Southern Delaware County Air Monitoring Project

Interim Report

December 17, 1996

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Air Quality

SOUTHERN DELAWARE COUNTY AIR MONITORING PROJECT
SUMMARY OF INTERIM RESULTS

In 1994, the United States Environmental Protection Agency (EPA), in conjunction with the Pennsylvania Department of Environmental Protection (DEP), initiated an environmental risk study for the City of Chester, Pennsylvania. At the beginning of 1995, DEP, in cooperation with EPA, began a study of the air in the City of Chester and Borough of Marcus Hook. The goal of this most recent study is to try to learn more about the quality of the air in Chester and Marcus Hook, and to determine what pollutants are present. This interim report is a summary of what has been learned so far. The study is continuing, so there will be future reports when more information has been collected.

DEP is collecting samples of the air on a regular basis at two places: Front Street and Highland Avenue in the City of Chester, and at 8th and Market Streets in the Borough of Marcus Hook. The sites were chosen for two reasons: 1) they are both close to several industrial facilities and along roads with high traffic volumes, and 2) the people who live in those neighborhoods have complained about odors and other environmental problems. DEP started collecting air samples in Chester on January 10, 1995 and in Marcus Hook on April 2, 1995. Every sample of air is tested to see if it contains any of the pollutants listed in the tables in Section 1 of this Interim Report. The test results are used to determine the excess lifetime cancer risk presented by the pollutants.

On a national average, 4,000 people in every 10,000 people will develop cancer in their lifetimes. The information DEP collected in this study showed that if the people who live in the Chester area lived there for 70 years in a row and the amount of pollutants in the air stayed the same the entire time, there is a possibility that about 1.5 more people in every 10,000 living in Chester could develop some kind of cancer from these pollutants. In Marcus Hook, the situation is very similar. If conditions stayed the same, then about 1.6 more people in every 10,000 who live in that area for 70 years may develop some kind of cancer from the pollutants. This is similar to other urban areas.

Of the pollutants measured, the five that posed the greatest risk to human health in Chester and Marcus Hook in 1995 were 1,3-butadiene, 1,2-dibromoethane, benzene, vinyl chloride, and carbon tetrachloride. Carbon tetrachloride is at the same level in Chester and Marcus Hook as almost everywhere else. To better evaluate the sources of the other four primary pollutants and to try to get a more complete picture of the air quality in the area, DEP has decided to set up a third sampling site in Swarthmore, PA.

DEP has also started to compare the data collected in Chester and Marcus Hook to air data from other industrial areas. The most recent data for Philadelphia are from 1993, and except for vinyl chloride, the levels of the other pollutants listed above were measured at higher levels in Philadelphia than in Chester or Marcus Hook. Chester and Marcus Hook were also compared to the Baltimore, MD area. The overall health risk associated with the pollutants is higher in Baltimore than it is in Chester or Marcus Hook. Philadelphia and Baltimore were chosen as points of comparison because the air sampling programs in place in those cities are the same as what DEP is doing in Chester and Marcus Hook. All of these results are summarized in Tables 2-3, 2-4, and 2-5 in Section 2 of this Interim Report. Comparisons to other urban areas are not possible at this time because the sampling programs are so different that a valid correlation could not be made.

Detailed descriptions of the sampling and analysis procedures and the toxicity assessment and inhalation risk characterization are in Sections 1 and 2, respectively.

SECTION 1

SAMPLING AND ANALYSIS PROGRAM FOR VOLATILE ORGANIC COMPOUNDS (VOCs)

The sampling and analysis program is part of a study undertaken by the Pennsylvania Department of Environmental Protection (DEP), in cooperation with the United States Environmental Protection Agency (EPA). The laboratory analyses were performed by the Maryland Department of the Environment.

The method used for sampling and analysis is based on EPA Method TO14. Whole air samples are collected in SUMMA® canisters, which are stainless steel canisters specially treated to create an inert inner surface. This inert surface ensures that pollutants will not be adsorbed or degraded by the canister, thus making the canisters suitable for air sampling. The canisters are cleaned and evacuated in the laboratory then shipped to the sampling site where they are filled with air at a constant rate over the sampling period. The filled canisters are then labeled and shipped back to the laboratory for analysis.

Samples are collected on a two days on, one day off schedule, except when equipment problems caused days to be missed. DEP and EPA chose this sampling schedule to ensure that samples are not always collected on the same days of the week and also to maximize the number of samples that can be collected and analyzed with the available resources. The initial sampling plan was developed for a one year study. After reviewing the data from approximately nine months of sampling, DEP and EPA decided to continue sampling for another year.

