

Vinyl Chloride

Job Health Hazard Series

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Endangered Workers

Most job health hazards—such as lead, mercury, and silica—have been recognized for decades or centuries. But vinyl chloride, a gas used in the production of more than half of today's plastic products, has only recently been shown to be highly dangerous.

Until January 1974, the gas was generally considered of low toxicity. Then it was found to cause a rare form of cancer of the liver—angiosarcoma—which cannot be diagnosed until it is incurable.

Vinyl chloride (VC), which has always been handled with relative care, since it is both explosive and highly flammable, is the basic ingredient in making polyvinyl chloride (PVC).

PVC is all around us. The chances are you ride to work on a vinyl seat, walk across vinyl-tiled floors on PVC-soled shoes, eat sandwiches wrapped in PVC from a vinyl tablecloth, relax to the sound of PVC records. Infants suck on PVC pacifiers.

Although studies are continuing in both government and private laboratories, no one has yet discovered any danger in these finished products. By the time the plastics reach this stage, most of the vinyl chloride has been chemically locked into the PVC and will not come out again.

The danger comes during the production process. Three basic steps are necessary to the production of vinyl products. First the vinyl chloride, or "monomer," is produced in a closed process, usually involving a reaction between ethylene and chlorine.

The VC monomer is shipped as a compressed, liquefied gas to plants that produce the PVC resin. Batches of VC are "polymerized" by mixing them with catalysts in giant vats or reactors.

After drying, the PVC resins are compounded by the addition of stabilizers, lubricants, and plasticizers. Before being shipped to fabrication plants, the resin may be converted to pellets, powders, pastes, or film.

The fabrication end of the PVC industry covers a huge range of processes in which the PVC is turned into its myriad of finished products.

In the United States there are 15 monomer plants employing about 1,000 workers, 36 PVC plants with 5,600 workers, and some 7,500 fabrication plants with about 350,000 employees. At each stage there are certain potential trouble spots where the VC gas may escape into the air and reach the workers.

Both monomer and polymerization plants face the problems of random leaks from pump seals, compressors, valves, gaskets, and storage tanks. Both must also deal with reducing the amount of the gas that escapes during quality control sampling. During loading or unloading of the monomer, tank car workers may be exposed to high concentrations in the air.

Because of the danger from fire and explosion, the plants are usually spread over sites of several acres, with the result that the VC gas is not confined to small areas, but often can be found in low levels throughout the plant.

Most plants that produce the basic monomer are open-air operations and generally have lower concentrations of gas in the air than polymerization plants.

The highest exposures in the entire industry apparently are those experienced by the workers who climb into the polymerization vats or reactors to chip out the PVC residue. In the past, these cleaners were surrounded by concentrations as high as 1,600 parts of VC per million parts of air; exposure levels for reactor cleaners still may reach 500 parts per million (ppm). Fourteen of the 16 men who have died from VC-related angiosarcoma in the United States had, at one time or another, been vat cleaners.

By the time the PVC reaches the fabricating plant, the danger is the small amount of VC gas that was not chemically locked into the PVC. These may leak out of the PVC in processing or handling. The fabrication procedures that hold the most potential for exposure involve mixing and heating the resin, as in extruding PVC around an electrical wire. The heat may drive off any remaining gas into the workplace air.

What It Can Do to You

In addition to the danger of angiosarcoma of the liver, recent studies of workers exposed to VC show that they have higher than normal rates of cancer of the lung, brain, and bone marrow. Suicide rates were found to be twice normal in one study of 161 workers in a Kentucky plant.

Vinyl chloride's attacks are slow; the cancers, for example, may not show any symptoms until 15 years after the beginning of a worker's exposure.