Evaluation of Volatile Organic Compounds Air Samples Collected Near Boulevard Cleaners

BOULEVARD CLEANERS
HAMPTON, VA

Letter Health Consultation

November 13, 2023

Virginia Department of Health
Office of Environmental Health Services
109 Governor Street
Richmond, Virginia 23219

COMMONWEALTH of VIRGINIA
Department of Health

Karen Shelton, MD
State Health Commissioner

P O BOX 2448
RICHMOND, VA 23218

TTY 7-1-1 OR
1-800-828-1120

November 13, 2023

Laura Casillas
1650 Arch Street
Philadelphia, PA 19103

Dear Laura Casillas,

Thank you for the opportunity to review the 2021 environmental sampling data collected near the former Boulevard Cleaners site in Hampton, VA for public health implications. Under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) the Virginia Department of Health (VDH) has finished reviewing the data. VDH concludes that the concentrations of volatile organic compounds (*cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, and trichloroethene) evaluated in 2012 as potential indoor air site-related contaminants are not a health hazard. VDH concludes that chronic exposure (24 hours/7 days a week over decades) to carbon tetrachloride and chloroform indoor air concentrations at the reported concentration in 2021 may be a health hazard; however, the source is unknown. VDH recommends sharing this consultation with the occupants of the sampled property.

BACKGROUND

The former Boulevard Cleaners site is in a residential neighborhood at 2519 Kecoughtan Road, Hampton, Virginia, 23661. Boulevard Cleaners operated as a dry-cleaning business from 1941 to 2000. From 2000 to May 2009, the front portion of the facility served as a dry-cleaning drop-off and pick-up location. Various dry-cleaning solvents, including tetrachloroethylene (PCE) and trichloroethylene (TCE), were routinely used by the dry-cleaning business. The Boulevard Cleaners building was demolished in the fall of 2011. In the surrounding neighborhood, EPA investigated the extent to which TCE, PCE, and vinyl chloride (VC) contamination exists in the air, shallow groundwater, and subsurface soils. In 2012, VDH was asked to evaluate the environmental data to determine if the chemical contamination posed a public health risk to nearby residents and future employees or patrons of the redeveloped property.

Summary of environmental data reviewed in the 2012 letter health consultation

The environmental data reviewed by VDH in 2012 included soil, groundwater, indoor air, and sub-slab vapor samples. Contaminant environmental concentrations assessed included *cis*-1,2-dichloroethene (*cis-1,2 DCE)*, *trans*-1,2-dichloroethene (*trans*-1,2 DCE), PCE, TCE, and VC, and were sampled in 2009, 2011, and 2012:

- Soil sampling was done in nine locations in 2009, 17 locations in 2011, and nine locations in 2012. Soil sampling results from 2012 show that only methylene chloride was detected in soil on site after contaminated soil was removed and replaced with uncontaminated soil.
- Groundwater sampling was done in nine locations in 2009, nine locations in 2011, and ten locations in 2012. The contaminants include *cis*-1,2-DCE, *trans*-1,2- DCE, PCE, TCE, and VC. PCE and TCE were chemicals identified in groundwater that potentially pose a health risk to any future structure or building built on site.
- Indoor air and sub-slab vapor samples were collected from a nearby home in 2011 and 2012. PCE and TCE were not detected in the indoor air. PCE was detected in sub-slab samples.

In 2012 VDH calculated the VOCs in indoor air concentration from shallow groundwater VOC concentrations. VDH calculated the indoor air concentration of *cis*-1,2-DCE, *trans*-1,2-DCE, methylene chloride, PCE, toluene, and TCE. At that time VDH concluded that VOCs in soil and groundwater were not a health hazard. VDH also concluded that the potential for vapor intrusion exists for any building constructed on site and for homes and buildings in the direction of the contaminated groundwater plume. To that end, VDH stated that actual indoor air concentrations would be necessary to make any health conclusions to residents of homes above the plume. Additional site background, sampling results, and demographics can be found in the 2012 Health Consultation.

2021 air sampling results

Indoor air samples were collected in a home adjacent to the site. See Table 1 for reported air concentrations. Samples were collected using EPA Method TO-15 in the first-floor bedroom, family room, and in the crawlspace of the basement. Certified-clean 6-liter SUMMA canisters were used to collect samples at an approximate height of 4 feet from the floor over a 24-hour period. A photoionization detector instrument was used to check the residence for any VOC sources such as aerosol insect repellants, air fresheners, bleach, detergents, and cleaning supplies. These items were removed prior to sample collection. Two outdoor samples were collected over a 24-hour period using 6-liter SUMMA canisters.

TABLE 1. 2021 Indoor and outdoor air sampling data (µg/m^3)

Compound	Family Room	Basement*	Bedroom	Front yard	Backyard*	Comparison Value	Type
Ethanol	-	245	1620	999	942	1,900,000	PEL
Chloromethane	4.34	2	1.47	1.05	1.38	62	$EMEG_c$
Ethyl acetate	-	-	-	2.66	-	1,400,000	PEL
Isopropyl alcohol	13.3	3.44	13.3	79.2	69.6	980,000	PEL
Acetone	-	26.6	42.5	29	41.8	590,000	PEL
Methylene chloride	-	52.8	50.7	8.34	58.7	63	CREG
2-Butanone	1.86	2.21	1.74	1.89	3.83	5,000	RMEG
Carbon tetrachloride	**0.44**	**0.44**	**0.44**	**0.38**	**0.31**	0.17	CREG
Chloroform	**5.86**	**3.32**	**13.2**	-	-	0.043	CREG
Trichloroethene		-	-	-	0.21	-	-
Toluene	7.91	3.66	6.41	2.71	2.6	3,800	$EMEG_c$
Tetrachloroethene	0.34	0.34	0.34	0.47	2.03	3.8	CREG
Hexane		19	18.7	2.78	21.9	700	RMEG

*Highest reported value used. PEL-permissible exposure limit, $EMEG_c$-environmental media exposure guideline (chronic), CREG-cancer risk evaluation guideline, RMEG-reference media evaluation guideline.

