Portsmouth Ohio Air Quality Study 2003

Division of Air Pollution Control
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Executive Summary

The Ohio EPA, Division of Air Pollution Control, has completed the second part of an urban air toxic monitoring study for the area surrounding the Portsmouth Water Treatment Plant located in Portsmouth, Ohio. This study is part of an ongoing investigation to monitor potential concerns for health risks calculated from measured concentrations of air toxic chemicals in the New Boston / Portsmouth area. Special interest was directed toward the above-average detection of benzene emissions in the ambient (outdoor) air in the immediate vicinity of the New Boston Coke Corporation (NBCC) coke oven facility. During 1999, a specific point source of organic emissions was discovered in an uncontrolled bleeder stack from the ovens. Ohio EPA issued orders requiring immediate mitigation of the source in the form of a flare installed on the stack to burn excess emissions. Vapors from the stack were immediately reduced, as documented by this study. Ambient air concentrations were reduced further when the facility ceased operations.

Ambient air monitoring data collected from January 2000 through December 2002 was used in a risk assessment to specifically compare the carcinogenic (cancer) and non-carcinogenic (non-cancer) risks to the results documented in 1999 Portsmouth Air Quality report. The data was also used to document the effectiveness of the technology used to control emissions from the facility's stack. Total carcinogenic risk lowers from 2.22 E-03 to 3.14 E-05 between the two studies. The Hazard Index (used to estimate the total non-cancer risk) remains below 1 and decreases from 0.69 to 0.59, remaining well below the safe level of one.

For carcinogens, "acceptable" health risk values historically range from one in one million (1E-06) for regulation of certain individual source categories, to some sources routinely operating in the one in 10,000 (1 E-04) range. For non-carcinogenic estimation of Hazard Indexes (HI), a calculated HI below 1 is generally regarded as a "safe" level of exposure. In the case of this study, a large emission source of volatile organic compounds (VOCs) was discovered in the area that correspondingly resulted in a high cancer risk number. Since 1999, these risk numbers have decreased dramatically due to the elimination of this VOC source.

Table A compares the total cancer risk from 1999 to 2002. The Table includes a column that documents the risk after the installation of the flare control technology at the NBCC and another column listing the results after the facility closed in April 2002. Note that for some of the chemicals, such as benzene, toxicity values (used to calculate cancer and non-cancer risk) have been updated by U.S. EPA since the 1999 study. However, for the purpose of making direct comparison with the 1999 Portsmouth Air Quality Study, the risk was calculated for each chemical using the same toxicity values listed in the 1999 study. **Appendix B** contains the risk tables that were calculated using updated U.S. EPA toxicity

values.

An evaluation of the results show that the potential risk in the New Boston area is significantly reduced by the control measures implemented at the NBCC facility, and the risk again drops when the facility ceases operation.

Table A: Total Risk from Volatile Organic Compounds (VOCs)
1999 Study vs. 2003 Study

	December 1999 study	January 00-April02 (after flare)	April02-December02 (shutdown)
Cancer risk	2.22 E-03	1.61 E-04	3.14 E-05

Table B compares risk results for two of the compounds (benzene and 1,3-butadiene) responsible for most of the cancer risk reported in the 1999 study. The Table documents the risk for these chemicals before and after installation of the control technology. In addition, the table includes the risk for these compounds calculated after the facility closed in April 2002. The results show that the cancer risk for both benzene and 1,3-butadiene are significantly reduced in the New Boston Village by the installation of the flare to the bleeder stack. It is also important to note that the most significant total risk reductions for these compounds since the 1999 study were observed after the facility shut down its processes in April of 2002.

Table B: Summary of Major Risk Compounds for Portsmouth Ohio
1999 Study vs. 2003 Study

	December 1999	January00-April02 (after flare)	April02-December02 (shutdown)
Benzene	9.98 E-04	6.01 E-05	9.75 E-06
1, 3- Butadiene	1.08 E-03	8.68 E-05	ND

ND - compound not detected

Based on an evaluation of the most recent data collected in the New Boston area from April 2002 - December 2002, the total cancer risk is in the range of E-05 (1 in 100,000 range), consistent to what is generally observed in urban industrial areas. The benzene concentrations decreased from an average value of 128 ug/m^3 to 7.70 ug/m^3 after the enforcement action of Ohio EPA. The average concentration further decreased to 1.25 ug/m^3 when the facility ceased operation. This overall benzene concentrations decreased

by a factor of 16 after the installation of the flare, and the total decreased by a factor of 100 when NBCC closed in April 2002. The results in this study also show that installation of controls and the shutdown of the facility has effectively reduced emissions and reduced the potential for risk in the Portsmouth community.

Introduction

The Ohio EPA, Division of Air Pollution Control (DAPC), has completed the second part of an urban air toxic monitoring study for the New Boston and Portsmouth, Ohio area. This study is the responsibility of the Air Toxics Unit (ATU) and Air Monitoring Section (AMS). As part of Ohio EPA's Urban Air Toxic Monitoring Program, this report continues to address the potential concerns for high cancer risks from multi-pollutant interactions in urban and industrial areas. Detailed background concerning this project is contained in the original report, *Portsmouth Ohio Air Quality Study 1999*. New Boston Coke Corporation (NBCC) was a major source of VOC (volatile organic compound) releases into the ambient air near New Boston, Ohio. This area was chosen for monitoring because of the close proximity of the significant pollution source to a population of approximately 25,000 people (1990 / 2000 census records list populations of 22,680 / 20,909 for Portsmouth and 2,565 / 2,340 for the Village of New Boston). During 1999, a specific point source of organic emissions was discovered in an uncontrolled bleeder stack from the ovens. Ohio EPA issued orders requiring immediate mitigation of the source in the form of a flare installed on the stack to burn excess emissions, which caused an immediate reduction in VOC emissions. Ambient air concentrations were reduced again when the facility ceased operation. To complete the 1999 study, Ohio EPA continues to conduct ambient air toxics monitoring for VOCs to ensure that concentrations remain at low levels.

Sampling at the Portsmouth Water Treatment Plant, 4862 Gallia Rd., Portsmouth, Ohio has been in effect intermittently from 1993 through the present. The VOC sampling device is located on the roof of the water treatment plant, in the same area as other Ohio EPA air pollution samplers (such as the PM_{10} particulate samplers). The water plant is located along Route 52 on the east side of New Boston. The monitoring site faces the NBCC, which is a few hundred meters away, located on the eastern edge of the Village along the Ohio River. There are businesses, restaurants, homes, a school and parks within a two-mile radius of the facility.

Methods

Volatile Organic Compound Sampling and Analysis

The primary component of this study consists of ambient sampling for volatile organic compounds (VOCs). These are defined as compounds that are generally found in the

vapor state at normal temperatures. These compounds can be chlorinated or simple hydrocarbons. VOC samples were collected using a whole-air sampling system that pumps ambient air into an evacuated stainless steel canister. The canister acts as a storage container which allows the air sample to be maintained virtually unchanged until it is analyzed. During this monitoring period, samples were collected twice a month (once every 13th day) for a 24-hour period, midnight to midnight. As outlined in the previous report, for the canister analysis, the standard procedure of using a gas chromatograph (GC) in combination with mass spectrometer (MS) was implemented.

In the early years of this study, the analytical standard contained 42 individual compounds. The analytical method was then modified by Ohio EPA both in 1998 and in 2000 to include an enhanced standard that now contains 73 compounds. **Table 1 lists the VOCs that are capable of being measured (target compounds) during the sampling periods identified outlined in this report.**

Risk Assessment Method

Risk assessment is a process that uses the most recent and best available toxicological information as a basis for estimating the potential health effects that individuals or populations may experience as a result of prolonged exposure to hazardous substances. The risk assessment guidelines provided by the NAS (National Academy of Science) and the U.S. EPA require the use of long-term data for accurately estimating long-term health risks. This report continues to add information to the assessment of the air quality in the Portsmouth / New Boston area.

