C	18	16.9	9	12.8	22	6.0	10	4.4
D	17	14.1	10	19.3	14	14.1	11	72.5
E	12	13.8	19	38.6	16	18.6	11	7.1
F	11	12.0	20	12.7	16	11.4	12	8.4
A1	21	26.5	--	--	--	--	--	--
B1	21	23.9	--	--	--	--	--	--
C1	20	24.0	--	--	--	--	--	--
D1	--	--	13	37.5	--	--	--	--
E1	--	--	21	30.1	--	--	--	--
F1	--	--	16	15.1	--	--	--	--

Note:
Number – total number of PAHs above detection limit
Total Conc – Total mass concentration (ng/m^3) of all PAHs above detection limit
✦ One hour samples. Results presented as samples A1-F1 are concentrations from successful second samples
* Three hour samples
-- no sample collected

Table 3: Concentration of the most prevalent[3] PAHs (ng/m^3), a complete list of PAH concentrations is presented in the Appendix

Sample Date	*Site*	*Naphthalene*	*Phenanthrene*	*Fluorene*	*Retene*	*Acenaphthylene*	*Acenaphthene*	*Fluoranthene*
15-Nov	Upwind	--	--	--	--	--	--	--
	A	11.99	1.16	0.76	1.18	0.29	0.23	0.27
	B	13.18	1.35	0.86	1.26	0.26	0.34	0.29
	C	12.02	1.10	0.76	1.51	0.25	0.19	0.28
	D	10.14	0.99	0.62	1.15	0.20	0.14	0.22
	E	10.39	0.90	0.68	0.83	bdl	0.15	0.22
	F	8.85	0.76	0.60	0.78	bdl	0.20	0.17
	A1	18.74	1.73	1.01	1.08	0.60	0.40	0.67
	B1	17.85	1.14	0.86	1.36	0.62	0.28	0.39
	C1	18.28	1.15	0.87	1.31	0.61	0.28	0.36
	Average	**13.49**	**1.14**	**0.78**	**1.16**	**0.40**	**0.25**	**0.32**
16-Nov	upwind	7.67	0.79	0.66	1.06	bdl	0.10	0.28
	A	33.74	1.58	1.40	1.01	0.85	0.73	0.31
	C	40.90	1.27	1.46	1.15	1.29	0.38	0.30
	B	8.91	0.82	0.82	1.23	bdl	0.18	0.24
	D	15.19	1.00	0.94	0.98	bdl	0.16	0.27
	E	32.99	1.24	1.14	0.90	0.65	0.51	0.26
	F	8.25	1.02	0.68	1.15	0.05	0.18	0.36
	D1	31.94	1.28	1.10	1.20	0.27	0.52	0.29
	E1	23.83	1.47	1.35	1.03	0.67	0.40	0.29
	F1	10.69	1.21	0.87	1.06	0.09	0.23	0.27
	Average	**22.94**	**1.21**	**1.08**	**1.08**	**0.55**	**0.37**	**0.29**
11-Mar	upwind	12.21	1.65	1.03	0.25	0.70	0.39	0.54
	A	3.66	1.17	0.95	0.26	0.31	0.44	0.22
	B	3.09	1.13	0.86	0.30	0.29	0.31	0.22
	C	2.35	1.03	0.71	0.27	0.26	0.19	0.31
	D	10.29	1.13	0.81	0.32	0.50	0.25	0.24
	E	13.43	1.39	1.07	0.31	0.83	0.36	0.28
	F	6.98	1.25	0.95	0.33	0.57	0.29	0.27
	Average	**6.63**	**1.18**	**0.89**	**0.30**	**0.46**	**0.31**	**0.26**
12-Mar	upwind	0.56	0.50	0.29	0.24	0.03	0.08	0.09
	A	2.63	0.80	0.70	0.21	0.22	0.53	0.13
	C	1.32	0.57	0.40	0.26	0.08	0.18	0.11
	B	2.12	0.61	0.54	0.27	0.15	0.31	0.09
	D	70.25	0.77	0.42	0.29	0.14	0.15	0.16
	E	4.81	0.62	0.51	0.26	0.20	0.27	0.11
	F	5.88	0.66	0.52	0.32	0.29	0.25	0.12
	Average	**14.50**	**0.67**	**0.52**	**0.27**	**0.18**	**0.28**	**0.12**

Note:

ng/m^3 – nano gram per cubic meter

Average denotes average concentration for downwind samples for the specified PAH.

Samples taken on **November 15 and 16** were one-hour integrated samples. On these days a second sample were collected. Missing second and upwind samples were due to equipment failure. Those taken on **March 11 and 12** were three hour integrated samples.

[3] The top seven PAHs most commonly observed. Naphthalene concentration was the highest for all samples.

3.2. Volatile organic compounds

Volatile organic compounds (VOCs) are a large group of chemical compounds that contain carbon and hydrogen. They can be present in the atmosphere due to natural and human caused sources. Biogenic VOCs such as isoprene, α and β pinene are emitted by vegetation[4]. Methane can be emitted during anaerobic rotting of organic matter. Human caused sources of VOCs include storage tanks, petroleum and chemical industries, fossil fuel (coal, oil and gas) combustion and some agriculture practices. VOCs can react in the atmosphere to produce secondary pollutants such as ground level ozone, fine particulate matter and oxygenated VOCs such as aldehydes and ketones. VOCs and their associated secondary pollutants are known to have harmful effects on human health and the environmental at elevated concentrations.

