ADDENDUM TO:
Collegeville Area Air Monitoring Project
Third Report

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Commonwealth of Pennsylvania
Department of Environmental Protection

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Executive Summary

On November 17, 2009, the Pennsylvania Department of Environmental Protection (DEP) released a third report on the Collegeville Area Air Monitoring Project. The project was initiated to fully evaluate trichloroethylene (TCE) concentrations in the Collegeville area after higher than normal TCE levels were discovered by the DEP Mobile Analytical Unit while working on a nearby monitoring project. Continuous monitoring of TCE, and other volatile organic compounds (VOCs), began in 2005 with the installation of a downwind monitoring site at each of the two large tubing manufacturers in the area. With excess lifetime cancer risk levels from TCE higher than other toxic monitoring sites in the state, the DEP persuaded the two facilities to initiate voluntary reductions in TCE usage and emissions. The DEP also applied for, and was awarded, a Community-Scale Air Toxics Ambient Monitoring Grant by the U.S. Environmental Protection Agency (EPA) to expand TCE monitoring in the area and to determine the effectiveness of the voluntary TCE reductions on the residual cancer risk to the public.

The third Collegeville report provided results and analysis of all data collected from the inception of project in 2005, through 2008. The overall findings were that the voluntary TCE reduction measures were effective in lowering the potential cancer risk to residents in the Collegeville area to levels comparable to other urban sites in the Commonwealth where the DEP conducts monitoring. A statistically significant decreasing trend was observed in TCE concentrations from 2007 to 2008 at the two main monitoring sites located in Collegeville and the Evansburg State Park. Intensive sampling collections conducted at the perimeter of each of the two major facilities at mostly downwind locations (areas where peak ambient TCE concentrations are expected to occur) yielded concentrations well under the acute- and intermediate-term non-cancer benchmark. Modeling of TCE concentrations around the Accellent facility show the highest concentrations occurring at the facility perimeter.

The purpose of this Addendum is to present the 2009 monitoring data and to satisfy closing requirements of the EPA grant. This addendum includes:

- The results of air toxics monitoring at all Collegeville area sites in operation in 2009.
- A re-calculation of all risk results (monitored and modeled) reported in the third Collegeville report using current risk values and a different risk assessment method.
- The results of TCE concentrations from the Perkin-Elmer Gas Chromatograph (GC) that was in operation at the Trappe Fire Station site during most of 2009.
- EPA grant close out requirements which involve a discussion on achievements with respect to the stated project objective, negative and positive technical aspects, and how the project was of benefit to the environment and human health.

The major findings discussed in this addendum include:

- The average TCE concentration at the Collegeville monitoring site in 2009 was comparable to the average concentration found at the same site in 2008. Similarly, the average TCE concentration at the current Evansburg site in 2009 was close to that found at the former Evansburg site, and at the Spring City background site, in 2008. This leveling of TCE concentrations can be attributed to the TCE emission reduction strategies implemented by the owners and operators of Accellent, Inc. and the Superior Tube Company, Inc. facilities in the Collegeville area in early 2008.
- Changes to risk analysis methods and risk factors produced lower estimates of risk to residents of the Collegeville area. Discussed in detail in this report, the most important of these changes was only the use of detected compounds in the risk analysis. Furthermore, with the current TCE cancer risk factor being lower than the one previously used, the contribution of TCE risk to the overall risk has been reduced. All sampling data results collected from the entire project as well as 24-hour maximum modeled contrations are below the EPA recommended level of 1 in 10,000 excess lifetime cancer risks.
- GC TCE results show a majority of the higher TCE concentrations were detected by the GC when the wind was predominantly from the southwest, the direction of the Accellent facility. TCE concentrations measured by the GC were higher than sampling and modeled predictions, however not in amounts to produce unacceptable cancer and non-cancer risk values.
- Overall the project, including the supporting funds provided by EPA, was successful in reducing ambient concentrations of TCE and consequently the exposure and cancer risk to the citizens of the Collegeville area.

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Introduction

On November 17, 2009, the Pennsylvania Department of Environmental Protection (DEP) released a third report on the Collegeville Area Air Monitoring Project. The project was initiated to fully evaluate trichloroethylene (TCE) concentrations in the Collegeville area after higher than normal TCE levels were discovered by the DEP Mobile Analytical Unit while working on a nearby monitoring project. Continuous monitoring of TCE, and other volatile organic compounds (VOCs), began in 2005 with the installation of a downwind monitoring site at each of the two large tubing manufacturers in the area. The two manufacturers in Collegeville are Accellent, Inc. and the Superior Tube Company, Inc. With excess lifetime cancer risk levels from TCE higher than other toxic monitoring sites in the Commonwealth, the DEP requested that the owners of the Accellent and Superior Tube facilities initiate voluntary measures to reduce TCE concentrations to the atmosphere. The DEP also applied for, and was awarded, an EPA Community-Scale Air Toxics Air Monitoring Grant ($ 269,166) in November 2008, to expand TCE monitoring and to determine the effectiveness of the voluntary reductions on the residual cancer risk to the public.

Prior to the voluntary TCE emission reductions, both facilities in the Collegeville area emitted approximately 60-70 tons/year and were in compliance with existing air quality regulatory requirements. On April 19, 2007, Accellent proposed the installation of two carbon adsorbers on two large degreasers. The first adsorber began operating in October, 2007 and the second in March, 2008. By the end of 2009, TCE emissions from the Accellent facility were approximately 50% lower than pre-control levels. DEP issued a revised operating permit on June 30, 2009, making the TCE reduction measures federally enforceable and reducing the facility's allowable TCE emissions from 94 to 45 tons/year.

On January 7, 2007, Superior Tube proposed reducing TCE emissions by 30% within 12 months using material reformulations and by consolidating its degreasing operations. In February 2008, Superior Tube advised DEP that it would completely replace TCE with 1-bromopropane. On May 1, 2008, a revised operating permit was issued allowing the replacement and making the TCE reduction measures federally enforceable.

Other introductory information on sampling, data management and risk assessment methods have not been repeated in this Addendum, except where changes have been made, or the information helps with the discussion. Please refer to the third Collegeville report for detailed explanations. Tables and Figures are numbered as if continued from the third report.

2009 Monitoring Results

Figure 9 shows the locations of the large TCE emissions sources and the DEP monitoring sites used in the Collegeville study. There were two new monitoring sites that started operation in the beginning of 2009. One site is located at the Trappe Fire Station (Trappe FS) where the DEP also operated a continuous gas chromatograph in 2009. The other site is located at a church near Evansburg (Evansburg UM).

For 2005 through 2008, annual average concentrations were calculated for 55 volatile organic compounds (VOCs)(also referred to as air toxics in this Addendum). Beginning in late 2008, the DEP lab added the capability to quantify concentrations of 1-bromopropane, a solvent used as a TCE substitute by one of the large facilities. Therefore, the monitoring results for 2009 include annual average concentrations for 56 VOC's.

In an effort to be more conservative with the annual averages, one-half the method detection limit (MDL) was used, rather than zero, whenever a VOC was not detected in a sample. The MDLs are determined annually by a standard laboratory quality control procedure (40 CFR Part 136, Appendix B). Refer to Table 18 for the 2009 MDLs. Table 19 shows the percent of samples each VOC was detected (above the MDL) at the 2009 Collegeville monitoring sites.

Annual average concentrations are used to compare levels of toxic air pollutants at different sites, and to estimate the cancer and non-cancer risk from inhalation exposure to ambient air. Table 20 presents the average annual concentrations of all toxic compounds at each Collegeville monitoring site for 2009.

The average TCE concentration at the Collegeville site in 2009 (0.095 ppbv) was close to the average concentration found in 2008 (0.090 ppbv). The average concentration was expected because most of the TCE emission controls at the Accellent facility were in place by early 2008. Similarly, the average TCE concentration at the Evansburg UM site (0.033 ppbv) was not much different than the 2008 concentration at the Evansburg SP site (0.026 ppbv) and the background site at Spring City (0.029 ppbv). This data most likely reflects the fact that Superior Tube stopped all use of TCE in early 2008 and ambient TCE levels have fallen in the surrounding area close to background level. The average TCE concentration at the Trappe FS site in 2009 (0.32 ppbv) was higher than at the Collegeville site (0.095 ppbv). The decreased ambient concentrations were anticipated because the Trappe FS site is less than half the distance from Accellent as the Collegeville site (Figure 9).

The Evansburg UM average 1-bromopropane concentration of 1.0 ppbv was the highest result of all three Collegeville sampling sites in 2009. The Evansburg UM site is located directly east of the Superior Tube facility approximately 800 feet from the southeast corner of the company building. The second closest monitoring site (Collegeville) also had the second highest average 1-bromopropane concentration (0.21 ppbv) in 2009. The lowest average 1-bromopropane concentration at 0.013 ppbv was detected at the Trappe FS site. Both the Collegeville and Trappe FS site are located in the prevailing upwind direction of the Superior Tube facility.

The Collegeville monitoring site is equipped with a roof-mounted meteorological system, which measures wind speed and direction, temperature, relative humidity, precipitation and solar radiation (visible sunlight). Wind data for 2009 is summarized in a wind rose format in Figure 10.