The risk assessment process produces a numerical prediction of the probability that an adverse health effect, such as cancer or other disease, could occur as a result of constant exposure to toxic compounds for long period of time. This assessment assumes that an individual is exposed 24 hours per day and 365 days per year for a lifetime to the pollutant(s). This conservative scenario provides the largest safety buffer in evaluating potential health risks. The actual risks will be no greater than the estimated risk. The actual risk will most likely be less than those estimated. Health risks generated for this study are examined for the inhalation exposure pathway only.

To determine the risk from the concentration of the chemicals detected and measured in this study, the results are compared to either the cancer potency factors [that are called unit risk factors (URFs)] for carcinogenic compounds or the Reference Concentrations (RfC) for non-carcinogenic compounds. This yields a quantitative estimate of human health risk. Both the RfCs and the URFs are determined by U.S. EPA and are made available to state and local health agencies for use in these type of assessments.

Cancer potency factors are used to assess health risk from carcinogenic compounds. The URF defines quantitatively the relationship between dose and response for air exposures to pollutants. Multiplying the URF by the average daily long-term dose will produce a probability of developing cancer as a result of long-term exposure. The results are

expressed as the probability of an excess cancer risk occurring, usually expressed as "so many chances in a million."

The RfCs are estimates of daily exposure levels for non-carcinogens to which people may be exposed constantly for long periods, without an appreciable risk of harmful health effects. These risks are evaluated by the use of a Hazard Quotient (HQ) which is a determination of the ratio of the average daily concentrations compared to the RfC for each compound. If the HQ exceeds 100% of the RfC for a particular compound or specific health effect, there may be concern for cause of potential health effects as a

result of exposure to the compound. For some compounds where RfCs were not available from U.S. EPA, Ohio EPA implemented its own toxic review system.

As in the 1999 study, the concentrations for these compounds were compared to the American Conference of Governmental and Industrial Hygienist's Threshold Limit Value (TLV). The TLV is divided by a modification factor of 42 to account for the differences in exposure between an 8-hour work day and 24-hour lifetime exposure, plus a safety factor of 10 to account for sensitive populations. This value is used as an RfC in the risk evaluation for non-cancer compounds without toxicity values. The use of this value is indicated in the tables by the source listing of TLV/42.

A summary of the calculation of excess cancer risk and the Hazard Quotient (HQ) for compounds measured above the detection limits during the sampling period is included in this report. For this report, compounds that were not detected above the lower detection limit of the sampling method and analysis were not included in the results. The toxicity numbers (health effects values) used to calculate the risk in this report are the same as used in the 1999 study. A few URF numbers have been modified or changed by U.S. EPA since 1999, but use of those numbers would have made direct comparisons between the two studies difficult. **Tables 7-10** contain the cancer and non-cancer results for all of the compounds detected for the entire 2000-2002 sampling period. **Appendix B** contains all the risk results calculated with the updated toxicity values. **Tables B1-B2** (in Appendix B) list the compounds by name and identify the change in toxicity value between 1999 and the current study. **Tables B3-B6** contain the cancer and non-cancer risk calculations for all compounds detected in both the 1999 and the current study using the newer toxicity values. The data in these tables show that some of the toxicity values were lowered with more conservative values, yielding higher estimations of risk per unit concentration than in 1999. These changes in toxicity values cause some risk and hazard values to appear increased since the 1999 study, but in fact most concentrations of pollutants have decreased since the original report. This information is presented in this report to provide the comparison with the 1999 study, and also to notify the reader of the current health risk estimations for the compounds studied.

Table 1. (2002 - 2003) Compound List of 73 Compounds for Canister Analysis

acetone	trans-1,3-dichloropropene
acetonitrile*	methanol*
acrylonitrile*	1,2-dichloro-1,1,2,2-tetrafluoroethane
benzene	n-dodecane
benzyl chloride	ethylbenzene
bromodichloromethane	4-ethyltoluene
bromoform	n–heptane
bromomethane / 1,2-dibromoethane	hexachlorobutadiene
1,3-butadiene	hexane
n-butane	methyl-butyl ether
2-butanone	methylene chloride / dichloromethane
carbon disulfide	4-methyl-2-pentagon
carbon tetrachloride	a-methylstyrene
chlorobenzene	napthalene
chlorodifluoromethane	n-nonane
chlorethane / ethyl chloride	n-octane
chloroform / trichloromethane	n-pentane
chloromethane / methyl chloride	n-propyl benzene
3-chloropropene	styrene
cumene	1,1,2,2-tetrachloroethane
cyclohexane	tetrachloroethylene
decane	toluene
dibromomethane	propylene*
ethanol*	1,1,2-trichlorobenzene
1,2-dibromoethane	1,1,1-trichloroethane
dibromomethane	1,1,2-trichloroethane
1,2-dichlorobenzene (ortho)	trichloroethene
1,3-dichlorobenzene (meta)	trichlorofluoromethane
1,4-dichlorobenzene (para)	1,1,2-trichloro-1,2,2-trifluoroethane
dichlorodifluoromethane	1,2,4-trimethylbenzene
1,1-dichloroethane	1,3,5-trimethylbenzene
1,2-dichloroethane	n-undecane
1,1-dichlorethene	vinyl acetate
cis-1,2-dichlorethene	vinyl chloride
trans-1,2-dichloroethene	o-xylene
1,2-dichloropropane	total m+xylene
cis-1,3-dichloropropene	

*chemicals added to the target list as of 2000

Results

The results for the average concentration of all volatile organic compounds (VOCs) collected from January 2000 through December 2002 are summarized. Results are presented for all compounds on the target list measured above the detection limit of analysis. The detection limit is the lowest measurement that the procedure can accurately quantify as a true measurement of the ambient air concentration. If a compound was detected once or more during the sampling period, the arithmetic mean (average) contains the value of ½ the detection limit for any non-detect measurement(s).

Tables 2-3 contain the calculated risk results for detected cancer and non-cancer compounds measured after the installation of the NBCC flare technology. Risk results for the compounds measured after the closing of NBCC are included in **Tables 4-5.** Compounds listed in these Tables have either a risk value (calculated by using the cancer risk URF) or a Hazard Quotient value (calculated by using the compound's RfC), or both. Compounds for which no health risk numbers are listed do not have current U.S. EPA peer-reviewed or published health assessment (cancer risk URF or non-cancer RfC) data. Detections listed as "ND" were not detected for that sample. Also note that Tables 2-5 only include results for compounds that were detected and analyzed in the Portsmouth 1999 study. **Table 6** shows how average concentrations for benzene and other compounds in New Boston compare with average concentrations of compounds detected for other Ohio counties.

Tables 7-10 represent the cancer and non-cancer risk for all of the compounds detected during the 2000-2002 sampling period. These tables differ from the results reported in Tables 2-5 in that these tables include additional results for the new compounds added to Ohio EPA laboratory analysis list since 1999.

Included in **Appendix A** is a summary of the average concentrations for all the results and each compound detected per year. Listed in each table is compound name, the arithmetic mean (average) for the data collected each year, the maximum and minimum detected sample values during the year, and the number of samples in which each compound was detected. The total possible number of samples collected each year is stated below each table. All units are micrograms per cubic meter air volume (ug/m^3).

