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Vinyl Chloride and Cancer

By John Saar

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BEFORE IT WAS identified earlier this year as the carcinogenic killer of 12 industrial workers, vinyl chloride was accepted as a cheap and almost innocuous gas with a variety of uses. Pressurized into consumer-sale aerosol cans, it served as the propellant for insecticides and hairsprays; as the base ingredient in a common plastic—polyvinyl chloride (PVC)—it is omnipresent of everyday life as bottles, pipes, wrapping, car upholstery, photograph records and sundry other products.

With dramatic speed over these last few months, our understanding of the apparently compliant slave gas has been unpleasantly changed. Unmasked by an Italian research chemist, it now stands convicted in the deaths by a rare and invariably fatal liver cancer of the 12 plastics workers in the last 13 years.

Now—in the words of one researcher—it “casts a long shadow” over the lives of many thousands of workers in second-echelon, plastic-using industries. And if the lethal qualities of vinyl chloride have been overlooked by the manufacturers, just how justified is the consumers’ reliance on that most commonly used artificial material—plastic?

The already proven relationship between vinyl chloride and angiosarcoma—a liver cancer which generally kills an average of only 21 persons a year in the United States—is the latest of the chemical time bombs to threaten our industrial workers and, if the forebodings of some researchers are borne out, it may be worst.

That suspicion is under high priority investigation by at least seven governmental and medical research groups—an effort one involved expert in environmental health calls “unprecedented in both scope and intensity.”

“Potent Carcinogen”

“VINYL CHLORIDE,” added Dr. Irving Selikoff, a professor of medicine at the Mount Sinai School of Medicine, New York and director of the Environmental Sciences Laboratory there, “is a very potent carcinogen in the center of our great chemical process industry and a product used throughout society and industry.”

Dr. Joseph A. Wagoner, working 13-hour days to direct another key investigation for the National Institute for

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Occupational Safety and Health (NIOSH), calls vinyl chloride “one of, if not the most potent carcinogens.”

With the dangers of vinyl chloride established in the grimmiest fashion by death certificates, researches are pressing with unusual urgency for some answers to a whole spectrum of far-reaching question. They want to know exactly what the health risks are for approximately 6,500 people who work in 37 plants where vinyl chloride is polymerized into polyvinyl chloride.

Beyond that, there is an urgent need to establish the hazards, if any, for the tens of thousands of other workers who fashion the raw PVC into products and for the public at large which uses them.

Other agencies engaged in active research are the National Institute for Environmental Health, the Environmental Protection Agency, the National Cancer Institute, Environmental Protection Administration for the City of New York and the Center for Disease Control, Atlanta.

The investigations are far from complete, but under the gun of a continuing health hazard of uncertain proportions, scientists will discuss their interim findings at an international conference May 10 organized by the New York Academy of Sciences.

That link is now just about as certain as the relationship between the tubercle bacillus and the etiology of tuberculosis, according to Selikoff: “I don’t think there’s any doubt of a firm, strong association between angiosarcoma and vinyl chloride exposure,” he said.

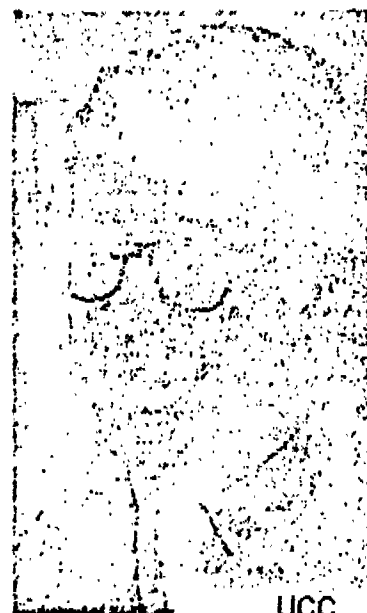
Problems Found

EXPERTS HERE expect reports from American and European scientists to further substantiate the link between vinyl chloride and angiosarcoma and to predict a potential death exposed workers.

Two months ago, Dr. Selikoff took a 50-strong team of medical personnel to the Niagara Falls, N.Y., plant where 400 men make polyvinyl chloride for Goodyear. He is unwilling yet to detail results of the mass clinical screening conducted there, but commented: “We have found problems there. We have found vinyl chloride-associated disease.”

The vinyl chloride hazard has been exposed at a quickening pace over the last few months as animal researchers found that mice and rats dosed with the chemical developed angiosarcoma and medical researchers found evidence of the same rare tumor among plastics workers.