DISCUSSION

VDH determines if the concentration of chemicals in environmental samples is of potential concern by comparing them to comparison values (CV). CVs are conservative environmental contaminant concentrations calculated from health-based values developed by the Agency for Toxic Substances and Disease Registry (ATSDR), EPA, and other federal or state agencies. They are used to screen environmental results and determine if further analysis is needed. If a contaminant's concentration exceeds the comparison value then it is selected for further evaluation. Contaminants found in concentrations below their CV are not evaluated.

Comparison values used to screen contaminants at Boulevard Cleaners are listed below. ATSDR defines the CVs as follows:

- ATSDR's Reference Dose Media Evaluation Guides (RMEGs)

  ATSDR derives RMEGs from EPA's oral reference doses, which are developed based on EPA evaluations. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse non-carcinogenic effects.

- ATSDR's Environmental Media Evaluation Guides (EMEGs)

  EMEGs are estimated contaminant concentrations that are not expected to result in adverse non-carcinogenic health effects based on ATSDR evaluation. EMEGs are based on ATSDR MRLs and conservative assumptions about exposure, such as intake rate, exposure frequency and duration, and body weight.

- ATSDR's Cancer Risk Evaluation Guides (CREGs)

  CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). ATSDR's CREGs are calculated from EPA's cancer slope factors for oral exposures or unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure.

- Occupational Safety and Health Administration Permissible Exposure Level (PEL)

  PEL is an 8-hour time-weighted average level of exposure established as the highest level of exposure an employee may be exposed to without incurring the risk of adverse health effects.

The indoor air concentrations of VOCs collected in 2021 were below their health-based CVs. This included *cis*-1,2- DCE, *trans*-1,2- DCE, PCE, TCE, methylene chloride, and toluene which were considered a potential concern in 2012. Only carbon tetrachloride and chloroform indoor air concentrations exceeded their respective CV in the recent round of samples. However, neither of these two contaminants are known to be site related.

Carbon tetrachloride and chloroform

Based on the percent detections reported in studies, carbon tetrachloride and chloroform are among the most frequently detected VOCs in indoor air due to background.[1] Outdoor measurements in several areas of the United States have reported average concentrations of carbon tetrachloride in air between 0.6 and 1.0 µg/m^3 (0.1-0.16 ppb). Typical indoor concentrations in homes in several U.S. cities were about 1.0 µg/m^3 (0.16 ppb), with some values up to 9 µg/m^3 (1.4 ppb). Indoor concentrations may be higher than in outdoor air because of the presence of carbon tetrachloride in building materials or household products.[2] Typical median indoor air concentrations of chloroform range from ≈0.2 to 4 ppb. The highest reported indoor air concentration sampled in the home was 13.2 ug/m^3 (2.7 ppb).[3]

Indoor sources that may emit VOCs include consumer products (e.g., cleaners, solvents, strippers, polish, adhesives, water repellants, lubricants, air fresheners, aerosols, mothballs, scented candles, insect repellants, plastic products); building materials (e.g., carpet, insulation, paint, wood finishing products); combustion processes (e.g., smoking, cooking, home heating); fuels in attached garages; dry-cleaned clothing or draperies; municipal tap water; swimming pools (treated with chlorine); or occupant activities (e.g., craft hobbies). Some chemicals may originate from several sources simultaneously. The presence of these indoor and outdoor "background" sources of VOCs can often make it challenging to assess the contribution of vapor intrusion to indoor air concentrations.

[1] https://www.epa.gov/vaporintrusion/background-indoor-air-concentrations-volatile-organic-compounds-north-american Last accessed October 2023.
[2] ATSDR Carbon Tetrachloride Tox Profile (cdc.gov) Last accessed October 2023.
[3] ATSDR Chloroform Tox Profile (cdc.gov) Last accessed October 2023.

CONCLUSIONS

VDH concludes that the indoor air concentrations of volatile organic compounds (*cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, and trichloroethene) sampled in 2021 are not a health hazard.

VDH concludes that chronic exposure to the indoor air concentrations of carbon tetrachloride and chloroform sampled in 2021 may be a health hazard.

VDH concludes that the indoor air concentrations of carbon tetrachloride and chloroform are consistent with residential indoor air concentrations in household studies.

RECOMMENDATION

VDH recommends that the EPA discuss with the occupant potential sources of carbon tetrachloride and chloroform in the homes and best practices to reduce exposure to them.

Authors

Dwight Flammia, Ph.D.
State Public Health Toxicologist
Office of Environmental Health Services
Virginia Department of Health
109 Governor Street Room 616
Richmond, VA 23219

Amy Hayes, Ph.D.
Health Assessor
Office of Environmental Health Services
Virginia Department of Health
109 Governor Street Room 615
Richmond, VA 23219

This publication was made possible by a cooperative agreement [program # TS-23-0001] from the Agency for Toxic Substances and Disease Registry (ATSDR). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the ATSDR, or the U.S. Department of Health and Human Services.