Samples are being collected at two sites: Front Street and Highland Avenue in the City of Chester, and at 8th and Market Streets, Marcus Hook. The approximate coordinates, taken from the USGS Marcus Hook Quadrangle, are N 39^{o} 49' 45", W 75^{o} 23' 18" for the Chester site, and N 39^{o} 49' 4", W 75^{o} 24' 51" for the Marcus Hook site (see Figure 1). The Chester site was chosen because of its proximity to industrial sources, while the Marcus Hook site was chosen because of odor problems arising from refinery operations and other industrial sources. A 6' x 8' air monitoring trailer was installed in Chester to house the sampling equipment. The Marcus Hook sampler was set up in an existing DEP air monitoring station. Each station is equipped with a canister sampler, which has a blower continuously drawing air through a glass sampling cane and manifold. The air is drawn from the manifold through a short sample line. This reduces the risk of contamination and ensures that the sample is of fresh, outside air. In addition to the canister samplers, the Chester site has an MDA Scientific model SPM toxic gas monitor that measures total hydrides as hydrogen sulfide. The Marcus Hook site has continuous analyzers for sulfur dioxide and hydrogen sulfide, and a weather tower to monitor wind speed, wind direction, and ambient temperature.

Location of the Chester and Marcus Hook Sampling Sites

Figure 1

Area Map of Chester, Marcus Hook, and the Proposed Sampling Site in Swarthmore

Figure 2

Samples have been collected at the Chester site since January 10, 1995, and at Marcus Hook since April 2, 1995. Between January 10, 1995, and March 27, 1995, four separate samplers were co-located at Chester, set to sample on different days. Two of the samplers were Scientific Instrumentation Specialists model AGS-1/C samplers and two were Nutech model 4000. Both types of samplers collect pressurized samples using similar Viton® diaphragm pumps, but operate somewhat differently. After March 27th the four single canister samplers at Chester were replaced with a Graesby-Nutech, AVOCS multi-canister sampler. It is similar to the Nutech model 4000 sampler, but has a built-in manifold, an internal heater to prevent condensation in the flow controller and lines, a pressure sensor, and a more sophisticated programmable controller. The AVOCS multi-canister sampler connects to a Valco 16 port rotary valve to collect up to 16 canisters sequentially. An AVOCS sampler was installed at the Marcus Hook site on April 2, 1995. (see Figure 3)

All samples are collected over a 23 hour 55 minute period running from midnight to 11:55 PM. The sampler flow rate is set to fill the canister to between 10 and 15 psig final pressure over the sampling period.

Samples are shipped to the Maryland Department of the Environment, Air Management Administration laboratory for analysis. Each canister is analyzed using two different methods. In the first method, gas chromatography/mass spectrometry (GC/MS) using selected ion monitoring (SIM) mode is used to analyze for the compounds specified in EPA Method TO14. This is quite sensitive and accurate for a selected list of non-polar hydrocarbons and halogenated hydrocarbons; however, only compounds on the target compound list can be identified. The target list of compounds consists of 41 chemicals that were chosen by EPA when the test method was developed and includes the most common chlorinated and non-polar industrial solvents. The GC/MS is programmed to only look for the selected ion "fingerprints" that identify target compounds, so other compounds which might be present are not seen. Table 1-1 lists the target compounds for the GC/MS SIM analysis. The results for the TO14 compounds are reported in parts per billion volume (ppbv).

The second method of analysis is gas chromatography (GC) with flame ionization detection (FID). The GC system was calibrated for the compounds listed in Table 1-2. These are specified by EPA for photochemical assessment monitoring sites (PAMS). GC/MS Scan mode was used to analyze samples collected before March 28, 1995. After March 28, the Maryland lab acquired a GC/FID, and all subsequent samples were analyzed by the GC/FID. Results for the GC/FID and GC/MS Scan analyses are reported in parts per billion carbon (ppbc). Note that parts per billion carbon is equal to parts per billion volume times the number of carbon atoms in the compound.
Table 1-1 lists the chemicals that are targeted when performing an analysis to assess the toxicity of the ambient air. Table 1-2 lists chemicals that are of greater concern when assessing the photochemical reactivity of emissions. The chemicals in Table 1-2 are included in this study for two reasons: first, they are the chemicals of concern when mobile source emissions are considered, and second, they are turned into ground-level ozone, or smog by photochemical reactions. A comparison of the chemicals on these two tables may possibly prove to be useful in determining the influence of mobile sources when more sample data have been collected.

Table 1-1. GC/MS SIM Analysis Target Compound List of Air Toxics

• Dichlorodifluoromethane	• Chloromethane	• 1,2-Dichloro-1,1,2,2-Tetrafluoroethane
• Chloroethene (Vinyl Chloride)	• 1,3-Butadiene	• Bromomethane
• Chloroethane	• Trichlorofluoromethane	• 1,1-Dichloroethene
• Methylene Chloride	• 1,1,2-Trichloro-1,2,2-Trifluoroethane	• 1,1-Dichloroethane
• cis 1,2-Dichloroethene	• Chloroform	• 1,2-Dichloroethane
• 1,1,1-Trichloroethane	• Benzene	• Carbon Tetrachloride
• 1,2-Dichloropropane	• Trichloroethene	• cis-1,3-Dichloropropene
• trans-1,3-Dichloropropene	• 1,1,2-Trichloroethane	• Toluene
• 1,2-Dibromoethane	• Tetrachloroethene	• Chlorobenzene
• Ethylbenzene	• meta- & para-Xylene	• Styrene
• 1,1,2,2-Tetrachloroethane	• ortho-Xylene	• 1-Ethyl-4-Methyl Benzene
• 1,3,5-Trimethylbenzene	• 1,2,4-Trimethylbenzene	• Chloromethylbenzene
• 1,3-Dichlorobenzene	• 1,4-Dichlorobenzene	• 1,2-Dichlorobenzene
• 1,2,4-Trichlorobenzene	• Hexachloro-1,3-Butadiene	

