

VINYL CHLORIDE AND HEALTH FAQ DOCUMENT

05/31/2023

Public health and other assisting & cooperating agencies supporting Unified Command involved in the response to the East Palestine train derailment have provided this document as an additional source of information regarding vinyl chloride exposure and detection using medical testing. Questions and concerns about vinyl chloride exposure have led residents to have independent testing of their urine, blood, breath, and tissue sampled.

This FAQ document aims to share information that is both easily understood, and technical for those who are interested.

Information is provided in response to several frequently asked questions by residents. In addition, a section that follows, in the “[Let’s Get Technical](#)” box, provides more scientific information.

Anyone with urgent concerns about their potential exposure to chemicals can call the East Palestine derailment specific poison-control hotline at 1-877-603-0170 (select #2 for PA residents).

What is vinyl chloride?

Vinyl chloride is a colorless gas with a mild or sweet odor. It is flammable and burns easily. Vinyl chloride decomposes upon burning and produces carbon monoxide, hydrogen chloride, carbon dioxide, and phosgene. **Since the evacuation order was lifted, vinyl chloride in the community has not been found sustained¹ at or above the intermediate screening level (0.05 mg/m³) in air which is designed to protect public health.** The intermediate screening level represents an estimate of the daily human exposure to a contaminant that is not expected to cause non-cancer health effects over an exposure duration of 15 to 364 days. The intermediate screening value is used (as opposed to a higher acute screening value) because the derailment incident occurred in early February 2023, and we are now more than 14 days past that time.

Let’s Get Technical...

Vinyl chloride is also known as chloroethane, chloroethylene, and ethylene monochloride. Most vinyl chloride is used to make polyvinyl chloride (PVC) plastic and vinyl products that is in many products such as floor coverings, children’s toys, and cars. Air inside new cars may contain low levels of vinyl chloride because it may outgas from the new plastic parts. Drinking water may contain low levels of vinyl chloride released from contact with PVC pipes. Intermediate exposure to vinyl chloride over a long duration may cause liver effects, such as fatty liver or liver cell hypertrophy (increased size of liver cells). A public health protective screening level for liver effects from intermediate exposure to vinyl chloride in air is 0.05 mg/m³ (0.02 ppm or 20 ppb). Ingestion of vinyl chloride is unlikely because it is a gas at room temperature. Small amounts can dissolve in other liquids, but in such small concentrations that acute toxicity is unlikely.

Information on the toxicity of vinyl chloride comes primarily from scientific literature on occupational worker studies and inhalation studies in animals, with similar health effects being exhibited in all species tested.

¹ The term “sustained” means that the chemical compound remains in the area for a longer period of time (several minutes or longer).

Results from occupational studies, and inhalation and oral animal studies identified liver damage, such as fatty liver or liver cell hypertrophy (increased size of liver cells), as the most sensitive health effects from inhaling (breathing) vinyl chloride for an intermediate inhalation exposure time period of 15 to 364 days. Occupational studies do not have dose-response data to calculate a screening value.

The intermediate vinyl chloride screening level of 0.05 milligram per cubic meter (mg/m^3) [0.02 parts per million (ppm)] is based on an increased incidence of liver cell hypertrophy in female rats exposed to vinyl chloride for 16–19 weeks.

Remember, the intermediate vinyl chloride screening level of 0.05 mg/m^3 (0.02 ppm or 20 ppb) is protective of public health because inhalation exposure to vinyl chloride concentrations below the screening value are not expected to cause health effect in people and does not pose a public health hazard. Therefore, the East Palestine area vinyl chloride concentrations in outdoor air below the screening guidelines are not expected to result in adverse health effects.

What are the short-term effects of vinyl chloride exposure?

Again, vinyl chloride in the community has not been found sustained at or above the intermediate screening level (0.05 mg/m^3) which is designed to protect public health. In addition, vinyl chloride air concentrations in the community did not exceed the **acute screening value of 1.3 mg/m^3 (0.5 ppm or 500 ppb)** which is designed to protect public health.

