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Re: Health assessment of air quality data for Norgetown Cleaners and Laundry/Fashion City

Dear Ms. Wiegiers:

Thank you for contacting the Environmental Public Health Program (EPHP) regarding concerns about air quality in Norgetown Laundry and Cleaners. After examining the data you provided, we have made the following health assessment:

Background

Norgetown Laundry and Cleaners is a former laundry and dry cleaning facility that was remodeled to meet the needs of the current occupant, Fashion City (a clothing retailer). Contamination was identified during a 1998 site assessment, which was performed by the Alaska Department of Transportation and Public Facilities (DOT PF) as part of a construction project. During sewer pipe remediation work performed at the site from 1999 to 2000, DOT PF contractors discovered that the 4-inch diameter cast iron bell and spigot sewer pipe outside the laundry had leaked through its joints. This pipe extended westward from the north building door, south across the front of the building, then westward to the Value Village mall building, for a total length of 140-ft. Subgrade soil samples below the joints contained elevated levels of tetrachloroethylene (PCE), and sludge samples from inside the pipe indicated that PCE was discharged into the sewer pipe by the laundry facility. Additionally, during pipe remediation in 2000, construction workers uncovered an abandoned 6-inch diameter sewer pipe that extended 43-feet from the north building door in a northward direction. The pipe was capped at the far end, and contained sludge with very high values of PCE, also indicating historical disposal of PCE through sewage pipes. Both pipes were removed, and the 4-inch diameter pipe was replaced.

In June 2017, the Alaska Department of Environmental Conservation (DEC) contacted the EPHP to report detection of PCE above the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Level (MRL) in air samples from Norgetown Laundry and Cleaners. The EPHP provided DEC (via e-mail correspondence) with health recommendations based on this information and suggested installation of a ventilation in Fashion City to protect the health of the current occupants.

In June 2018, DEC contacted the EPHP with the results of follow-up air sampling from October 2017. Results revealed that both PCE and trichloroethylene (TCE) were detected at levels above the ATSDR

MRLs. Based on the October 2017 data, EPHP provided DEC with health recommendations (via phone and e-mail correspondence), which are detailed in this letter health consultation.

Potential Health Effects of PCE and TCE

Exposure to high levels of PCE can adversely affect the central nervous system, kidney, liver, immune and hematologic (pertaining to blood) systems, development, and reproduction. Inhalation of elevated levels of PCE, particularly in poorly ventilated areas, can cause dizziness, headache, sleepiness, confusion, nausea, difficulty speaking and walking, and unconsciousness (ATSDR, 2014).

Studies suggest that exposure to PCE may increase the risk of developing bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma in humans; however, the results of these studies did not always agree and some did not take into account other factors that could affect cancer risk, such as cigarette smoking and alcohol use. Many agencies have classified PCE as a potential human carcinogen, including the EPA (classified as a "probable human carcinogen"), the International Agency for Research on Cancer (IARC; classified as "probably carcinogenic to humans") and the Department of Health and Human Services (DHHS; classified as "reasonably anticipated to be a human carcinogen") (ATSDR, 2014).

People who are exposed to TCE may experience headaches, dizziness, and sleepiness; while large doses of TCE may cause coma and even death. Some people who breathe high levels of TCE may develop damage to some of the nerves in the face. Other effects seen in people exposed to high levels of TCE include evidence of nervous system effects related to hearing, seeing, and balance, changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Some people who get concentrated solutions of TCE on their skin develop rashes. Relatively short-term exposure of animals to TCE resulted in harmful effects on the nervous system, liver, respiratory system, kidneys, blood, immune system, heart, and body weight (ATSDR, 2016).

There is strong evidence that TCE can cause kidney cancer, and some evidence that it causes liver cancer and malignant lymphoma (a blood cancer). The National Toxicology Program (NTP) has determined that trichloroethylene is a "known human carcinogen". The EPA and the IARC have determined that trichloroethylene is "carcinogenic to humans" (ATSDR, 2016).

TCE can cross the placenta in pregnant women, providing a route of exposure to the developing fetus. Studies suggest that fetal exposure to TCE leads to an increase in the occurrence of fetal heart defects, particularly when exposure occurs early in the first trimester. Exposure to TCE may also occur through breast milk, creating a route of exposure for nursing infants. However, the positive health effects of breastfeeding generally outweigh these possible risks (PEHSU, 2016).

Exposure and Health Evaluation

Vapor intrusion usually occurs with migration of volatile organic compounds (VOCs) from contaminated soil or groundwater into an overlying building. As a result, people may inhale potentially harmful vapors that infiltrate in their working or living space. Both PCE and TCE are volatile chemicals and likely infiltrated Norgetown Laundry and Cleaners because of the contaminated soil from the leaking pipe below the building.