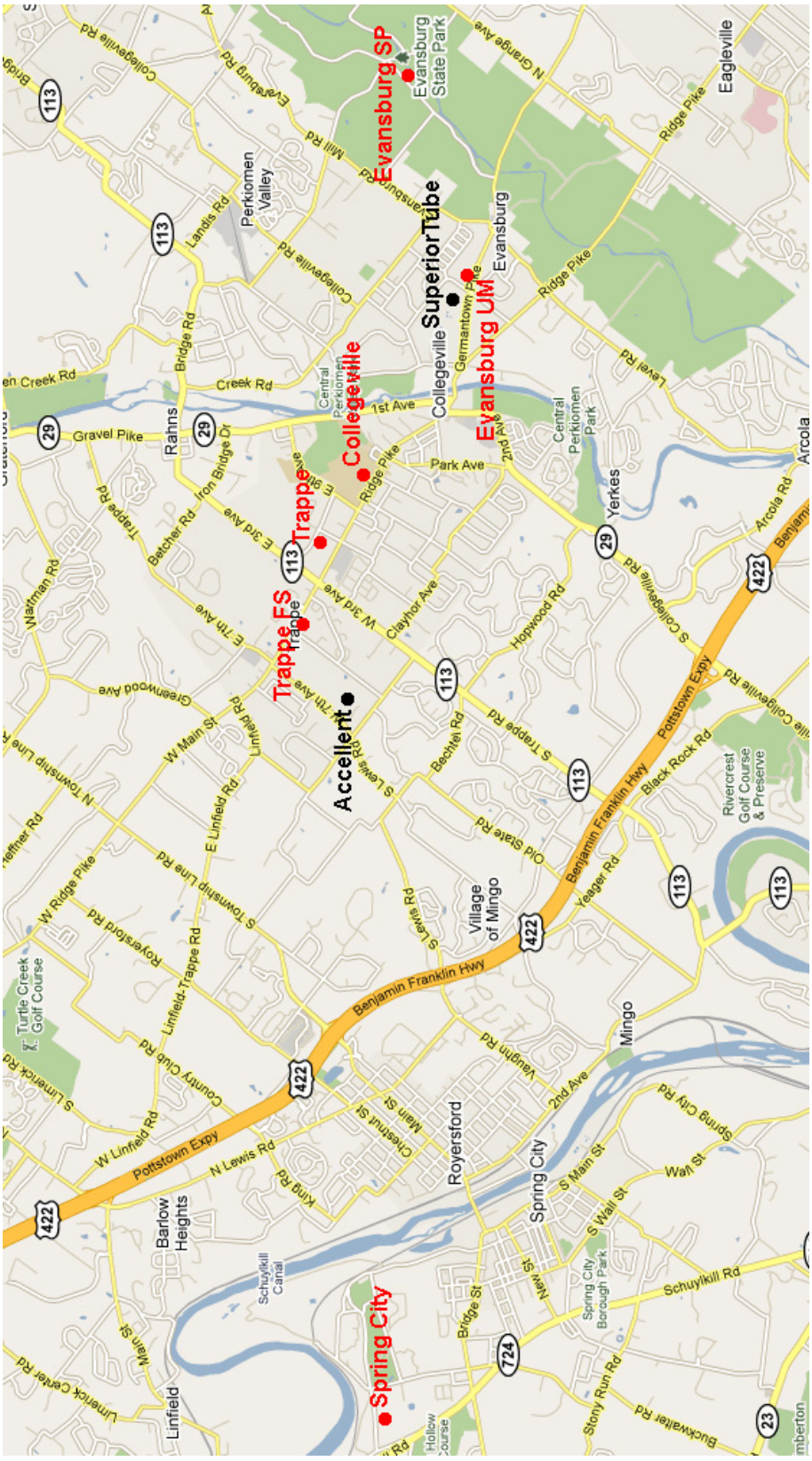

Figure 9. Map of major TCE sources (in black) and air sampling sites (in red) in the Collegeville Area Monitoring Project.

Table 18. The Method Detection Limits (MDL) for 2009 for all compounds reported.

Compound	2009 MDL (ppbv)	Compound	2009 MDL (ppbv)
1-Bromopropane	0.02	Chloroform	0.02
1,3-Butadiene	0.16	Chloromethane	0.03
1,2-Dibromoethane	0.03	Cyclohexane	0.03
cis-1,3-Dichloro-1-propene	0.04	Dibromochloromethane	0.02
trans-1,3-Dichloro-1-propene	0.04	Dichlorodifluoromethane	0.03
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.03	Ethylbenzene	0.02
1,2-Dichlorobenzene	0.05	n-Heptane	0.02
1,3-Dichlorobenzene	0.05	Hexachloro-1,3-butadiene	0.05
1,4-Dichlorobenzene	0.05	n-Hexane	0.02
1,1-Dichloroethane	0.04	Methylene chloride	0.02
1,2-Dichloroethane	0.02	Propene	0.15
1,1-Dichloroethene	0.02	Styrene	0.02
cis-1,2-Dichloroethene	0.02	Tetrachloroethene	0.02
trans-1,2-Dichloroethene	0.03	Tetrahydrofuran	0.05
1,2-Dichloropropane	0.02	Toluene	0.02
1-Ethyl-4-methyl benzene	0.05	Trichloroethylene (TCE)	0.02
1,1,2,2-Tetrachloroethane	0.07	Trichlorofluoromethane	0.03
1,1,2-Trichloro-1,2,2-trifluoroethane	0.03	m & p- Xylene	0.05
1,2,4-Trichlorobenzene	0.04	o-Xylene	0.02
1,1,1-Trichloroethane	0.04		
1,1,2-Trichloroethane	0.02		
1,2,4-Trimethylbenzene	0.04		
1,3,5-Trimethylbenzene	0.06		
2-Butanone	0.16		
2-Hexanone	0.15		
2-Methoxy-2-methyl propane	0.04		
4-Methyl-2-pentanone	0.15		
Acetone	0.18		
Benzene	0.02		
Bromodichloromethane	0.02		
Bromoform	0.02		
Bromomethane	0.03		
Carbon disulfide	0.15		
Carbon tetrachloride	0.02		
Chlorobenzene	0.02		
Chloroethane	0.03		
Chloroethene	0.03		

Table 19. Percentage of 2009 samples where compound concentrations were above the method detection limit.

Compound	Collegeville	Evansburg UM	Trappe FS	Compound	Collegeville	Evansburg UM	Trappe FS
1-Bromopropane	23	77	4	Chloroform	16	31	28
1,3-Butadiene	2	6	0	Chloromethane	98	100	100
1,2-Dibromoethane	0	3	0	Cyclohexane	16	9	16
cis-1,3-Dichloro-1-propene	0	0	0	Dibromochloromethane	0	6	0
trans-1,3-Dichloro-1-propene	0	0	0	Dichlorodifluoromethane	100	97	100
1,2-Dichloro-1,1,2,2,tetrafluoroethane	0	6	0	Ethylbenzene	64	86	72
1,2-Dichlorobenzene	0	0	0	n-Heptane	59	66	64
1,3-Dichlorobenzene	0	0	0	Hexachloro-1,3-butadiene	0	6	8
1,4-Dichlorobenzene	0	3	0	n-Hexane	48	66	52
1,1-Dichloroethane	0	0	0	Methylene chloride	98	91	92
1,2-Dichloroethane	2	6	8	Propene	100	100	100
1,1-Dichloroethene	0	3	0	Styrene	7	17	60
cis-1,2-Dichloroethene	0	3	0	Tetrachloroethene	52	57	60
trans-1,2-Dichloroethene	0	3	4	Tetrahydrofuran	0	9	4
1,2-Dichloropropane	2	9	12	Toluene	100	100	100
1-Ethyl-4-methyl benzene	0	0	0	Trichloroethylene (TCE)	75	51	72
1,1,2,2-Tetrachloroethane	0	0	0	Trichlorofluoromethane	98	100	100
1,1,2-Trichloro-1,2,2-trifluoroethane	100	97	100	m & p- Xylene	75	91	68
1,2,4-Trichlorobenzene	23	43	32	o-Xylene	66	83	72
1,1,1-Trichloroethane	0	0	0				
1,1,2-Trichloroethane	0	3	0				
1,2,4-Trimethylbenzene	7	26	24				
1,3,5-Trimethylbenzene	0	0	0				
2-Butanone	80	80	84				
2-Hexanone	7	11	20				
2-Methoxy-2-methyl propane	0	0	0				
4-Methyl-2-pentanone	2	6	4				
Acetone	98	94	100				
Benzene	100	100	100				
Bromodichloromethane	0	3	0				
Bromoform	0	3	0				
Bromomethane	5	9	0				
Carbon disulfide	5	3	4				
Carbon tetrachloride	100	100	100				
Chlorobenzene	0	3	0				
Chloroethane	52	29	44				
Chloroethene	7	0	0				

Table 20. Summary of annual average concentrations of targeted VOCs across all Pennsylvania monitoring sites.

	Collegeville					Spring City				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
Compound	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
1-Bromopropane	-	-	-	-	0.21	-	-	-	-	-
1,3-Butadiene	-	-	0.093	0.041	0.087	-	-	-	0.044	-
1,2-Dibromoethane	-	-	0.030	0.020	0.013	-	-	-	0.020	-
cis-1,3-Dichloro-1-propene	-	-	0.020	0.020	0.020	-	-	-	0.020	-
trans-1,3-Dichloro-1-propene	-	-	0.020	0.020	0.020	-	-	-	0.020	-
1,2-Dichloro-1,1,2,2-tetrafluoroethane	-	-	0.020	0.010	0.013	-	-	-	0.010	-
1,2-Dichlorobenzene	-	-	0.020	0.010	0.025	-	-	-	0.010	-
1,3-Dichlorobenzene	-	-	0.020	0.010	0.025	-	-	-	0.010	-
1,4-Dichlorobenzene	-	-	0.020	0.010	0.025	-	-	-	0.011	-
1,1-Dichloroethane	-	-	0.020	0.010	0.018	-	-	-	0.010	-
1,2-Dichloroethane	-	-	0.030	0.010	0.013	-	-	-	0.010	-
1,1-Dichloroethene	-	-	0.030	0.020	0.012	-	-	-	0.020	-
cis-1,2-Dichloroethene	-	-	0.030	0.020	0.011	-	-	-	0.020	-
trans-1,2-Dichloroethene	-	-	0.050	0.022	0.013	-	-	-	0.020	-
1,2-Dichloropropane	-	-	0.030	0.021	0.012	-	-	-	0.020	-
1-Ethyl-4-methyl benzene	-	-	0.020	0.011	0.024	-	-	-	0.012	-
1,1,2,2-Tetrachloroethane	-	-	0.020	0.010	0.034	-	-	-	0.010	-
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-	0.068	0.070	0.090	-	-	-	0.070	-
1,2,4-Trichlorobenzene	-	-	0.030	0.010	0.032	-	-	-	0.010	-
1,1,1-Trichloroethane	-	-	0.020	0.010	0.021	-	-	-	0.010	-
1,1,2-Trichloroethane	-	-	0.030	0.020	0.012	-	-	-	0.020	-
1,2,4-Trimethylbenzene	-	-	0.044	0.018	0.027	-	-	-	0.033	-
1,3,5-Trimethylbenzene	-	-	0.021	0.011	0.032	-	-	-	0.010	-
2-Butanone	-	-	1.5	1.5	0.84	-	-	-	1.6	-
2-Hexanone	-	-	0.17	0.26	0.092	-	-	-	0.46	-
2-Methoxy-2-methyl propane	-	-	0.022	0.010	0.021	-	-	-	0.010	-
4-Methyl-2-pentanone	-	-	0.12	0.14	0.080	-	-	-	0.19	-
Acetone	-	-	9.1	11	7.8	-	-	-	12	-
Benzene	-	-	0.19	0.17	0.20	-	-	-	0.18	-
Bromodichloromethane	-	-	0.030	0.020	0.012	-	-	-	0.020	-
Bromoform	-	-	0.020	0.010	0.012	-	-	-	0.010	-
Bromomethane	-	-	0.030	0.021	0.014	-	-	-	0.021	-
Carbon disulfide	-	-	0.18	0.14	0.084	-	-	-	0.11	-
Carbon tetrachloride	-	-	0.080	0.085	0.10	-	-	-	0.082	-
Chlorobenzene	-	-	0.030	0.020	0.012	-	-	-	0.020	-
Chloroethane	-	-	0.036	0.052	0.077	-	-	-	0.040	-
Chloroethene	-	-	0.030	0.020	0.020	-	-	-	0.020	-

Table 20. (continued).

