



Air Quality Monitoring

Fire at Custom Environmental Services

May 5, 2005

Supplementary Monitoring Information

Summary

On Thursday May 5, 2005 at approximately 15:50, an uncontrolled fire began during waste handling activities at Custom Environmental Services Limited (CES); Alberta Environment was requested to provide air monitoring support. The Mobile Air Monitoring Laboratory (MAML) was deployed to southeast Edmonton immediately after Alberta Environment received notification that there was a fire at the CES facility; monitoring began at 16:29.

In a previous report, Alberta Environment published monitoring data collected by the MAML during the incident at CES. This supplementary report presents monitoring data for non-continuous samples that were collected and later analyzed in a laboratory.

Alberta Environment conducted three types of sampling during the Custom Environmental fire. Continuous measurements were made with the Mobile Air Monitoring Laboratory, a sample was taken with a Partisol sampler, and samples were collected with SilcoSteel Canisters. Monitoring indicates that several compounds were emitted from the fire, however most were detected at very low concentrations at the downwind sampling locations. Meteorological conditions on May 5, 2005 and the high temperatures of the fire perhaps promoted the fire's plume upwards and dispersed it aloft.

Both the Partisol Sampler and SilcoSteel Canisters sampled air approximately 500 meters downwind from the fire at 16th Street and 78th Avenue. For comparison purposes, a background Canister sample was also collected near Alberta Environment's Air Monitoring and Audit Centre at 89th Street and 49th Avenue.

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Mobile Air Monitoring Laboratory Results Summary

The MAML measured ammonia, carbon monoxide, total polycyclic aromatic hydrocarbons, oxides of nitrogen, ozone, particulate matter, reduced sulphur compounds, temperature, relative humidity, wind speed and wind direction. All of the contaminants measured by the MAML were detected below applicable Alberta Ambient Air Quality Objectives (AAAQO), where comparisons can be made.

In a large fire, the buoyant forces of the rising hot air column often override surface wind direction, especially if wind speed is low. Monitoring during the fire indicated a very low average wind speed of about 7 km/h. Smoke and contaminants were likely dispersed at higher altitudes because of the hot rising air generated by the fire.

Partisol Sampler Results Summary

The Partisol sampler was used to draw one cubic meter of air through a filter for one hour. Air contaminants were identified and quantified through laboratory analysis of particles that were collected on the filter cartridge. Alberta Environment analyzed the filter cartridge for heavy metals, dioxins & furans, and speciated polycyclic aromatic hydrocarbons (PAH).

The cartridge was analyzed for 27 metals; 19 metals were below the detection limit of the laboratory instrument and eight were found at very low concentrations. No applicable AAAQOs, including those that have been recently introduced, were exceeded.

The cartridge was analyzed for 21 polycyclic aromatic hydrocarbons and all were found to be below the detection limit of the laboratory instrument.

There are seventeen dioxins and furans of concern for health reasons; these compounds were generally found at low concentrations at the sampling location. All dioxins were below the detection limit of the laboratory instrument. With the exception of 1,2,3,4,7,8-hexachlorodibenzofuran, all furans were also found to be below the detection limit of the laboratory instrument. The relative ambient air concentration of these compounds was 0.5^I picograms TEQ^{II}/m³ measured over one hour. Although a direct comparison cannot be made, this concentration is below the 1998 Ontario Ambient Air Quality Criterion of 5 picograms TEQ/m³ measured over 24-hours. The Ontario standard is protective of human health over a lifetime of exposure.

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- I This is a worst-case scenario where the non-detectable compounds are assigned a value equal to the detection limit of the laboratory instrument rather than assuming a concentration of zero.
- II There are 210 dioxins and furans; 17 of these compounds are considered to be serious human health concerns. These 17 are assigned toxic equivalency factors relative to 2,3,7,8-tetrachlorodibenzodioxin (TCDD). These factors are called the International Toxicity Equivalency Factors (I-TEF) and were developed by scientific experts in several countries. They were adopted by Canada in 1990. These factors are used to calculate individual Toxicity Equivalents (TEQ) for each dioxin and furan; individual TEQs are summed to calculate the Total TEQ.