As the evidence hardened, government agencies have drastically changed legislation regarding vinyl chloride. Some of the pressure for changes stemmed from the alarming



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Dr. Sidney Wolfe: “Injection . . . may be fatal.”

results of internal research programs. More in the form of petitions, dozens of phone calls and disclosure actions came from the feisty, guiding of a Ralph Nader-funded Health Research

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In mid-January, U.F. Goodrich announced the death of three long-term employees at the Louisville polyvinyl chloride plant with the significant addendum that the company was investigating whether the deaths "were related to occupational causes."

Since then, 94 consumer products containing vinyl chloride have been either voluntarily withdrawn by manufacturers or banned from sale by the EPA and FDA. These included 41 aerosol pesticides for household use, 28 home and professional hairsprays, 13 deodorants and anti-perspirants.

The radical change in attitude toward the colorless gas is reflected in Department of Labor regulations on the exposure of industrial workers. Previous regulations limiting workers to 500 parts per million were based on avoiding combustible concentrations and toxic levels sufficient to cause dizziness and nausea. A new emergency standard limiting exposure to 50 parts per million is now in force and the Occupational and Safety Health Administration (OSHA) plans to seek a permanent standard of no measurable level.

Though their studies are incomplete, the researchers are sure enough about vinyl chloride to express a uniform consternation at the idea of workers being exposed to levels as relatively low as 50 ppm. "I don't think it's adequate," said Selikoff. "It would be foolhardy to say this lower level is safe. If cancer occurs at higher levels, it will occur at lower levels, though less frequently."

'It's Heartbreaking!'

THE PERCEPTION of vinyl chloride as dangerous in any amount leads to a depressing comparison with the levels accepted as reasonable by the chemical industry as late as January this year. Vinyl chloride readings declared by the companies themselves ranged in ordinary production from 20-100 ppm. But occasional very high readings were admitted. The plastics division of Uniroyal at Painesville, Ohio, for instance, told NIOSH researchers that workers sealing the vessels in which PVC is made were briefly exposed to levels as high as 1,600 ppm. When told that, Selikoff exclaimed, "It's heartbreaking!"

With responsibility for governing vinyl chloride use falling between the overlapping jurisdictions of several federal agencies — all adjusting at differing speeds to new knowledge on the gas — some important gaps still exist.

Vinyl chloride production is estimated at 7 billion pounds a year and it is still being transported by rail and highway under dangerously outdated hazard rules. On April 14 a freight train derailed and dumped a tank car of vinyl chloride on a Philadelphia expressway. Dr. Waggoner broke from his work in Cincinnati to place telephone calls to the Pennsylvania Poison Center and the Penn Central Railway. Neither knew they were dealing with a proven cancer-causing agent. In the past three years, eight spillage incidents have been reported.

The Health Research Group, partially responsible for persuading the EPA to

ban sales of inside insecticides, is now pushing the agency to seize all outdoor vinyl chloride aerosols with the logical argument that on present knowledge any further consumer exposure is intolerable.

Emergency Revision

THE RECENT history of vinyl chloride shows a fascinating better-late-than-never pattern of scientific initiative and governmental response as society staged a hurried retreat from a chemical regarded as relatively benign since it was first manufactured in 1939.

Jan. 20, Dr. Joseph A. Waggoner director of NIOSH's field investigation division begins, with "a sense of national urgency," an epidemiological study of four long-established PVC manufacturing plants. At this time the research is going full-force, occupying 18 out of 32 people on his staff. One branch has shut down work on every other project to handle the vinyl chloride emergency.

In mid-February, Italian scientist Prof. Cesare Maltoni told a hurriedly assembled OSHA hearing that two out of 67 rats subjected to daily dosages of vinyl chloride developed angiosarcomas. At a very high level of 6,000 parts per million, 11 out of 72 rats developed the rare tumors. However, the bombshell in Maltoni's findings that led to an immediate emergency revision of the industrial atmospheric levels then standing at 500 ppm was the statement that some rats developed the tumors at 250 ppm.

Feb. 14, EPA forms a task force under Glenn Schweitzer to assess overall health and environmental risks associated with vinyl chloride and PVC. On April 10, he directs EPA's 10 regional offices to test the water, air and solid waste emissions from at least one plant using vinyl chloride to make PVC.

Feb. 21, the HRG petitioned the FDA to ban and name cosmetics employing vinyl chloride as a propellant on the basis of "well-documented carcinogenicity." A similar petition went to EPA Administrator Russell Train, calling for suspension of vinyl chloride products regulated by the EPA.

March 23, Responding to the HRG petition on pesticides, the EPA states they have no listing of products containing vinyl chloride and are sending a warning letter to all 35,000 pesticide manufacturers suggesting the substitution of another gas.

March 26, The Health Research Group — unsuccessful in persuading Clairol to withdraw vinyl chloride-powered hairsprays from the market — takes the dispute to the FDA in a letter to the administrator Dr. Alexander N. Schmidt. The substance of the HRG's case was Clairol's admission that users of the sprays were exposed to 200 ppm for a one-minute duration. The HRG director, Dr. Sidney M. Wolfe, reproved the FDA: "Whereas this inaction by the FDA must be welcome and financially beneficial to Bristol-Myers and its Clairol subsidiary, it may be fatal to many unsuspecting citizens of this country."