Compound	Collegeville					Spring City				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Chloroform	-	-	0.030	0.015	0.016	-	-	-	0.012	-
Chloromethane	-	-	0.44	0.49	0.57	-	-	-	0.49	-
Cyclohexane	-	-	0.027	0.020	0.027	-	-	-	0.012	-
Dibromochloromethane	-	-	0.030	0.020	0.012	-	-	-	0.020	-
Dichlorodifluoromethane	-	-	0.43	0.46	0.53	-	-	-	0.45	-
Ethylbenzene	-	-	0.042	0.033	0.033	-	-	-	0.030	-
n-Heptane	-	-	0.10	0.076	0.045	-	-	-	0.055	-
Hexachloro-1,3-butadiene	-	-	0.020	0.010	0.027	-	-	-	0.010	-
n-Hexane	-	-	0.13	0.13	0.064	-	-	-	0.099	-
Methylene chloride	-	-	0.090	0.091	0.13	-	-	-	0.076	-
Propene	-	-	1.1	1.0	1.0	-	-	-	1.2	-
Styrene	-	-	0.020	0.010	0.019	-	-	-	0.061	-
Tetrachloroethene	-	-	0.033	0.037	0.024	-	-	-	0.024	-
Tetrahydrofuran	-	-	0.020	0.027	0.025	-	-	-	0.017	-
Toluene	-	-	0.31	0.28	0.25	-	-	-	0.26	-
Trichloroethylene (TCE)	-	-	0.67	0.090	0.095	-	-	-	0.029	-
Trichlorofluoromethane	-	-	0.34	0.32	0.33	-	-	-	0.24	-
m & p- Xylene	-	-	0.13	0.089	0.094	-	-	-	0.089	-
o-Xylene	-	-	0.055	0.037	0.036	-	-	-	0.036	-

Table 20. (continued).

Compound	Evansburg SP					Evansburg UM				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
1-Bromopropane	-	-	-	-	-	-	-	-	-	1.0
1,3-Butadiene	0.020	0.022	0.090	0.045	-	-	-	-	-	0.097
1,2-Dibromoethane	0.020	0.020	0.030	0.020	-	-	-	-	-	0.014
cis-1,3-Dichloro-1-propene	0.010	0.020	0.020	0.020	-	-	-	-	-	0.020
trans-1,3-Dichloro-1-propene	0.010	0.020	0.020	0.020	-	-	-	-	-	0.020
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.020	0.020	0.020	0.010	-	-	-	-	-	0.015
1,2-Dichlorobenzene	0.080	0.020	0.020	0.010	-	-	-	-	-	0.025
1,3-Dichlorobenzene	0.070	0.020	0.020	0.010	-	-	-	-	-	0.025
1,4-Dichlorobenzene	0.070	0.020	0.020	0.010	-	-	-	-	-	0.026
1,1-Dichloroethane	0.020	0.020	0.020	0.010	-	-	-	-	-	0.018
1,2-Dichloroethane	0.020	0.020	0.030	0.010	-	-	-	-	-	0.014
1,1-Dichloroethene	0.020	0.020	0.030	0.020	-	-	-	-	-	0.012
cis-1,2-Dichloroethene	0.020	0.040	0.030	0.020	-	-	-	-	-	0.012
trans-1,2-Dichloroethene	0.020	0.020	0.050	0.020	-	-	-	-	-	0.014
1,2-Dichloropropane	0.020	0.020	0.030	0.020	-	-	-	-	-	0.022
1-Ethyl-4-methyl benzene	0.080	0.020	0.020	0.013	-	-	-	-	-	0.024
1,1,2,2-Tetrachloroethane	0.070	0.020	0.020	0.010	-	-	-	-	-	0.034
1,1,2-Trichloro-1,2,2-trifluoroethane	0.062	0.062	0.063	0.069	-	-	-	-	-	0.081
1,2,4-Trichlorobenzene	0.10	0.030	0.030	0.010	-	-	-	-	-	0.060
1,1,1-Trichloroethane	0.020	0.020	0.020	0.010	-	-	-	-	-	0.021
1,1,2-Trichloroethane	0.020	0.020	0.030	0.020	-	-	-	-	-	0.013
1,2,4-Trimethylbenzene	0.070	0.021	0.024	0.012	-	-	-	-	-	0.041
1,3,5-Trimethylbenzene	0.070	0.021	0.021	0.011	-	-	-	-	-	0.032
2-Butanone	1.2	1.1	1.1	1.3	-	-	-	-	-	0.84
2-Hexanone	0.61	0.097	0.15	0.23	-	-	-	-	-	0.19
2-Methoxy-2-methyl propane	0.21	0.071	0.020	0.010	-	-	-	-	-	0.021
4-Methyl-2-pentanone	0.44	0.027	0.10	0.14	-	-	-	-	-	0.096
Acetone	6.0	6.2	6.0	9.1	-	-	-	-	-	8.5
Benzene	0.18	0.15	0.16	0.16	-	-	-	-	-	0.18
Bromodichloromethane	0.020	0.020	0.030	0.020	-	-	-	-	-	0.013
Bromoform	0.010	0.020	0.020	0.010	-	-	-	-	-	0.013
Bromomethane	0.022	0.023	0.030	0.022	-	-	-	-	-	0.015
Carbon disulfide	0.041	0.22	0.13	0.10	-	-	-	-	-	0.12
Carbon tetrachloride	0.087	0.077	0.086	0.088	-	-	-	-	-	0.10
Chlorobenzene	0.020	0.020	0.030	0.020	-	-	-	-	-	0.013
Chloroethane	0.027	0.023	0.040	0.033	-	-	-	-	-	0.032
Chloroethene	0.020	0.020	0.030	0.020	-	-	-	-	-	0.013

Table 20. (continued).

Compound	Evansburg SP					Evansburg UM				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Chloroform	0.020	0.020	0.030	0.016	-	-	-	-	-	0.018
Chloromethane	0.48	0.43	0.46	0.51	-	-	-	-	-	0.55
Cyclohexane	0.023	0.022	0.022	0.013	-	-	-	-	-	0.014
Dibromochloromethane	0.020	0.020	0.030	0.020	-	-	-	-	-	0.013
Dichlorodifluoromethane	0.43	0.43	0.44	0.47	-	-	-	-	-	0.54
Ethylbenzene	0.027	0.025	0.025	0.026	-	-	-	-	-	0.054
n-Heptane	0.071	0.054	0.080	0.062	-	-	-	-	-	0.045
Hexachloro-1,3-butadiene	0.060	0.020	0.020	0.010	-	-	-	-	-	0.030
n-Hexane	0.11	0.076	0.093	0.093	-	-	-	-	-	0.085
Methylene chloride	0.071	0.081	0.17	0.14	-	-	-	-	-	0.13
Propene	1.0	0.96	0.99	0.93	-	-	-	-	-	0.93
Styrene	0.010	0.020	0.020	0.010	-	-	-	-	-	0.019
Tetrachloroethene	0.024	0.022	0.031	0.024	-	-	-	-	-	0.023
Tetrahydrofuran	0.025	0.020	0.046	0.045	-	-	-	-	-	0.036
Toluene	0.34	0.29	0.29	0.28	-	-	-	-	-	0.37
Trichloroethylene (TCE)	0.14	0.12	0.073	0.026	-	-	-	-	-	0.033
Trichlorofluoromethane	0.21	0.21	0.25	0.25	-	-	-	-	-	0.26
m & p- Xylene	0.074	0.063	0.070	0.071	-	-	-	-	-	0.18
o-Xylene	0.031	0.026	0.025	0.029	-	-	-	-	-	0.058

Table 20. (continued).

Compound	Trappe					Trappe FS				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
1-Bromopropane	-	-	-	-	-	-	-	-	-	0.013
1,3-Butadiene	0.027	0.031	0.090	-	-	-	-	-	-	0.082
1,2-Dibromoethane	0.020	0.020	0.030	-	-	-	-	-	-	0.013
cis-1,3-Dichloro-1-propene	0.010	0.020	0.020	-	-	-	-	-	-	0.020
trans-1,3-Dichloro-1-propene	0.010	0.020	0.020	-	-	-	-	-	-	0.020
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.020	0.020	0.020	-	-	-	-	-	-	0.013
1,2-Dichlorobenzene	0.080	0.020	0.020	-	-	-	-	-	-	0.025
1,3-Dichlorobenzene	0.070	0.020	0.020	-	-	-	-	-	-	0.025
1,4-Dichlorobenzene	0.070	0.020	0.020	-	-	-	-	-	-	0.025
1,1-Dichloroethane	0.020	0.020	0.020	-	-	-	-	-	-	0.018
1,2-Dichloroethane	0.020	0.020	0.030	-	-	-	-	-	-	0.014
1,1-Dichloroethene	0.020	0.020	0.030	-	-	-	-	-	-	0.012
cis-1,2-Dichloroethene	0.020	0.040	0.030	-	-	-	-	-	-	0.011
trans-1,2-Dichloroethene	0.020	0.020	0.050	-	-	-	-	-	-	0.016
1,2-Dichloropropane	0.020	0.020	0.030	-	-	-	-	-	-	0.017
1-Ethyl-4-methyl benzene	0.080	0.020	0.020	-	-	-	-	-	-	0.024
1,1,2,2-Tetrachloroethane	0.070	0.020	0.020	-	-	-	-	-	-	0.034
1,1,2-Trichloro-1,2,2-trifluoroethane	0.065	0.064	0.061	-	-	-	-	-	-	0.093
1,2,4-Trichlorobenzene	0.10	0.030	0.030	-	-	-	-	-	-	0.045
1,1,1-Trichloroethane	0.020	0.020	0.020	-	-	-	-	-	-	0.021
1,1,2-Trichloroethane	0.020	0.020	0.030	-	-	-	-	-	-	0.012
1,2,4-Trimethylbenzene	0.076	0.025	0.024	-	-	-	-	-	-	0.043
1,3,5-Trimethylbenzene	0.070	0.021	0.020	-	-	-	-	-	-	0.032
2-Butanone	0.99	0.73	1.1	-	-	-	-	-	-	1.3
2-Hexanone	0.71	0.055	0.13	-	-	-	-	-	-	0.24
2-Methoxy-2-methyl propane	0.27	0.100	0.020	-	-	-	-	-	-	0.021
4-Methyl-2-pentanone	0.44	0.022	0.10	-	-	-	-	-	-	0.080
Acetone	7.0	7.5	6.3	-	-	-	-	-	-	12
Benzene	0.23	0.20	0.19	-	-	-	-	-	-	0.21
Bromodichloromethane	0.020	0.020	0.030	-	-	-	-	-	-	0.012
Bromoform	0.010	0.020	0.020	-	-	-	-	-	-	0.012
Bromomethane	0.022	0.024	0.030	-	-	-	-	-	-	0.013
Carbon disulfide	0.048	0.13	0.28	-	-	-	-	-	-	0.11
Carbon tetrachloride	0.093	0.081	0.11	-	-	-	-	-	-	0.11
Chlorobenzene	0.020	0.020	0.030	-	-	-	-	-	-	0.012
Chloroethane	0.023	0.027	0.041	-	-	-	-	-	-	0.050
Chloroethene	0.020	0.020	0.030	-	-	-	-	-	-	0.013

Table 20. (continued).