Volatile Organic Compound Results Summary

Alberta Environment collected two one-hour canister samples for volatile organic compound (VOC) analysis. These samples were collected using six litre stainless steel electro-polished (SilcoSteel) canisters and were analyzed for more than 180 VOCs. Environment Canada's Environmental Technology Centre in Ottawa conducted the preparation and analysis of the VOC samples. Several VOCs were found to be present, however, most compounds were detected at very low concentrations.

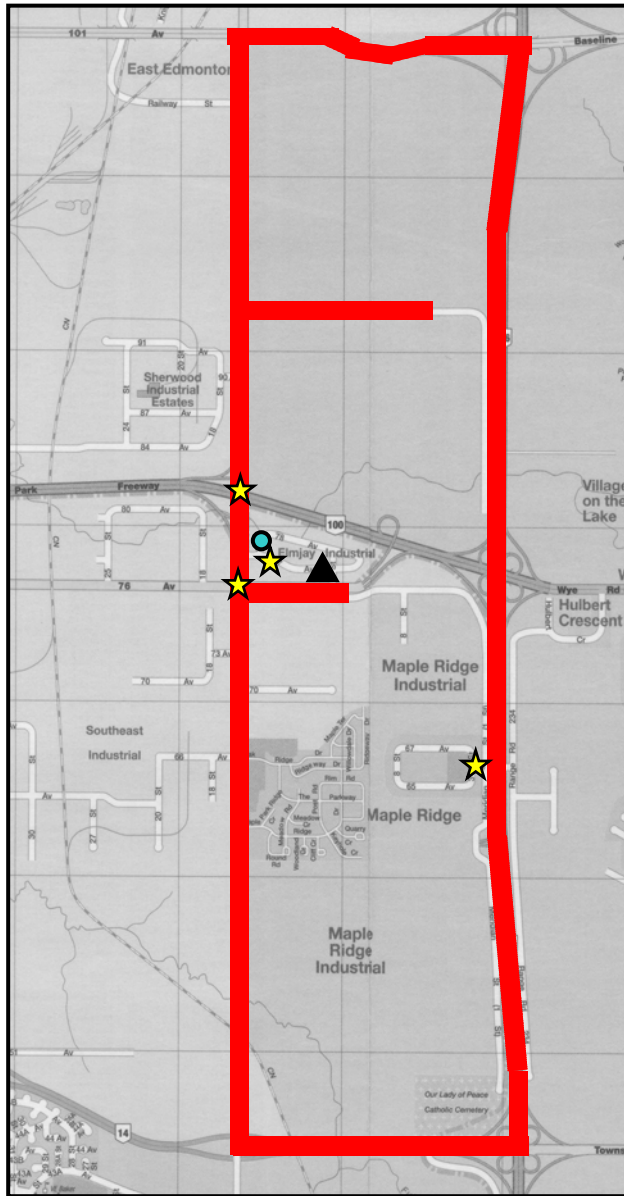
Analysis of the downwind canister sample revealed that acetaldehyde exceeded its one-hour Objective. The one-hour AAAQO for acetaldehyde is $90\mu\text{g}/\text{m}^3$ and has been adopted from the Texas Short Term Effects Screening Level (ESL)^{III}. The ESL is based on odour nuisance potential. Downwind from the fire, the acetaldehyde concentration was $209\mu\text{g}/\text{m}^3$; the background concentration was $21\mu\text{g}/\text{m}^3$. At concentrations below $18,000\mu\text{g}/\text{m}^3$, short-term^{IV} or acute exposure to acetaldehyde may result in temporary health effects including irritation of the eyes, skin and respiratory tract.

Acetaldehyde is *always* found in ambient air because it is produced by plant respiration. Higher concentrations of acetaldehyde are found because of poorly controlled or inefficient combustion processes; it is also found in urban areas because of vehicle exhaust. Residential fireplaces and wood-burning stoves are estimated to be the two largest sources of acetaldehyde followed by various industrial emissions.

Alberta does not have a one-hour AAAQO for propionaldehyde, however, it was found to be above the Texas ESL. The ESL is $20\mu\text{g}/\text{m}^3$ over one-hour and is based on odour nuisance potential. Downwind from the fire, the propionaldehyde concentration was $39\mu\text{g}/\text{m}^3$; the background concentration was $5\mu\text{g}/\text{m}^3$. Propionaldehyde is typically released from municipal waste incinerators, and from the combustion of wood, gasoline, diesel fuel, and plastics. Tobacco smoke also contains propionaldehyde. Little information is available on the effects of acute exposure to propionaldehyde in humans. Neither Canadian health or environmental authorities nor the United States Environmental Protection Agency have established the health risks associated with chronic (continuous) inhalation exposure to propionaldehyde to the human population.