The canister samplers were tested for background contamination by the Maryland laboratory. They were leak checked and cleaned, then purged with humidified ultra pure air until the canisters had less than 20 ppbc total contaminants, as measured using EPA Method TO12. (This method measures unspeciated total nonmethane organic compounds.) Although the samplers passed the quality control check for total contaminants, it was later found that two of the samplers had background contamination of up to a few ppb for three of the target compounds; Styrene, Ethylbenzene, and 1,3-Butadiene. No contamination problems were found with the AVOCS multi-canister sampler which replaced the four single canister samplers.

Data in the report have been flagged for samples where sampler contamination is suspected. Suspect data were not used in the calculation of the average concentration.

Table 1-2. PAMS Compound List - Photochemically Reactive Compounds.

• Ethene	• Ethyne (Acetylene)	• Ethane
• Propene	• Propane	• 2-Methylpropane (Isobutane)
• 1-Butene	• n-Butane	• trans-2-Butene
• cis-2-Butene	• 3-Methyl-1-Butene	• 2-Methylbutane (Isopentane)
• 1-Pentene	• n-Pentane	• 2-Methyl-1,3-Butadiene (isoprene)
• trans-2-Pentene	• cis-2-Pentene	• 2-Methyl-2-Butene
• 2,2-Dimethylbutane	• Cyclopentene	• 4-Methyl-1-Pentene
• Cyclopentane	• 2,3-Dimethylbutane	• 2-Methylpentane
• 3-Methylpentane	• 2-Methyl-1-Pentene	• n-Hexane
• trans-2-Hexene	• 2-Methyl-2-Pentene	• cis-2-Hexene
• Methylcyclopentane	• 2,4-Dimethylpentane	• Benzene
• Cyclohexane	• 2-Methylhexane	• 2,3-Dimethylpentane
• 3-Methylhexane	• 2,2,4-Trimethylpentane	• n-Heptane
• Methylcyclohexane	• 2,3,4-TriMethylpentane	• Toluene
• 2-Methylheptane	• 3-Methylheptane	• n-Octane
• Ethylbenzene	• meta-& para-Xylene	• Styrene
• ortho-Xylene	• n-Nonane	• Isopropylbenzene
• n-Propylbenzene	• 1,3,5-Trimethylbenzene	• beta-Pinene
• 1,2,4-Trimethylbenzene	• n-Decane	• n-Undecane

The average ambient air concentration of each compound is the arithmetic average of all valid 24-hour measured concentrations for that compound. In the cases where the compound in question was not detected, the value used in the average calculation was 0.00 ppb. The Department did not choose to use the detection limit divided by two in the case of non-detects. The average concentrations were calculated both ways and the differences in the calculated values were insignificant. For purposes of calculating the excess lifetime cancer risks, the Department used the arithmetic averages as an approximation to the annual average air concentrations for all the chemicals.

Canisters are cleaned and evacuated by the laboratory following standard preparation protocol, then shipped to the Marcus Hook Elementary School and distributed to each sampling site. The site operator records the sample information on a tag that is tied onto the canister.

Future Plans

The Department has established a third sampling site in the Swarthmore, PA area (see Figure 2). The reason for this choice is to try to develop a more complete picture of the air quality in the area. It is possible that as the study continues, more sampling sites may be added but, beyond the third site, nothing has been firmly established.