Discussion

The data generated in this Portsmouth 2003 Study present the measured concentrations for VOC compounds on the roof of the Portsmouth Water Treatment Plant, located near the Village of New Boston, Ohio. As in the 1999 Study, the ambient air monitoring results are evaluated by an inhalation risk assessment. This process uses the most current available toxicological information as a basis for estimating the health effects that individuals or populations may experience as a result of prolonged exposure to the measured air pollutants. For purposes of comparison, and to maintain consistency, the toxicity values that were used to calculate the risk in the 1999 Study are the same values used to calculate risk for this 2003 Study. **Appendix B** contains the results that were calculated using updated toxicity values as recommended by U.S. EPA. All risk calculations assume that the inhalation exposure is constant, 24 hours per day and 365 days per year. These assumptions are conservative in general, in order to ensure that the actual risks will be no greater than the estimated risk. In fact, the actual risks will most likely be less than those estimated in this study.

The current method of estimating the total health effects risk from exposure to mixtures of carcinogenic compounds consists of adding individual risk numbers to approximate the total risk. This summation is based upon the principle that the addition of each risk produces a combined total risk estimate. This is the method currently recommended by U.S. EPA, in the absence of additional information. It has been suggested in scientific literature that exposure to combinations of pollutants may cause greater or lesser risk than can be explained by merely the summation of the individual exposure risks.

For an accurate interpretation of the predicted risks, these risks must be placed in perspective with common daily activities. A range of "acceptable" health risk values for carcinogens has been proposed by U.S. EPA. Historically, acceptability ranges from one in one million (E-06) for regulation of certain source categories of individual toxic air pollutants, to some source categories routinely operating in the one in 10,000 (E-04) range. For non-carcinogenic estimation of Hazard Indexes, an individual calculated index below one (100%) is generally regarded as a "safe" level of exposure.

Most large urban areas in the United States exhibit aggregate or total carcinogenic risks in the E-04 to E-06 range. While it is common for industrial or light industrial areas to have risks greater than those, some smaller suburban and rural areas have combined carcinogenic risks in the E-06 to E-07 range. Areas of higher risk characteristically may also contain large volumes of congested automobile traffic. Workers in such areas routinely are exposed only during working hours, and return to residential areas of decreased exposure concentrations during non-working hours. While it is certainly desirable to have these aggregate risks minimized to the lowest possible level, a no-risk scenario would be impossible to achieve in any industrial area. For comparison, **Table 6** lists average concentrations for benzene and other compounds detected in New Boston and other Ohio counties. The table shows that the average concentrations for benzene monitored after the NBCC closing (April 2002 through December 2002) are within the

range of concentrations detected in other counties.

Within the above framework for describing acceptable risk, the decrease in total risk from 2.22 E-03 to 3.14 E-05 represents a significant reduction in health risk from air pollution in the area of the Water Treatment Plant in New Boston, Ohio. There are some significant reasons for the difference in the 1999 and current (2000 - 2002) risk ranges exhibited by these results. The benzene component of the 1999 summary risk is 9.98 E-04 (average concentration 128 ug/m^3), which was an unacceptably high value to be reported for a single compound. The average 2000 - 2002 benzene risk number is 6.01 E-05 (average concentration 7.70 ug/m^3). This represents a decrease in the average ambient air concentration of benzene from 128 ug/m^3 to 7.70 ug/m^3 (close to a 16x reduction). The flare and other control strategies included in Ohio EPA's orders to NBCC proved effective in reducing benzene and other toxic air pollutant emissions from this facility. After NBCC ceased operation, the benzene concentration further decreased to 1.25 ug/m^3, representing a risk of 9.75 E-06. Ohio EPA has documented the lowered carcinogenic risks and non-carcinogenic adverse health effects associated with air toxics concentrations measured in the Portsmouth / New Boston, Ohio area. As a result of the removal of the NBCC facility, the single largest source of emissions in the study area, ambient VOC concentrations and risk have been greatly reduced. If the pattern of documented low measured levels of VOCs remains throughout calendar year 2003, the monitoring program near the NBCC site will be discontinued.

For further information concerning the risk assessment portions of this report, contact Paul Koval or Diane McClure of the DAPC Air Toxics Unit. For questions concerning the ambient monitoring portion of this assessment, contact Phil Downey of the DAPC Air Monitoring Section. The address for DAPC is: Ohio EPA, Division of Air Pollution Control, P.O. Box 1049, Columbus, Ohio 43216-1049. The phone number for the division is 614-644-2270.

Portsmouth Ohio Air Quality Study 2003

Tables

Table 2: Carcinogenic Risk From January 2000 - April 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	**(?g/m^3)$^{-1}$**		**(?g/m^3)**	
benzene	7.80e-06	IRIS	7.70	6.01e-05
benzyl chloride	4.86e-06	IRIS^e	ND	0.00e+00
1,3-butadiene	2.80e-04	IRIS	0.31	8.68e-05
carbon tetrachloride	1.50e-05	IRIS	0.41	6.15e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.26	5.98e-06
chloromethane / methyl chloride	1.80e-06	HEAST	0.96	1.73e-06
1,1-dichloroethene	5.00e-05	IRIS	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.35	1.65e-07
styrene	5.70e-07	HEAST	0.72	4.10e-07
tetrachloroethylene / tetrachloroethene	9.50e-07	IRIS^w	ND	0.00e+00
trichloroethene / trichloroethylene	1.70e-06	IRIS^w	ND	0.00e+00
TOTAL CARCINOGENIC RISK				**1.61e-04**

IRIS^e - extrapolated from oral route IRIS^w - value withdrawn from IRIS

ND - compound not detected

Table 3: Non-Carcinogenic Risk From January 2000 - April 2002

Compounds	Reference Conc.	Source	Average Conc.	Hazard Quotient (HQ)
VOCs	**(?g/m^3)$^{-1}$**		**(?g/m3)**	
acetone	3.50e+02	IRIS^e	9.17	0.026
n-butane	4.50e+04	TLV/42	7.71	0.000
2-butanone	1.00e+03	IRIS	0.95	0.001
carbon disulfide	7.00e+02	IRIS	4.38	0.006
carbon tetrachloride	2.45e+00	IRIS^e	0.41	0.167
chlorodifluoromethane	5.00e+04	IRIS	0.58	0.000
chloroform / trichloromethane	3.50e+01	IRIS^e	0.26	0.007
1,4-dichlorobenzene (para)	8.00e+02	IRIS	ND	0.000
dichlorodifluoromethane	7.00e+02	IRIS^e	2.28	0.003
ethylbenzene	1.00e+03	IRIS	0.24	0.000
hexane	2.00e+02	IRIS	0.59	0.003
methylene chloride / dichloromethane	2.10e+02	IRIS^e	0.35	0.002
styrene	1.00e+03	IRIS	0.72	0.001
tetrachloroethylene	3.50e+01	IRIS^e	ND	0.000
toluene	4.00e+02	IRIS	2.15	0.005
1,1,1-trichloroethane	1.00e+03	HEAST	0.30	0.000
trichlorofluoromethane	1.05e+03	IRIS^e	71.44	0.068
1,1,2-trichloro-1,2,2-trifluoroethane	1.05e+05	IRIS^e	0.45	0.000
1,2,4-trimethylbenzene	7.90e+03	TLV/42	0.42	0.000
vinyl actetate	2.00e+02	IRIS	0.38	0.002
o-xylene	7.00e+02	HEAST	0.25	0.000
total m+p-xylene	7.00e+02	HEAST	0.55	0.001
naphthalene	1.40e+01	HEAST	3.19	0.228
HAZARD PERCENT INDEX (HI)				**0.522**