III If measured airborne levels of a constituent do not exceed the Texas Short Term Effects Screening Level (ESL), adverse health or welfare effects would not be expected to result. If ambient levels of constituents in air exceed the screening levels, it does not necessarily indicate a problem, but rather, triggers a more in-depth review. The Texas Effects Screening Levels are generally triggers for action.

IV The American Industrial Hygiene Association's Emergency Response Planning (Level One) Guideline for acetaldehyde is $18,000\mu\text{g}/\text{m}^3$. This is the maximum airborne concentration below which it is believed nearly all individuals could be exposed to, for up to one hour, and experience no more than mild *transient* adverse health effects or perceive a clearly defined objectionable odour.



KEY:

- ▲ Custom Environmental Services Site
- MAML Mobile Monitoring Route
- ★ MAML Stationary Monitoring Location
- Partisol and Canister Sampling Location

Figure 1: Sampling locations and routes monitored during the Custom Environmental Fire.
 Adapted from: MapArt Publishing Corporation: Steet Map for Edmonton, Sherwood Park, Fort Saskatchewan

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APPENDIX A: Polycyclic Aromatic Hydrocarbons (ug/m³)

Alberta Tier 1 PAHs		
Naphthalene	<0.1	ug
Acenaphthylene	<0.1	ug
Acenaphthene	<0.1	ug
Fluorene	<0.1	ug
Phenanthrene	<0.1	ug
Anthracene	<0.1	ug
Fluoranthene	<0.1	ug
Pyrene	<0.1	ug
Benzo(c)phenanthrene	<0.1	ug
Benzo(a)anthracene	<0.1	ug
Chrysene	<0.1	ug
7,12-Dimethylbenz(a)anthracene	<0.1	ug
Benzo(b)fluoranthene	<0.1	ug
Benzo(j)fluoranthene	<0.1	ug
Benzo(k)fluoranthene	<0.1	ug
Benzo(a)pyrene	<0.1	ug
3-Methylcholanthrene	<0.1	ug
Indeno(1,2,3-cd)pyrene	<0.1	ug
Dibenzo(ah)anthracene	<0.1	ug
Benzo(ghi)perylene	<0.1	ug
Dibenzo(a,h/a,i/a,l)pyrene	<0.1	ug

APPENDIX B: Dioxins and Furans (pg/m³)

Dioxins and Furans		
2378 TeCDD	<0.20	pg
12378 PeCDD	<0.20	pg
123478 HxCDD	<0.20	pg
123678 HxCDD	<0.20	pg
123789 HxCDD	<0.20	pg
1234678 HpCDD	<0.20	pg
OCDD	<0.40	pg
Total TCDD	<0.20	pg
Total PeCDD	<0.20	pg
Total HxCDD	<0.20	pg
Total HpCDD	<0.20	pg
Total PCDDs	<0.20	pg
2378 TeCDF	<0.10	pg
12378 PeCDF	<0.20	pg
23478 PeCDF	<0.10	pg
123478 HxCDF	0.79	pg
123678 HxCDF	<0.10	pg
123789 HxCDF	<0.10	pg
234678 HxCDF	<0.10	pg
1234678 HpCDF	<0.10	pg
1234789 HpCDF	<0.20	pg
OCDF	<0.40	pg
Total TCDF	<0.10	pg
Total PeCDF	<0.20	pg
Total HxCDF	0.79	pg
Total HpCDF	<0.20	pg
Total PCDFs	0.79	pg
Total TEQ (ND=0)	0.10	pg
Total TEQ (ND=0.5DL)	0.30	pg
Total TEQ (ND=DL)	0.50	pg

APPENDIX C: Metals (ug/m³)

