

# Letter Health Consultation

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Evaluation of 2013 Indoor Air TCE Concentrations after Installation of  
Temporary Air Filtration System at the

CHEM FAB SITE  
DOYLESTOWN, BUCKS COUNTY, PENNSYLVANIA

**Prepared by**  
**Pennsylvania Department of Health**

FEBRUARY 12, 2015

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Agency for Toxic Substances and Disease Registry  
Division of Community Health Investigations  
Atlanta, Georgia 30333

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

Evaluation of 2013 Indoor Air TCE Concentrations after Installation of  
Temporary Air Filtration System at the

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DOYLESTOWN, BUCKS COUNTY, PENNSYLVANIA

Prepared By:

Pennsylvania Department of Health  
Division of Environmental Health  
Under a cooperative agreement with the  
Agency for Toxic Substances and Disease Registry



To: Eduardo Rovira, On Scene Coordinator, US Environmental Protection Agency (EPA) Region 3

From: Sasidevi Arunachalam, Epidemiology Program Specialist, Health Assessment Program, Division of Environmental Health Epidemiology, Pennsylvania Department of Health (PADOH)

Subject: Evaluation of 2013 Indoor Air trichloroethylene (TCE) concentrations after Installation of air filtration System at the Chem Fab Site, follow-up and recommendations.

Date: February 12, 2015

EPA requested PADOH and ATSDR evaluate indoor air trichloroethylene (TCE) data for samples collected on January 2013 after the installation of temporary air filtration units in the businesses and offices located in buildings on Chem Fab Superfund Site in Doylestown, PA. TCE vapor intrusion mitigation efforts were initiated at this site in October 2011 by EPA<sup>1</sup>. Previous sampling events (pre-activation of gas mitigation system) showed a maximum indoor air concentration of TCE of 225 $\mu\text{g}/\text{m}^3$ . TCE levels found in the main building posed a public health threat to employees of businesses, their patrons, or visitors prior to gas mitigation system. Follow-up sampling in August 2012 showed a decrease of TCE concentrations in indoor air at all office/commercial space locations after the activation of a gas mitigation system. However, the maximum indoor air concentration of TCE detected in the August 2012 sampling event was still elevated (30 $\mu\text{g}/\text{m}^3$ ). Based on the evaluation of the August 2012 data, PADOH and ATSDR concluded that the indoor air TCE concentrations remained a health concern for workers of certain office spaces at this site and recommended additional monitoring and further reductions in TCE exposure<sup>2</sup>.

PADOH and ATSDR evaluated TCE data from air samples collected on January 2013, after EPA installed temporary air filtration units. PADOH and ATSDR conclude that the current TCE levels are not expected to harm the health of office workers and visitors. The adjusted TCE levels are below the RfC/MRL (2  $\mu\text{g}/\text{m}^3$ ) indicating non-cancer health effects are not expected. Also, no apparent increase in cancer risk was found due to exposure to chemicals at the Chem Fab site. However, this conclusion is based on limited data for only one season of sampling and the data do not account for potential seasonal variations. PADOH and ATSDR recommend 1) continued monitoring of the air levels to ensure that TCE remains at levels below health concern and 2) proper operation and maintenance of air filters to prevent the potential for future TCE exposure above levels of health concern. PADOH and ATSDR will review and evaluate any

future environmental data for this site as requested and distribute the findings to the community during community advisory group meetings.

### **Background and Statement of Issues**

The Chem Fab Site, located on North Broad Street in Doylestown, operated as an electroplating and metal processing facility from 1965-1994 and stored waste chemicals on the property. EPA removed 117 drums of chemicals and 8,400 gallons of liquid waste in 1994. Past and current indoor air TCE exposures are associated with the on-site TCE contaminated surface water, surface soil and ground water and resulting vapor migration through the subsurface into the indoor air of the buildings. At the recommendation of PADOH and ATSDR to reduce TCE levels in indoor air, EPA installed gas vapor mitigation system and resampled the air in August 2012. Air sampling after the mitigation system was operational revealed a maximum level of TCE that was still above levels of health concern ( $30\mu\text{g}/\text{m}^3$ ). Modifications are often required to optimize the performance of venting systems<sup>3</sup>. To further reduce the levels, in January 2013, EPA installed Austin air filtration units (Figure 1, Appendix 1). This Austin air 360°-air intake operating mechanism system draws air from all sides and provides clean indoor air by removing submicron particles, noxious gases, and chemicals. Following installation, EPA collected indoor air samples from the main building to determine whether TCE concentrations had fallen below levels of health concern following the installation of the temporary air filtration units.