April 3, The FDA announces action to end the use of vinyl chloride in products under its control. The order concerns three manufacturers and about 50 products. Calling the hazard to hairspray users "extremely remote," Clairol Inc. nevertheless announces the recall of 100,000 cans of Summer Blonde and Miss Clairol aerosol hair sprays.

April 5, In response to a March 11 recommendation from NIOSH that the acceptable industrial level should be zero, the Department of Labor announces an interim emergency level of 50 ppm.

April 17, The EPA identifies 20 products containing vinyl chloride, leaves 21 more unnamed pending manufacturers' approval of their publication.

April 19, EPA administrator Russell Train hears the result of some crucial experimentation by his own people. Under test, pesticides on public sale raised the vinyl chloride concentration in a small room such as a bathroom to 400 ppm in a 30-second burst. Without light or ventilation, the researchers reported to their chief, the concentration of gas diminished by only 1 per cent in a four-day period.

April 24, Citing those tests and the easy availability of substitute gases, Train signs an order banning all vinyl chloride products for indoor uses. The EPA administrator was doubtless also aware of some preliminary findings in a long-term study by the Manufacturing Chemists Association which disclosed tumors in mice at levels of only 50 ppm. The names of seven of the vinyl chloride products regulated by the EPA still have not been released.



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Gloomy Prediction

THE POSSIBLE significance of the 12 deaths currently associated with vinyl chloride-induced angiosarcoma for the 6,500 work force drew a gloomy prognostication from Dr. Sellikoff: "Twelve deaths may not sound many, but put it in this perspective. In the early 1950s there were maybe 1,000 workers in PVC plants. In the normal course of events something like 100-150 would have died. Twelve deaths out of 100-150 suggests a rate of 12 per cent."

Sellikoff's study of Goodyear's vinyl chloride operation included a trace on 98 per cent of all employees with five or more years service. To the company's discovery of one angiosarcoma death, Sellikoff's workers added the names of two others whose causes of death were misdiagnosed on death certificates. Researchers interviewed family doctors and hospital pathology departments and studied original pathology slides to verify the true cause of death as angiosarcoma.

Misdiagnosis owing to the rarity of the particular strain of cancer is also

troubling. Wagoner's NIOSH researchers: "Out of the 12 deaths so far confirmed, 33 per cent were misdiagnosed. One was classified as cirrhosis and another as a benign liver tumor." (The National Cancer Institute has taken the unprecedented action of opening a national registry of all angiosarcoma cases.)

Though Wagoner's primary concern is with the safety of industrial workers, the three questions he is trying to answer encompass far broader ramifications.

"We want to assess the magnitude of the risk — how many other cases are there? And secondly, whether other organs of the body are affected by vinyl chloride. I would suspect we should be looking at the lung as a target organ."

Wagoner's third area of investigation is the potential vulnerability of other industrial workers, and finally, the consumers. "We want to know how widespread exposure to vinyl chloride is in the making of PVC and in the variety of uses of PVC."

Casting the Net Wide

SO FAR, Wagoner's "walk-through" survey teams of doctors, engineers, biostatisticians and epidemiologists have studied and microfilmed personnel records at four plants. They have examined conditions under which vinyl chloride has been used and the likely exposure by leakage of the workers.

But the prime objective is a comprehensive study of mortality among workers at the plants. From a search of the microfilmed personnel records, the NIOSH researchers are establishing how many of the plants' past and present employees are dead, and what they died from. The net is cast wide to examine all fatalities because the Goodyear Company's own screening program at the Louisville plant disclosed 20 cases of liver abnormalities in addition to previously undiagnosed angiosarcoma in two workers.

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Cooperation by all peripherally involved in the NIOSH study has been excellent, Wagoner says. The Ohio State motor vehicle registry which is able to provide an initial check on whether former employees of an Ohio plant are alive has cut the response time from three months to three hours, and police scout cars have been offered to ferry materials.

The pressure is constant. "Everyone wants results," says Wagoner. "We are looking for long-term carcinogenic results, but at the moment we have more questions than answers."

When properly cured and aged, finished PVC is thought not to exude vinyl chloride fumes. This belief is being tested by NIOSH in experiments involving the placing of PVC pellets in closed chambers and measurement with sensitive devices. The extent of consumer hazard will depend on the as yet unknown frequency with which vinyl chloride "leaches" out of a host of everyday products.

NIOSH is now placing a contract for the full investigation of "leaching." Wagoner will say only, "We don't know what the full spectrum of disease is, but there are concerns for the consumer."