Metals		
Silver (Ag)	<0.5	ug
Aluminum (Al)	<20	ug
Arsenic (As)	<0.05	ug
Barium (Ba)	0.15	ug
Beryllium (Be)	<0.05	ug
Calcium (Ca)	50	ug
Cadmium (Cd)	0.02	ug
Cobalt (Co)	<0.05	ug
Chromium (Cr)	<0.5	ug
Copper (Cu)	<0.5	ug
Iron (Fe)	<20	ug
Mercury (Hg)	<0.05	ug
Potassium (K)	<20	ug
Magnesium (Mg)	9	ug
Manganese (Mn)	<0.2	ug
Molybdenum (Mo)	<0.2	ug
Sodium (Na)	60	ug
Nickel (Ni)	0.1	ug
Lead (Pb)	<0.2	ug
Antimony (Sb)	0.05	ug
Selenium (Se)	<0.1	ug
Tin (Sn)	<0.5	ug
Strontium (Sr)	0.3	ug
Vanadium (V)	<0.1	ug
Tungsten (W)	<0.5	ug
Zinc (Zn)	<5	ug
Zirconium (Zr)	<5	ug

Appendix D: Volatile Organic Compounds (ug/m³)

Project	Custom Environmental Services		Objectives, Limits and Screening Levels				
	Description / Comments	500m Downwind of Source	McIntyre Centre, Background	Alberta One-hour Objective ^a	Ontario Half-hour Point of Impingement Limit ^b	Odour Threshold Range ^{c,d}	
Sample Date	5-May-05	5-May-05	Low			High	
Sample Start Time	1 hour	1 hour					
Duration							
Canister Number	1933	2162					
1,1,1-Trichloroethane	0.40	0.11		350000	122135		
1,1,2,2-Tetrachloroethane	0.02	0.00			21000	35000	70
1,1,2-Trichloroethane	0.01	0.00					
1,1-Dichloroethane	0.00	0.00		600	891536		4000
1,1-Dichloroethene	0.00	0.00		30			
1,2,3-Trimethylbenzene	0.45	0.02					
1,2,4-Trichlorobenzene	0.13	0.01		100	24000		
1,2,4-Trimethylbenzene	1.23	0.09		500			
1,2-Dibromoethane (EDB)	0.00	0.00		9	76800		4
1,2-Dichlorobenzene	0.02	0.00		37000	12000	300000	
1,2-Dichloroethane	0.32	0.04		6	24000	44000	16
1,2-Dichloropropane	0.04	0.01		2400	1167	606666	1150
1,2-Diethylbenzene	0.04	0.00					
1,3,5-Trimethylbenzene	0.41	0.01					1250
1,3-Butadiene	1.18	0.01			352	2860	110
1,3-Dichlorobenzene	0.02	0.00					
1,3-Diethylbenzene	0.11	0.01					
1,4-Dichlorobenzene	0.04	0.01		285	288		
1,4-Dichlorobutane	0.00	0.00					
1,4-Diethylbenzene	0.35	0.02					
1-Butanol (Butyl alcohol)	0.98	0.23					
1-Butene/2-Methylpropene	2.80	0.20					160
1-Butyne	0.02	0.00					
1-Decene	0.12	0.01		180000			
1-Heptene	1.16	0.00					
1-Hexene/2-Methyl-1-Pentene	0.68	0.02					
1-Methylcyclohexene	0.04	0.00					
1-Methylcyclopentene	0.11	0.00					
1-Nonene	0.33	0.03					
1-Octene	0.23	0.02		150000			
1-Pentene	0.56	0.03					
1-Undecene	0.06	0.00					
2,2,3-Trimethylbutane	0.01	0.00					
2,2,4-Trimethylpentane	0.63	0.34					
2,2,5-Trimethylhexane	0.04	0.02					
2,2-Dimethylbutane	0.05	0.03					
2,2-Dimethylhexane	0.56	0.00					
2,2-Dimethylpentane	0.03	0.01					
2,2-Dimethylpropane	0.02	0.01					
2,3,4-Trimethylpentane	0.08	0.08					
2,3-Dimethylbutane	0.12	0.09					
2,3-Dimethylpentane	2.72	0.22					
2,4-Dimethylhexane	0.54	0.06					
2,4-Dimethylpentane	0.08	0.11					
2,5-Dimethylhexane	0.40	0.04					
2-Butanone (MEK)	13.08	3.62			7690		3900
2-Butanol	0.00	0.00					
2-Butenal (Crotonaldehyde)	8.66	0.00					
2-Ethyl-1-Butene	0.00	0.00					
2-Ethyltoluene	0.32	0.05					

Continued ...