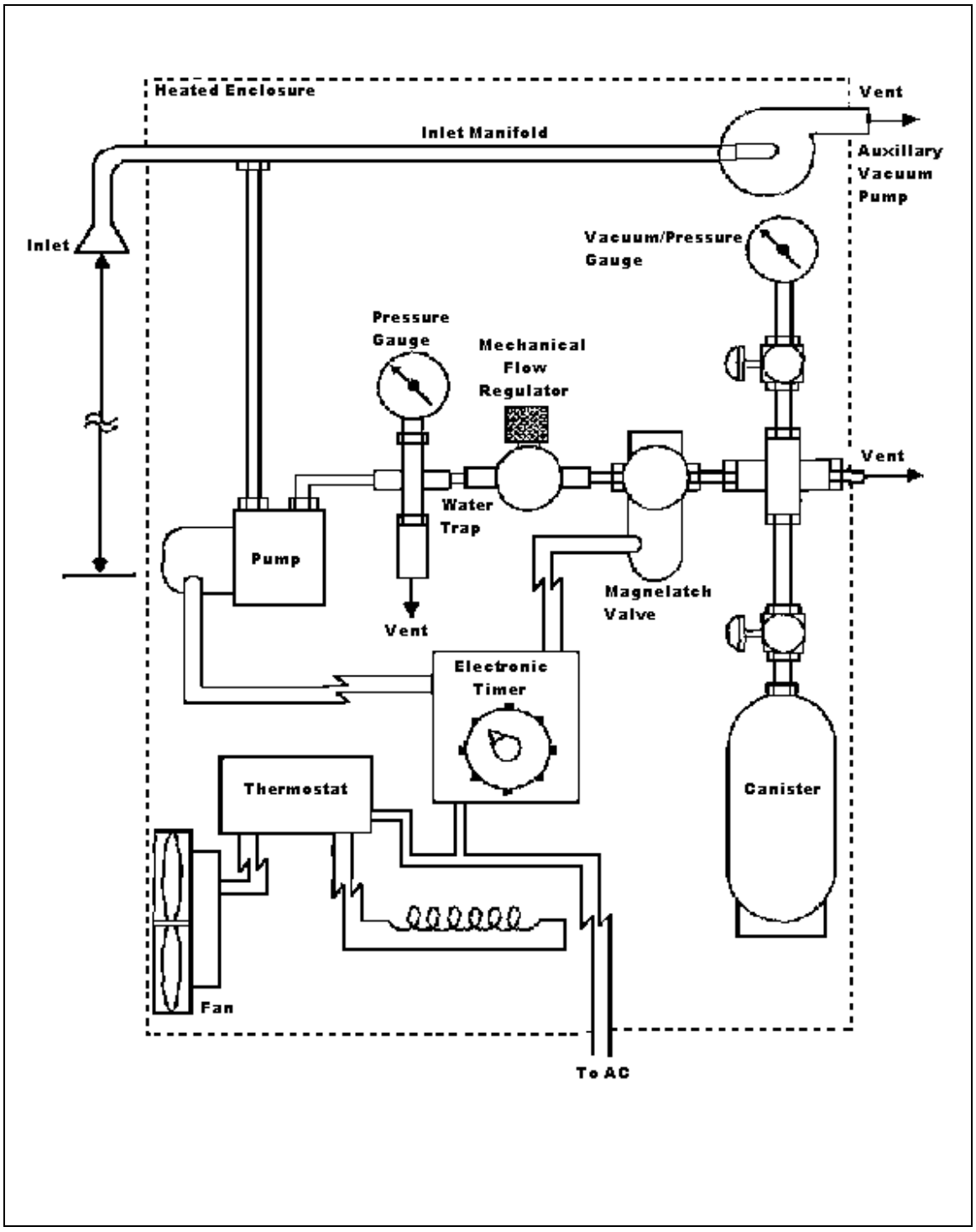

Figure 1-3. Sampler Diagram for Pressurized Canister Sampling

SECTION 2
TOXICITY ASSESSMENT AND INHALATION RISK CHARACTERIZATION

The excess lifetime cancer risk for each of the chemicals was calculated by using EPA's unit risk factors (URFs). Dr. Roy L. Smith of the United States Environmental Protection Agency has established a risk-based concentration (RBC) table for nearly 600 chemicals. Four different chronic toxicological constants are examined for approximately 600 chemical compounds: 1) Oral Reference Dose (RfDo), 2) Inhalation Reference Dose (RfDi), 3) Oral Cancer Potency Slope (CPSo), and 4) Inhalation Cancer Potency Slope (CPSi). The sources of the toxicological constants are: 1) the Integrated Risk Information System (IRIS), 2) Health Effects Assessment Summary Tables (HEAST), 3) withdrawn from IRIS or HEAST, 4) EPA-NCEA Regional Support Provisional Value, and 5) other EPA documents. In some cases, there were no data for the chemicals on the RBC table, and other sources, such as the Boilers and Industrial Furnaces (BIF) Regulation, had to be referenced. Of the 41 chemicals described above, a total of 33 had data for either the inhalation reference dose or inhalation cancer potency slope.

The URF is derived from the CPSi by assuming that an adult, weighing 70 kilograms (154 pounds), will breathe 20 m^3 (706 ft^3) of air a day for 365 days a year, over a 70 year lifetime of exposure. This approach is the universal standard conversion methodology and is detailed on page 3 of the "Answers to Frequently Asked Questions" section of the RBC table.

The conversion from CPSi to URF is carried out as follows:

(kg-day)/mg x (1/70 kg) x (20 m^3/day) x (mg/1000 ug) = m^3/ug

The Department examined data from the four quarters (4/2/95-3/31/96) that were available for both sampling sites. Next, the Department examined the first five available quarters of data (1/10/95-3/31/96) for the Chester sampling site. From January 10, 1995, through March 31, 1996, at the Chester sampling site, the results of the sampling analysis indicate that the cumulative excess lifetime cancer risk is 1.46 in 10,000 (1.46E-04). This risk number means that if the population of Chester in the area of the sampling site were exposed for 70 consecutive years to the compounds of concern at the levels measured in that area, there would be an increased potential for about 15 people in every 100,000 exposed to contract some form of cancer. From April 2, 1995, through March 31, 1996, the data gathered from the Chester site show that the cumulative excess lifetime cancer risk is 1.39 in 10,000 (1.39E-04), or an increase in cancer risk of about 14 people in every 100,000 exposed to the pollutants in the Chester area. From January 10, 1995, through December 31, 1995, the results of the sampling analyses indicate that the cumulative excess lifetime cancer risk is 1.48 in 10,000 (1.48E-04). All of these results are summarized in Table 2-1.