IRIS^e - extrapolated from oral route ND - compound not detected

Table 4: Carcinogenic Risk From April 2002 - December 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	**(?g/m^3)$^{-1}$**		**(?g/m^3)**	
benzene	7.80e-06	IRIS	1.25	9.75e-06
benzyl chloride	4.86e-06	IRIS^e	ND	0.00e+00
1,3-butadiene	2.80e-04	IRIS	ND	0.00e+00
carbon tetrachloride	1.50e-05	IRIS	0.66	9.90e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.38	8.74e-06
chloromethane / methyl chloride	1.80e-06	HEAST	1.50	2.70e-06
1,1-dichloroethene	5.00e-05	IRIS	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.30	1.41e-07
styrene	5.70e-07	IRIS	0.23	1.31e-07
tetrachloroethylene / tetrachloroethene	9.50e-07	IRIS^w	ND	0.00e+00
trichloroethene / trichloroethylene	1.70e-06	IRIS^w	ND	0.00e+00
TOTAL CARCINOGENIC RISK				**3.14e-05**

IRIS^e - extrapolated from oral route IRIS^w - value withdrawn from IRIS

ND - compound not detected

Table 5: Non-Carcinogenic Risk From April 2002 - December 2002

Compounds	Reference Conc.	Source	Average Conc.	Hazard Quotient (HQ)
VOCs	(?g/m^3)$^{-1}$		(?g/m3)	
acetone	3.50e+02	IRIS^e	7.15	0.020
n-butane	4.50e+04	TLV/42	6.62	0.000
2-butanone	1.00e+03	IRIS	2.01	0.002
carbon disulfide	7.00e+02	IRIS	1.69	0.002
carbon tetrachloride	2.45e+00	IRIS^e	0.66	0.269
chlorodifluoromethane	5.00e+04	IRIS	0.74	0.000
chloroform / trichloromethane	3.50e+01	IRIS^e	0.38	0.011
1,4-dichlorobenzene (para)	8.00e+02	IRIS	ND	0.000
dichlorodifluoromethane	7.00e+02	IRIS^e	3.76	0.005
ethylbenzene	1.00e+03	IRIS	0.27	0.000
hexane	2.00e+02	IRIS	0.32	0.002
methylene chloride / dichloromethane	2.10e+02	IRIS^e	0.30	0.001
styrene	1.00e+03	IRIS	0.23	0.000
tetrachloroethylene	3.50e+01	IRIS^e	ND	0.000
toluene	4.00e+02	IRIS	1.23	0.003
1,1,1-trichloroethane	1.00e+03	HEAST	ND	0.000
trichlorofluoromethane	1.05e+03	IRIS^e	4.44	0.004
1,1,2-trichloro-1,2,2-trifluoroethane	1.05e+05	IRIS^e	0.70	0.000
1,2,4-trimethylbenzene	7.90e+03	TLV/42	0.39	0.000
vinyl actetate	2.00e+02	IRIS	0.65	0.003
o-xylene	7.00e+02	HEAST	0.30	0.000
total m+p-xylene	7.00e+02	HEAST	0.48	0.001
naphthalene	1.40e+01	HEAST	3.74	0.267
HAZARD PERCENT INDEX (HI)				**0.593**

IRIS^e - extrapolated from oral route ND - compound not detected

Table 6: State-Wide Summary Comparison of Ambient Air Data Units µg/m^3

COMPOUNDS	Portsmouth 1999	Portsmouth Jan. 2000 -	Portsmouth Apr. 2002 -	Butler	Cuyahoga 1	Cuyahoga 2	Hamilton	Washington	Ohio Average
acetone	14.88	9.17	7.15	7.62	10.03	6.02	11.04	7.67	8.39
acetonitrile	ND	0.35	ND	0.37	ND	0.37	0.44	0.34	0.27
acrylonitrile	ND	0.67	0.47	ND	0.58	0.50	0.45	0.85	0.50
benzene	128.00	7.70	1.25	0.73	1.00	1.10	1.38	0.52	1.96
bromodichloromethane	ND	ND	0.36	ND	ND	ND	ND	ND	0.05
1,3-butadiene	3.86	0.31	ND	0.25	ND	0.30	0.35	0.23	0.21
n-butane	10.13	7.71	6.62	3.61	5.09	9.32	9.14	4.98	6.64
2-butanone	1.67	0.95	2.01	1.34	1.66	1.53	2.07	1.33	1.56
carbon disulfide	10.47	4.38	1.69	0.89	1.09	1.93	1.59	5.99	2.51
carbon tetrachloride	0.60	0.41	0.66	0.47	0.42	0.34	ND	0.39	0.38
chlorodifluoromethane	1.05	0.58	0.74	0.80	ND	0.66	0.90	1.19	0.70
chloroethane / ethyl chloride	ND	0.33	ND	ND	ND	ND	0.39	ND	0.10
chloroform	ND	0.26	0.38	ND	ND	ND	0.75	ND	0.20
chloromethane / methyl chloride	1.14	0.96	1.50	0.86	1.07	1.13	1.40	1.09	1.14
cumene	ND	0.43	0.53	ND	ND	ND	ND	ND	0.14
cyclohexane	ND	0.32	ND	0.24	0.19	0.27	0.26	0.52	0.26
decane	ND	0.33	0.36	0.79	ND	0.38	0.32	0.33	0.36
dichlorodifluoromethane	2.30	2.28	3.76	2.32	2.25	2.55	2.43	2.18	2.54
1,2-dichloro-1,1,2,2-tetrafluoroethane	ND	ND	0.37	ND	ND	ND	ND	ND	0.05
ethanol	ND	7.55	ND	7.59	7.76	1.09	95.82	6.40	18.03
ethylbenzene	0.50	0.24	0.27	0.24	ND	0.43	0.55	0.23	0.28
n-heptane	ND	0.39	0.43	0.62	ND	0.60	0.66	0.41	0.44
hexane	3.07	0.59	0.32	0.65	1.19	1.49	2.23	1.18	1.09
methylene chloride / dichloromethane	ND	0.35	0.30	0.49	0.37	1.08	0.87	0.44	0.56
naphthalene	2.96	3.19	3.74	ND	ND	1.00	1.07	1.07	1.44

n-pentane	ND	2.46	1.97	1.77	2.56	4.10	8.41	1.99	3.32
propylene	ND	1.34	ND	0.62	0.76	0.52	0.76	ND	0.57
styrene	1.55	0.72	0.23	ND	ND	0.24	1.10	0.27	0.37
toluene	18.56	2.15	1.23	1.29	1.56	3.28	3.86	0.94	2.04
trichlorofluoromethane	57.95	71.44	4.44	25.77	1.08	1.66	2.47	12.67	17.08
1,1,2-trichloro-1,2,2-trifluoroethane	0.59	0.45	0.70	0.41	ND	ND	0.43	0.74	0.39
1,2,4-trimethylbenzene	0.83	0.42	0.39	0.49	0.27	0.55	1.03	0.53	0.53
n-undecane	ND	0.38	0.36	0.34	ND	0.36	0.35	ND	0.26
vinyl acetate	0.49	0.38	0.65	ND	0.44	0.39	ND	ND	0.27
o-xylene	1.13	0.25	0.30	0.27	ND	0.55	0.70	0.31	0.34
total m+p-xylene	5.61	0.55	0.48	0.47	0.39	1.64	1.91	0.52	0.85

Table 7: Carcinogenic Risk for all compounds detected January 2000 - April 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	**(?g/m^3)**		**(?g/m^3)**	
acrylonitrile*	6.80e-05	IRIS	0.67	4.56e-05
benzene	7.80e-06	IRIS	7.70	6.01e-05
benzyl chloride	4.86e-06	IRIS^e	ND	0.00e+00
1,3-butadiene	2.80e-04	IRIS	0.31	8.68e-05
carbon tetrachloride	1.50e-05	IRIS	0.41	6.15e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.26	5.98e-06
chloromethane / methyl chloride	1.80e-06	HEAST	0.96	1.73e-06
1,1-dichloroethene	5.00e-05	IRIS	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.35	1.65e-07
styrene	5.70e-07	IRIS	0.72	4.10e-07
tetrachloroethylene / tetrachloroethene	9.50e-07	IRIS^w	ND	0.00e+00
trichloroethene / trichloroethylene	1.70e-06	IRIS^w	ND	0.00e+00
TOTAL CARCINOGENIC RISK				**2.07e-04**