A summary of the total VOCs concentrations and the number of species detected is presented in Table 4. A greater number and higher concentration of VOCs were measured at a downwind site. Short chain hydrocarbons such as propane, butane, 2-methyl butane and isobutane were the most abundant VOCs. The total concentrations of VOCs measured at the various sites ranged from 12.33 to 430.46 micro grams per cubic meter ($\mu g/m^3$), with the lowest concentration often being measured at the upwind site.

In general, one to three downwind sites were found to have twice the concentration measured at the upwind site. There were some exceptions[5], these were likely due to variability in the wind direction affecting the relative location of the sample sites and tank platform. The highest concentrations were observed on November 16; on this day the wind direction was consistently from the southeast placing the sample sites downwind of the tank for the whole sample period (Figure A 2).

Alberta has ambient air quality objectives (AAAQO) for a number of VOCs. Table 5 presents a comparison of AAAQO and ambient concentrations. Measured VOCs during the current study did not exceed ambient objectives. VOC concentrations were also compared to

[4] Kesselmeier, j. and Staudt, M., 1999 : Biogenic Volatile Organic Compounds (VOC): An Overview on Emission, Physiology and Ecology, *Journal of Atmospheric Chemistry* **33**:23-88,

[5] Second sample on November 15 and first sample March 12.

odour thresholds and were found to be substantially lower. Maximum measured VOC concentrations are presented in Table A 6 in the appendix.

Table 4: Summary of VOCs results, concentration for all 150 individual VOCs are presented in the appendix

		Site						
		Upwind	A	B	C	D	E	F
Date	sample	Number of VOCs above detection limit (total number of VOCs = 150)						
15-Nov	1	*118*	119	120	115	117	112	134
15-Nov	2	*116*	92	115	116	115	118	128
16-Nov	1	*109*	121	119	120	114	124	119
16-Nov	2	*110*	130	113	125	118	120	110
11-Mar	1	*90*	117	124	115	113	118	132
11-Mar	2	*104*	98	120	118	122	117	120
12-Mar	1	*113*	116	115	138	126	107	120
12-Mar	2	*101*	125	113	125	126	117	93
		Total mass concentration ($\mu g/m^3$)						
15-Nov	1	*13.69*	20.50	57.05	13.89	14.09	14.13	48.16
15-Nov	2	*19.62*	18.19	20.36	20.14	22.82	20.48	20.67
16-Nov	1	*16.06*	232.95	29.93	87.13	21.37	85.01	21.47
16-Nov	2	*14.15*	430.46	18.31	107.11	20.23	102.01	15.70
11-Mar	1	*31.90*	103.11	322.13	55.30	39.19	84.90	70.44
11-Mar	2	*53.89*	122.87	49.88	44.31	44.79	51.16	41.32
12-Mar	1	*55.92*	34.42	31.46	85.86	28.73	45.42	66.49
12-Mar	2	*12.33*	37.47	19.38	52.61	21.99	36.49	34.13

Note:

$\mu g/m^3$- micro grams per cubic meter

Table 5: Comparison of maximum measured VOCs concentration and Alberta's ambient air quality objectives. Concentration of VOCs is in micro grams per cubic meter (μg/m^3)

Pollutant	1-hr AAAQO	15-Nov-07	16-Nov-07	11-Mar-08	12-Mar-08
Benzene	30	0.30	1.456	0.566	0.592
Ethlybenzene	2000	0.07	2.216	0.186	0.296
Hexane	21000	0.27	9.258	1.662	1.06
Styrene	215	0.01	0.816	0.066	0.02
Toluene	1880	0.32	21.558	0.676	1.326
Xylenes	2300	0.21	6.786	0.816	1.094

Note:

1-hr AAAQO – Alberta's ambient air quality objective for concentration measured during one hour sample interval

3.3. Summary

VOC and PAH concentrations measured at the downwind sites can be substantially higher than the reference upwind site. This indicates that the sample sites were most likely impacted by emissions from the cold flow tanks. Six simultaneous samples at the downwind sites showed highly variable VOCs and PAHs concentrations within the small sample area. These results indicate that close to the source site there is limited mixing of the emitted substance into the air, resulting in a heterogeneous air mass and sample. PAHs concentrations were largely composed of napthalene and other smaller PAHs typically found in the gas phase. The results indicate minimal contribution from particle phase PAHs. Short chain hydrocarbons, which are typically found in the gas phase, were the most abundant VOCs. Although at times elevated, measured VOC concentrations were orders of magnitude lower than Alberta Ambient Air Quality Objectives.

