

# Health Hazards: Vinyl-Chloride Risk Was Known By Many People Even Before the First Deaths

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its allowance of averaging—nevertheless falls short of the "no detectable" limit advocated by unions, many medical experts and such groups as the National Institute for Occupational Safety and Health, and the American Chemical Society. This no-detectable limit would have constant, not average, adherence to one-part-per-million levels. Therefore, it seems certain that the argument won't abate.

As the controversy continues, it is revealing to examine how the link between vinyl chloride and cancer was established. If nothing else, such an examination points out the grave weaknesses of the present system—or lack thereof—of protecting workers and others from industrial hazards.

The judgment is made in hindsight, but the history of vinyl chloride shows that evidence of its toxicity was often ignored. What's more, the chemical companies knew, but kept secret for at least six months, the fact that Italian researchers had shown that rats develop tumors, including angiosarcoma, when exposed to low levels of vinyl chloride monomer. European companies, which paid for the animal research, knew of this research for more than a year before the first human cases were reported but didn't reduce the exposure of their workers to vinyl chloride.

But Dr. Irving J. Selkoff, an expert on environmental carcinogens, or cancer-causing agents, claims that blame shouldn't be placed at industry's door alone. "We're all a bit responsible," he says. "None of us did our homework." Culpability, he says, should be shared by scientists, government agencies and labor unions.

The case of Earl Parks is illustrative. Mr. Parks first came to the attention of Goodrich medical people in 1964, when the company, concerned about the known liver toxicity of ethylene dichloride (a chemical from which vinyl chloride is made) tested the liver function of workers in the Louisville plant.

Mr. Parks's readings were abnormal. Nevertheless, he continued to work at the same job. In October 1964, however, he was hospitalized with what was initially diagnosed as a bleeding ulcer. Doctors treated the "ulcer" without surgery, and Mr. Parks was released.

He was readmitted to the hospital the following May, and the decision was made to operate. But when the operation was begun, surgeons, instead of finding an ulcer, found instead that Mr. Parks's problem resulted from severe liver damage, which had caused blood to back up in the portal vein leading into the liver. The surgeons corrected the vein problem with a shunt and took a sample of liver tissue for analysis. The analysis showed that the liver had been damaged by exposure to "chemicals."

(According to testimony at OSHA's hearings on vinyl chloride, held last June and July, Mr. Parks received a total of almost \$6,000 in workman's compensation from Goodrich before he died, but only after Goodrich protested that his illness couldn't have resulted from exposure to the chemical.)

It was an alert Louisville doctor

disease called acroosteolysis among vinyl-chloride workers. The disease consists of skin lesions and changes in the blood vessels, leading to degeneration of the bones at the tips of the fingers and toes in those exposed to high levels of the monomer. (Emissions of vinyl chloride are generally lower at plants where the monomer, or gas, is made, since the process is less complex, and there is less chance for leaks than at the polymerization plants; none of the reported angiosarcoma cases in this country has occurred among workers making vinyl-chloride monomer, and only one of the 10 deaths in Europe was in a monomer plant.)

In early 1967, the Manufacturing Chemists Association arranged with the University of Michigan to study acroosteolysis among vinyl-chloride workers, particularly those who cleaned the reactor vessels and others who were exposed to large concentrations of vinyl chloride in the air. The Michigan scientists reported in 1970 that although they couldn't pinpoint vinyl chloride as the cause of the disease, worker exposure to the monomer should be cut to 50 parts per million or below.

Other than Dow, which had already instituted reductions in air levels of the monomer, the rest of the industry in the U.S. ignored the recommendation. Nor was there any significant reaction to findings by European industry that animals developed adverse effects from vinyl chloride. This was at least partly because the Europeans downgraded the importance of some of their findings. For example, Prof. Pier Luigi Viola, a medical director, employed in Italy by Solvay & Cie., the Belgian chemicals company, found bone changes in rats exposed to air levels of 30,000 parts per million of vinyl chloride; even more important, he found that vinyl chloride at that level caused malignant tumors in the ear canals, lungs and bones of rats.

Prof. Viola reported his findings before an international cancer congress in Houston in 1970. It was the first reported link between cancer and vinyl chloride. But the professor expressed doubt about the purity of the vinyl-chloride gas he had used and stated that the rat cancer findings, because they occurred at such high levels of the monomer, had no human implications.

(Prof. Viola subsequently found tumors in rats exposed to 500 parts per million; but this fact wasn't revealed until well after the first human angiosarcoma cases were revealed.)

The Research Goes On... Based on Prof. Viola's early cancer findings in rats, Montedison S.p.A., the huge Italian chemicals company, in 1970 asked Cesare Maltoni, a respected researcher at the Institute of Oncology in Bologna, Italy, to do more extensive animal studies. By October 1972, Prof. Maltoni says, he had found that 250 parts per million of vinyl chloride produced tumors in rats in three parts of the body: the ear canals, kidneys and the liver. The liver tumors included angiosar-

coma. The professor immediately informed his sponsors.

The Europeans offered their information to the Manufacturing Chemists' Association in the U.S., but only if the Americans guaranteed confidentiality. With great reluctance, the association says, it finally agreed to the secrecy condition "because of the vital importance of learning of any indications from the European research... without the delays which could have resulted from duplication of effort."

On Jan. 30, 1973, a year before the first human angiosarcoma cases were reported by B. F. Goodrich, the MCA finally got the Maltoni data. For five months, the secrecy restrictions were such that government agencies, PVC workers exposed to vinyl chloride and even company doctors were kept in the dark. Then, in the late spring, the Europeans agreed that the chemists' association could pass the information on to the U.S. National Institute for Occupational Safety and Health, the Labor Department agency that monitors worker safety. On July 17, 1973, representatives of the association and the agency met.

## One Certainty

There is some dispute as to what transpired at the meeting. The Labor Department agency claims it wasn't given the full story; the chemists' association claims that the agency misunderstood the findings. But one thing is certain: The agency, and OSHA, made no move to change the standard of 500 parts per million and didn't do so until after the human angiosarcoma cases were announced. In Europe, by contrast, Great Britain had lowered the maximum level to 200 parts per million following the cases of acroosteolysis in the '60s; and West Germany had set a level of 100 parts per million in 1970, based on Dow's 1961 results with animals. According to New Scientist, the British science journal, "No other section of the U.S. or European industry followed Dow's lead. The reasons for this international confusion are obscure."

This all changed quickly, of course, once the first human cases of angiosarcoma were reported by Goodrich. Indeed, the swiftness with which new research has been carried out since Jan. 23 is perhaps without precedent in the world of medicine and science.

Much of this recent research is concerned with studies of the incidence of all types of cancer among vinyl-chloride workers. Thus far, some studies show that workers exposed to high levels of vinyl chloride show greater than expected incidences not only of angiosarcoma but certain other cancers as well. The ramifications of these findings for the future of the industry and its workers remain to be seen. However, for the veteran PVC workers, whatever changes the findings produce will be useless in counteracting the insidious effects of working day after day, year after year, in what now is generally viewed as a contaminated atmosphere.

## Sharp Drop in Vinyl Chloride Exposure

By [illegible]