Acute (short-term exposures less than 14 days) exposure to high levels (8,000-25,000 ppm) of vinyl chloride through inhalation (breathing in) may impact the central nervous system (CNS), and cause you to feel dizzy or sleepy, and at very high levels can cause you to pass out. Vinyl chloride is reported to be slightly irritating to the eyes and respiratory tract. It is unknown what concentrations may cause these symptoms in some individuals, but the symptoms are expected to be short-lasting once exposure ends. Acute exposure to extremely high levels (greater than 100,000 ppm) of vinyl chloride may cause lung and kidney irritation, and a stopping or slowing of blood clotting. It is important to emphasize that all data available indicates exposure to high or extremely high levels of vinyl chloride did not occur as part of this incident.

Let's Get Technical...

The scientific literature on acute inhalation animal studies of mice, rats, and rabbits indicates a developmental endpoint of delayed ossification (bone development) of skull and sternum in fetuses as the most sensitive toxic effects following inhaling (breathing) vinyl chloride for an acute inhalation exposure time period of 1 to 15 days. However, vinyl chloride air concentrations in the community did not exceed the acute screening value of 1.3 mg/m^3 (0.5 ppm or 500 ppb) which is designed to protect public health. Therefore, East Palestine area vinyl chloride concentrations in the air are below the acute screening value and are not expected to result in adverse health effects.

What are the potential long-term effects of vinyl chloride?

Based on the sampling and monitoring data collected to date, long-term (chronic) effects from vinyl chloride exposure are not expected due to current and predicted concentrations present within the community. Previous published studies have shown that some people exposed through their employment to high levels of vinyl chloride for several years had decreased liver function. Cases of individuals who routinely work with vinyl

chloride show that repeated exposure can lead to immune system deficiencies and nerve damage. Some workers exposed to very high levels of vinyl chloride have problems with blood flow in their hands, which causes their fingers to turn white and are painful when exposed to cold temperatures. Workers exposed to extremely high levels (greater than 250 ppm over their work-lifetime) have also developed a specific type of liver cancer known as angiosarcoma.

Let's Get Technical...

During the initial derailment and vent and burn, it is likely that vinyl chloride levels in the air were highest but would have been of relatively short duration (several days) and likely below the acute screening value of 1300 µg/m³ or 500 ppb, except potentially near the railroad. The acute screening value is higher than the intermediate value due to the shorter period of exposure for the acute screening level, from initial exposure up to 14 days. Although no exposure to hazardous substances is the ideal situation, for many chemicals toxicologists generally determine that a shorter period of exposure allows for a higher concentration of a chemical in air that should be protective of public health.

Can vinyl chloride cause cancer?

Vinyl chloride has been classified by the U.S. Department of Health and Human Services (HHS), the US Environmental Protection Agency (EPA), and the International Agency for Research on Cancer (IARC) as a known human carcinogen, meaning it can cause cancer. Continuous lifetime exposure² to low levels of vinyl chloride can increase an individual's risk of [developing liver cancer, as well as other cancers](#).

Should I get my blood or urine tested for vinyl chloride?

We have heard residents' concerns about potential exposure to vinyl chloride. At low levels of exposure, most of the vinyl chloride that you breathe, or swallow enters your blood rapidly, then is eliminated from your body in your urine within 24-48 hours. Available medical lab tests do not accurately assess inhalation exposure to vinyl chloride at levels present in the East Palestine community setting from this incident, or this long after the incident. These medical lab tests cannot give useful or reliable information as to the source of vinyl chloride, where one was exposed to vinyl chloride, or for how long they were exposed to vinyl chloride. Therefore, public health agencies do not currently recommend blood or urine testing for vinyl chloride to determine if individuals were exposed to vinyl chloride in a community setting.

Let's Get Technical...