Appendix A

Figure A 1: Cold flow tank platform

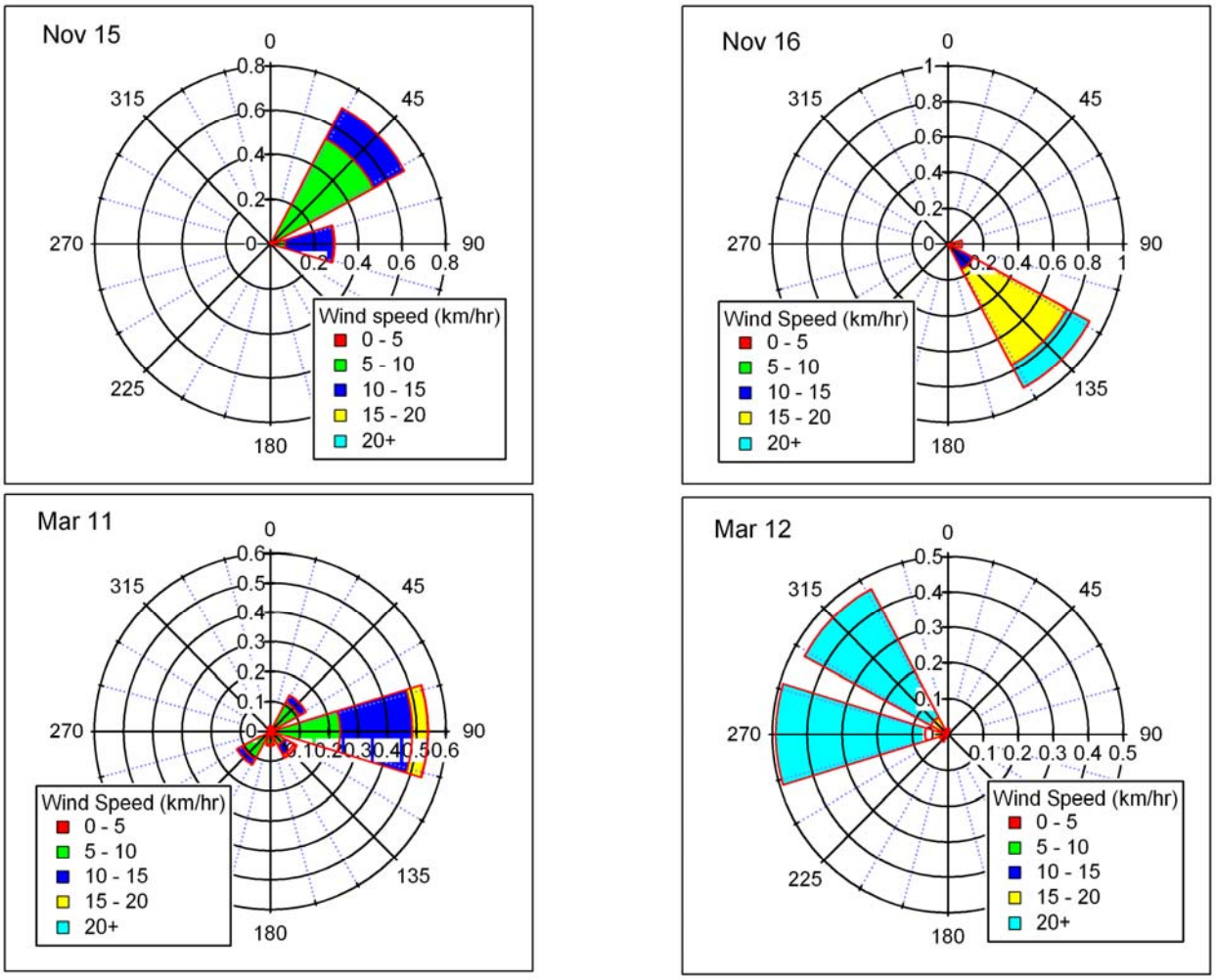

Figure A 2: Wind speed and direction on the various sample days.

Table A 1: Chemical information for PAHs analyzed for in samples taken at the various sites.

	Compounds	*Formula*	*MW*	*Rings*
1	1-Methyl-pyrene	CH3-C16H9	216	4
2	2-Methyl-fluorene	CH3-C13H9	178	3
3	3-Methyl-cholanthrene	CH3-C20H14	268	5
4	7-Methyl-Benz(a)anthracene	CH3-C18H11	242	4
5	Acenaphthene	C12H10	154	3
6	Acenaphthylene	C12H8	152	3
7	Anthanthrene	C22H12	276	6
8	Anthracene	C14H10	178	3
9	Benz(a)anthracene	C18H12	228	4
10	Benzo(a)fluorene	C17H12	216	4
11	Benzo(a)pyrene	C20-H12	252	5
12	Benzo(b)chrysene	C22H14	278	5
13	Benzo(b)fluoranthene	C20-H12	252	5
14	Benzo(b)fluorene	C17H12	216	4
15	Benzo(e)pyrene	C20-H12	252	5
16	Benzo(ghi)fluoranthene	C18H10	226	5
17	Benzo(ghi)perylene	C22H12	276	6
18	Benzo(k)fluoranthene	C20-H12	252	5
19	Chrysene	C18H12	228	4
20	Dibenz(ah)anthracene	C22H14	278	5
21	Fluoranthene	C16H10	202	4
22	Fluorene	C13H10	166	3
23	Indeno(1,2,3-cd)pyrene	C22H12	276	6
24	Indeno(123cd)fluoranthene	C22H12	276	6
25	Naphthalene	C10H8	128	2
26	Perylene	C20-H12	252	5
27	Phenanthrene	C14H10	178	3
28	Pyrene	C16H10	202	4
29	Retene	C4H10-C14H8	234	3
30	Triphenylene	C18H12	228	4

Note:

MW – molecular weight
Rings – number of benzene rings

Table A 2: PAHs concentrations at the various sites for one-hour integrated samples collected on November 15, 2007