Compound	Trappe					Trappe FS				
	Annual Avg (ppbv)[1]					Annual Avg (ppbv)[1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
Chloroform	0.020	0.020	0.030	-	-	-	-	-	-	0.017
Chloromethane	0.47	0.45	0.48	-	-	-	-	-	-	0.64
Cyclohexane	0.026	0.026	0.020	-	-	-	-	-	-	0.052
Dibromochloromethane	0.020	0.020	0.030	-	-	-	-	-	-	0.012
Dichlorodifluoromethane	0.43	0.44	0.44	-	-	-	-	-	-	0.60
Ethylbenzene	0.042	0.039	0.026	-	-	-	-	-	-	0.033
n-Heptane	0.074	0.084	0.055	-	-	-	-	-	-	0.079
Hexachloro-1,3-butadiene	0.060	0.020	0.020	-	-	-	-	-	-	0.032
n-Hexane	0.14	0.10	0.10	-	-	-	-	-	-	0.067
Methylene chloride	0.062	0.076	0.067	-	-	-	-	-	-	0.15
Propene	1.1	1.3	1.2	-	-	-	-	-	-	1.1
Styrene	0.011	0.020	0.020	-	-	-	-	-	-	0.024
Tetrachloroethene	0.035	0.030	0.030	-	-	-	-	-	-	0.029
Tetrahydrofuran	0.020	0.020	0.020	-	-	-	-	-	-	0.027
Toluene	0.37	0.30	0.21	-	-	-	-	-	-	0.29
Trichloroethylene (TCE)	0.26	0.22	0.25	-	-	-	-	-	-	0.32
Trichlorofluoromethane	0.22	0.21	0.27	-	-	-	-	-	-	0.28
m & p- Xylene	0.15	0.13	0.074	-	-	-	-	-	-	0.091
o-Xylene	0.066	0.055	0.030	-	-	-	-	-	-	0.037

[1] Annual Avg is the arithmetic mean of valid samples with 1/2 the MDL substituted for non-detects.

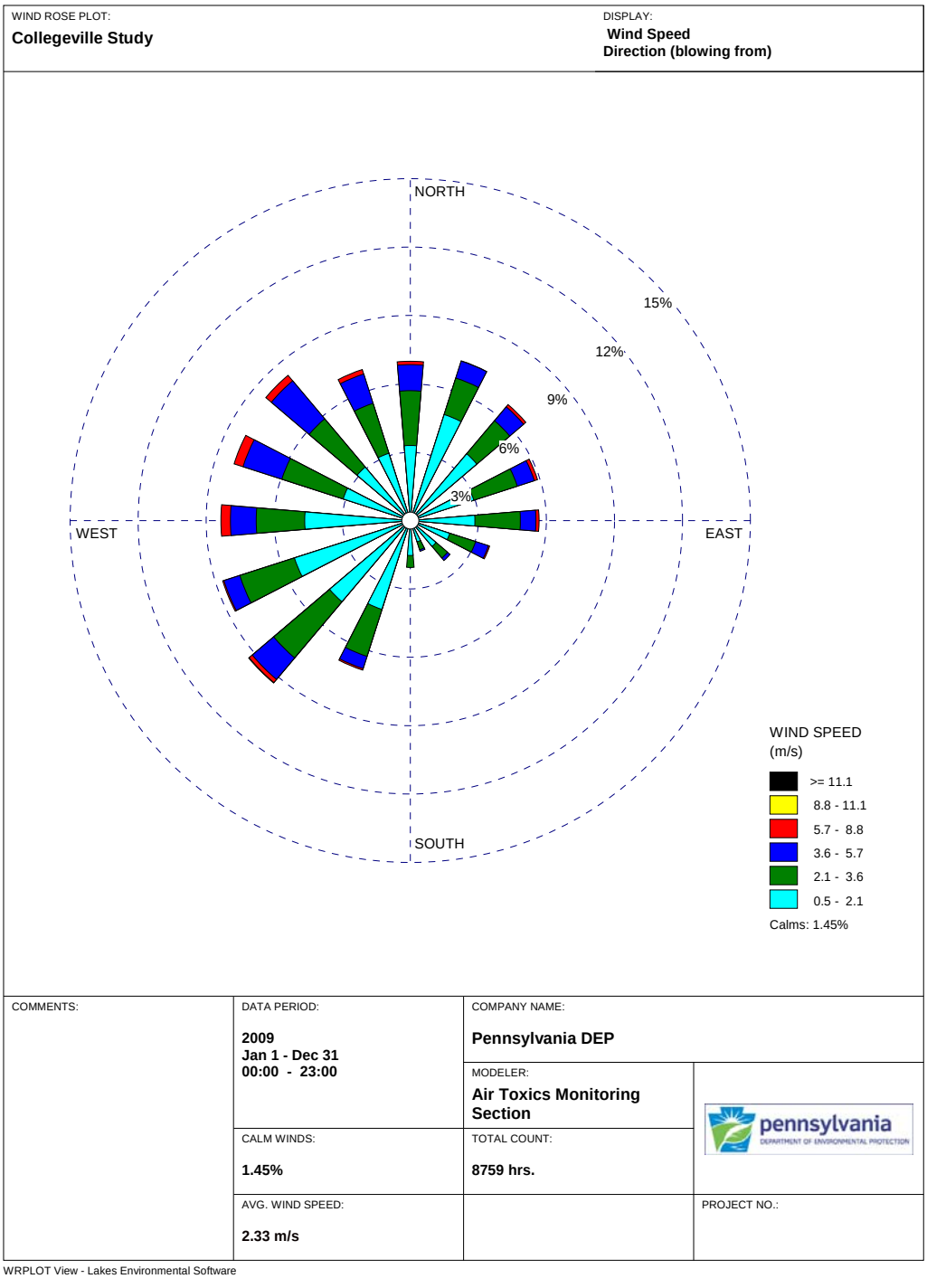

Figure 10. Wind rose of meteorological data collected at the Collegeville site in 2009.

Risk Characterization

Adjusted Monitoring Risk

Slight changes were made to the risk assessment method DEP used in this Addendum compared to the methodology used for the third Collegeville report. Changes to the risk assessment method include:

- The selection of risk factors for calculation of cancer and non-cancer risk was based on a hierarchy used by various EPA programs. The risk factor values were directly selected from the Department of Energy's Risk Assessment Information System (RAIS) database which also uses the same hierarchy. However, one adjustment was made where a more conservative risk factor was used for chloroethene, a value more protective of children's health.
- Risk factors and risk results presented in a 1-in-10,000 format as opposed to a scientific format.
- Risk results for the Collegeville sites not directly compared to other PA toxics monitoring sites. Instead, DEP has adopted EPA guidance where risks less than 1-in-10,000 are considered acceptable.
- Compounds that are mostly not seen (detected in less than 15% of the samples during the year) are not included in the risk analysis.

The excess lifetime cancer risk (ELCR)(due to inhalation) for each chemical compound was calculated using unit risk factors (URFs), and the risk for non-cancer health effects was calculated using reference air concentrations (RfCs). The URF is a measure of the probability of developing cancer from inhalation exposure over a lifetime to a specified concentration of a given chemical. The RfC is the concentration below which no (non-cancer) adverse health effects are expected to occur over a lifetime of continuous exposure.

Table 21 of this Addendum lists the URFs and RfCs, and summarizes their sources. A total of 48 of the 56 targeted VOCs had data for either the URF or the RfC. Table 21 also shows a comparison of these current risk factors to those used in the third Collegeville report. Notable changes have occurred to the TCE URF and RfC values. In all three Collegeville reports, the DEP used a draft 2001 EPA provisional value of 0.000114 m^3/ug as the TCE URF in an effort to be more conservative with the risk. This draft value was never finalized after issues were raised during peer-review, and is no longer endorsed by the EPA. The California EPA (CalEPA) value of 0.0000020 m3/ug is now accepted. With the CalEPA URF value being 57 times lower than the previously used EPA URF, the TCE cancer risk is no longer the main driver of the total risk.

Furthermore, the previously used RfC value of 40 ug/m^3 has now been dropped pending finalization of EPA's Toxicological Review of TCE. Once finalized, the toxicological review will provide the scientific basis supporting new URF and RfC values that will appear on the Integrated Risk Information System (IRIS) database.

Table 21. List of Unit Risk Factors (URFs) and Reference Air Concentrations (RfCs).

Compound[1]	Third Collegeville Report				Addendum			
	URF (in 10,000) (m^3/µg)	Source	RfC (µg/m^3)	Source	URF (in 10,000) (m^3/µg)	Source	RfC (µg/m^3)	Source
1,3-Butadiene	0.30	IRIS	2.0	IRIS	0.30	IRIS	2.0	IRIS
1,2-Dibromoethane	6.0	IRIS	9.0	IRIS	6.0	IRIS	9.0	IRIS
cis-1,3-Dichloro-1-propene	0.040	IRIS	20	IRIS	0.040	IRIS	20	IRIS
trans-1,3-Dichloro-1-propene	0.040	IRIS	20	IRIS	0.040	IRIS	20	IRIS
1,2-Dichlorobenzene	-	-	200	O	-	-	200	HEAST
1,4-Dichlorobenzene	0.11	O	800	IRIS	0.11	CALEPA	800	IRIS
1,1-Dichloroethane	0.016	O	500	O	0.016	CALEPA	-	-
1,2-Dichloroethane	0.26	IRIS	2430	O	0.26	IRIS	2430	ATSDR
1,1-Dichloroethene	-	-	200	IRIS	-	-	200	IRIS
trans-1,2-Dichloroethene	-	-	60	O	-	-	60	PPRTV
1,2-Dichloropropane	0.10	O	4.0	IRIS	0.10	CALEPA	4.0	IRIS
1,1,2,2-Tetrachloroethane	0.58	IRIS	-	-	0.58	IRIS	-	-
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-	30000	O	-	-	30000	HEAST
1,2,4-Trichlorobenzene	-	-	4.0	O	-	-	2.0	PPRTV
1,1,1-Trichloroethane	-	-	5000	IRIS	-	-	5000	IRIS
1,1,2-Trichloroethane	0.16	IRIS	-	-	0.16	IRIS	-	-
1,2,4-Trimethylbenzene	-	-	7.0	O	-	-	7.0	PPRTV
1,3,5-Trimethylbenzene	-	-	6.0	O	-	-	-	-
2-Butanone (MEK)	-	-	5000	IRIS	-	-	5000	IRIS
2-Hexanone	-	-	-	-	-	-	30	IRIS
2-Methoxy-2-methylpropane (MTBE)	0.0026	O	3000	IRIS	0.0026	CALEPA	3000	IRIS
4-Methyl-2-pentanone (MIBK)	-	-	3000	IRIS	-	-	3000	IRIS
Acetone	-	-	-	-	-	-	30900	ATSDR
Benzene	0.078	IRIS	30	IRIS	0.078	IRIS	30	IRIS
Bromodichloromethane	0.37	O	-	-	0.37	CALEPA	-	-
Bromoform	0.011	IRIS	-	-	0.011	IRIS	-	-
Bromomethane	-	-	5.0	IRIS	-	-	5.0	IRIS
Carbon disulfide	-	-	700	IRIS	-	-	700	IRIS
Carbon tetrachloride	0.15	IRIS	40	O	0.15	IRIS	189	ATSDR
Chlorobenzene	-	-	50	O	-	-	50	PPRTV
Chloroethane	-	-	10000	IRIS	-	-	10000	IRIS
Chloroethene	0.088	IRIS	100	IRIS	0.088	IRIS	100	IRIS
Chloroform	0.23	IRIS	300	O	0.23	IRIS	97.7	ATSDR
Chloromethane	0.018	O	90	IRIS	-	-	90	IRIS
Cyclohexane	-	-	6000	IRIS	-	-	6000	IRIS
Dibromochloromethane	0.27	O	-	-	0.27	CALEPA	-	-
Dichlorodifluoromethane	-	-	200	O	-	-	200	HEAST
Ethylbenzene	0.025	O	1000	IRIS	0.025	CALEPA	1000	IRIS
Hexachloro-1,3-butadiene	0.22	IRIS	-	-	0.22	IRIS	-	-
n-Hexane	-	-	700	IRIS	-	-	700	IRIS
Methylene chloride	0.0047	IRIS	400	O	0.0047	IRIS	1040	ATSDR
Propene	-	-	3000	O	-	-	3000	CALEPA
Styrene	-	-	1000	IRIS	-	-	1000	IRIS
Tetrachloroethene (PERC)	0.059	O	600	O	0.059	CALEPA	271	ATSDR
Toluene	-	-	5000	IRIS	-	-	5000	IRIS
Trichloroethylene (TCE)	1.14	O	40	O	0.020	CALEPA	-	-
Trichlorofluoromethane	-	-	700	O	-	-	700	HEAST
m&p-Xylene	-	-	100	IRIS	-	-	100	IRIS
o-Xylene	-	-	100	IRIS	-	-	100	IRIS

