Vinyl Chloride

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Vinyl chloride is known also as chloroethene, chloroethylene, ethylene monochloride, or monochloroethylene. Vinyl chloride is a manufactured substance that does not occur naturally. At room temperature, it is a colorless gas, it burns easily, and it is not stable at high temperatures. Vinyl chloride exists in liquid form if kept under high pressure or at low temperatures. Vinyl chloride has a mild, sweet odor [ATSDR].

Usage and exposure:

Most of the vinyl chloride produced in the United States is used to make a polymer called polyvinyl chloride (PVC), which consists of long repeating units of vinyl chloride. PVC is used to make a variety of plastic products including pipes, wire and cable coatings, and packaging materials. Other uses include furniture and automobile upholstery, wall coverings, housewares, and automotive parts. At one time, vinyl chloride was used as a coolant, as a propellant in spray cans, and in some cosmetics. However, since the mid-1970s, vinyl chloride mostly has been used in the manufacture of PVC [ATSDR]

The largest use of PVC is in the production of plastic piping [IARC].

Routs of exposure:

The main route of occupational exposure to vinyl chloride is by inhalation, which occurs primarily in vinyl chloride/PVC plants and in PVC-processing plants [IARC].

Vinyl chloride exposure in humans is most likely to occur by inhalation or oral exposure routes. Effects from dermal exposures are unlikely, as vinyl chloride is not well absorbed across the skin [ATSDR]**.**

Pulmonary absorption of vinyl chloride in humans appears to be rapid and the percentage absorbed is independent of the concentration inhaled [IARC].

Target organ:

The liver is the most sensitive target organ for vinyl chloride toxicity [ATSDR].

Health hazards:

Acute exposure of humans to high levels of vinyl chloride via inhalation has resulted in effects on the CNS, such as dizziness, drowsiness, headaches, and giddiness. Vinyl chloride is reported to be slightly irritating to the eyes and respiratory tract in humans. Acute exposure to extremely high levels of vinyl chloride has caused loss of consciousness, lung and kidney irritation, and inhibition of blood clotting in humans [EPA].

Chronic-duration, occupational exposures to high levels of vinyl chloride have resulted in a specific suite of effects in humans, including narcotic effects, Raynaud's phenomenon (blanching and numbness of fingers and discomfort experienced upon exposure to cold temperatures), acroosteolysis, scleroderma-like skin changes, hepatocellular alterations, and the development of hepatic angiosarcoma, a liver cancer [ATSDR].

Neurological effects of vinyl chloride have been observed following inhalation exposures. No data were available for neurological effects resulting from oral exposures. Inhalation-related neurological effects in humans include dizziness, drowsiness and fatigue, headache, euphoria and irritability, nervousness and sleep disturbances, nausea, visual and hearing disturbances, and loss of consciousness. Signs of pyramidal and cerebellar disturbances have also been observed. Dizziness has been also reported by volunteers acutely exposed to 8,000 ppm, while nausea and subsequent headache resulted from exposures of 20,000 ppm. Peripheral neurological effects have been reported, including parasthesia, tingling or warmth in the extremities, numbness or pain in the fingers, and depressed reflexes. Chronic-duration exposures resulted in damaged nerve tissue, including degeneration of brain tissue and fibrosis of peripheral nerve endings.

There is compelling evidence that exposure to vinyl chloride is associated with angiosarcoma of the liver, and strong evidence that it is associated with hepatocellular carcinoma. There is strong evidence that the carcinogenicity of vinyl chloride operates by a genotoxic mechanism that involves metabolic

activation to reactive metabolites, binding of the metabolites to DNA, promutagenic action of these adducts leading to mutations in proto-oncogenes and tumour-suppressor genes. Many of these key events identified in experimental animals have also been demonstrated in humans.

Vinyl chloride is carcinogenic to humans (Group 1) [IARC].

References:

- ATSDR. Agency for Toxic Substances & Disease Registry. Toxicological profile for vinyl chloride. https://www.atsdr.cdc.gov/toxprofiles/tp20.pdf
- EPA. Environmental Protection Agency. Vinyl chloride Hazard Summary. https://www.epa.gov/sites/production/files/2016-09/documents/vinyl-chloride.pdf
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