PAH Analysis									
Concentration ng/m^3									
Sample date	**15-Nov-07**								
Location	**A**	**B**	**C**	**D**	**E**	**F**	**A2**	**B2**	**C2**
1-Methyl-pyrene	0.03	0.02	0.02	0.02	bdl	bdl	0.04	0.04	0.03
2-Methyl-fluorene	0.18	0.20	0.14	0.15	0.14	0.19	0.26	0.26	0.17
3-Methyl-cholanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
7-Methyl-Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Acenaphthene	0.23	0.34	0.19	0.14	0.15	0.20	0.40	0.28	0.28
Acenaphthylene	0.29	0.26	0.25	0.20	bdl	bdl	0.60	0.62	0.61
Anthanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Anthracene	0.02	0.03	0.03	bdl	0.12	0.13	0.05	bdl	bdl
Benz(a)anthracene	bdl	0.02	0.04	bdl	bdl	bdl	0.06	0.04	0.04
Benzo(a)fluorene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(a)pyrene	0.02	0.02	bdl	0.01	bdl	bdl	0.03	0.03	0.03
Benzo(b)chrysene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)fluoranthene	0.07	0.07	0.07	0.07	0.06	0.04	0.14	0.16	0.12
Benzo(b)fluorene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.02	0.01
Benzo(e)pyrene	0.03	0.03	0.03	0.03	bdl	bdl	0.06	0.06	0.05
Benzo(ghi)fluoranthene	0.03	0.03	0.03	0.03	bdl	bdl	0.07	0.07	0.06
Benzo(ghi)perylene	0.03	0.03	0.04	0.04	bdl	bdl	0.06	0.07	0.06
Benzo(k)fluoranthene	0.02	bdl	bdl	bdl	bdl	bdl	0.04	0.04	0.02
Chrysene	0.05	0.05	0.05	0.05	0.05	0.04	0.09	0.10	0.08
Dibenz(ah)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Fluoranthene	0.27	0.29	0.28	0.22	0.22	0.17	0.67	0.39	0.36
Fluorene	0.76	0.86	0.76	0.62	0.68	0.60	1.01	0.86	0.87
Indeno(1,2,3-cd)pyrene	0.03	bdl	bdl	bdl	bdl	bdl	0.05	0.07	bdl
Indeno(123cd)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Naphthalene	11.99	13.18	12.02	10.14	10.39	8.85	18.74	17.85	18.28
Perylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Phenanthrene	1.16	1.35	1.10	0.99	0.90	0.76	1.73	1.14	1.15
Pyrene	0.30	0.32	0.32	0.26	0.23	0.19	1.26	0.46	0.41
Retene	1.18	1.26	1.51	1.15	0.83	0.78	1.08	1.36	1.31
Triphenylene	0.02	0.02	0.02	0.02	0.02	bdl	0.03	0.03	0.03
TSP (µg/m^3)	bdl	21.6	9.4	13.8	bdl	10.9	26.2	13.3	bdl
number above detection limit	20	19	18	17	12	11	21	21	20
Total mass (ng/m^3)	16.72	18.39	16.92	14.15	13.79	11.97	26.48	23.93	23.99

Notes:
µg/m^3 – micrograms per cubic meter **ng/m^3** – nanograms per cubic meter
bdl – below detection limit

Table A 3: PAHs concentrations at the various sites for one-hour integrated samples collected on November 16, 2007

PAH Analysis										
Concentration ng/m^3										
Sample date	**16-Nov-07**									
Location	**upwind**	**A**	**C**	**B**	**D**	**E**	**F**	**D1**	**E1**	**F1**
1-Methyl-pyrene	bdl	0.03	bdl	bdl	bdl	0.03	0.02	0.03	0.02	0.02
2-Methyl-fluorene	0.19	0.44	0.42	0.14	0.25	0.32	0.22	0.27	0.32	0.25
3-Methyl-cholanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
7-Methyl-Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Acenaphthene	0.10	0.73	0.38	0.18	0.16	0.51	0.18	0.52	0.40	0.23
Acenaphthylene	bdl	0.85	1.29	bdl	bdl	0.65	0.05	0.27	0.67	0.09
Anthanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Anthracene	0.18	0.23	0.34	0.18	0.21	0.10	bdl	0.21	0.10	bdl
Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.02	bdl
Benzo(a)fluorene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(a)pyrene	bdl	bdl	bdl	bdl	bdl	0.02	0.02	bdl	0.02	bdl
Benzo(b)chrysene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)fluoranthene	0.06	bdl	bdl	bdl	bdl	0.04	0.09	0.06	0.07	0.05
Benzo(b)fluorene	bdl	bdl	bdl	bdl	bdl	0.01	0.01	bdl	0.01	bdl
Benzo(e)pyrene	bdl	bdl	bdl	bdl	bdl	0.02	0.03	bdl	0.03	0.03
Benzo(ghi)fluoranthene	bdl	bdl	bdl	bdl	bdl	0.02	0.06	bdl	0.02	bdl
Benzo(ghi)perylene	bdl	bdl	bdl	bdl	bdl	0.03	0.03	bdl	0.03	0.03
Benzo(k)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	0.03	bdl	bdl	bdl
Chrysene	0.05	0.04	0.04	bdl	0.03	0.03	0.09	0.05	0.04	0.04
Dibenz(ah)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Fluoranthene	0.28	0.31	0.30	0.24	0.27	0.26	0.36	0.29	0.29	0.27
Fluorene	0.66	1.40	1.46	0.82	0.94	1.14	0.68	1.10	1.35	0.87
Indeno(1,2,3-cd)pyrene	bdl	bdl	bdl	bdl	bdl	bdl	0.02	bdl	0.03	0.02
Indeno(123cd)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Naphthalene	7.67	33.74	40.90	8.91	15.19	32.99	8.25	31.94	23.83	10.69
Perylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Phenanthrene	0.79	1.58	1.27	0.82	1.00	1.24	1.02	1.28	1.47	1.21
Pyrene	0.27	0.34	0.33	0.27	0.29	0.28	0.42	0.30	0.35	0.27
Retene	1.06	1.01	1.15	1.23	0.98	0.90	1.15	1.20	1.03	1.06
Triphenylene	bdl	bdl	bdl	bdl	bdl	0.02	0.03	bdl	0.02	0.02
TSP (µg/m^3)	12.3	23	5.7	bdl	2.7	7.6	bdl	12.9	11.5	19.7
number above detection limit	11	12	11	9	10	19	20	13	21	16
Total mass (ng/m^3)	11.31	40.70	47.89	12.79	19.31	38.58	12.73	37.52	30.14	15.15