IRIS^e - extrapolated from oral route

IRIS^w - value withdrawn from IRIS

ND - compound not detected

* - compound added after 1999

Table 8: Non-Carcinogenic Risk for all Compounds Detected January 2000- April 2002

Compounds	Reference Conc.	Source	Average Conc.	Hazard Quotient
VOCs	**(?g/m^3)$^{-1}$**		**(?g/m3)**	
acetone	3.50e+02	IRIS^e	9.17	0.026
acetonitrile*	6.00e+01	IRIS	0.35	0.006
acrylonitrile*	2.00e+00	IRIS	0.67	0.335
n-butane	4.50e+04	TLV/42	7.71	0.000
2-butanone	1.00e+03	IRIS	0.95	0.001
carbon disulfide	7.00e+02	IRIS	4.38	0.006
carbon tetrachloride	2.45e+00	IRIS^e	0.41	0.167
chlorodifluoromethane	5.00e+04	IRIS	0.58	0.000
chloroform / trichloromethane	3.50e+01	IRIS^e	0.26	0.007
chloroethane / ethyl chloride	1.00e+04	TLV/42	0.33	0.000
chloromethane / methyl chloride	2.40e+03	TLV/42	0.96	0.000
cumene		NA	0.43	
cyclohexane	2.40e+04	TLV/42	0.32	0.000
decane		NA	0.33	
1,4-dichlorobenzene (para)	8.00e+02	IRIS	ND	0.000
dichlorodifluoromethane	7.00e+02	IRIS^e	2.28	0.003
1,2-dichloro-1,1,2,2-tetrafluoroethane		NA	ND	
n-dodecane		NA	0.37	
ethanol	4.50e+04	TLV/42	7.55	0.000
ethylbenzene	1.00e+03	IRIS	0.24	0.000
n-heptane		NA	0.39	
hexane	2.00e+02	IRIS	0.59	0.003

methylene chloride / dichloromethane	2.10e+02	IRIS^{e}	0.35	0.002
styrene	1.00e+03	IRIS	0.72	0.001
n-pentane	4.20e+04	TLV/42	2.46	0.000
propylene		NA	1.34	
tetrachloroethylene	3.50e+01	IRIS^{e}	ND	0.000
toluene	4.00e+02	IRIS	2.15	0.005
1,1,1-trichloroethane	1.00e+03	HEAST	0.30	0.000
trichlorofluoromethane	1.05e+03	IRIS^{e}	71.44	0.068
1,1,2-trichloro-1,2,2-trifluoroethane	1.05e+05	IRIS^{e}	0.45	0.000
1,2,4-trimethylbenzene	7.90e+03	TLV/42	0.42	0.000
n-undecane		NA	0.38	
vinyl actetate	2.00e+02	IRIS	0.38	0.002
o-xylene	7.00e+02	HEAST	0.25	0.000
total m+p-xylene	7.00e+02	HEAST	0.55	0.001
naphthalene	1.40e+01	IRIS	3.19	0.228
HAZARD PERCENT INDEX (HI)				**0.863**

IRIS^{e} - extrapolated from oral route * - compound added after 1999

ND - compound not detected NA - not available

Table 9: Carcinogenic Risk for all compounds detected April 2002 - December 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	**(?g/m^{3})$^{-1}$**		**(?g/m^{3})**	
acrylonitrile*	6.80e-05	IRIS	0.47	3.20e-05
benzene	7.80e-06	IRIS	1.25	9.75e-06
benzyl chloride	4.86e-06	IRIS^{e}	ND	0.00e+00
1,3-butadiene	2.80e-04	IRIS	ND	0.00e+00
carbon tetrachloride	1.50e-05	IRIS	0.66	9.90e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.38	8.74e-06
chloromethane / methyl chloride	1.80e-06	HEAST	1.50	2.70e-06
1,1-dichloroethene	5.00e-05	IRIS	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.30	1.41e-07
styrene	5.70e-07	IRIS	0.23	1.31e-07
tetrachloroethylene / tetrachloroethene	9.50e-07	IRIS^{w}	ND	0.00e+00
trichloroethene / trichloroethylene	1.70e-06	IRIS^{w}	ND	0.00e+00
TOTAL CARCINOGENIC RISK				**3.14e-05**

IRIS^{e} - extrapolated from oral route IRIS^{w} - value withdrawn from IRIS

ND - compound not detected * - compound added after 1999

Table 10: Non-Carcinogenic Risk for All Compounds Detected April 2002 - December 2002

Compounds	Reference Conc.	Source	Average Conc.	Hazard Quotient (HQ)
VOCs	(?g/m^3)$^{-1}$		(?g/m3)	
acetone	3.50e+02	IRIS^e	7.15	0.020
acetonitrile*	6.00e+01	IRIS	ND	0.000
acrylonitrile*	2.00e+00	IRIS	0.47	0.235
bromodichloromethane		NA	0.36	
n-butane	4.50e+04	TLV/42	6.62	0.000
2-butanone	1.00e+03	IRIS	2.01	0.002
carbon disulfide	7.00e+02	IRIS	1.69	0.002
carbon tetrachloride	2.45e+00	IRIS^e	0.66	0.269
chlorodifluoromethane	5.00e+04	IRIS	0.74	0.000
chloroform / trichloromethane	3.50e+01	IRIS^e	0.38	0.011
chloroethane / ethyl chloride	1.00e+04	TLV/42	ND	0.000
chloromethane / methyl chloride	2.40e+03	TLV/42	1.50	0.001
cumene		NA	0.53	
cyclohexane	2.40e+04	TLV/42	ND	0.000
decane	8.00e+02	NA	ND	0.000
1,4-dichlorobenzene (para)		IRIS	0.36	
dichlorodifluoromethane	7.00e+02	IRIS^e	3.76	0.005
1,2-dichloro-1,1,2,2-tetrafluoroethane		NA	0.37	
n-dodecane		NA	ND	
ethanol	4.50e+04	TLV/42	ND	0.000
ethylbenzene	1.00e+03	IRIS	0.27	0.000
n-heptane		NA	0.43	
hexane	2.00e+02	IRIS	0.32	0.002
methylene chloride / dichloromethane	2.10e+02	IRIS^e	0.30	0.001
styrene	4.20e+04	IRIS	1.97	0.000
n-pentane		TLV/42	ND	
propylene	1.00e+03	NA	0.23	0.000
tetrachloroethylene	3.50e+01	IRIS^e	ND	0.000
toluene	4.00e+02	IRIS	1.18	0.003
1,1,1-trichloroethane	1.00e+03	HEAST	ND	0.000
trichlorofluoromethane	1.05e+03	IRIS^e	4.44	0.004
1,1,2-trichloro-1,2,2-trifluoroethane	1.05e+05	IRIS^e	0.70	0.000
1,2,4-trimethylbenzene	7.90e+03	TLV/42	0.39	0.000
n-undecane		NA	0.36	

vinyl actetate	2.00e+02	IRIS	0.65	0.002
o-xylene	7.00e+02	HEAST	0.30	0.000
total m+p-xylene	7.00e+02	HEAST	0.48	0.001
naphthalene	1.40e+01	IRIS	3.74	0.267
HAZARD PERCENT INDEX (HI)				**0.827**

IRIS^{e} - extrapolated from oral route ND - compound not detected * - compound added after 1999