Target Source Facility	Custom Environmental Services		Objectives, Limits and Screening Levels				
	500m Downwind of Source	McIntyre Centre, Background	Alberta One-hour Objective ^a	Ontario Half-hour Point of Impingement Limit ^b	Odour Threshold Range ^{c,d}		2003 Texas Effects Screening Level ^e
Description / Comments	5-May-05	5-May-05			Low	High	
Sample Date	5-May-05	5-May-05					
Sample Start Time							
Duration	1 hour	1 hour					
Canister Number	1933	2162					
2-Methyl-1-Butene	0.31	0.02					
2-Methyl-2-Butene	0.23	0.01					
2-Methylbutanal(Isovaleraldehyde)	0.00	0.00					
2-Methylbutane	0.98	1.06					
2-Methylfuran	1.41	0.00					
2-Methylheptane	0.37	0.12					
2-Methylhexane	7.54	0.19					
2-Methylpentane	0.67	0.31					
2-Pentanone	0.00	0.00					
3,6-Dimethyloctane	0.12	0.01					
3-Ethyltoluene	0.60	0.09					
3-Methyl-1-Butene	0.12	0.01					
3-Methyl-1-Pentene	0.04	0.01					
3-Methylheptane	0.29	0.11					
3-Methylhexane	13.88	0.24					
3-Methylpentane	0.68	0.25					
4-Ethyltoluene	0.31	0.06					
4-Methyl-1-Pentene	0.10	0.00					
4-Methylheptane	0.16	0.03					
Acetaldehyde	209.07	20.49	90		15	120	90
Acetone	46.83	20.56	5900	48000	474667	1613860	5900
Acetonitrile	7.52	0.71					340
Acrolein (2-Propenal)	14.90	0.79					2
Acrylonitrile (2-Propennitrile)	0.00	0.00	43				40
a-Pinene	0.00	0.00					60
Benzaldehyde	1.95	0.23					
Benzene	4.87	0.66	30		4500	270000	75
Benzyl Chloride	0.05	0.00			235	1550	50
b-Pinene	0.00	0.00					
Bromodichloromethane	0.20	0.02					
Bromoform	0.00	0.01		165			50
Bromomethane	0.21	0.06		4000			
Bromotrichloromethane	0.00	0.00					
Butane	3.96	2.46			2850	484610	19000
Butylacetate	0.78	0.00		315			1850
Butylaldehyde (Butanal)	11.70	1.91					
c-1,2-Dichloroethene	0.00	0.00					
c-1,2-Dimethylcyclohexane	0.09	0.02					
c-1,3-Dichloropropene	0.00	0.00					
c-1,3-Dimethylcyclohexane	0.28	0.06					
c-4-Methyl-2-Pentene	0.05	0.00					
Camphene	0.00	0.00					50
Carbon Disulfide	0.26	0.03	30				30
Carbontetrachloride	0.04	0.59		7	60000	128400	130
Chlorobenzene	0.03	0.00		4200	980	280000	460
Chloroethane	0.08	0.08					50
Chloroform	0.52	0.06		300	250000	1000000	100
Chloromethane	1.85	1.50		20000			
Cyclohexane	0.17	0.05		300000		1435	1400
Cyclohexanone	0.50	0.00					480

Continued ...