Notes:
µg/m^3 – micrograms per cubic meter **ng/m^3** – nanograms per cubic meter
bdl – below detection limit

Table A 4: PAHs concentrations at the various sites for three-hours integrated samples collected on March 11, 2008

PAH Analysis							
Concentration ng/m^3							
Sample date	**11-Mar-08**						
Location	**upwind**	**A**	**B**	**C**	**D**	**E**	**F**
1-Methyl-pyrene	0.07	0.01	0.02	0.02	0.02	0.02	0.01
2-Methyl-fluorene	0.39	0.29	0.29	0.20	0.20	0.32	0.28
3-Methyl-cholanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
7-Methyl-Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Acenaphthene	0.39	0.44	0.31	0.19	0.25	0.36	0.29
Acenaphthylene	0.70	0.31	0.29	0.26	0.50	0.83	0.57
Anthanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Anthracene	0.15	bdl	0.02	0.03	0.02	0.06	0.04
Benz(a)anthracene	0.04	0.01	bdl	0.03	bdl	bdl	bdl
Benzo(a)fluorene	0.06	bdl	bdl	0.02	bdl	bdl	bdl
Benzo(a)pyrene	bdl	bdl	bdl	0.03	bdl	bdl	bdl
Benzo(b)chrysene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)fluoranthene	0.04	0.03	0.03	0.06	bdl	0.04	0.03
Benzo(b)fluorene	0.03	bdl	bdl	0.01	bdl	bdl	bdl
Benzo(e)pyrene	0.03	0.02	bdl	0.03	bdl	0.02	0.02
Benzo(ghi)fluoranthene	0.08	0.03	0.02	0.02	0.02	0.03	0.02
Benzo(ghi)perylene	0.05	0.03	0.03	0.04	0.03	0.03	0.03
Benzo(k)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Chrysene	0.06	0.03	0.02	0.05	0.01	0.03	0.02
Dibenz(ah)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Fluoranthene	0.54	0.22	0.22	0.31	0.24	0.28	0.27
Fluorene	1.03	0.95	0.86	0.71	0.81	1.07	0.95
Indeno(1,2,3-cd)pyrene	0.02	bdl	bdl	0.03	bdl	bdl	bdl
Indeno(123cd)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Naphthalene	12.21	3.66	3.09	2.35	10.29	13.43	6.98
Perylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Phenanthrene	1.65	1.17	1.13	1.03	1.13	1.39	1.25
Pyrene	0.79	0.28	0.27	0.34	0.23	0.33	0.29
Retene	0.25	0.26	0.30	0.27	0.32	0.31	0.33
Triphenylene	0.02	bdl	bdl	0.01	bdl	bdl	bdl
TSP (µg/m³)	60	13.1	12.2	18	12.5	16.2	12.8
number above detection limit	21	16	15	22	14	16	16
Total mass (ng/m^3)	18.60	7.73	6.88	6.03	14.07	18.57	11.39

Notes:
µg/m^3 – micrograms per cubic meter **ng/m^3** – nanograms per cubic meter
bdl – below detection limit

Table A 5: PAH concentrations at the various sites for three-hours integrated samples collected on March 12, 2008

PAH Analysis							
Concentration ng/m^3							
Sample date	**12-Mar-08**						
Location	**upwind**	**A**	**C**	**B**	**D**	**E**	**F**
1-Methyl-pyrene	0.01	0.01	0.01	0.01	0.01	0.02	0.01
2-Methyl-fluorene	0.07	0.32	0.13	0.19	0.14	0.19	0.18
3-Methyl-cholanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
7-Methyl-Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Acenaphthene	0.08	0.53	0.18	0.31	0.15	0.27	0.25
Acenaphthylene	0.03	0.22	0.08	0.15	0.14	0.20	0.29
Anthanthrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Anthracene	0.01	bdl	bdl	bdl	0.02	0.02	0.02
Benz(a)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(a)fluorene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(a)pyrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)chrysene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(b)fluorene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(e)pyrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(ghi)fluoranthene	0.01	bdl	bdl	bdl	bdl	bdl	0.02
Benzo(ghi)perylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Benzo(k)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Chrysene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Dibenz(ah)anthracene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Fluoranthene	0.09	0.13	0.11	0.09	0.16	0.11	0.12
Fluorene	0.29	0.70	0.40	0.54	0.42	0.51	0.52
Indeno(1,2,3-cd)pyrene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Indeno(123cd)fluoranthene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Naphthalene	0.56	2.63	1.32	2.12	70.25	4.81	5.88
Perylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
Phenanthrene	0.50	0.80	0.57	0.61	0.77	0.62	0.66
Pyrene	0.12	0.12	0.14	0.11	0.17	0.09	0.16
Retene	0.24	0.21	0.26	0.27	0.29	0.26	0.32
Triphenylene	bdl	bdl	bdl	bdl	bdl	bdl	bdl
TSP (µg/m^3)	1.3	7.3	0.7	2.2	2.3	2.6	2.6
number above DL	12	10	10	10	11	11	12
Total mass (ng/m^3)	2.01	5.68	3.20	4.40	72.53	7.09	8.43