From April 2, 1995, through March 31, 1996, at the Marcus Hook sampling site, the cumulative excess lifetime cancer risk was found to be 1.60 in 10,000 (1.60E-04), or an increased potential for about 16 people in every 100,000 exposed to the pollutants in the Marcus Hook area for 70 consecutive years to develop some form of cancer. All of these results are summarized in Table 2-2.

The five chemicals with the highest estimated excess lifetime cancer risk are 1,3-butadiene, 1,2-dibromoethane, benzene, vinyl chloride, and carbon tetrachloride. To assess how the measured data from Chester and Marcus Hook compare to other industrial areas, data from Philadelphia and the Baltimore, MD area were compiled. Of the five chemicals described above, annual averages for 1995 for benzene and vinyl chloride were higher in Chester and Marcus Hook than in Baltimore, levels of 1,2-dibromoethane were very similar, and the measured levels of 1,3-butadiene were lower in Chester and Marcus Hook. Annual averages in Philadelphia for 1993 (the last year for which data are available) were compared to the 1995 annual averages in Chester and Marcus Hook. Only the levels of vinyl chloride were higher in Chester and Marcus Hook than in Philadelphia. The other four chemicals of concern were all measured at very similar or higher levels in Philadelphia. These results (retrieved from the Aerometric Information Retrieval System (AIRS)) are summarized in Tables 2-3, 2-4, and 2-5. According to the Agency for Toxic Substances and Disease Registry's Public Health Statement, background carbon tetrachloride concentrations around the world are 0.1 parts per billion. The air sampling analyses from Chester and Marcus Hook have yielded results demonstrating that carbon tetrachloride levels in both locations are at the world's background level.

Note: All raw data collected, including the data used to compile Tables 2-1 through 2-5 are available for inspection in Microsoft Excel or ASCII format.

Table 2-1

Summary of Excess Lifetime Cancer Risks from Inhalation Across Chemicals of Concern for Chester, Pennsylvania

Chemical	(Period 1/10/95 through 3/31/96)			(Period 4/2/95 through 3/31/96)			(Period 1/10/95 through 12/31/95)		
Name	Average Ambient Concentration		Excess Lifetime Cancer Risk	Average Ambient Concentration		Excess Lifetime Cancer Risk	Average Ambient Concentration		Excess Lifetime Cancer Risk
	(ppmv)	(ug/m3)		(ppmv)	(ug/m3)		(ppmv)	(ug/m3)	
1,3-Butadiene	9.79E-05	2.19E-01	6.14E-05	8.67E-05	1.94E-01	5.44E-05	9.70E-05	2.17E-01	6.09E-05
1,2-Dichlorobenzene	8.53E-06	5.19E-02	-	7.48E-06	4.55E-02	-	8.77E-06	5.34E-02	-
1,4-Dichlorobenzene	2.17E-05	1.32E-01	-	1.80E-05	1.10E-01	-	2.40E-05	1.46E-01	-
1,2-Dibromoethane	1.57E-05	1.22E-01	2.69E-05	1.76E-05	1.37E-01	3.01E-05	1.85E-05	1.44E-01	3.16E-05
1,1-Dichloroethane	5.46E-07	2.24E-03	-	4.03E-07	1.65E-03	-	5.47E-07	2.24E-03	-
1,2-Dichloroethane	2.17E-05	8.90E-02	2.31E-06	1.97E-05	8.06E-02	2.10E-06	1.75E-05	7.16E-02	1.86E-06
1,1-Dichloroethene	9.01E-06	3.62E-02	1.81E-06	1.03E-05	4.14E-02	2.07E-06	1.10E-05	4.44E-02	5.52E-10
1,2-Dichloropropane	9.47E-06	4.43E-02	3.19E-08	8.38E-06	3.92E-02	2.82E-08	9.16E-06	4.28E-02	3.09E-08
1,3-Dichloropropene	2.04E-06	9.37E-03	3.48E-07	8.56E-07	3.94E-03	1.46E-07	2.54E-06	1.17E-02	4.33E-07
1,1,2,2-Tetrachloroethane	4.33E-06	3.01E-02	1.75E-06	4.63E-06	3.22E-02	1.87E-06	4.28E-06	2.98E-02	1.73E-06
1,2,4-Trichlorobenzene	2.10E-06	1.58E-02	-	1.76E-06	1.32E-02	-	1.94E-06	1.46E-02	-
1,1,1-Trichloroethane	4.68E-04	2.59E+00	-	4.34E-04	2.40E+00	-	5.48E-04	3.03E+00	-
1,1,2-Trichloroethane	2.00E-06	1.10E-02	1.76E-07	2.22E-06	1.23E-02	1.96E-07	2.32E-06	1.28E-02	2.05E-07
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.11E-04	8.61E-01	-	1.11E-04	8.58E-01	-	1.17E-04	9.05E-01	-
Benzene	9.14E-04	2.96E+00	2.45E-05	7.58E-04	2.45E+00	2.03E-05	9.19E-04	2.97E+00	2.47E-05
Bromomethane	3.34E-05	1.31E-01	-	1.71E-05	6.71E-02	-	3.38E-05	1.33E-01	-
Carbon Tetrachloride	1.05E-04	6.72E-01	1.01E-05	1.05E-04	6.71E-01	1.01E-05	1.05E-04	6.68E-01	1.00E-05
Chlorobenzene	5.79E-06	2.70E-02	-	6.48E-06	3.02E-02	-	7.09E-06	3.31E-02	-
Chloroethane	5.05E-05	1.35E-01	-	5.14E-05	1.37E-01	-	5.18E-05	1.38E-01	-
Chloroethene (Vinyl Chloride)	4.07E-05	1.05E-01	8.85E-06	4.53E-05	1.17E-01	9.85E-06	3.94E-05	1.02E-01	8.57E-06
Chloroform	4.19E-05	2.07E-01	4.76E-06	3.93E-05	1.94E-01	4.47E-06	4.38E-05	2.16E-01	4.98E-06
Chloromethane	5.20E-04	1.09E+00	1.96E-06	5.07E-04	1.06E+00	1.91E-06	5.09E-04	1.06E+00	1.91E-06
Dichlorodifluoromethane	6.14E-04	3.07E+00	-	6.23E-04	3.12E+00	-	6.14E-04	3.08E+00	-
Ethylbenzene	1.65E-04	7.25E-01	-	1.49E-04	6.53E-01	-	1.61E-04	7.08E-01	-
Hexachloro-1,3-butadiene	2.94E-07	3.17E-03	6.98E-08	3.38E-07	3.65E-03	8.03E-08	2.49E-07	2.69E-03	5.91E-08
Methylene Chloride	1.95E-04	6.85E-01	3.22E-07	1.89E-04	6.65E-01	3.12E-07	1.83E-04	6.44E-01	3.03E-07
Styrene	4.30E-05	1.86E-01	-	3.34E-05	1.44E-01	-	4.30E-05	1.86E-01	-
Tetrachloroethylene	7.24E-05	4.97E-01	2.88E-07	6.42E-05	4.41E-01	2.56E-07	6.56E-05	4.51E-01	2.61E-07
Toluene	1.84E-03	7.01E+00	-	1.80E-03	6.86E+00	-	1.85E-03	7.05E+00	-
Trichloroethylene	9.14E-05	4.97E-01	8.50E-07	8.21E-05	4.47E-01	7.64E-07	9.74E-05	5.30E-01	9.06E-07
Trichlorofluoromethane	3.05E-04	1.73E+00	-	3.07E-04	1.75E+00	-	3.07E-04	1.75E+00	-
o-Xylene	2.15E-04	9.47E-01	-	2.02E-04	8.87E-01	-	2.16E-04	9.51E-01	-
m,p-Xylene	6.10E-04	2.68E+00	-	5.81E-04	2.55E+00	-	6.25E-04	2.75E+00	-
			1.46E-04			1.39E-04			1.48E-04