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Appendix A

Sampling Result Tables

Table A1: 2000 Sampling Results

Units ug/m^3

COMPOUNDS	ARITHMETIC MEAN	MAX. OBS.	MIN. OBS.	SAMPLES DETECTED
acetone	11.36	55.57	4.11	26
acetonitrile	0.28	1.16	0.38	6
acrylonitrile	0.75	4.86	0.66	12
benzene	6.51	23.72	0.58	30
1,3-butadiene	0.25	1.87	0.27	7
n-butane	8.13	31.43	1.26	31
2-butanone	1.61	3.30	0.57	31
carbon disulfide	5.66	20.59	3.10	17
carbon tetrachloride	0.34	0.64	0.64	2
chlorodifluoromethane	0.53	3.45	0.61	11
chloroethane	0.16	0.94	0.94	1
chloroform	0.26	0.60	0.60	1
chloromethane	0.81	2.06	0.53	24
cyclohexane	0.43	4.90	0.60	3
decane	0.32	1.18	1.18	1
dichlorodifluoromethane	1.89	4.02	1.06	30
n-dodecane	0.40	1.28	0.71	2
ethanol	13.71	191.63	0.98	19
ethylbenzene	0.24	0.62	0.53	2
n-heptane	0.27	1.00	0.50	4
hexane	0.89	2.01	0.36	22
methylene chloride	0.44	1.91	0.42	8
a-methylstyrene	0.26	0.84	0.84	1
naphthalene	2.05	10.66	0.64	16
n-pentane	2.90	26.41	0.66	30
propylene	0.69	7.18	1.31	5
toluene	1.92	5.37	0.57	24
1,2,4-trichlorobenzene	0.39	0.83	0.83	1
1,1,1-trichloroethane	0.31	1.39	1.39	1
trichlorofluoromethane	113.63	800.02	4.63	30
1,1,2-trichloro-1,2,2-trifluoroethane	0.46	2.42	2.42	1
1,2,4-trimethylbenzene	0.37	1.85	0.55	6
n-undecane	0.39	2.34	2.34	1
vinyl acetate	0.39	0.86	0.79	2

o-xylene	0.27	0.79	0.57	3
total m+p-xylene	0.61	2.25	0.57	6
Total				31

Table A2: 2001 Sampling Results

Units µg/m^3

COMPOUNDS	ARITHMETIC MEAN	MAX. OBS.	MIN. OBS.	SAMPLES DETECTED
acetone	6.41	13.53	6.52	12
acetonitrile	0.36	0.56	0.34	5
acrylonitrile	0.48	0.73	0.49	5
benzene	7.40	24.04	0.78	13
1,3-butadiene	0.34	0.63	0.29	10
n-butane	6.50	18.37	2.1	13
2-butanone	0.18	0.69	0.69	1
carbon disulfide	2.97	8.23	2.06	9
carbon tetrachloride	0.34	0.64	0.64	1
chlorodifluoromethane	0.64	0.09	0.54	13
chloromethane	0.90	1.58	0.88	13
cumene	0.51	0.75	0.75	1
dichlorodifluoromethane	2.27	3.37	2.67	13
ethylbenzene	0.23	0.44	0.44	1
hexane	0.25	0.86	0.72	2
methylene chloride	0.23	0.71	0.39	3
naphthalene	3.44	14.93	0.75	12
n-pentane	1.67	3.9	0.66	13
propylene	0.49	2.8	2.8	1
styrene	1.80	14.29	0.52	3
toluene	2.06	5.37	0.65	13
trichlorofluoromethane	23.14	154.29	2.86	13
1,2,4-trimethylbenzene	0.53	1.2	0.6	9
o-xylene	0.23	0.53	0.49	2
total m+p-xylene	0.59	1.37	0.88	7
Total				16

Table A3: February 2002 - April 2002 Sampling Results

Units µg/m^3

COMPOUNDS	ARITHMETIC MEAN	MAX. OBS.	MIN. OBS.	SAMPLES DETECTED
acetone	6.89	11.35	4.83	8
acetonitrile	0.35	0.41	0.41	1
benzene	12.96	25.02	3.25	8
1,3-butadiene	0.33	0.90	0.45	2
n-butane	8.82	18.86	4.35	8
carbon disulfide	2.60	6.02	3.04	4
carbon tetrachloride	0.83	0.90	0.77	8
chlorodifluoromethane	0.43	0.94	0.94	1
chloromethane	1.58	1.72	1.34	8
decane	0.41	1.18	1.18	1
dichlorodifluoromethane	3.77	3.97	3.62	8
ethylbenzene	0.27	0.62	0.62	1
hexane	0.28	0.97	0.97	1
methylene chloride	0.27	0.46	0.39	3
naphthalene	6.02	12.79	2.35	6
n-pentane	2.51	6.00	1.29	8
propylene	5.47	11.55	3.15	7
toluene	3.13	6.51	1.65	8
trichlorofluoromethane	12.16	74.29	2.69	8
1,1,2-trichloro-1,2,2-trifluoroethane	0.57	0.94	0.78	3
1,2,4-trimethylbenzene	0.33	0.90	0.90	1
n-undecane	0.41	0.98	0.98	1
total m+p-xylene	0.65	1.99	1.90	2
Total				8

Table A4: April 2002 - December 2002 Sampling Results

Units µg/m^3

COMPOUNDS	ARITHMETIC MEAN	MAX. OBS.	MIN. OBS.	SAMPLES DETECTED
acetone	7.15	24.16	3.87	18
acrylonitrile	0.47	1.08	0.46	2
benzene	1.25	3.22	0.42	21
bromodichloromethane	0.36	0.75	0.75	1
n-butane	6.62	43.52	1.06	21
2-butanone	2.01	25.19	1.59	11
carbon disulfide	1.69	6.33	1.58	9
carbon tetrachloride	0.66	1.86	0.77	14
chlorodifluoromethane	0.74	2.20	0.43	16
chloroform	0.38	2.23	0.60	4
chloromethane	1.50	5.25	0.78	22
cumene	0.53	0.75	0.65	3
decane	0.36	1.78	1.78	1
dichlorodifluoromethane	3.76	11.64	1.76	22
1,2-dichloro-1,1,2,2-tetrafluoroethane	0.37	0.71	0.71	1
ethylbenzene	0.27	0.57	0.44	4
n-heptane	0.43	0.58	0.58	1
hexane	0.32	1.33	0.75	4
methylene chloride	0.30	0.88	0.39	6
naphthalene	3.74	31.26	0.75	6
n-pentane	1.97	7.80	0.36	21
styrene	0.23	0.48	0.48	1
toluene	1.23	3.49	0.46	20
trichlorofluoromethane	4.44	24.57	1.26	22
1,1,2-trichloro-1,2,2-trifluoroethane	0.70	1.56	0.86	11
1,2,4-trimethylbenzene	0.39	1.00	0.80	5
n-undecane	0.36	1.04	1.04	1
vinyl acetate	0.65	2.61	1.22	4
o-xylene	0.30	0.93	0.53	4
total m+p-xylene	0.48	1.72	1.10	5
Total				24

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Appendix B

Risk Reference Tables

Table B1: Carcinogenic Compounds With Updated Unit Risk Values

Compounds	Carcinogenic Unit Risk	1999 study	Carcinogenic Unit Risk	Updated values
VOCs	(?g/m3)-1	Source	(?g/m3)-1	Source
acrylonitrile*	NA	NA	6.80e-05	IRIS
1,3-butadiene**	2.80e-04	IRIS	3.00e-05	IRIS
benzyl chloride**	4.86e-05	IRIS	4.90e-05	CAL
chloromethane / methyl chloride**	1.80e-06	Heast	Withdrawn	IRIS
1,1-dichloroethene**	5.00e-05	IRIS	Withdrawn	IRIS
tetrachloroethylene / tetrachloroethene**	9.50e-07	Heast	5.90e-06	CAL
trichloroethene / trichloroethylene**	1.70e-06	Heast	2.00e-06	CAL