Notes:
µg/m^3 – micrograms per cubic meter **ng/m^3** – nanograms per cubic meter
bdl – below detection limit

Table A 6: Maximum VOCs concentrations measured at the various sites

VOC Analysis									
Maximum Concentration (µg/m^3)									
Sample Date	November 15, 16, March 11 and 12							Odour Threshold Range[e f]	
Location	**Upwind**	***A***	**B**	***C***	**D**	***E***	**F**	**Low**	**High**
Propane	8.14	71.76	42.83	26.79	9.19	24.36	12.02	1800000	36000000
2-Methylbutane	3.70	54.49	32.26	6.88	2.62	6.96	6.60		
Butane	8.22	52.78	66.87	14.39	5.82	10.57	15.11	2850	484610
Isobutane (2-Methylpropane)	3.48	32.08	66.69	6.80	3.77	8.81	9.58		
Freon 22 (Chlorodifluoromethane)	4.30	24.96	0.94	1.14	0.62	0.61	0.87		
Pentane	2.59	24.83	23.10	3.03	2.11	4.65	4.32	6600	3000000
Toluene	14.02	21.56	0.84	1.33	0.48	0.92	1.17	603	150000
Methylcyclohexane	1.14	16.39	5.62	6.91	1.29	7.38	3.10	2000000	2528390
Methylcyclopentane	1.51	14.47	13.17	6.02	1.34	5.70	2.81		
Cyclohexane	1.43	14.30	11.88	5.94	1.35	5.22	2.71	1435	
2-Methylpentane	0.84	10.77	4.87	1.47	0.77	1.76	1.23		
3-Methylpentane	0.56	9.34	2.75	1.94	0.52	1.88	0.85		
Hexane	1.23	9.26	4.38	1.26	0.91	1.71	1.24	228958	873564
2,3-Dimethylbutane	0.46	5.55	4.31	2.22	0.49	2.23	0.93		
Cyclopentane	0.67	5.38	10.87	2.10	0.63	2.22	1.69		
m,p-Xylene	8.97	5.28	0.53	1.65	0.59	0.72	0.66	1406	2126
1-Heptene	0.17	3.96	1.21	1.73	0.26	2.09	0.88		
3-Methylhexane	0.29	3.60	1.18	0.73	0.30	0.76	0.46		
2,3-Dimethylpentane	0.33	3.31	1.25	1.39	0.33	1.54	0.61		
2-Methylhexane	0.27	3.26	1.02	0.59	0.27	0.64	0.36		
2,2-Dimethylpropane	0.19	3.03	5.07	1.08	0.30	1.08	0.72		
Heptane	0.35	2.83	1.56	0.85	0.34	0.96	0.58	40013	1280000
Propene	0.48	2.82	0.68	1.58	0.42	1.14	0.60		
c-1,3-Dimethylcyclohexane	0.15	2.59	0.68	1.07	0.20	1.03	0.37		
Freon 12 (Dichlorodifluoromethane)	2.41	2.59	2.56	2.51	2.47	2.53	2.47		
Dichloromethane	6.18	2.43	0.25	1.15	0.24	0.24	1.76	3166	
Ethylbenzene	2.56	2.22	0.25	0.46	0.18	0.26	0.21	8700	870000
t-1,2-Dimethylcyclohexane	0.20	2.10	0.90	0.86	0.23	0.89	0.38		
2,2-Dimethylbutane	0.18	2.03	1.87	0.81	0.19	0.82	0.34		
2,4-Dimethylpentane	0.15	1.96	0.62	0.71	0.15	0.67	0.28		
2,2,4-Trimethylpentane	0.20	1.90	0.47	5.50	2.08	3.30	0.95		
Freon 11 (Trichlorofluoromethane)	1.44	1.90	1.68	1.65	1.61	1.66	1.52	28000	1170400
Octane	0.11	1.58	0.35	0.37	0.13	0.41	0.22	26846	1208330
o-Xylene	2.12	1.51	0.18	0.57	0.23	0.24	0.29	3693	
Benzene	0.52	1.46	0.43	0.70	0.47	0.58	0.59	4500	270000
1-Nonene	0.17	1.36	0.59	0.60	0.28	0.50	0.92		
2-Methylheptane	0.13	1.32	0.59	0.47	0.12	0.50	0.24		
a-Pinene	0.06	1.21	0.03	0.05	0.02	0.08	0.03		
t-1,4-Dimethylcyclohexane	0.07	1.12	0.31	0.47	0.11	0.46	0.20		
1-Butene/2-Methylpropene	0.22	1.12	0.37	0.40	0.24	0.26	0.41		
Chloromethane	1.08	1.10	1.16	1.10	1.18	1.20	1.22		
1-Octene	0.17	0.99	0.58	0.46	0.24	0.49	0.77		
3-Methylheptane	0.07	0.96	0.27	0.27	0.08	0.23	0.11		
2,4-Dimethylhexane	0.08	0.92	0.32	0.37	0.08	0.38	0.15		
2,3,4-Trimethylpentane	0.06	0.91	0.19	0.35	0.11	0.21	0.12		
2,2-Dimethylpentane	0.04	0.89	0.24	0.31	0.06	0.30	0.11		
Freon 113 (1,1,2-Trichlorotrifluoroet	0.58	0.86	0.61	0.58	0.60	0.58	0.55	342000	3729626
Bromodichloromethane	0.06	0.85	0.31	0.35	0.07	0.26	0.17		
Styrene	0.03	0.82	0.07	0.03	0.03	0.03	0.08	202	860000
Undecane	0.12	0.80	0.26	3.80	0.42	0.33	0.28		
2-Methyl-2-Butene	0.04	0.73	0.12	0.64	0.30	0.12	0.57		
Carbontretrachloride	0.45	0.64	0.62	0.69	0.67	0.67	0.48	60000	255884
t-2-Octene	0.03	0.62	0.54	0.20	0.12	0.47	0.22		
Dodecane	0.10	0.62	0.12	0.19	0.10	0.13	0.15		
2,2,3-Trimethylbutane	0.06	0.59	0.49	0.25	0.06	0.23	0.10		
Decane	0.05	0.59	0.13	1.22	0.09	0.11	0.08		
Nonane	0.09	0.58	0.11	0.36	0.07	0.15	0.08	6605	3412500