Description of Averaging Periods

1/10/95 through 3/31/95 All currently available data, 4/2/95 through 3/31/95 Period with data available at the Marcus Hook site, 1/10/95 through 12/31/95 Full calendar year for comparison to AIRS Data

Table 2-2

Summary of Excess Lifetime Cancer Risks from Inhalation
Across Chemicals of Concern for Marcus Hook, Pennsylvania
(Period 4/2/95 through 3/31/96)

Chemical Name	Average Ambient Concentration (ppmv)	Average Ambient Concentration (ug/m3)	Unit Risk (m3/ug)	Reference Air Concentration (ug/m3)	Excess Lifetime Cancer Risk
1,3-Butadiene	1.18E-04	2.64E-01	2.80E-04	-	7.40E-05
1,2-Dichlorobenzene	9.41E-06	5.73E-02	-	1.40E+02	-
1,4-Dichlorobenzene	1.63E-05	9.91E-02	-	8.00E+02	-
1,2-Dibromoethane	1.61E-05	1.25E-01	2.20E-04	2.00E-01	2.75E-05
1,1-Dichloroethane	3.33E-07	1.37E-03	-	5.00E+02	-
1,2-Dichloroethane	1.42E-05	5.84E-02	2.60E-05	1.00E+01	1.52E-06
1,1-Dichloroethene	9.56E-06	3.84E-02	5.00E-05	-	1.92E-06
1,2-Dichloropropane	3.75E-06	1.75E-02	7.20E-07	4.00E+00	1.26E-08
1,3-Dichloropropene	6.02E-07	2.77E-03	3.71E-05	2.00E+01	1.03E-07
1,1,2,2-Tetrachloroethane	4.39E-06	3.06E-02	5.80E-05	-	1.77E-06
1,2,4-Trichlorobenzene	2.24E-06	1.68E-02	-	2.00E+02	-
1,1,1-Trichloroethane	2.08E-04	1.15E+00	-	1.00E+03	-
1,1,2-Trichloroethane	6.89E-06	3.80E-02	1.60E-05	-	6.09E-07
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.28E-04	9.94E-01	-	3.00E+04	-
Benzene	9.12E-04	2.95E+00	8.30E-06	6.00E+00	2.45E-05
Bromomethane	1.41E-05	5.56E-02	-	5.00E+00	-
Carbon Tetrachloride	1.03E-04	6.55E-01	1.50E-05	2.00E+00	9.83E-06
Chlorobenzene	1.45E-05	6.77E-02	-	2.00E+01	-
Chloroethane	3.95E-05	1.05E-01	-	1.00E+04	-
Chloroethene (Vinyl Chloride)	5.32E-05	1.38E-01	8.40E-05	-	1.16E-05
Chloroform	2.98E-05	1.47E-01	2.30E-05	-	3.39E-06
Chloromethane	5.39E-04	1.13E+00	1.80E-06	-	2.03E-06
Dichlorodifluoromethane	6.39E-04	3.20E+00	-	2.00E+02	-
Ethylbenzene	2.29E-04	1.01E+00	-	1.00E+03	-
Hexachloro-1,3-butadiene	4.55E-07	4.91E-03	2.20E-05	-	1.08E-07
Methylene Chloride	1.90E-04	6.67E-01	4.70E-07	3.00E+03	3.14E-07
Styrene	6.04E-05	2.61E-01	-	1.00E+03	-
Tetrachloroethylene	5.58E-05	3.83E-01	5.80E-07	8.10E+01	2.22E-07
Toluene	3.05E-03	1.16E+01	-	4.00E+02	-
Trichloroethylene	5.50E-05	2.99E-01	1.71E-06	3.00E+02	5.12E-07
Trichlorofluoromethane	3.01E-04	1.71E+00	-	7.00E+02	-
o-Xylene	3.23E-04	1.42E+00	-	8.00E+01	-
m,p-Xylene	1.03E-03	4.53E+00	-	8.00E+01	-
					1.60E-04