At the National Cancer Institute, where another major vinyl chloride research program is under way, and an angiosarcoma patient is undergoing chemotherapy and study Dr. Umberto Saffiotti associate director of carcinogenesis, considers the gas "a major potential hazard," and "a serious problem for consumers."

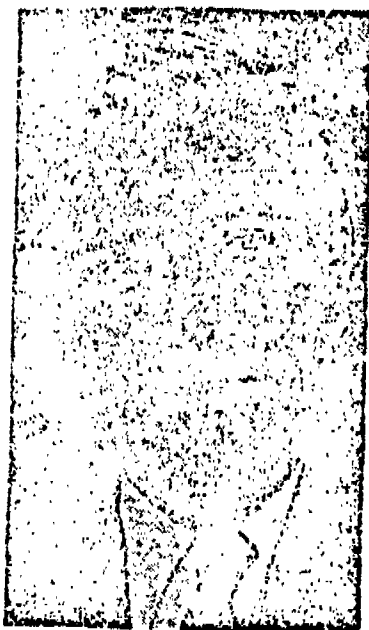
While the exposure of an individual consumer is lower than a vinyl chloride worker, an infinitely greater number of people are involved, he points out: "There may be millions of people involved and an incidence at a much lower rate in a large population may still be a substantial number of cancer cases."

HRG director Wolfe sees the known angiosarcoma deaths as the start of a series of cases and the best reason for reducing consumer exposure to vinyl chloride immediately.

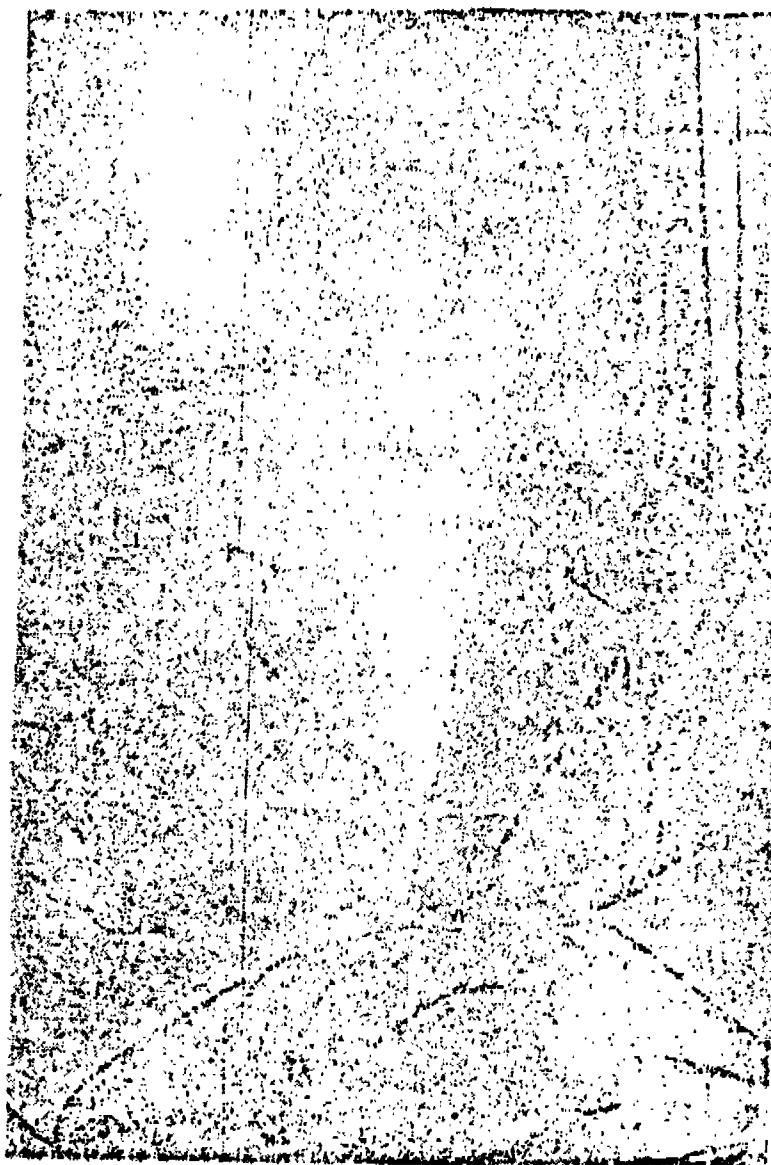
"We are now seeing people who got really high doses. In the next few years we may see beauticians exposed to doses not quite so high through hair sprays. A very few years later we may see consumers who just happened to be heavy aerosol users."



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*Russell Train: Bans indoor use of
vinyl chloride products.*



Dr. Irving Selikoff: "It's heartbreaking!"



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