Continued on next page

Table A 6 continued : Maximum VOCs concentrations measured at the various sites

VOC Analysis									
Maximum Concentration (µg/m^3)									
Sample Date	November 15, 16, March 11 and 12							Odour Threshold Range[e f]	
Location	Upwind	*A*	B	*C*	D	*E*	F	Low	High
2,5-Dimethylhexane	0.04	0.53	0.16	0.18	0.04	0.20	0.08		
4-Methylheptane	0.06	0.49	0.24	0.13	0.05	0.15	0.08		
t-2-Pentene	0.08	0.47	0.13	0.38	0.18	0.20	0.35		
t-3-Heptene	0.00	0.46	0.01	0.02	0.01	0.01	0.01		
2-Methyl-1-Butene	0.09	0.44	0.15	0.34	0.19	0.22	0.41		
c-1,4/t-1,3-Dimethylcyclohexane	0.03	0.42	0.12	0.16	0.04	0.16	0.07		
1,2,4-Trimethylbenzene	0.03	0.37	0.09	0.51	0.21	0.12	0.29		
1,1,1-Trichloroethane	0.06	0.37	0.08	0.08	0.08	0.08	0.06	122135	
1-Decene	0.06	0.33	0.16	0.17	0.07	0.21	0.97		
Trichloroethene	0.02	0.32	0.06	0.02	0.03	0.03	0.07		
Freon 114 (1,2-Dichlorotetrafluoroet	0.26	0.30	0.11	0.16	0.11	0.10	0.13		
1-Hexene/2-Methyl-1-Pentene	0.11	0.29	0.05	0.23	0.12	0.11	0.41		
c-2-Pentene	0.04	0.28	0.07	0.22	0.10	0.10	0.18		
3-Ethyltoluene	0.03	0.28	0.05	0.14	0.13	0.07	0.13		
1-Pentene	0.16	0.28	0.12	0.18	0.14	0.17	0.47		
1,2-Dichloroethane	0.07	0.28	0.14	0.08	0.07	0.08	0.08	77255	
Tetrachloroethene	0.05	0.25	0.03	0.05	0.40	0.04	0.05		
Chlorobenzene	0.02	0.24	0.07	0.10	0.01	0.11	0.01	980	280000
Limonene	0.13	0.22	0.04	0.14	0.05	0.10	0.13		
2,2,5-Trimethylhexane	0.01	0.21	0.02	0.04	0.01	0.03	0.01		
c-1,2-Dimethylcyclohexane	0.02	0.21	0.07	0.08	0.02	0.08	0.04		
p-Cymene (1-Methyl-4-Isopropylben	0.03	0.20	0.03	6.74	0.11	0.05	0.02		
n-Propylbenzene	0.03	0.19	0.10	0.14	0.12	0.06	0.13		
Chloroform	0.07	0.16	0.07	0.07	0.06	0.06	0.06	57089	1000000
Naphthalene	0.02	0.16	0.04	0.20	0.24	0.11	0.13	79	125000
3,6-Dimethyloctane	0.02	0.15	0.23	0.16	0.01	0.11	0.05		
1-Undecene	0.07	0.15	0.21	0.62	0.07	0.08	1.70		
4-Ethyltoluene	0.02	0.15	0.03	0.11	0.06	0.04	0.07		
Propyne	0.03	0.14	0.03	0.12	0.05	0.11	0.05		
1,2,3-Trimethylbenzene	0.01	0.14	0.05	0.45	0.06	0.05	0.06		
Isoprene (2-Methyl-1,3-Butadiene)	0.03	0.13	0.02	0.06	0.04	0.04	0.04		
c-3-Methyl-2-Pentene	0.00	0.13	0.01	0.10	0.04	0.05	0.06		
c-2-Butene	0.06	0.13	0.11	0.12	0.05	0.09	0.14		
Camphene	0.12	0.13	0.02	0.05	0.04	0.02	0.02		
1,3,5-Trimethylbenzene	0.01	0.13	0.05	0.19	0.06	0.05	0.08		
1,4-Diethylbenzene	0.01	0.12	0.08	0.18	0.07	0.05	0.08		
t-2-Hexene	0.01	0.12	0.03	0.10	0.04	0.06	0.05		
2-Ethyltoluene	0.01	0.12	0.03	0.07	0.05	0.04	0.06		
iso-Propylbenzene	0.02	0.11	0.05	0.05	0.02	0.03	0.03		
Cyclopentene	0.01	0.11	0.02	0.05	0.03	0.02	0.05		
1-Methylcyclopentene	0.00	0.11	0.01	0.09	0.04	0.04	0.05		
1,3-Butadiene	0.06	0.10	0.02	0.12	0.04	0.07	0.06	352	2860
1,4-Dichlorobenzene	0.01	0.09	0.05	0.08	0.01	0.01	0.01	288	
Chloroethane	0.05	0.08	0.06	0.06	0.12	0.03	0.13		
c-4-Methyl-2-Pentene	0.01	0.08	0.02	0.04	0.02	0.03	0.04		
c-3-Heptene	0.04	0.08	0.01	0.00	0.02	0.08	0.08		
3-Methyl-1-Butene	0.04	0.08	0.05	0.07	0.03	0.05	0.07		
2-Ethyl-1-Butene	0.05	0.07	0.09	0.04	0.01	0.04	0.05		
b-Pinene	0.01	0.07	0.01	0.03	0.01	0.01	0.01		
c-2-Hexene	0.00	0.06	0.01	0.05	0.02	0.03	0.03		
t-3-Methyl-2-Pentene	0.00	0.06	0.00	0.04	0.02	0.02	0.03		
Indan (2,3-Dihydroindene)	0.00	0.06	0.01	0.04	0.02	0.02	0.02		
1,3-Diethylbenzene	0.00	0.05	0.04	0.06	0.02	0.03	0.02		
2,2-Dimethylhexane	0.03	0.05	0.01	0.06	0.04	0.00	0.03		
Bromomethane	0.04	0.05	0.05	0.05	0.07	0.05	0.07		
4-Methyl-1-Pentene	0.01	0.05	0.03	0.02	0.01	0.02	0.04		
1,2-Diethylbenzene	0.00	0.05	0.03	0.03	0.01	0.02	0.01		
sec-Butylbenzene	0.00	0.04	0.02	0.04	0.01	0.02	0.01		
n-Butylbenzene	0.01	0.04	0.03	0.05	0.03	0.02	0.03		