Table 2- 3
1993 AIRS Data for Comparison to Chester Area Data

Compound	Site ID	Location	State	Mean (ppb)
1,2-DIBROMOETHANE	24-510-0035	Baltimore*	MD	0.013
1,2-DIBROMOETHANE	24-510-0006	Baltimore*	MD	0.012
1,2-DIBROMOETHANE	24-510-0040	Baltimore*	MD	0.013
1,2-DIBROMOETHANE	24-510-0043	Baltimore*	MD	0.018
1,2-DIBROMOETHANE	24-005-3001	Essex	MD	0.015
1,2-DIBROMOETHANE	24-003-1003	Glen Burnie	MD	0.017
1,3-BUTADIENE	24-510-0006	Baltimore*	MD	0.174
1,3-BUTADIENE	24-510-0035	Baltimore*	MD	0.116
1,3-BUTADIENE	24-510-0040	Baltimore*	MD	0.251
1,3-BUTADIENE	24-510-0043	Baltimore*	MD	0.100
1,3-BUTADIENE	24-005-3001	Essex	MD	0.248
1,3-BUTADIENE	24-003-1003	Glen Burnie	MD	0.186
BENZENE	24-510-0035	Baltimore*	MD	1.590
BENZENE	24-510-0006	Baltimore*	MD	0.716
BENZENE	24-510-0040	Baltimore*	MD	1.018
BENZENE	24-510-0043	Baltimore*	MD	0.604
BENZENE	24-005-3001	Essex	MD	0.843
BENZENE	24-003-1003	Glen Burnie	MD	0.902
CARBON TETRACHLORIDE	24-510-0043	Baltimore*	MD	0.120
CARBON TETRACHLORIDE	24-510-0035	Baltimore*	MD	0.170
CARBON TETRACHLORIDE	24-510-0006	Baltimore*	MD	0.110
CARBON TETRACHLORIDE	24-510-0040	Baltimore*	MD	0.120
CARBON TETRACHLORIDE	24-005-3001	Essex	MD	0.110
CARBON TETRACHLORIDE	24-003-1003	Glen Burnie	MD	0.120
VINYL CHLORIDE	24-510-0035	Baltimore*	MD	0.005
VINYL CHLORIDE	24-510-0006	Baltimore*	MD	0.005
VINYL CHLORIDE	24-510-0040	Baltimore*	MD	0.005
VINYL CHLORIDE	24-510-0043	Baltimore*	MD	0.005
VINYL CHLORIDE	24-005-3001	Essex	MD	0.005
VINYL CHLORIDE	24-003-1003	Glen Burnie	MD	0.005
1,2-DIBROMOETHANE			**Area Mean:**	0.015
1,3-BUTADIENE			**Area Mean:**	0.179
BENZENE			**Area Mean:**	0.946
CARBON TETRACHLORIDE			**Area Mean:**	0.125
VINYL CHLORIDE			**Area Mean:**	0.005
1,2-DIBROMOETHANE	42-101-0004	Philadelphia	PA	0.016
1,3-BUTADIENE	42-101-0004	Philadelphia	PA	0.190
BENZENE	42-101-0004	Philadelphia	PA	1.031
CARBON TETRACHLORIDE	42-101-0004	Philadelphia	PA	0.110
VINYL CHLORIDE	42-101-0004	Philadelphia	PA	0.017