* - compound added after 1999 ** - reference concentration updated since 1999

Table B2: Non-Carcinogenic Compounds With Updated Reference Concentration Risk Values

Compounds	Reference Concentration	1999 Study	Reference Concentration	2002 Study
VOCs	(?g/m3)-1	Source	(?g/m3)	Source
acetone**	3.50e+02	IRIS[e]	3.14e+04	ATSDR
acetonitrile*	NA	NA	6.00e+01	IRIS
acrylonitrile*	NA	NA	2.00e+00	IRIS
benzene**	NA	NA	3.00e+01	IRIS
1,3-butadiene**	NA	NA	2.00e+00	IRIS
n-butane**	4.50e+04	TLV/42	Withdrawn	IRIS
carbon tetrachloride**	2.45e+00	IRIS[e]	4.00e+01	CAL
chloroform / trichloromethane**	3.50e+01	IRIS[e]	9.93e+01	ATSDR
chloromethane / methyl chloride**	NA	NA	9.00e+01	IRIS
cumene**	NA	NA	4.00e+02	IRIS
1,1-dichloroethene**	NA	NA	2.00e+02	IRIS
methylene chloride / dichloromethane**	NA	NA	1.06e+03	ATSDR
naphthalene**	1.40e+01	HEAST	3.00e+00	IRIS
tetrachloroethylene / tetrachloroethene**	3.50e+01	IRIS[e]	2.76e+02	ATSDR
1,2,4-trichlorobenzene**	3.50e+01	IRIS[e]	2.00e+02	HEAST
1,1,1-trichloroethane**	1.00e+03	HEAST	1.00e+03	CAL

trichloroethene / trichloroethylene**	NA	NA	6.00e+02	CAL
1,2,4-trimethylbenzene	7.90e+03	TLV/42	Withdrawn	IRIS
o-xylene**	7.00e+02	HEAST	1.00e+02	IRIS
total m+p-xylene**	7.00e+02	HEAST	1.00e+02	IRIS

* - compound added after 1999 ** - reference concentration updated since 1999

IRIS[e] - extrapolated from oral route NA - not available

Table B3: Updated Carcinogenic Risk for All Compounds from 1999 Study

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	**(?g/m3)-1**		**(?g/m^3)**	
acrylonitrile*	6.80e-05	IRIS	NA	0.00e+00
benzene	7.80e-06	IRIS	128.00	9.98e-04
benzyl chloride**	4.90e-05	CAL	0.87	4.26e-05
1,3-butadiene**	3.00e-05	IRIS	3.86	1.16e-04
carbon tetrachloride	1.50e-05	IRIS	0.60	9.00e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.38	8.74e-06
1,4-dichlorobenzene (para)**	1.10e-05	CAL	0.40	4.40e-06
methylene chloride / dichloromethane	4.70e-07	IRIS	0.38	1.79e-07
styrene	5.70e-07	HEAST	1.55	8.84e-07
tetrachloroethylene / tetrachloroethene**	5.90e-06	CAL	0.46	2.71e-06
trichloroethene / trichloroethylene**	2.00e-06	CAL	0.30	6.00e-07
TOTAL CARCINOGENIC RISK				**1.18e-03**

* - compound added after 1999 ** - reference concentration updated since 1999

NA - not available

Table B4: Updated Non-Carcinogenic Risk for All compounds from 1999 Study

Compounds	Reference Concentration	Source	Average Concentration	Hazard Quotient (HQ)
VOCs	(?g/m^3)$^{-1}$		(?g/m^3)	
acetone**	3.14e+04	ATSDR	18.88	0.001
acetonitrile*	6.00e+01	IRIS	NA	0.000
acrylonitrile*	2.00e+00	IRIS	NA	0.000
benzene**	3.00e+01	IRIS	128.00	4.267
bromodichloromethane		NA	ND	
1,3-butadiene**	2.00e+00	IRIS	3.86	1.930
n-butane**		NA	10.13	
2-butanone	1.00e+03	IRIS	1.67	0.002
carbon disulfide	7.00e+02	IRIS	10.47	0.015
carbon tetrachloride**	4.00e+01	CAL	0.60	0.015
chlorodifluoromethane	5.00e+04	IRIS	1.05	0.000
chloroethane	1.00e+04	IRIS	ND	0.000
chloroform / trichloromethane**	9.93e+01	ATSDR	0.29	0.003
chloromethane / methyl chloride**	9.00e+01	IRIS	1.14	0.013
cumene**	4.00e+02	IRIS	ND	0.000
cyclohexane		NA	ND	
decane		NA	ND	
1,4-dichlorobenzene (para)	8.00e+02	IRIS	0.40	0.000
dichlorodifluoromethane	7.00e+02	IRIS[e]	2.30	0.003
1,1-dichloroethene**	2.00e+02	IRIS	0.64	0.003
1,2-dichloro-1,1,2,2-tetrafluoroethane		NA	ND	
n-dodecane		NA	ND	
ethylbenzene	1.00e+03	IRIS	0.50	0.000
n-heptane		NA	ND	
hexane	2.00e+02	IRIS	3.07	0.015
methylene chloride / dichloromethane**	1.06e+03	ATSDR	0.38	0.000

a-methylstyrene		NA	ND	
naphthalene**	3.00e+00	IRIS	2.96	0.987
n-pentane		NA	ND	
propylene		NA	ND	
styrene	1.00e+03	IRIS	1.55	0.002
tetrachloroethylene / tetrachloroethene**	2.76e+02	ATSDR	0.46	0.002
toluene	4.00e+02	IRIS	18.56	0.046
1,2,4-trichlorobenzene**	2.00e+02	HEAST	0.59	0.003
1,1,1-trichloroethane**	1.00e+03	CAL	1.18	0.001
trichloroethene / trichloroethylene**	6.00e+02	CAL	0.30	0.000
trichlorofluoromethane	1.10e+03	IRIS[e]	57.95	0.053
1,1,2-trichloro-1,2,2-trifluoroethane	1.10e+05	IRIS[e]	0.59	0.000
1,2,4-trimethylbenzene**		NA	0.83	
n-undecane		NA	ND	
vinyl acetate	2.00e+02	IRIS	0.49	0.002
o-xylene**	1.00e+02	IRIS	1.13	0.011
total m+p-xylene**	1.00e+02	IRIS	5.61	0.056
Hazard Percent Index (HI)				**7.431**

* - compound added after 1999 ** - reference concentration updated since 1999

NA - not available ND - compound not detected

IRIS[e] - extrapolated from oral route

Table B5: Updated Carcinogenic Risk for All Compounds Detected From January 2000 - April 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	(?g/m3)-1		(?g/m^3)	
acrylonitrile*	6.80e-05	IRIS	0.67	4.56e-05
benzene	7.80e-06	IRIS	7.70	6.01e-05
benzyl chloride**	4.90e-05	CAL	ND	0.00e+00
1,3-butadiene**	3.00e-05	IRIS	ND	0.00e+00
carbon tetrachloride	1.50e-05	IRIS	0.31	4.65e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.26	5.98e-06
1,4-dichlorobenzene (para)**	1.10e-05	CAL	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.35	1.65e-07
styrene	5.70e-07	HEAST	0.72	4.10e-07
tetrachloroethylene / tetrachloroethene**	5.90e-06	CAL	ND	0.00e+00
trichloroethene / trichloroethylene**	2.00e-06	CAL	ND	0.00e+00
TOTAL CARCINOGENIC RISK				1.17e-04

* - compound added after 1999 ** - reference concentration updated since 1999

ND - compound not detected

Table B6: Updated Non-Carcinogenic Risk for All Compounds Detected from January 2000 - April 2002