Continued on next page

Table A 6 continued : Maximum VOCs concentrations measured at the various sites

VOC Analysis									
Maximum Concentration (µg/m^3)									
Sample Date	**November 15, 16, March 11 and 12**							**Odour Threshold Range[e f]**	
Location	**Upwind**	***A***	**B**	***C***	**D**	***E***	**F**	**Low**	**High**
iso-Butylbenzene	0.00	0.04	0.02	0.03	0.01	0.02	0.01		
Dibromomethane	0.03	0.04	0.03	0.03	0.03	0.03	0.04		
3-Methyl-1-Pentene	0.01	0.04	0.02	0.02	0.01	0.01	0.02		
Hexylbenzene	0.02	0.04	0.03	0.03	0.05	0.01	0.01		
Benzyl Chloride	0.00	0.03	0.02	0.04	0.01	0.01	0.01	235	1550
Cyclohexene	0.01	0.03	0.01	0.01	0.01	0.01	0.01		
t-2-Heptene	0.00	0.03	0.01	0.02	0.01	0.01	0.01		
1,2-Dichloropropane	0.01	0.02	0.02	0.02	0.02	0.02	0.02	1167	606666
1-Methylcyclohexene	0.00	0.02	0.01	0.02	0.01	0.01	0.01		
1,2,4-Trichlorobenzene	0.01	0.02	0.01	0.01	0.01	0.00	0.01	24000	
Bromoform	0.01	0.02	0.02	0.02	0.02	0.02	0.02	5300000	
1,2-Dichlorobenzene	0.00	0.02	0.00	0.01	0.00	0.00	0.01	12000	300000
c-1,3-Dichloropropene	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
t-4-Methyl-2-Pentene	0.00	0.01	0.14	0.01	0.01	0.03	0.02		
t-1,3-Dichloropropene	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
t-2-Butene	0.07	0.01	0.05	0.13	0.05	0.09	0.14		
c-1,2-Dichloroethene	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
1,3-Dichlorobenzene	0.00	0.01	0.00	0.01	0.00	0.00	0.01		
t-1,2-Dichloroethene	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
c-2-Heptene	0.01	0.01	0.01	0.00	0.05	0.00	0.03		
1-Butyne	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
Dibromochloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.01		
Vinylchloride (Chloroethene)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	646	
tert-Butylbenzene	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Methyl-t-Butyl Ether (MTBE)	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Hexachlorobutadiene	0.00	0.00	0.00	0.00	0.00	0.00	0.01	12000	
Ethylbromide	0.00	0.00	0.00	0.00	0.00	0.00	0.01	890000	
Bromotrichloromethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1,4-Dichlorobutane	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1,2-Dibromoethane (EDB)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	76800	
1,1-Dichloroethene	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1,1-Dichloroethane	0.01	0.00	0.00	0.00	0.00	0.00	0.01	1031422	
1,1,2-Trichloroethane	0.00	0.00	0.00	0.02	0.00	0.00	0.01		
1,1,2,2-Tetrachloroethane	0.00	0.00	0.00	0.01	0.00	0.00	0.01	21000	35000

Notes:

µg/m^3 – micrograms per cubic meter