### **Discussion**

*Environmental Data:* The January 2013 24-hour indoor air samples were collected (while mitigation systems were operating). Summa canisters were placed in eight office locations: 300, 310, 314, 320-322, 324, 328, and 330. Table 1 below summarizes TCE concentrations detected in the indoor air samples collected in the main building on October 2011, January 2012, August 2012 and January 2013.

**Table 1: Unadjusted Indoor Air Sample Results (24-hr) for TCE from the Main Building, Chem Fab NPL site**

Office Location		Pre-Activation of Gas Mitigation System		Post-Activation of Gas Mitigation System	Post-Installation of Temporary Air filtration units
		Oct 2011	Jan 2012	Aug 2012	Jan 2013
300-1	1 <sup>st</sup> floor-conf.room	NA	NA	6.1	<b>5.4</b>
300-2	1 <sup>st</sup> floor-file cab.	80.5/32.1	78	6	<b>5.4</b>
310	1 <sup>st</sup> floor	44.7	25.0	6.0	<b>3.8</b>
310	2 <sup>nd</sup> floor	52.7	22.0	5.3	<b>3.8</b>
314-1	1 <sup>st</sup> floor-office	225.0	6.1	4.5	<i>1.1</i>
314-2	1 <sup>st</sup> floor kitchen	NA	NA	3.7	<i>1.1</i>
320-322	1 <sup>st</sup> floor	26.4	18.0	15.0	ND
324	1 <sup>st</sup> floor	18.3	NA	15.0	ND
328	1 <sup>st</sup> floor	29.4	27.0	17.1	ND
330-1	1 <sup>st</sup> floor	44.7	44.0	30.0	ND

All TCE concentrations in micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

Bolded and Italicized values are unadjusted concentrations that exceed the EPA RfC of  $2\mu\text{g}/\text{m}^3$  and ATSDR Cancer Risk Evaluation Guide (CREG) value of  $0.24\mu\text{g}/\text{m}^3$  respectively. NA: No samples collected from these office spaces. ND: not detected

The January 2013 sample results show a decrease of TCE concentrations in indoor air at all office/commercial space locations. The maximum indoor air concentration of TCE detected was  $5.4\mu\text{g}/\text{m}^3$ , a decrease from the previous sampling maximum of  $30\mu\text{g}/\text{m}^3$ . Even though the latest 24-hour indoor air results for TCE have decreased, at two locations (offices 300 and 310) TCE levels are still above ATSDR's Minimum Risk Level (MRL), as well as the EPA's Reference Concentration (RfC) of  $2\mu\text{g}/\text{m}^3$ . The RfC is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful non-cancer effects during a lifetime. Furthermore, TCE levels exceeded ATSDR's Cancer Risk Evaluation Guide (CREG) of  $0.24\mu\text{g}/\text{m}^3$  at building 300, 310, as well as building 314 ( $1.1\mu\text{g}/\text{m}^3$ ). CREGs are estimated contaminant concentrations in water, soil, or air that would be expected to cause no more than one excess in a million persons exposed over a life time. CREGs are calculated from EPA's cancer slope factors. Though vapor intrusion varies on

an hourly, daily, and seasonal basis<sup>4</sup>, vapor intrusion variability tends to be dampened by active venting systems<sup>3</sup>.