[1] Highlighted compounds indicate a different URFs and/or RfCs between the third Collegeville report and the Addendum.

Table 21. (continued).

Source	Definition
IRIS	EPA Integrated Risk Information System
HEAST	NCEA Health Effects Assessment Summary Tables
CALEPA	California Environmental Protection Agency Toxicity Criteria Database
ATSDR	Agency for Toxics Substances Disease Registry
PPRTV	EPA Provisional Peer Reviewed Toxicity Values
O	Sources Other than IRIS

The ELCR is calculated for "detected" compounds only, that is, compounds that are detected in 15% or more of the samples during a year. The ELCR for a compound is calculated by multiplying its corresponding URF value by the average concentration (in ug/m3) of all the valid air samples collected during the year. The individual ELCR for each chemical are added to get the total excess lifetime cancer risk at that site. If the total risk is below 1-in-10,000, then action is generally not necessary unless warranted by other factors.

The ELCR numbers are written in a 1-in-10,000 format. For example, an ELCR of 0.19 means that 0.19 more people in a population of 10,000 are likely to develop cancer compared to the national average or 1.9 in 100,000 or 19 in a million. In the United States, on average, slightly less than 1 in 2 in men, and slightly more than 1 in 3 in women will get some form of cancer during their lifetime.

Table 22 shows the calculated ELCR at the Collegeville sampling sites. Again, the ELCR is not calculated for compounds that are detected in less than 15% of the samples during the year. Compounds that are detected in 85% or more of the samples are shown with the associated risk in bold face. Compounds between these two criteria (detected in 15% or more but less than 85%) are shown with the associated risk in normal font. The ELCR results for total VOC's and TCE are summarized in Tables 23 and 24, respectively.

The risk values for 2005 through 2008 in Tables 22, 23 and 24 may vary from the risk values found in the previous Collegeville reports. This variation is due to using the latest available URF and RfC values which were applied to the 2005 through 2009 average annual concentrations.

At the Collegeville site, the 2009 TCE ELCR (0.010 in 10,000) was consistent with the value from 2008 (0.0096 in 10,000). With the TCE risk no longer the main component of the total risk (due to lowering of the TCE URF value) the total ELCR stayed relatively flat for the three years the site was in operation (0.20 in 10,000 in 2007, 0.17 in 2008 and 0.19 in 2009). Only at the Trappe FS site does the higher TCE ELCR (0.035 in 10,000) push the total ELCR (0.23 in 10,000) higher than the other sites.

In the absence of an established URF and RfC for 1-bromopropane, DEP looked at other available exposure guidelines. In 2003, EPA determined that the proper use of 1-bromopropane in solvent cleaning would not approach an estimated community exposure guideline of 1,000 ppb (derived from a 2001 sperm motility and liver effects study for spray adhesive applications) and therefore would not pose measurable risks to the general population. Both the 1.0 ppbv annual average for 1-bromopropane, as well as the maximum sample result of 9.6 ppbv, seen at the Evansburg UM site fall well below the 1,000 ppb community exposure guideline.

There were no VOCs measured at the Collegeville sampling sites from 2005 through 2009 with annual average concentrations (Table 20) above their respective RfC (Table 21). Consequently, chronic non-cancer health effects are not expected from breathing the air within the Collegeville area.

Adjusted Modeling Risk

Please refer to the Third Collegeville Report, Appendix G, for a full discussion of the air dispersion modeling conducted on TCE emissions in the Collegeville area. This section does not adjust the modeling results but applies the current risk factors to the modeled concentrations.

Again, only the TCE emission data for the period 1/1/09 through 6/30/09 for the Accellent, Inc. facility was used in the model. This represents the time period after which TCE emission reduction efforts were fully implemented at the facility. Superior Tube, the other facility, eliminated the use of TCE in 2008 and their reported TCE emissions (approximately 15 pounds per month) were considered negligible and were not included in the model.

The highest annual average TCE concentration was 4.6 ppbv and occurred at a location at the plant perimeter. As expected, the average annual TCE concentration drops precipitously the farther one moves from the plant perimeter. The minimum annual average concentration in the modeling region was 0.02 ppbv found at locations 1.5 kilometers and greater from the facility.

Modeled TCE concentrations were compared to the Trappe FS canister results, a sampling point within the modeling area. The modeled annual average TCE concentration at the grid point closest to the sampling site was 0.28 ppbv. This compares well to the Trappe FS annual average TCE concentration for 2009 of 0.32 ppbv. A harder comparison to make is between the modeled maximum 24-hour TCE concentration and a single canister sample result (which is a 24-hour sample). The modeled maximum 24-hour TCE concentration at the closest grid point to the sampling site was 2.8 ppbv, whereas the maximum sampling result was 1.0 ppbv. Most likely the reason for this discrepancy is the fact that the sampling at the Trappe FS was on a 1-in-12-day schedule and did not operate on a day when a higher value may have been attained.

Table 22. Excess lifetime cancer risk (ELCR)(in 10,000) from inhalation of detected VOCs.

	Collegeville ELCR Risk (in 10,000)[1]					Spring City ELCR Risk (in 10,000)[1]				
Compound	**2005**	**2006**	**2007**	**2008**	**2009**	**2005**	**2006**	**2007**	**2008**	**2009**
1,3-Butadiene	-	-				-	-	-		-
1,2-Dibromoethane	-	-				-	-	-		-
cis-1,3-Dichloro-1-propene	-	-				-	-	-		-
Trans-1,3-Dichloro-1-propene	-	-				-	-	-		-
1,2-Dichlorobenzene	-	-				-	-	-		-
1,4-Dichlorobenzene	-	-				-	-	-		-
1,1-Dichloroethane	-	-				-	-	-		-
1,2-Dichloroethane	-	-				-	-	-		-
1,1-Dichloroethene	-	-				-	-	-		-
Trans-1,2-Dichloroethene	-	-				-	-	-		-
1,2-Dichloropropane	-	-				-	-	-		-
1,1,2,2-Tetrachloroethane	-	-				-	-	-		-
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-				-	-	-		-
1,2,4-Trichlorobenzene	-	-				-	-	-		-
1,1,1-Trichloroethane	-	-				-	-	-		-
1,1,2-Trichloroethane	-	-				-	-	-		-
1,2,4-Trimethylbenzene	-	-				-	-	-		-
2-Butanone	-	-				-	-	-		-
2-Hexanone	-	-				-	-	-		-
2-Methoxy-2-methyl propane	-	-				-	-	-		-
4-Methyl-2-pentanone	-	-				-	-	-		-
Acetone	-	-				-	-	-		-
Benzene	-	-	**0.048**	**0.041**	**0.049**	-	-	-	**0.044**	-
Bromodichloromethane	-	-				-	-	-		-
Bromoform	-	-				-	-	-		-
Bromomethane	-	-				-	-	-		-
Carbon disulfide	-	-				-	-	-		-
Carbon tetrachloride	-	-	**0.076**	**0.080**	**0.098**	-	-	-	**0.078**	-
Chlorobenzene	-	-				-	-	-		-
Chloroethane	-	-				-	-	-		-
Chloroethene	-	-				-	-	-		-
Chloroform	-	-		0.016	0.018	-	-	-		-
Chloromethane	-	-				-	-	-		-
Cyclohexane	-	-				-	-	-		-
Dibromochloromethane	-	-				-	-	-		-
Dichlorodifluoromethane	-	-				-	-	-		-
Ethylbenzene	-	-	0.0045	0.0036	0.0035	-	-	-	0.0032	-
Hexachloro-1,3-butadiene	-	-				-	-	-		-
n-Hexane	-	-				-	-	-		-
Methylene chloride	-	-	0.0015	**0.0015**	**0.0022**	-	-	-	**0.0012**	-
Propene	-	-				-	-	-		-
Styrene	-	-				-	-	-		-
Tetrachloroethene	-	-		0.015	0.0095	-	-	-		-
Toluene	-	-				-	-	-		-
Trichloroethylene (TCE)	-	-	0.072	0.0096	0.010	-	-	-	0.0031	-
Trichlorofluoromethane	-	-				-	-	-		-
m & p- Xylene	-	-				-	-	-		-
o-Xylene	-	-				-	-	-		-
Total Risk	**-**	**-**	0.20	0.17	0.19	**-**	**-**	**-**	0.13	**-**

Table 22. (continued).