EPA air monitoring data results show vinyl chloride below levels of health concerns, which means it would not be expected for exposures that would result in long-term health concerns. Lab tests are available that can measure vinyl chloride or its metabolites (break-down substances of vinyl chloride after vinyl chloride goes through the liver) in your blood, breath, urine, skin, and internal organs. However, these tests are not useful for measuring exposure to low levels of vinyl chloride concentrations in the air. The tests may show if you have been exposed to vinyl chloride, but they cannot tell you if you will be sick, or the sources of the vinyl chloride, or how long you were exposed. People's exposure to airborne vinyl chloride is not the only way they can absorb and metabolize thiodiglycolic acid. The same metabolite can result from eating, breathing-in, drinking and then digesting other chemicals. Therefore, public health and medical professionals do not recommend vinyl chloride

² Continuous lifetime exposure assumes exposure for 24 hours a day, 7 days a week, throughout adulthood or from birth through adulthood.

tests in the community setting unless there is a recent (within 24 hours) very high occupational-type inhalation exposure. In such situations, one's exhaled breath would be sampled for vinyl chloride, whereas vinyl chloride metabolites are tested for in urine and blood.

If I get a urine test for vinyl chloride, what does that indicate?

Urine tests do not analyze for vinyl chlorides. Urine tests measure the level of thiodiglycolic acid—a break-down product of vinyl chloride. This test does not reliably indicate exposure to vinyl chloride. There are several other sources of thiodiglycolic acid in urine, including some chemicals, foods, and medications (See a list of common items listed below). Thiodiglycolic acid levels are expected in almost everyone and reflects exposure from all sources in the environment. It is not currently known what level of thiodiglycolic acid in urine may be related to the development of specific health outcomes. In addition, there is no recommended medical treatment for people with elevated levels of thiodiglycolic acid.

Let's Get Technical...

Several residents expressed that they have received positive results for vinyl chloride in their urine. However, urine tests do not analyze for the vinyl chloride compound. Instead, urine is tested for the metabolites of vinyl chloride. This is because vinyl chloride is very quickly (typically within 24 hours) metabolized by the body and excreted in urine, particularly if the exposure to vinyl chloride was below the intermediate screening level and of short duration. As part of natural biological processes, metabolites are excreted and can be detected in urine. These metabolites have different chemical structures than the primary chemical compound. Primary metabolites of vinyl chloride include thiodiglycolic acid, also known as thiodiacetic acid, and N-acetyl-S-(2-hydroxyethyl)-cysteine, also known as 2-hydroxyethyl mercapturic acid (HEMA). Whether you are exposed to vinyl chloride from inhalation or ingestion, the metabolism process is the same.

It is important to note, the metabolites that can be detected in urine for vinyl chloride are **not specific** to vinyl chloride (meaning exposure to other chemicals can also cause these metabolites to be detected in urine) and can be present in urine from many other chemicals, food, and/or water exposures. Additionally, vinyl chloride is metabolized into these new chemicals within approximately 24 hours and excreted from the body; this means that a positive urine test result for thiodiglycolic acid likely indicates a more recent exposure.

What else can cause urine to test positive for metabolites associated with vinyl chloride?

Thiodiglycolic acid and/or HEMA is commonly found in general populations who have not been exposed to vinyl chloride. Some sources can include:

- Certain foods including raw onions, meat, poultry, and seafood.
- Some medications, including Zyrtec, and vitamins, such as B12 and folates.
- Alcoholic beverages.
- Smoke, including from wood fireplaces, cooking, and cigarettes.
- Some household products including paints and varnishes.
- Chemicals used in the workplace

Let's Get Technical...

The same metabolite, thiodiglycolic acid, can result from eating, inhaling, drinking and then metabolizing other chemicals. Potential sources of these chemicals include, but are not limited to:

- Food, since thiodiglycolic acid is present in a wide variety of meat and poultry, or seafood that is contaminated with some chemicals, such as [bis\(2-chloroethoxy\)methane \(CEM\)](#)
- Public drinking water disinfected with a certain class of chemicals ([haloacetic acids](#) such as monochloroacetic acid);
- Disposable products with elastomers or plastics, medications, or industrial sources (e.g., acrylonitrile, ifosfamide, 2-chloroacetaldehyde);
- Indoor smoke including from wood fireplaces, kitchens, and cigarettes;
- Home and cleaning products including paint, lacquers, and varnishes;
- Indoor environments containing certain construction materials, furnishings, and office equipment; and
- Industrial sources including manufacturing plastics, specific types of facility emissions and solvent evaporation.