After installation and during operation of the temporary air filtration units, indoor air samples were collected over a 24-hour period. In an occupational setting, people do not work 24 hours straight. Therefore, to evaluate the potential health effects of TCE, PADOH and ATSDR calculated the adjusted exposure concentrations using a range of site-specific exposure durations as full-time workers are at the facility for eight to ten hours per day and part-time workers and visitors spend 4, 2 and 1 hour at these locations. For this reason, indoor air concentrations of TCE were adjusted for 10, 8, 4, 2 and 1 hour exposure durations. The adjusted exposure concentrations were calculated by multiplying the adjusted exposure factor by the concentration of the chemical (see Appendix 2). Table 2 below shows the adjusted exposure concentrations to TCE only for the office locations where TCE levels exceeded EPA's RfC of  $2\mu\text{g}/\text{m}^3$  as well as CREG's comparison value of  $0.24\mu\text{g}/\text{m}^3$ . The adjusted TCE concentrations are below the RfC for the office locations at 300, 310 and 314, but exceeded the CREG for the locations 300, 310 and 314.

**Table 2: Adjusted TCE exposure concentrations in Main Building, Chem Fab NPL site, following installation of Temporary air filtration units**

Offices in Main building	Adjusted TCE exposure concentrations (Jan.2013), in micrograms per cubic meter( $\mu\text{g}/\text{m}^3$ ) by Exposure Duration				
	<u>10-hr</u>	<u>8-hr</u>	<u>4-hr</u>	<u>2-hr</u>	<u>1-hr</u>
300	<b>1.8</b>	<b>1.2</b>	<b>0.62</b>	<b>0.31</b>	0.12
310	<b>1.3</b>	<b>0.84</b>	<b>0.43</b>	0.22	0.08
314	<b>0.37</b>	<b>0.24</b>	0.13	0.06	0.02

Bolded values are adjusted concentrations that exceed the ATSDR CREG ( $0.24\mu\text{g}/\text{m}^3$ ). Calculations for adjusting exposure concentrations are shown in Appendix 2.

### **Public Health Implications of TCE in Indoor Air**

The most likely exposure scenario is a worker exposed for 8-10 hours per day and visitors or part-time workers from 1-4 hours per day. The TCE concentrations are lower for all the offices when adjusted for these shorter exposure scenarios. No adjusted concentrations exceed ATSDR's MRL or EPA's RfC of  $2 \mu\text{g}/\text{m}^3$ ; hence harmful non-cancer effects are not expected for these exposure durations. Some of the adjusted TCE concentrations exceed the ATSDR CREG and were evaluated further. Using the adjusted 8-10 hour indoor air concentrations of TCE for the office 300, the estimated increased cancer risks for workers in the main building with installation of temporary air filtration units, based on a 10-year exposure, ranged from  $6 \times 10^{-7}$  to  $9 \times 10^{-7}$ . EPA has characterized TCE as "carcinogenic to humans" by all routes of exposure and has estimated an inhalation unit risk (IUR) of  $4 \times 10^{-6}$  per  $\mu\text{g}/\text{m}^3$ . National Toxicology Program (NTP) has proposed to reclassify TCE as "known to be a human carcinogen," but this has not been finalized. Based on our evaluation, TCE exposures pose a no apparent increased cancer risk to the workers in building 300 as well as in buildings 310, 314, 320-322, 324, 328, and 330.

### **Conclusions**

Based on the January 2013 data, PADOH and ATSDR conclude that the levels of TCE measured in indoor air are not expected to harm the health of workers or visitors. However, it should be noted that this conclusion is based on the use of a temporary air filtration units and the indoor air data being representative of average indoor air concentrations over time.

### **Recommendations**

Although the levels of TCE measured in indoor air are not expected to harm the health of workers or visitors, PADOH and ATSDR have three recommendations:

- Continue operating the air filtration system at the Chem Fab site to maintain low TCE levels in the indoor air,
- Monitor/maintain the filters or implement a more permanent remedy, and
- Conduct periodic sampling, including sampling during the summer season to ensure TCE levels in indoor air do not increase over time.

If you have any questions, please contact me at 717-547-3310, or by e-mail at [sarunachal@pa.gov](mailto:sarunachal@pa.gov).