Compound	Evansburg SP ELCR Risk (in 10,000) [1]					Evansburg UM ELCR Risk (in 10,000) [1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
1,3-Butadiene					-	-	-	-	-	
1,2-Dibromoethane					-	-	-	-	-	
cis-1,3-Dichloro-1-propene					-	-	-	-	-	
trans-1,3-Dichloro-1-propene					-	-	-	-	-	
1,2-Dichlorobenzene					-	-	-	-	-	
1,4-Dichlorobenzene					-	-	-	-	-	
1,1-Dichloroethane					-	-	-	-	-	
1,2-Dichloroethane					-	-	-	-	-	
1,1-Dichloroethene					-	-	-	-	-	
trans-1,2-Dichloroethene					-	-	-	-	-	
1,2-Dichloropropane					-	-	-	-	-	
1,1,2,2-Tetrachloroethane					-	-	-	-	-	
1,1,2-Trichloro-1,2,2-trifluoroethane					-	-	-	-	-	
1,2,4-Trichlorobenzene					-	-	-	-	-	
1,1,1-Trichloroethane					-	-	-	-	-	
1,1,2-Trichloroethane					-	-	-	-	-	
1,2,4-Trimethylbenzene					-	-	-	-	-	
2-Butanone					-	-	-	-	-	
2-Hexanone					-	-	-	-	-	
2-Methoxy-2-methyl propane	**0.0020**	0.00067			-	-	-	-	-	
4-Methyl-2-pentanone					-	-	-	-	-	
Acetone					-	-	-	-	-	
Benzene	**0.045**	**0.037**	**0.040**	**0.040**	-	-	-	-	-	**0.044**
Bromodichloromethane					-	-	-	-	-	
Bromoform					-	-	-	-	-	
Bromomethane					-	-	-	-	-	
Carbon disulfide					-	-	-	-	-	
Carbon tetrachloride	**0.082**	**0.072**	**0.081**	**0.083**	-	-	-	-	-	**0.097**
Chlorobenzene					-	-	-	-	-	
Chloroethane					-	-	-	-	-	
Chloroethene					-	-	-	-	-	
Chloroform				0.018	-	-	-	-	-	0.020
Chloromethane					-	-	-	-	-	
Cyclohexane					-	-	-	-	-	
Dibromochloromethane					-	-	-	-	-	
Dichlorodifluoromethane					-	-	-	-	-	
Ethylbenzene	0.0029				-	-	-	-	-	**0.0059**
Hexachloro-1,3-butadiene					-	-	-	-	-	
n-Hexane					-	-	-	-	-	
Methylene chloride	**0.0012**	0.0013	**0.0027**	**0.0022**	-	-	-	-	-	**0.0021**
Propene					-	-	-	-	-	
Styrene					-	-	-	-	-	
Tetrachloroethene					-	-	-	-	-	0.0092
Toluene					-	-	-	-	-	
Trichloroethylene (TCE)	0.015	0.013	0.0079	0.0028	-	-	-	-	-	0.0035
Trichlorofluoromethane					-	-	-	-	-	
m & p- Xylene					-	-	-	-	-	
o-Xylene					-	-	-	-	-	
Total Risk	0.15	0.12	0.13	0.15	-	-	-	-	-	0.18

Table 22. (continued).

Compound	Trappe ELCR Risk (in 10,000) [1]					Trappe FS ELCR Risk (in 10,000) [1]				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
1,3-Butadiene				-	-	-	-	-	-	
1,2-Dibromoethane				-	-	-	-	-	-	
cis-1,3-Dichloro-1-propene				-	-	-	-	-	-	
trans-1,3-Dichloro-1-propene				-	-	-	-	-	-	
1,2-Dichlorobenzene				-	-	-	-	-	-	
1,4-Dichlorobenzene				-	-	-	-	-	-	
1,1-Dichloroethane				-	-	-	-	-	-	
1,2-Dichloroethane				-	-	-	-	-	-	
1,1-Dichloroethene				-	-	-	-	-	-	
trans-1,2-Dichloroethene				-	-	-	-	-	-	
1,2-Dichloropropane				-	-	-	-	-	-	
1,1,2,2-Tetrachloroethane				-	-	-	-	-	-	
1,1,2-Trichloro-1,2,2-trifluoroethane				-	-	-	-	-	-	
1,2,4-Trichlorobenzene				-	-	-	-	-	-	
1,1,1-Trichloroethane				-	-	-	-	-	-	
1,1,2-Trichloroethane				-	-	-	-	-	-	
1,2,4-Trimethylbenzene				-	-	-	-	-	-	
2-Butanone				-	-	-	-	-	-	
2-Hexanone				-	-	-	-	-	-	
2-Methoxy-2-methyl propane	**0.0026**	0.00094		-	-	-	-	-	-	
4-Methyl-2-pentanone				-	-	-	-	-	-	
Acetone				-	-	-	-	-	-	
Benzene	**0.058**	**0.049**	**0.047**	-	-	-	-	-	-	**0.051**
Bromodichloromethane				-	-	-	-	-	-	
Bromoform				-	-	-	-	-	-	
Bromomethane				-	-	-	-	-	-	
Carbon disulfide				-	-	-	-	-	-	
Carbon tetrachloride	**0.088**	**0.076**	**0.099**	-	-	-	-	-	-	**0.10**
Chlorobenzene				-	-	-	-	-	-	
Chloroethane				-	-	-	-	-	-	
Chloroethene				-	-	-	-	-	-	
Chloroform				-	-	-	-	-	-	0.019
Chloromethane				-	-	-	-	-	-	
Cyclohexane				-	-	-	-	-	-	
Dibromochloromethane				-	-	-	-	-	-	
Dichlorodifluoromethane				-	-	-	-	-	-	
Ethylbenzene	0.0046	0.0042	0.0028	-	-	-	-	-	-	0.0036
Hexachloro-1,3-butadiene				-	-	-	-	-	-	
n-Hexane				-	-	-	-	-	-	
Methylene chloride	0.0010	0.0012	0.0011	-	-	-	-	-	-	**0.0024**
Propene				-	-	-	-	-	-	
Styrene				-	-	-	-	-	-	
Tetrachloroethene	0.014	0.012		-	-	-	-	-	-	0.012
Toluene				-	-	-	-	-	-	
Trichloroethylene (TCE)	0.027	0.023	0.027	-	-	-	-	-	-	0.035
Trichlorofluoromethane				-	-	-	-	-	-	
m & p- Xylene				-	-	-	-	-	-	
o-Xylene				-	-	-	-	-	-	
Total Risk	0.20	0.17	0.18	**-**	**-**	**-**	**-**	**-**	**-**	0.23

[1] Risk values are bolded for compounds that were detected in 85% or more of the samples during the year.

Table 23. Excess lifetime cancer risk for inhalation of ambient VOC concentrations per population of 10,000.

Site	Excess Lifetime Cancer Risk (in 10,000) (Total VOC)				
	2005	2006	2007	2008	2009
Collegeville	-	-	0.20	0.17	0.19
Spring City	-	-	-	0.13	-
Evansburg SP	0.15	0.12	0.13	0.15	-
Evansburg UM	-	-	-	-	0.18
Trappe	0.20	0.17	0.18	-	-
Trappe FS	-	-	-	-	0.23

Table 24. Excess lifetime cancer risk for inhalation of ambient TCE concentrations per population of 10,000.

Site	Excess Lifetime Cancer Risk (in 10,000) (TCE)				
	2005	2006	2007	2008	2009
Collegeville	-	-	0.072	0.0096	0.010
Spring City	-	-	-	0.0031	-
Evansburg SP	0.015	0.013	0.0079	0.0028	-
Evansburg UM	-	-	-	-	0.0035
Trappe	0.027	0.023	0.027	-	-
Trappe FS	-	-	-	-	0.035

The excess lifetime cancer risk associated with the modeling results are summarized in Table 25. The minimum and maximum modeled annual average TCE values correspond to an excess lifetime cancer risk of 0.0021 to 0.49 per 10,000 population. The average annual TCE concentration across the entire modeling domain was estimated to be 0.31 ppbv which corresponds to an excess lifetime cancer risk of 0.033 per 10,000.

All of the maximum annual TCE concentrations (4.6 ppbv or less) were lower than the previously recognized reference concentration for TCE (40 $\mu g/m^3$ or 7.5 ppbv). Therefore, the model did not predict TCE concentrations within the modeling region that are likely to result in chronic non-cancer health risks.

The maximum daily (24-hour) TCE concentration predicted by the model was 25.1 ppbv located at the plant perimeter. All maximum daily TCE concentrations calculated by the model were lower than either the acute (2000 ppbv) or intermediate minimal risk level (100 ppbv). Therefore, the model did not predict any levels showing a concern for short-term non-cancer health risks.

Table 25. Summary of modeling results for average annual TCE concentrations.

Parameter	Average Annual TCE Concentration (ppbv)	Excess Lifetime Cancer Risk (in 10,000)
Maximum value in modeling region	4.6	0.49
2nd highest value in modeling region	4.1	0.44
Minimum value in modeling region	0.02	0.0021
Average value in modeling region	0.31	0.033

Trappe Gas Chromatograph

A Perkin-Elmer Gas Chromatograph (GC) with an Automated Thermal Desorber (ATD) became available for the Collegeville project after replacement of the GC system at the DEP Photochemical Assessment Monitoring Station (PAMS) in Arendtsville, PA. With the older system still having useable life, the DEP utilized a Perkin Elmer kit to convert the GC for air toxics use. The conversion included: the replacement one of two flame ionization detectors (FID) with an electron capture detector (ECD), replacing the capillary column and upgrading the ATD. The converted system was designed to provide continuous automated sampling and analysis for TCE on a 1-hour cycle. The goal was to provide information on diurnal variation in TCE concentration that cannot be obtained with 24-hour canister samples. The DEP had over thirteen years experience operating the GC/ATD as a Photochemical Assessment Monitoring System.

The Trappe Fire Station (Trappe FS) site was established to house the GC equipment. Installation of the site was slow due to decisions at the site (on Trappe Fire Company property) requiring board approval and other factors. However the site installation was mostly completed by mid 2008. A meteorological tower for the site was installed and began collecting data on 6/3/08.

Installation of GC equipment by the Perkin Elmer service contractor began the week of 7/28/08. The hydrogen and zero-air generator that was purchased for the GC did not performed according to expectations. A hydrogen leak that caused the station CO sensor to alarm, forced return of the unit to the manufacturer. Furthermore, the zero air generated was not dry enough for use by the GC equipment. The unit was eventually replaced by a different zero-air generator and cylinder hydrogen. The GC service contractor completed installation and GC began operating by the beginning of 2009.

Along with installation problems however, there were also problems with fine tuning of the instrument. Peak identification was a lingering problem for the first half of 2009. In an effort to resolve this issue, sample tubes of the DEP standard were sent to Perkin-Elmer for analysis on their GC/MS and sample tubes were sent to us by Perkin-Elmer for analysis on the Trappe GC/FID/ECD. In September 2009, it was discovered that Perkin Elmer initially misidentified the TCE peak. It wasn't until enough data had been collected that DEP personnel noticed that TCE concentrations weren't acting as they should based on minimum concentrations and wind directions.

Further examination confirmed the TCE peak had been misidentified and that the correct peak was a product of co-elution of TCE and another halogenated compound. A test was conducted to determine the ratio of the two compounds comprising the peak. The ratio factor was applied to the data to determine TCE concentrations. The test was repeated to confirm the ratio factor value. Time was also put into developing a new GC method with a longer running time to get better separation of TCE and its co-eluter.