Compounds	Reference Concentration	Source	Average Concentration	Hazard Quotient (HQ)
VOCs	(?g/m^3)$^{-1}$		(?g/m^3)	
acetone**	3.14e+04	ATSDR	9.17	0.000
acetonitrile*	6.00e+01	IRIS	0.35	0.006
acrylonitrile*	2.00e+00	IRIS	0.67	0.335
benzene**	3.00e+01	IRIS	7.70	0.257
bromodichloromethane		NA	ND	
1,3-butadiene**	2.00e+00	IRIS	0.31	0.155
n-butane**		NA	7.71	
2-butanone	1.00e+03	IRIS	0.95	0.001
carbon disulfide	7.00e+02	IRIS	4.38	0.006
carbon tetrachloride**	4.00e+01	CAL	0.41	0.010
chlorodifluoromethane	5.00e+04	IRIS	0.58	0.000
chloroethane	1.00e+04	IRIS	0.33	0.000
chloroform / trichloromethane**	9.93e+01	ATSDR	0.26	0.003
chloromethane / methyl chloride**	9.00e+01	IRIS	0.96	0.011
cumene**	4.00e+02	IRIS	0.43	0.001
cyclohexane		NA	0.32	
decane		NA	0.33	
1,4-dichlorobenzene (para)	8.00e+02	IRIS	ND	0.000
dichlorodifluoromethane	7.00e+02	IRIS[e]	2.28	0.003

1,1-dichloroethene**	2.00e+02	IRIS	ND	0.000
1,2-dichloro-1,1,2,2-tetrafluoroethane		NA	ND	
n-dodecane		NA	0.37	
ethylbenzene	1.00e+03	IRIS	0.24	0.000
n-heptane		NA	0.39	
hexane	2.00e+02	IRIS	0.59	0.003
methylene chloride / dichloromethane**	1.06e+03	ATSDR	0.35	0.000
a-methylstyrene		NA	0.26	
naphthalene**	3.00e+00	IRIS	3.19	1.063
n-pentane		NA	2.46	
propylene		NA	1.34	
styrene	1.00e+03	IRIS	0.72	0.001
tetrachloroethylene / tetrachloroethene**	2.76e+02	ATSDR	ND	0.000
toluene	4.00e+02	IRIS	2.15	0.005
1,2,4-trichlorobenzene**	2.00e+02	HEAST	0.39	0.002
1,1,1-trichloroethane**	1.00e+03	CAL	0.30	0.000
trichloroethene / trichloroethylene**	6.00e+02	CAL	ND	0.000
trichlorofluoromethane	1.10e+03	IRIS[e]	71.44	0.065
1,1,2-trichloro-1,2,2-trifluoroethane	1.10e+05	IRIS[e]	0.45	0.000
1,2,4-trimethylbenzene**		NA	0.42	
n-undecane		NA	0.38	
vinyl acetate	2.00e+02	IRIS	0.38	0.002
o-xylene**	1.00e+02	IRIS	0.25	0.002
total m+p-xylene**	1.00e+02	IRIS	0.55	0.006
Hazard Percent Index (HI)				1.938

* - compound added after 1999 ** - reference concentration updated since 1999

NA - not available ND - compound not detected

IRIS[e] - extrapolated from oral route

Table B7: Updated Carcinogenic Risk for All Compounds Detected From April 2002 - December 2002

Compounds	Carcinogenic Unit Risk	Source	Average Concentration	Carcinogenic Risk
VOCs	(?g/m3)-1		(?g/m^3)	
acrylonitrile*	6.80e-05	IRIS	0.47	3.20e-05
benzene	7.80e-06	IRIS	1.25	9.75e-06
benzyl chloride**	4.90e-05	CAL	ND	0.00e+00
1,3-butadiene**	3.00e-05	IRIS	ND	0.00e+00
carbon tetrachloride	1.50e-05	IRIS	0.66	9.90e-06
chloroform / trichloromethane	2.30e-05	IRIS	0.38	8.74e-06
1,4-dichlorobenzene (para)**	1.10e-05	CAL	ND	0.00e+00
methylene chloride / dichloromethane	4.70e-07	IRIS	0.30	1.41e-07
styrene	5.70e-07	HEAST	0.23	1.31e-07
tetrachloroethylene / tetrachloroethene**	5.90e-06	CAL	ND	0.00e+00
trichloroethene / trichloroethylene**	2.00e-06	CAL	ND	0.00e+00
TOTAL CARCINOGENIC RISK				6.06e-05

* - compound added after 1999 ** - reference concentration updated since 1999

ND - compound not detected

Table B8: Updated Carcinogenic Risk for All Compounds Detected From April 2002 - December 2002

Compounds	Reference Concentration	Source	Average Concentration	Hazard Quotient (HQ)
VOCs	(?g/m^3)$^{-1}$		(?g/m^3)	
acetone**	3.14e+04	ATSDR	7.15	0.000
acetonitrile*	6.00e+01	IRIS	ND	0.000
acrylonitrile*	2.00e+00	IRIS	0.47	0.235
benzene**	3.00e+01	IRIS	1.25	0.042
bromodichloromethane		NA	0.36	
1,3-butadiene**	2.00e+00	IRIS	ND	0.000
n-butane**		NA	6.62	
2-butanone	1.00e+03	IRIS	2.01	0.002
carbon disulfide	7.00e+02	IRIS	1.69	0.002
carbon tetrachloride**	4.00e+01	CAL	0.66	0.016
chlorodifluoromethane	5.00e+04	IRIS	0.74	0.000
chloroethane	1.00e+04	IRIS	ND	0.000
chloroform / trichloromethane**	9.93e+01	ATSDR	0.38	0.004
chloromethane / methyl chloride**	9.00e+01	IRIS	1.50	0.017

cumene**	4.00e+02	IRIS	0.53	0.001
cyclohexane		NA	ND	
decane		NA	0.36	
1,4-dichlorobenzene (para)	8.00e+02	IRIS	ND	0.000
dichlorodifluoromethane	7.00e+02	IRIS[e]	3.76	0.005
1,1-dichloroethene**	2.00e+02	IRIS	ND	0.000
1,2-dichloro-1,1,2,2-tetrafluoroethane		NA	0.37	
n-dodecane		NA	ND	
ethylbenzene	1.00e+03	IRIS	0.27	0.000
n-heptane		NA	0.43	
hexane	2.00e+02	IRIS	0.32	0.002
methylene chloride / dichloromethane**	1.06e+03	ATSDR	0.30	0.000
a-methylstyrene		NA	ND	
naphthalene**	3.00e+00	IRIS	3.74	1.247
n-pentane		NA	1.97	
propylene		NA	ND	
styrene	1.00e+03	IRIS	0.23	0.000
tetrachloroethylene / tetrachloroethene**	2.76e+02	ATSDR	ND	0.000
toluene	4.00e+02	IRIS	1.23	0.003
1,2,4-trichlorobenzene**	2.00e+02	HEAST	ND	0.000
1,1,1-trichloroethane**	1.00e+03	CAL	ND	0.000
trichloroethene / trichloroethylene**	6.00e+02	CAL	ND	0.000
trichlorofluoromethane	1.10e+03	IRIS[e]	4.44	0.004
1,1,2-trichloro-1,2,2-trifluoroethane	1.10e+05	IRIS[e]	0.70	0.000
1,2,4-trimethylbenzene**		NA	0.39	
n-undecane		NA	0.36	
vinyl acetate	2.00e+02	IRIS	0.65	0.003
o-xylene**	1.00e+02	IRIS	0.30	0.003
total m+p-xylene**	1.00e+02	IRIS	0.48	0.005
Hazard Percent Index (HI)				1.592

* - compound added after 1999 ** - reference concentration updated since 1999

NA - not available ND - compound not detected

IRIS[e] - extrapolated from oral route