Sincerely,



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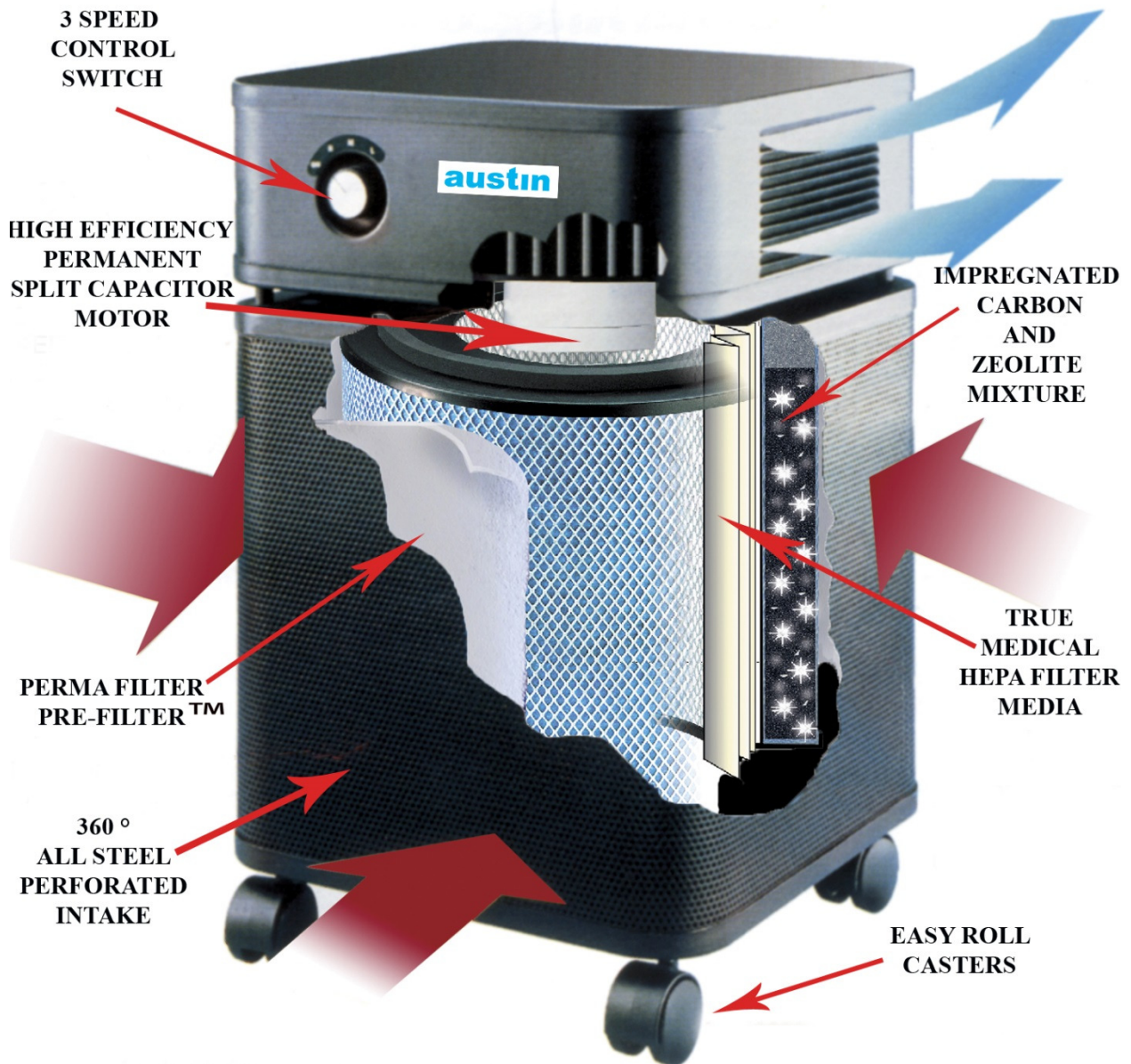