There were other GC problems that had to be dealt with during the course of the project:

- Of the two detectors in the GC, the ECD chromatograms, for halogenated compounds like TCE, show well-formed peaks. The FID chromatograms, for other toxics, are not well formed. This is due to not enough of the sample being sent into the FID detector. Perkin Elmer was to make changes to send more of the sample to the FID and less to the ECD once other problems were solved
- Early on the ECD chromatograms for halogenated compounds, show well-formed peaks, but some were going off-scale. Standard concentrations were lowered to compensate for this.
- Progress has been hampered by issues with a third party service purchase contract resulting in delays and disputed claims.

Even with the difficulties in installation and fine tuning of the GC, TCE and 1-bromopropane results are available for portions of 2009, mainly April through July and September and October. The first acceptable calibration didn't run until 4/2/09, therefore TCE data cannot be retrieved before then.

A total of 2,595 1-hour samples were collected by the GC. TCE was detected in 47% of these hourly samples. The average TCE concentration of all hourly samples was 0.88 ppbv with a maximum 1-hour result of 24.81 ppbv. The maximum 24-hour average (average of 12 to 24 1-hour results during a calendar day) was 5.2 ppbv. Table 26 contains all 24-hour averages calculated during GC operation at the Trappe FS site in 2009. The compound 1-bromopropane, was detected less than 1% of GC samples and therefore not discussed in this report.

A pollutant rose that plots the TCE results from the GC against wind directions collected by a meteorological system at the site, is shown in Figure 11. It should be noted that the majority of the higher TCE concentrations were detected by the GC when the wind was predominantly from the southwest, the direction of the Accellent facility.

A comparison was made between GC data and canister data for those dates where both pieces of equipment were running (a total of 9 dates during the year). The hourly results from the GC were averaged over the day and then compared to the 24-hour canister results. A graph of the comparison is shown in Figure 12. The GC results were consistently higher than the canister sampling results, however both tracked relatively well. The average percent difference between the GC and canister results was 43%. A possible explanation for the consistently higher GC results over the canister results could be in the fact they are two completely different methods: the GC using an electron capture detector (ECD), the canister analysis using a flame ionization detector (FID) and mass spectrometry (MS). In this case, it is not unreasonable to expect differences of at least 30%. Another source of error could be in the calculation of the ratio factor, which was applied to the GC results due to the co-elution problem (discussed earlier).

The calculated maximum 24-hour average GC TCE concentration of 5.20 ppbv is almost twice as high as the modeled maximum 24-hour TCE concentration of 2.85 ppbv at the grid point closest to the Trappe FS. Likewise, the mean 24-hour average GC TCE concentration of 0.86 ppbv (assumed to be the annual average) is much higher than the modeled value of 0.28ppbv.

Again assuming the mean 24-hour average GC TCE result of 0.86 ppbv was the annual average for the year, then the ELCR would be 0.093 (in 10,000). The maximum 24-hour average GC TCE concentration of 5.20 ppbv produces an ELCR of 0.56 (in 10,000). The maximum 1-hour GC TCE concentration 24.8 ppbv was lower than either the acute (2000 ppbv) or intermediate minimal risk level (100 ppbv). Therefore, the GC did not detect any levels showing a concern for short-term non-cancer health risks.

The GC continued to operate January and February, 2010 at DEP's expense, to collect as much data as is possible. Next steps include moving the GC equipment to the DEP lab in Harrisburg to finish the method development which will be applied to past data. Activities will include running standard tubes for more peak identification, developing a new GC method with a longer running time to get better separation of TCE and it co-eluter, decreasing the attenuation on the ECD detector to increase peak size, and changing split amounts between the two detectors.

Table 26. Trappe gas chromatograph results (24-hour average)(ppbv) in 2009.

Date	TCE 24-Hour Average (ppbv)	Date	TCE 24-Hour Average (ppbv)	Date	TCE 24-Hour Average (ppbv)	Date	TCE 24-Hour Average (ppbv)
4/2/09	0.00	5/2/09	0.36	7/17/09	0.94	10/11/09	0.86
4/3/09	0.26	5/3/09	0.21	7/18/09	0.31	10/12/09	0.15
4/4/09	0.09	5/4/09	0.05	7/19/09	2.50	10/13/09	0.36
4/5/09	0.22	5/12/09	0.11	7/20/09	0.65	10/14/09	0.50
4/6/09	0.06	5/13/09	0.77	7/21/09	0.03	10/15/09	0.06
4/7/09	0.34	5/15/09	0.17	7/22/09	0.60	10/16/09	0.00
4/8/09	1.48	5/16/09	0.32	7/23/09	0.08	10/17/09	0.00
4/9/09	2.04	5/17/09	0.59	7/24/09	1.34	10/18/09	0.29
4/10/09	0.94	5/18/09	0.08	7/25/09	1.00	10/19/09	2.08
4/11/09	0.00	5/19/09	0.90	7/26/09	0.69	10/20/09	5.17
4/12/09	0.00	5/20/09	2.54	7/27/09	2.36	10/21/09	2.77
4/13/09	0.42	5/21/09	5.20	7/28/09	3.28	10/22/09	4.32
4/14/09	0.13	5/22/09	2.88	9/23/09	0.81	10/23/09	0.41
4/15/09	0.06	5/23/09	2.31	9/24/09	0.48	10/24/09	0.06
4/16/09	0.74	5/24/09	0.62	9/25/09	0.01	10/25/09	0.24
4/17/09	1.06	6/23/09	0.00	9/26/09	0.00	10/26/09	0.53
4/18/09	1.25	6/24/09	0.03	9/27/09	0.80	10/27/09	0.25
4/19/09	0.86	6/25/09	0.52	9/28/09	2.14	10/28/09	0.18
4/20/09	0.00	6/26/09	1.80	9/29/09	2.14	10/29/09	0.13
4/21/09	0.20	6/27/09	0.34	9/30/09	0.18	10/30/09	0.00
4/22/09	1.39	6/28/09	0.08	10/1/09	2.91	10/31/09	0.04
4/23/09	1.60	6/29/09	0.45	10/2/09	0.38	11/1/09	0.18
4/24/09	1.30	6/30/09	0.74	10/3/09	1.87	11/2/09	0.19
4/25/09	0.61	7/10/09	0.04	10/4/09	1.46		
4/26/09	1.64	7/11/09	0.00	10/5/09	2.61		
4/27/09	0.54	7/12/09	0.30	10/6/09	0.80		
4/28/09	0.65	7/13/09	1.51	10/7/09	0.41		
4/29/09	0.01	7/14/09	0.34	10/8/09	2.24		
4/30/09	0.02	7/15/09	0.71	10/9/09	1.13		
5/1/09	0.80	7/16/09	1.13	10/10/09	0.65		

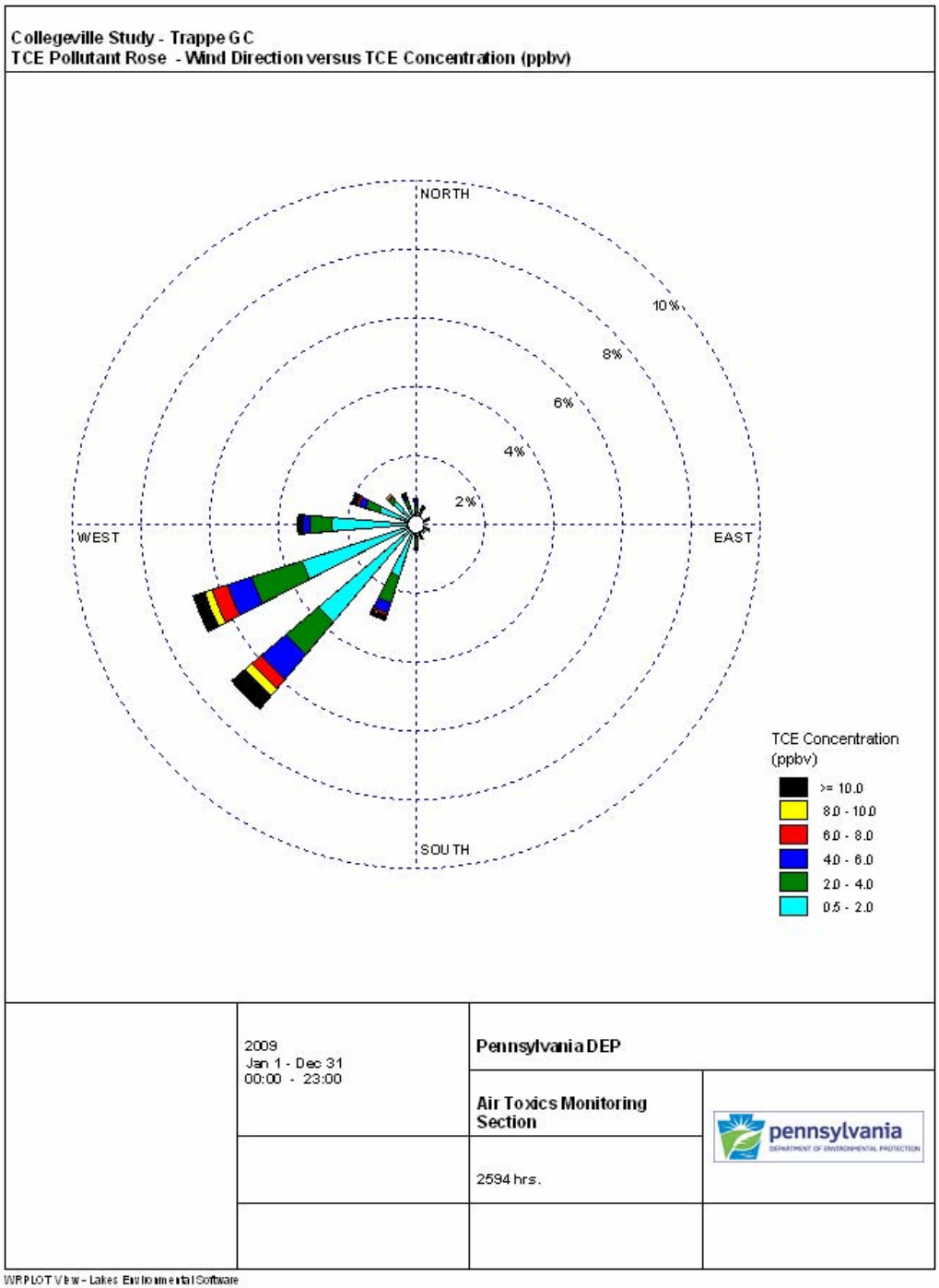

Figure 11. Pollutant rose of TCE results from the Trappe FS Gas Chromatograph.