Target Source Facility	Custom Environmental Services		Objectives, Limits and Screening Levels				
	Description / Comments	500m Downwind of Source	McIntyre Centre, Background	Alberta One-hour Objective ^a	Ontario Half-hour Point of Impingement Limit ^b	Odour Threshold Range ^{c,d}	
Sample Date	5-May-05	5-May-05	Low			High	
Sample Start Time	1 hour	1 hour					
Duration							
Canister Number	1933	2162					
Cyclohexene	0.08	0.00					600
Cyclopentane	0.12	0.06					3400
Cyclopentanone	0.00	0.00					1700
Cyclopentene	0.11	0.00					8100
Decane	3.41	0.13					10000
Dibromochloromethane	0.00	0.00					
Dibromomethane	0.06	0.02					
Dichloromethane	15.69	0.17		5300	540000	2160000	
Dodecane	0.62	0.04					
Ethanol	6.45	6.64		19000	342	9690000	18800
Ethylacetate	1.32	0.00					14400
Ethylbenzene	3.11	0.25	2000	3000	8700	870000	2000
Ethylbromide	0.00	0.00			890000		
Ethylene oxide	0.00	0.53	15	15	520000	1400000	20
Freon 11 (Trichlorofluoromethane)	1.54	1.46		18000	28000	1170400	28000
Freon 113 (1,1,2-Trichlorotrifluoroethane)	0.60	0.52		2400000	342000	3729626	38000
Freon 114 (1,2-Dichlorotetrafluoroethane)	0.14	0.10		2100000			70000
Freon 12 (Dichlorodifluoromethane)	2.52	2.40		1500000			28000
Freon 22 (Chlorodifluoromethane)	0.59	0.50		1050000			18000
Heptane	21.08	0.35		33000	40013	1280000	3500
Hexachlorobutadiene	0.04	0.00			12000		2
Hexanal	2.82	0.71					
Hexane	4.89	0.17		35000	77141		1760
Hexylbenzene	0.01	0.01					
Indan (2,3-Dihydroindene)	0.14	0.02					
Isobutane (2-Methylpropane)	1.16	0.55					4800
Isobutylacetate	0.00	0.00					630
Isobutylalcohol	0.00	0.00					1520
Isobutylaldehyde(2-Methylpropanal)	3.05	0.47					140
iso-Butylbenzene	0.04	0.00					
Isoprene (2-Methyl-1,3-Butadiene)	0.43	0.01					14
Isopropyl Alcohol	2.84	2.87	7850				7850
Isopropylacetate	0.00	0.00					3760
iso-Propylbenzene	0.17	0.01		100			500
Limonene	0.43	0.00					
m,p-Xylene	7.64	0.46	2300	2300	348	174000	3700
MAC (2-Methyl-2-propenal)	1.83	0.25					
Methanol	44.69	15.25	2600	12000			2620
Methylcyclohexane	2.67	0.28			2000000		16100
Methylcyclopentane	0.53	0.14					2600
Methyl-t-Butyl Ether (MTBE)	0.00	0.00		2200			450
MIBK	1.19	0.11					2050
MVK	0.00	0.00					6
Naphthalene	0.77	0.03		36	1500	125000	440
n-Butylbenzene	0.15	0.01					2740
Nonane	1.73	0.13			6605	3412500	10500
n-Propylbenzene	0.25	0.06					
Octane	0.66	0.19		45400	26846	1208330	3500
o-Xylene	1.83	0.24			3693		3700
p-Cymene (1-Methyl-4-Isopropylbenzene)	0.08	0.01					2750

Continued ...

Target Source Facility	Custom Environmental Services		Objectives, Limits and Screening Levels				
Description / Comments	500m Downwind of Source	McIntyre Centre, Background	Alberta One-hour Objective ^a	Ontario Half-hour Point of Impingement Limit ^b	Odour Threshold Range ^{c,d}		2003 Texas Effects Screening Level ^e
	Sample Date	Sample Start Time			Duration	Low	
Canister Number	1933	2162					
Pentanal	0.00	0.00					
Pentane	2.31	0.40			6600	3000000	3500
Propane	41.16	0.95			1800000	36000000	18000
Propene	5.76	0.27					
Propionaldehyde	39.30	5.33			10	37	20
Propyl alcohol (1-Propanol)	0.72	0.69					4900
Propyne	0.36	0.06					16400
sec-Butylbenzene	0.07	0.00					2740
Styrene	2.67	0.00	215	400	202	860000	110
t-1,2-Dichloroethene	0.02	0.00					
t-1,2-Dimethylcyclohexane	0.29	0.06					
t-1,3-Dichloropropene	0.00	0.00					
t-1,4-Dimethylcyclohexane	0.11	0.02					
t-2-Butene	0.34	0.00					
t-2-Heptene	0.05	0.00					
t-2-Hexene	0.07	0.00					
t-2-Octene	0.00	0.00					
t-2-Pentene	0.22	0.01					
t-3-Heptene	0.02	0.00					
t-3-Methyl-2-Pentene	0.00	0.00					
t-4-Methyl-2-Pentene	0.01	0.00					
tert-Butylbenzene	0.00	0.00					
Tetrachloroethene	2.87	0.08		10000			3400
Toluene	31.20	1.87	1880	2000	8025	150000	1880
Trichloroethene	1.05	0.02		3500			
Undecane	1.68	0.10					
Vinylchloride (Chloroethene)	0.02	0.00	130	3		646	130

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