*Site ID	Address	*Site ID	Address
24-510-0006	NE Police station, 19	24-510-0038	Ft. Holabird Elementary School
24-510-0011	Sun And Chesapeake St.	24-510-0040	Old Town Fire Department
24-510-0035	1900 E. Patapsco Ave.	24-510-0043	Fort McHenry Visitor
42-101-0004	1501 E. Lycoming Ave., Phil. PA		

Table 2-4
1995 AIRS Data for Comparison to Chester Area Data

Compound	Site ID		Location	State	Mean (ppb)
1,2-DIBROMOETHANE	24-510-0035	MD		Baltimore*	0.008
1,2-DIBROMOETHANE	24-510-0006	MD		Baltimore*	0.016
1,2-DIBROMOETHANE	24-510-0040	MD		Baltimore*	0.018
1,2-DIBROMOETHANE	24-510-0043	MD		Baltimore*	0.012
1,2-DIBROMOETHANE	24-510-0050	MD		Clifton Park	0.026
1,2-DIBROMOETHANE	24-005-3001	MD		Essex	0.007
1,2-DIBROMOETHANE	24-003-1003	MD		Glen Burnie	0.012
1,3-BUTADIENE	24-510-0006	MD		Baltimore*	0.141
1,3-BUTADIENE	24-510-0035	MD		Baltimore*	0.500
1,3-BUTADIENE	24-510-0040	MD		Baltimore*	0.201
1,3-BUTADIENE	24-510-0043	MD		Baltimore*	0.079
1,3-BUTADIENE	24-510-0050	MD		Clifton Park	0.100
1,3-BUTADIENE	24-005-3001	MD		Essex	0.203
1,3-BUTADIENE	24-003-1003	MD		Glen Burnie	0.168
BENZENE	24-510-0035	MD		Baltimore*	0.996
BENZENE	24-510-0006	MD		Baltimore*	0.571
BENZENE	24-510-0040	MD		Baltimore*	0.798
BENZENE	24-510-0043	MD		Baltimore*	0.394
BENZENE	24-510-0050	MD		Clifton Park	0.467
BENZENE	24-005-3001	MD		Essex	0.719
BENZENE	24-003-1003	MD		Glen Burnie	1.014
CARBON TETRACHLORIDE	24-510-0040	MD		Baltimore*	0.103
CARBON TETRACHLORIDE	24-510-0035	MD		Baltimore*	0.105
CARBON TETRACHLORIDE	24-510-0043	MD		Baltimore*	0.106
CARBON TETRACHLORIDE	24-510-0006	MD		Baltimore*	0.107
CARBON TETRACHLORIDE	24-510-0050	MD		Clifton Park	0.098
CARBON TETRACHLORIDE	24-005-3001	MD		Essex	0.102
CARBON TETRACHLORIDE	24-003-1003	MD		Glen Burnie	0.102
VINYL CHLORIDE	24-510-0006	MD		Baltimore*	0.019
VINYL CHLORIDE	24-510-0040	MD		Baltimore*	0.022
VINYL CHLORIDE	24-510-0043	MD		Baltimore*	0.022
VINYL CHLORIDE	24-510-0035	MD		Baltimore*	0.011
VINYL CHLORIDE	24-510-0050	MD		Clifton Park	0.022
VINYL CHLORIDE	24-005-3001	MD		Essex	0.015
VINYL CHLORIDE	24-003-1003	MD		Glen Burnie	0.013
1,2-DIBROMOETHANE				**Area Mean:**	**0.014**
1,3-BUTADIENE				**Area Mean:**	**0.199**
BENZENE				**Area Mean:**	**0.708**
CARBON TETRACHLORIDE				**Area Mean:**	**0.103**
VINYL CHLORIDE				**Area Mean:**	**0.018**

*Site ID

24-510-0006	NE Police station, 19	24-510-0038	Ft. Holabird Elementary School
24-510-0011	Sun And Chesapeake St.	24-510-0040	Old Town Fire Department
24-510-0035	1900 E. Patapsco Ave.	24-510-0043	Fort McHenry Visitor
42-101-0004	1501 E. Lycoming Ave., Phil. PA		

Table 2-5
Comparison of Mean Values Other Locations
With Chester and Marcus Hook Mean Values

Chemical Name	Baltimore's 1995 Mean Value		Chester's 1995 Mean Value		*Marcus Hook's Mean Value		Philadelphia's 1993 Mean Value	
	(ppbv)	Risk	(ppbv)	Risk	(ppbv)	Risk	(ppbv)	Risk
1,2-Dibromoethane	0.014	2.40E-05	0.018	3.08E-05	0.016	2.74E-05	0.016	2.74E-05
1,3-Butadiene	0.199	1.25E-04	0.097	6.09E-05	0.118	7.40E-05	0.190	1.19E-04
Benzene	0.708	1.90E-05	0.919	2.47E-05	0.912	2.45E-05	1.031	2.77E-05
Carbon Tetrachloride	0.103	9.84E-06	0.105	1.00E-05	0.103	9.84E-06	0.110	1.05E-05
Vinyl Chloride	0.018	3.91E-06	0.039	8.48E-06	0.053	1.15E-05	0.017	3.70E-06
	Total =	1.82E-04		1.35E-04		1.47E-04		1.88E-04

* Data for Marcus Hook are for 4/2/95 through 3/31/96