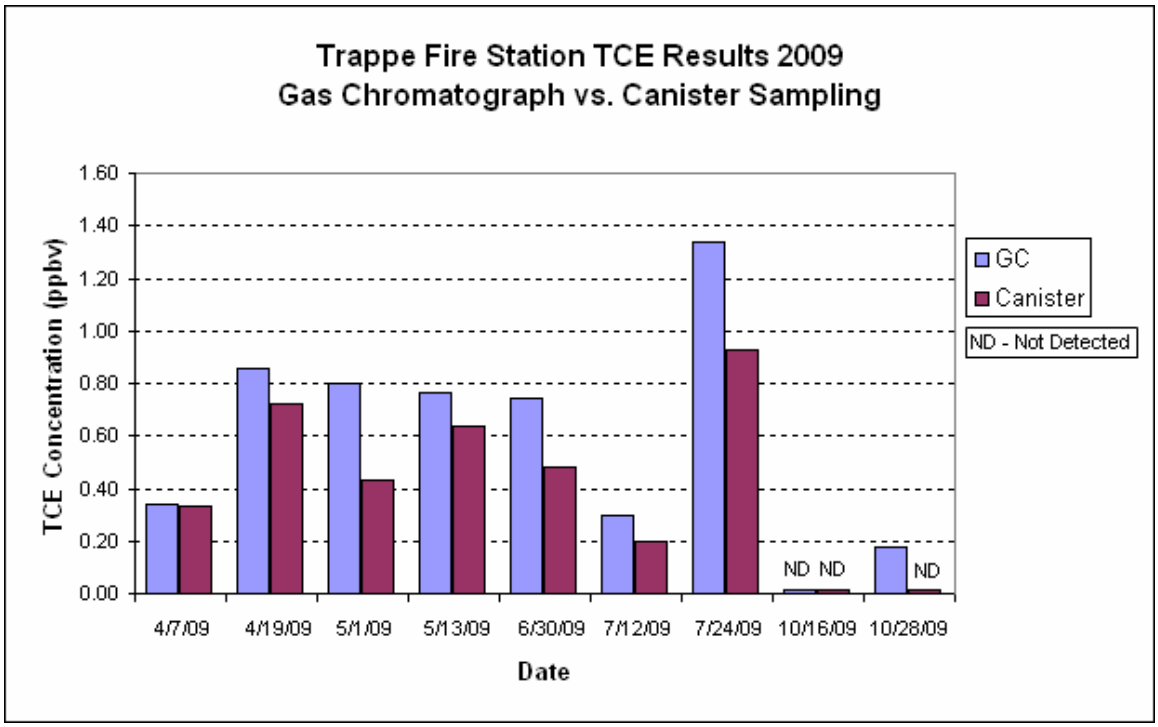

Figure 12. Comparison of Trappe Gas Chromatograph TCE results (average of 24 1-hour results) to canister sampling results for all matched dates in 2009.

Grant Close-Out Discussion

Detailed project activities over the entire period of funding can be found in the third Collegeville report. A general timeline of activities follows:

- 4/1/04 - As part of an air toxics monitoring project in nearby Pottstown, higher than normal levels of TCE were discovered in the Collegeville area.
- 1/4/05 - Permanent monitoring sites were established downwind of each large TCE source, one at the former YMCA in Trappe (Trappe) and the other at the Evansburg State Park (Evansburg SP).
- 11/17/06 - The DEP met with representatives of Superior Tube (and Accellent on 12/1/06), regarding the elevated monitoring results to date, and asked the companies to consider voluntary emission reductions of TCE. Both facilities were in compliance with existing regulatory requirements, but agreed to do so.
- 1/19/07 - The first of three Collegeville reports on the TCE monitoring project was released to the public.

- 2/20/07 - The first of three public meeting was held to discuss sampling findings. The meeting was attended by approximately 700 people demonstrating enormous concern for the elevated TCE levels and associated risk to the citizens of Collegeville.
- 5/18/07 - Trappe site was moved to the Collegeville site located on the campus of Ursinus College due to closure of the YMCA.
- 10/15/07 - The first, of eventually five, intensive sampling event (spaced each quarter through 2008) was conducted to determine TCE concentrations near the large sources and to compare results against acute screening levels.
- 12/7/07 - DEP applied for an EPA Community-Scale Air Toxics Ambient Monitoring Grant to expand toxics monitoring in Collegeville.
- 1/16/08 - DEP was awarded the EPA grant totaling $269,166 for the period 1/1/08 through 12/31/09.
- 1/25/08 - An upwind site was established in nearby Spring City.
- 3/08 - The owners of the Accellent facility installed the second of two carbon adsorbers on processes that accounted for 95% of its TCE emissions. The first adsorber came online in 10/2/07. The voluntary installation of these controls has reduced TCE emissions by 50%.
- 3/7/08 - The second of three Collegeville reports on the TCE monitoring project was released to the public.
- 3/26/08 - The second of three public meetings was held to discuss sampling findings. Approximately 100 people attended.
- 5/1/08 - DEP issued an amended Operating Permit to Superior Tube that incorporated voluntary TCE emission reduction measures including the consolidation of degreasing operations that resulted in a 60% decrease in TCE emissions and, allowing the use of 1-bromopropane as a substitute for TCE.
- 11/26/08 - DEP began to quantify 1-brompropane in all toxics air samples.
- 1/13/09 - A new monitoring site was established at the Trappe Fire Station equipped with a continuous gas chromatograph and a canister sampler for comparison.
- 2/18/09 - Due to discontinued use of TCE at the Superior Tube facility, the Evansburg SP site was moved to the United Methodist church in Evansburg (Evansburg UM). This site being closer to facility should provide information on maximum ambient concentrations of 1-bromopropane, the TCE substitute.
- 11/17/09 - DEP released the third Collegeville report on the TCE monitoring project to the public.
- 12/1/09 - DEP held its third public meeting to discuss sampling findings. Approximately 70 people attended the meeting. With the substantial decrease in attendance down (from 700 in first meeting), one can assume that the public concerns with TCE levels in Collegeville were being addressed.

- 12/31/09 - The PA Community-Scale Air Toxics Ambient Monitoring Grant ends.
- 3/31/10 - An Addendum to the third Collegeville report was sent to EPA that presents the 2009 monitoring data, updates the risk assessment using current risk factors and provides data to satisfy EPA grant close- out requirements.
- Present - DEP continues to operate the Collegeville and Evansburg UM sites to further assess TCE levels in the Collegeville area and to monitor ambient 1-bromopropane levels at the Evansburg UM site. The Department intends to keep both sites running at least through 2010. Work on the GC used at the Trappe FS site will continue in an attempt to extract additional VOC data from 2009.

The following is a list of positive and negative technical aspects discovered during the course of monitoring, and the project findings.

Positives:

- Sampling and analysis using EPA Compendium Method TO-15 was an effective tool in gathering information on the ambient concentrations of TCE, 1-brompropane and other VOC's.
- The frequency of intensive sampling events provided under the grant were not only useful in collecting data to compare against acute and intermediate risk levels, but also from a public relations point-of-view, helped to promote DEP presence in the area.
- EPA grant money allowed the hiring of an outside consultant and a more complete technical analysis of the data collected during the project.
- The partnership with Ursinus College and the Environmental Studies Program and the use of students to collect canister samples at the Collegeville site allowed DEP staff to focus on other monitoring projects and worked to provide a reciprocal educational experience.

Negatives:

- Even though TCE emissions and permit emission limits were substantially reduced, TCE use was not eliminated. The owner of the Superior Tube facility replaced TCE with 1-bromopropane, an EPA-accepted replacement but a chemical with less documented health effects information.
- Even with the assurances from Perkin Elmer, the conversion of an existing PAMS GC to one that samples for toxic pollutants, did not proceed as planned and resulted in a "manpower" drain.

2009 Findings:

- The average TCE concentration at the Collegeville monitoring site in 2009 was comparable to the average concentration found at the same site in 2008. Similarly, the average TCE concentration at the current Evansburg site in 2009 was close to that found at the former Evansburg site, and at the Spring

City background site, in 2008. This leveling of TCE concentrations can be explained by the TCE emission reduction strategies implemented by the two large facilities in the Collegeville area in early 2008.

- Changes to risk analysis methods and risk factors produced lower estimates of risk to residents of the Collegeville area. With the current TCE cancer risk factor being lower than the one previously used, the contribution of TCE risk to the overall risk has been reduced. All sampling data results collected from the entire project as well as 24-hour maximum modeled contrations are below the EPA recommended level of 1 in 10,000 excess lifetime cancer risks.
- GC TCE results show a majority of the higher TCE concentrations were detected by the GC when the wind was predominantly from the southwest, the direction of the Accellent facility. TCE concentrations measured by the GC were somewhat higher than sampling and modeled predictions. However, not in amounts to produce unacceptable cancer and non-cancer risk values.

Overall Findings:

- DEP's decision to work closely with the owners and operators of two large TCE-emitting facilities to obtain enforceable voluntary TCE emission reductions succeeded as a relatively quick solution to the problem. This decision was due in part to the former DEP Air Program Manager's belief that a partnering approach would be more effective than a confrontational, possibly expensive and time-consuming litigation approach.
- Expanded monitoring allowed by the grant showed emission reductions by the two large TCE emitting facilities were effective in reducing ambient TCE concentrations.
- A statistically significant decreasing trend was observed in TCE concentrations from 2007 to 2008 at both the Collegeville and Evansburg SP sites.
- Intensive sampling events conducted at the perimeter of each of the two major facilities at mostly downwind locations (areas where peak ambient TCE concentrations are expected to occur) yielded concentrations well under acute- and intermediate-term minimum risk levels.
- Modeling of TCE emissions from the Accellent facility confirmed that ambient TCE concentrations are the highest near the facility. Modeling results were similar to the canister sampling concentrations found at the Trappe FS site and could be useful in predicting TCE concentrations in areas where no sampling occurred.
- Overall, the project was successful in reducing ambient concentrations of TCE and the exposure and potential cancer risk to the citizens of the Collegeville area.

The Collegeville community-scale monitoring project helped in the understanding of ambient TCE levels around major emitters and the effectiveness of controlling TCE emissions. The information collected in the Collegeville project not only helped the citizens of that community but also promoted awareness of the solvent's use and its effects on health.

As a result of early findings in Collegeville, the DEP has evaluated the environmental impacts of this degreasing agent in this industrial sector at locations across the state. Specifically, the DEP conducted ambient air sampling around the Tube Methods facility in nearby Bridgeport, Pa. and the Summerill Tube Corp. in Scottsdale, Pa. (western PA). The Tube Methods facility is located in downtown Bridgeport immediately adjacent to a residential area. With emission of 16.9 tons annually (2006), DEP measured 24-hour average ambient concentrations of TCE as high as 8.2 ppbv downwind of the facility. Likewise, sampling in a residential area next to the Summerill Tube Corp. found ambient concentrations of 2.2 ppbv.

Again, voluntary TCE emissions reductions were requested by the DEP. The owners of the Tube Methods facility switched all use of TCE to 1-bromopropane in early 2008. Sampling in Bridgeport after the switch was complete confirmed that TCE concentrations dropped to near background levels and 1-bromopropane concentrations peaked (e.g. 13.0 ppbv immediately downwind). With far fewer resident complaints, the Summerill Tube Corp. did not make the switch to an alternative solvent but did lower their annual emissions of TCE from 36 tons in 2006 to 29 tons in 2009.