## References

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2. Agency for Toxic Substances and Disease Registry (ATSDR). August 2013. Letter health Consultation on Evaluation of Indoor Air TCE Concentration after Activation of Mitigation System for Businesses located at the Chem Fab Site Doylestown, Bucks County, Pennsylvania. Atlanta, GA: U.S. Department of Health and Human Services.
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4. Lutes C, Cosky B, Schumacher B, Zimmerman J, Truesdale R, Norberg R. Four Winters of Continuous Vapor Intrusion Monitoring in Indianapolis – Temporal Variability in Indoor Air. Presented at: EPA Vapor Intrusion Workshop; March 2014; San Diego, CA. Available from: [https://iavi.rti.org/attachments/WorkshopsAndConferences/4\\_Lutes\\_EPAORD\\_31714.pdf](https://iavi.rti.org/attachments/WorkshopsAndConferences/4_Lutes_EPAORD_31714.pdf)

## Appendix 1

Figure 1 – Austin Air Filtration Unit



## Appendix 2 – Calculations

### Exposure Calculations

$$EC = (CA \times ET \times EF \times ED) / AT$$

Where:

EC ( $\mu\text{g}/\text{m}^3$ ) = exposure concentration;

CA ( $\mu\text{g}/\text{m}^3$ ) = contaminant concentration in air;

ET (hours/day) = exposure time;

EF (days/year) = exposure frequency;

ED (years) = exposure duration; and

AT (ED in years  $\times$  365 days/year  $\times$  24 hours/day) = averaging time

Note: If the duration of the exposure period is less than one year, the units in the above equation can be changed to the following: EF (days/week); ED (weeks/exposure period); and AT (hours/exposure period).

### Adjusted Exposure Factor for industrial workers and visitors:

10 hours of exposure per day: 10 hours  $\times$  6 days  $\times$  50 weeks / 24 hours  $\times$  7 days  $\times$  52 weeks = 0.34

8 hours of exposure per day: 8 hours  $\times$  5 days  $\times$  50 weeks / 24 hours  $\times$  7 days  $\times$  52 weeks = 0.22

4 hours of exposure per day: 4 hours  $\times$  5 days  $\times$  50 weeks / 24 hours  $\times$  7 days  $\times$  52 weeks = 0.114

2 hours of exposure per day: 2 hours  $\times$  5 days  $\times$  50 weeks / 24 hours  $\times$  7 days  $\times$  52 weeks = 0.057

1 hour of exposure per day: 1 hour  $\times$  4 days  $\times$  50 weeks / 24 hours  $\times$  7 days  $\times$  52 weeks = 0.022

### Adjusted Exposure Concentration ( $\mu\text{g}/\text{m}^3$ )

Adjusted Exposure Concentration = Adjusted Exposure Factor  $\times$  Concentration

For 10 hours: 0.34  $\times$  5.4  $\mu\text{g}/\text{m}^3$  = 1.8  $\mu\text{g}/\text{m}^3$

For 8 hours: 0.22  $\times$  5.4  $\mu\text{g}/\text{m}^3$  = 1.2  $\mu\text{g}/\text{m}^3$

For 4 hours: 0.114  $\times$  5.4  $\mu\text{g}/\text{m}^3$  = 0.62  $\mu\text{g}/\text{m}^3$

For 2 hours: 0.057  $\times$  5.4  $\mu\text{g}/\text{m}^3$  = 0.31  $\mu\text{g}/\text{m}^3$

For 1 hour: 0.022  $\times$  5.4  $\mu\text{g}/\text{m}^3$  = 0.12  $\mu\text{g}/\text{m}^3$

### Cancer Risk Calculation

Risk = IUR  $\times$  EC  $\times$  (10 yrs / 78 yrs) for 10 years of exposure

Where:

IUR ( $\mu\text{g}/\text{m}^3$ )<sup>-1</sup> = Inhalation Unit Risk = 0.000004

EC ( $\mu\text{g}/\text{m}^3$ ) = exposure concentration

0.000004  $\times$  1.2  $\mu\text{g}/\text{m}^3$  (max)  $\times$  10/78 = 6  $\times$  10<sup>-7</sup>