The metabolite N-acetyl-S-(2-hydroxyethyl)-cysteine, also known as 2-hydroxyethyl mercapturic acid (HEMA) can be detected in urine after eating, drinking, inhaling and then metabolizing other chemicals. [HEMA](#) is a urine metabolite included in the National Health and Nutrition Examination Survey (NHANES) program. NHANES is a survey that combines interviews with physical examinations to assess the health and nutritional status of children and adults in the United States. HEMA is included as a urine metabolite of acrylonitrile, ethylene oxide, and vinyl chloride. From the NHANES dataset, HEMA is detected at significantly higher levels in smokers than non-smokers because of the HEMA-producing chemicals present [in tobacco smoke \(Calafat et al., 1999\)](#). HEMA has been detected in urine of children and adults, male and female, from NHANES participants 2005-2006, 2011-2018, which were the years this biomarker was included in the survey. Creatinine-corrected urine concentrations of HEMA, provided as micrograms of HEMA per gram of creatinine, for NHANES participants 2005-2006, 2011-2018 are shown below:

- Total population: 95% of the general population at or below 6.38 µg HEMA/g creatinine
- Males: 95% of males at or below 4.90 µg HEMA/g creatinine
- Females: 95% of females at or below 7.35 µg HEMA/g creatinine
- For more specific results of urine N-Acetyl-S-(2-hydroxyethyl)-L-cysteine broken down by age, race, and study years, click the link [here](#)

Potential chemicals or sources include but are not limited to:

- Tobacco smoke
- [Ethylene oxide](#) – chemical used for sterilization of medical devices and equipment at sterilization facilities and medical facilities, sterilization of spices and seasonings, and as a pesticide; ethylene oxide is produced when tobacco is burned and naturally produced by the body during breakdown of ethylene.
- [Ethylene dibromide](#) – also known as [1,2-dibromoethane](#), is a chemical used historically as an additive in leaded gasoline and as a fumigant for grain crops, citrus, and vegetables and on turf and golf courses (but has since been banned since 1984 for use on soil or grains). Currently it is used as a chemical intermediate for the production of resins, waxes, gums, and dyes and as a pesticide for felled logs.

- [Acrylonitrile](#) – exposure likely from occupational sources where acrylonitrile is used in the manufacturing of acrylic fibers, plastics, rubbers, and resins.

What if I have additional, ongoing health concerns?

For more information about vinyl chloride exposure and health recommendations, please refer to [ATSDR's Vinyl Chloride ToxGuide](#).

If you have any questions or concerns about your personal health related to derailment impacts, please contact local health professionals to assist you in understanding and taking appropriate action if necessary.

Ohio Residents:

Visit the East Palestine Clinic at 139 North Walnut Street, East Palestine or call 330-383-6020 to make an appointment.

The clinic is:

- Open Monday to Friday 9 a.m. - 5 p.m.
- Free for those without insurance coverage
- Available to any residents with concerns
- Providing comprehensive primary care (treatment, prescriptions, lab testing, consultation with specialists and referrals if needed)
- Staffed by physicians, registered nurses, and mental health professionals

Pennsylvania Residents:

Call the Department of Health Hotline 877-PA-HEALTH to connect with a nurse and find appropriate local health care services. For more information, please access the [Train Derailment FAQ](#).

In addition, if you have urgent concerns, there is an East Palestine derailment specific poison-control hotline. call 1-877-603-0170 (select #2 for PA residents). If you feel you are having a medical emergency, call 9-1-1 immediately.

Where can I get more information about the progress of the East Palestine cleanup actions?

For more information about site progress and efforts to protect public health and the environment, please visit [EPA's website](#).

Residents can also contact EPA at its Welcome Center at 330-775-6517 or stop by at 25 N. Market Street in East Palestine. Please visit the website above for current hours of operation.