To evaluate potential health risks pertaining to PCE and TCE exposure from the pipe leak and resulting contaminated soil and air, we used the air quality data collected by DEC. The PCE and TCE concentration data and our analysis for both cancer and non-cancer health risks are presented in Appendix Table 1. Once adjusted for exposure time (8 hrs/day, 5 days/week), the airborne concentrations of neither PCE nor TCE exceeded the ATSDR inhalation exposure MRL; however, there may be health risks for

employees who exceed this exposure duration and frequency considerably. Pregnant women and women who may become pregnant may also be at risk from TCE concentrations because developing fetuses are more sensitive to these chemicals as described above; therefore we recommend that they limit their exposure further. We discuss these points more below.

Non-cancer Risk Estimates

We compared the measured concentration of each detected compound with a health standard or “comparison value” (CV). These CVs are set by federal or state agencies for each contaminant to protect human health against non-cancer health effects (Appendix Table 1). When the concentration of a contaminant is below its CV, exposure is not expected to increase the risk of experiencing adverse health effects, and further actions are not taken. When a person is exposed to a contaminant at concentrations above the CV, the contaminant is classified as a “contaminant of concern (COC)”, and further toxicological evaluation is warranted. However, it is important to note that exposure to a COC does not always result in harmful health effects.

The CV’s used in this analysis for PCE and TCE were MRLs provided by ATSDR (2018). These substance-specific values serve as screening levels to inform health assessors of potential human health concerns at contaminated sites. It is important to note that CVs are not intended to define clean up or action levels for ATSDR or other agencies. CVs are expressed in concentration units of micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and are designed to be protective of all segments of the population, including sensitive and vulnerable populations (e.g., women in their first trimester of pregnancy; ATSDR, 2005). CVs are based on the assumption of continuous exposure (i.e., 24-hours per day) to a measured concentration of a contaminant. In the case of Fashion City, an assumption of continuous exposure would greatly overestimate the inhaled dose of these chemicals, as employees typically spend a maximum of eight hours per day, five days per week at the store. Therefore, MRLs were adjusted to reflect the amount of time the employees spend at Fashion City. We also used the EPA Region 9 Interim TCE Indoor Air Response Action Level for the commercial/industrial scenario for an 8-hour workday.

To assess the potential risks of non-cancer health effects associated with a given contaminant, the measured air concentration of each contaminant was divided by the CV to yield a hazard quotient (HQ). Exposure scenarios with a HQ less than 1 are not expected to lead to an increased risk of developing the adverse health outcomes attributed to that contaminant. Where the HQ is greater than 1, the risk of adverse human health effects is elevated. HQs for Fashion City were calculated using time-adjusted MRLs for PCE and TCE. HQs for both contaminants were less than one in all parts of the building. Consequently, we do not expect the measured air concentrations of PCE or TCE to increase the risk of adverse non-cancer health effects for employees of Fashion City. However, the HQs for TCE were only slightly below 1 in the showroom. Given the toxicity of TCE to the developing fetus (particularly during the first trimester of pregnancy), pregnant women and women who may become pregnant should consider working less than 8-hours per day, 5-days per week at Fashion City, to reduce inhalation exposure during pregnancy.

Cancer Risk Estimates

To evaluate possible cancer risks from the contaminants in Fashion City, EPHP calculated the excess cancer risk that could be associated with the cumulative daily exposure from the individual contaminants over a lifetime. Contaminant concentrations in the air were multiplied by each contaminant’s Inhalation Unit Risk factor (IUR)¹, an estimate of the risk of cancer associated with exposure to a carcinogenic or

¹ Inhalation Unit Risk (IUR): The highest possible cancer risk from continuous exposure to an inhaled substance over a lifetime. For example: if $\text{IUR} = 6 \times 10^{-6} (\mu\text{g}/\text{m}^3)^{-1}$, not more than 6 additional cancers are expected to develop per 1,000,000 people if exposed continuously for a lifetime (78 years) to 1 μg of the chemical per cubic meter of inhaled air.

potentially carcinogenic substance in air. In this assessment, we assumed a 20-year length of employment at the business. Cancer calculations typically assume a 24-hour exposure time, seven days per week, so our assumptions are conservative (as we did not time-adjust values in our cancer risk calculations).

