



A Division of The Society of The Plastics Industry, Inc.

- ★ Data indicate VCM risks to workers have been virtually eliminated.
- ★ Data have revealed no community health risks from VCM.
- ★ PVC production process "a classic case of waste minimization."

Environmental Profile: Facts About the Safe Manufacture of PVC

The manufacture of PVC, like most other chemical processes, is closely regulated to minimize its impact on human health and the environment. All air and water emissions resulting from the process are regulated by the U.S. EPA and all companies that manufacture PVC or its feedstock, vinyl chloride monomer (VCM), must report their compliance with these standards. The U.S. EPA has estimated that the industry's VCM emissions have been reduced by over 99 percent since new workplace standards were introduced in the 1970s.

Revised Procedures Safeguard Environment, Workers

Like almost all manufacturing processes, the production of PVC (polyvinyl chloride) involves the use of materials that can be hazardous if improperly handled. In day-to-day operations, however, the PVC industry has amassed an outstanding record of safe operation. Today, the entire PVC production process is essentially a closed one, with most activities taking place within closed vessels.

Not only does this maximize production efficiencies, it also reduces environmental emissions and minimizes potential worker exposure to VCM.

In the 1970s, a link was made between extremely high, prolonged exposure levels to VCM among PVC production workers and a rare form of liver cancer, angiosarcoma. Angiosarcoma has also been linked to thorium dioxide given medically, arsenic given medically and perhaps, to the use of anabolic steroids. Approximately 180 VCM-related angiosarcoma cases have been recorded worldwide since the link with exposure to VCM was made — all in VCM/PVC plant workers. This includes 44 cases in the U.S. However, over half of the U.S. cases were identified between 1973 and 1980.¹ The number has dropped significantly since then, and is expected to continue to drop due to extensive revisions that were made in the PVC production process after the problem was identified. Not one case of angiosarcoma has been identified in any vinyl production worker whose work history began after the introduction of revised processing technology in the late 1970s.²

In 1977, a study of more than 15,000 workers in PVC fabrication plants (plants that convert PVC resin or compound into finished products) found no evidence of VCM-related health effects in that group.³

CTL032742

-more-

Monitoring Workplace Exposure

Today, all PVC production facilities in the U.S. continually monitor workers to track any health problems that might be associated with the production process. No hazard, other than those typically associated with an industrial process, has been identified.

The U.S. Occupational Safety and Health Administration oversees all workplace standards related to PVC production. Since 1975, OSHA has set an eight-hour time weighted average VCM occupational exposure limit of 1 ppm (part per million). OSHA standards for working with VCM also:

- restrict entry to any work area where exposures are above 0.5 ppm.
- require medical exams and maintenance of exposure records for specified employees.
- identify and require the use of acceptable respirators in restricted areas.
- require monitoring and alarm systems for the workplace, and routine measurement of worker exposure.
- mandate labels and signage in specified areas and on all containers used to ship and store VCM and materials with any significant VCM concentration.
- require safety training programs for employees.

Reducing Environmental Emissions

The U.S. Environmental Protection Agency regulates the release of many chemicals, including VCM, under several statutes: the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, and the Resource Conservation and Recovery Act. The 1976 EPA standard for VCM ensures that the annual average ambient air concentration within five miles of a ethylene dichloride (EDC), VCM or PVC manufacturing plant does not exceed 1 ppb (part per billion) and also:

- requires "fugitive" emission controls on pumps, compressors and other equipment.
- sets work practices for opening specific equipment.
- limits the amount of "residual" VCM in resin and wastewater.
- reduces emissions from specific points in the production process to 10 ppm.
- prohibits discharges from "relief" valves, except for emergencies, and requires reports on all such emergency releases.
- mandates extensive monitoring, reporting and recordkeeping.

The EPA has set a goal of zero for VCM in drinking water, and has established a maximum contaminant level of 2 ppb. (Two parts per billion are equivalent to one inch in 8,000 miles.)

Assessing Community Risk

Since the 1970s, individual manufacturing plants have conducted monitoring of surrounding communities to identify potential health threats to nearby residents resulting from the PVC production process. Several independent studies have also been undertaken to detect an association between angiosarcoma in the general population and exposure to VCM, as well as correlations between exposure and other types of cancer. These include studies conducted by the U.S. Center for Disease Control and specific reviews conducted in the state of New York, Wisconsin, Great Britain, Sweden, Holland and Canada.⁴ In no case could a correlation be found. Representatives of the U.S. EPA have further stated that the agency has been unable to establish a link between living near a VCM/PVC plant and angiosarcoma.

-more-

Based on chance alone, or due to factors other than VCM exposure, research has shown that there is likely to be one case of angiosarcoma about every two years among the five million individuals who live within five miles of a VCM/PVC production facility.⁵ However, there is no confirmed case on record in which a member of the general population has been harmed by exposure to VCM, and the actual risk among the five million individuals presumed to live within five miles of a VCM or PVC production facility has been calculated to be less than 0.1 case of cancer in the next 70 years. This compares with the risk of smoking 1.4 cigarettes; drinking one-half liter of wine; traveling 10 miles by bicycle, 300 miles by car or 1,000 miles by jet; or having one chest X-ray.⁶ No other community health problem has been linked with any validity to the presence of PVC or VCM production facilities.

Production Process A Model of Resource Conservation

In 1992, an independent consulting firm, Chem Systems, of Tarrytown, New York, conducted a lifecycle assessment of several vinyl products. Among other results, Chem Systems characterized the manufacture of VCM as a "classic case of waste minimization," since virtually all material used to make VCM is recycled back into the process.⁷ Solid wastes created by the PVC production process, as well as air and water emissions, are regulated by the U.S. EPA. Industry-wide, those totals are decreasing as individual plants improve their environmental controls, recycle more material back into their own production processes, and reduce accidental discharges to air and water. Additional material is recycled via resale to other industries, which use the by-products as raw materials for their own production processes.

¹"World Register of Cases of Angiosarcoma of the Liver (ASL) Due to VCM," 1993 edition. Published by the Association of Plastics Manufacturers of Europe.

²Industry records.

³Chiazze et al 1977, 1980.

⁴H. Popper et al, American Journal of Pathology, 92, 349; 1978.

H. Falk et al, Environmental Health Prospect, 41, 107; 1981.

J. Brady et al, Journal of the National Cancer Institute, 59, 1383; 1977.

J. Flechner et al, Morbidity, Mortality Weekly Report, Center for Disease Control, 25, 57; 1976.

P.J. Baxter et al, Br. Med J., II, 919; 1977. Updated in the Br. J. Ind. Medicine, 37, 213; 1980.

M. Saric et al, Environment, Health Perspective, 17, 189; 1976.

C. G. Ellinder and O. Pershagen, "Pilot Study Concerning the Mortality in Njurunda Community," Swedish Nature Conservancy Board, April 1978.

L. M. Dalderup et al, Lancet, I, 246; 1976. Also, Journal of Occupational Medicine, 17, 285; 1975.

H. Inura, Proceeds of the Air Environment Specialty Conference, Pittsburgh, 1976, page 96.

⁵J. Brady et al, Journal of the National Cancer Institute, 59, 1383; 1977. Also C.W. Heath and P.S. Landrigan, Hemangiosarcoma of the Liver, Connecticut Public Health Service, Center for Disease Control, Report EPI 74-104-2; 10/9/74.

⁶R. Wilson, "Analyzing the Risks of Life," Technology Review, 81(4), 1979.

⁷"Vinyl Products Lifecycle Assessment," Chem Systems, Inc., Tarrytown, New York, March 1992.