Excess cancer risks associated with exposure to PCE, and TCE at this site were calculated as follows:

$$\text{Calculated possible cancer risk (individual contaminant)} = EF \times \text{Chronic Daily Dose} \times IUR$$

Where,

- EF = Exposure Factor, an expression of how often and how long a person may be contacting a substance in the environment
- Chronic Daily Dose = Amount of contaminant inhaled daily on a chronic basis per kilogram body weight
- IUR = Inhalation Unit Risk Factor

Because both PCE and TCE are separately carcinogenic, the potential for additive cancer risk exists in co-exposure scenarios. Therefore, the excess cancer risk for simultaneous exposure to PCE and TCE was determined as follows:

$$\text{Calculated possible cancer risk (combined contaminants)} = \text{TECR} = \sum \text{CRX}$$

Where,

- TECR = Total excess cancer risk
- $\sum \text{CRX}$ = Sum of possible cancer risks from individual contaminants

The resulting risk of cancer is called an excess cancer risk because it is the risk of cancer above the already existing background risk of cancer. The excess risk could also be zero. Therefore, one interprets the excess cancer risk as being between 0 and some number for every defined number of people (usually for every 10,000, 100,000, or 1,000,000 people) who are exposed to a contaminant or contaminants over their lifetime (78 years). According to the National Cancer Institute, the background risk of cancer in the U.S. population is about 1 in every 2 men and 1 in every 3 women over a lifetime (ACS, 2016). The estimated cancer risk from the equations above is in addition to this background cancer risk.

If the TECR equals 1 in 10,000 exposed or less (e.g., 1 in 100,000 or 1 in a 1,000,000) then the cancer risk is considered very low or insignificant. If the TECR is greater than 1 in 10,000 exposed (e.g., 1 in 1,000 or 1 in a 100) then that population may be at increased cancer risk. It is important to note that a cancer risk greater than 1 in 10,000 does not necessarily mean that exposed individuals will develop cancer. The calculated excess cancer risk for an employee at Fashion City is considered very low, at 3 excess cancer cases for every 1,000,000 people, assuming an employment duration of 20 years at the business (Appendix Table 1).

Uncertainties

Indoor air levels can vary greatly due to meteorological factors such as temperature, barometric pressure, precipitation, ground cover by snow, and wind direction. As a result, data collected from the building reflect a snapshot in time, which may not be reflective of levels experienced every day in the building. Furthermore, only two air samples were analyzed for PCE and TCE. Performing an assessment of

exposure and risk with only two data points introduces additional uncertainty factors. Our analysis of the potential risk could also be affected by other uncertainties, such as:

- The assumptions made on employment time for the cancer risk calculation. We assumed employees work at Fashion City for eight hours per day, five days per week for a maximum of 20 years. These assumptions may overestimate the cancer risk if the employees work part-time shifts or work at Fashion City for less than 20 years.
- The possibility that the levels of contaminants in the building decrease when occupants and customers open the doors.

Conclusions

Results of our evaluation indicate that the measured air concentrations of PCE and TCE at Fashion City should not present a health risk to the general population. However, pregnant women and women who may become pregnant should consider working less than 8-hours per day, 5-days per week at Fashion City to minimize inhalation exposure to TCE (a known developmental toxicant).

Recommendations

1. Occupants should avoid any additional exposures to PCE or TCE from other sources. We recommend storing chemicals and cleaning agents in a designated chemical safety cabinet, and appropriately discarding VOC-containing products that are no longer needed.
2. Pregnant women and women who may become pregnant should consider working less than 8-hours per day, 5-days per week.
3. If not already done, install a ventilation system to mitigate exposure to PCE and TCE. If a ventilation system is already installed, ensure that it is being properly maintained.
4. If possible, DEC and EPHP should perform and review additional air sampling data to reduce uncertainty. In the event additional data is made available, EPHP may make additional recommendations to protect human health.

Please feel free to contact us with any questions that you may have.

Sincerely,



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Appendix

Table 1. Concentration Data and Health Calculation Results for PCE and TCE.

	CV	Time Adjusted MRL	IUR	Norgetown Cleaners/Fashion City		
	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$) ⁻¹	Concentration ($\mu\text{g}/\text{m}^3$)	Non-cancer Hazard Quotient	Cancer 20 Year Employment
PCE (Showroom)	41.4	173.7	2.6E-07	65	0.37	1.04E-06
PCE (Storage room)	41.4	173.7	2.6E-07	100	0.58	1.60E-6
TCE (Showroom)	2.2	9.2, 8*	4.1E-06	7.9	0.86, 0.99	1.99E-06
TCE (North Restroom and Storage room)	2.2	9.2, 8*	4.1E-06	6.3	0.69, 0.79	1.55E-06
					Total Cancer Risk (Showroom)	3.02E-06
					Total Cancer Risk (Storage Room)	3.18E-06

CV = Comparison Value. Comparison values are all Minimum Risk Levels for chronic exposure set by the Agency for Toxics and Disease Registry.

Time Adjusted MRL accounts for an employee spending 8-hours per day, 5 days per week, rather than 24-hours per day, seven days per week in the building.

*EPA Region 9 Interim TCE Indoor Air Response Action Level for commercial/industrial 8-hour workday scenario.

Hazard Quotient = Concentration of contaminant ($\mu\text{g}/\text{m}^3$) /Time Adjusted MRL ($\mu\text{g}/\text{m}^3$)

IUR = Inhalation Unit Risk Factor