BIO-MEDICAL RESEARCH
DOCUMENT DESCRIPTION FORM

Duplicate in all cards: →

63 68	69 76	77 78
1980	0000335	VC
year as-1961-	File number [Right justify [Numeric only]	Sub-Index Code

R&S 111774

Author(s), as Last Name FS (No Punctuation) and coden for journal as JAMA preceeded by one blank space

1 20	21 40	41 60	61 62
WIENER, F.	OSHA		11
			12
			13

Title of Report; end with space-hyphen-hyphen-space. Follow with Index Terms, separated from each other with comma-space. Avoid other punctuation; do not abbreviate.

1 2	61 62
	21
THE VINYL CHLORIDE THREAT AND THE RESPONSE OF GOVERNMENT, INDUSTRY AND LABOR	22
	23
	24

Source (Journal, Vol., Number, Pages, Date)

1 2 PROTECTING PEOPLE AT WORK (1980)	61 62
	31
	32

Brief Summary

1 2 10	61 62
SUMMARY:	61
	62
	63
	64

R&S 111775

From
J. TRAVIS SEAWELL

Dear Tork,

Here is the document of which we spoke during our telephone conversation.

"Debbie" is Deborah Sebastiani my former secretary in whose behalf I have worked toward her admission into graduate school - one good turn deserves another.

I called her in an effort to secure the date of publication of "Protecting People At Work". It has

been "recently published" and bears the date "1980" only.

The book may be ordered from the Supt. of Documents and has been assigned the Stock No.

029-015-00055-4

Best regards.

Joe

R&S 111776

The Vinyl Chloride Threat and the Response of Government, Industry and Labor

Frank Wiener

We just got to noticing that there was just too few of us young men . . . too many of us guys were getting out of this world too young.

Raymond P. Gettelfinger, Jr.
vinyl chloride worker
born: 1930 died: 1976
cause of death: angiosarcoma of the liver

We use it every time we place a phonograph record on a turntable. And relax on it when we are sitting in our cars. And walk on it in our kitchens. We use it to paint our homes, to pipe our water, to hose our lawns, to package our food and drugs, and to insulate the wires and cables that conduct our electricity. It is contained in the shoes we wear, the toys with which our children play, the tables on which we eat, the counters on which we are served, our clothing, and even the dentures in our mouths. The plastic products manufactured from vinyl chloride are everywhere.

In only 30 years, vinyl chloride has grown from a fireproofing product in fighter planes to a $65 billion-a-year way of life. Through a process called polymerization, vinyl chloride, a sweet-smelling gas consisting of ethylene and chlorine, is converted by pressure and heat into a white, powdery resin called polyvinyl chloride (PVC), the second most widely used plastic in the United States. More than 5 billion pounds of polyvinyl chloride are produced annually in the United States.

Vinyl chloride is also a carcinogen. It causes cancer in human beings.

As early as 1949, Russian scientists discovered that workers who processed polyvinyl chloride into finished products such as shoes and insulation suffered bronchial and liver defects. The researchers believed, however, that these injuries resulted from a plasticizer, polychlorinated biphenyl (PCB), in the compound, and not from PVC. Of 75 polyvinyl chloride workers examined in the Russian study, 18 had a liver condition that resembled hepatitis.

Other European studies in the 1950s showed that polyvinyl chloride workers were subject to skin lesions and circulatory disorders. As a result of these findings, the Manufacturing Chemists Association (MCA), an industry group composed of such giant corporations as Dow, Allied, Monsanto, and Union Carbide, in 1954 recommended that exposure levels

Vinyl chloride has been linked to cancers, lung obstructions, and reproductive damage among workers and their families. This worker is wearing a personal monitor to measure the level of vinyl chloride vapors at his worksite.
B.F. Goodrich Company

June 10, 1980

Dear Mr. Seawell:

The Department of Labor has recently published a book entitled "Protecting People at Work" which is a reader in Occupational Safety and Health. In reading the book, I came to the case studies and discovered there was a chapter on "The Vinyl Chloride Threat and the Response of Government, Industry and Labor" by a free-lance writer named Frank Wiener. I thought you would be most interested in reading it, if you haven't already, so I am enclosing a copy of the chapter.

All is well with me. I'm still waiting to hear if I've been accepted to Graduate School. I've been spending a lot of time in Salisbury visiting my parents as they'll be moving to California this fall. I hope all is well with you. Hope to get over to have lunch with you one of these days.

Take care,

Debbie

Debbie

R&S 111778

be limited to 500 parts of vinyl chloride per million parts of air (500 ppm).

The MCA standard was voluntary and was often ignored. Workers directly involved in the polymerization process unknowingly continued to be exposed to levels as high as 1,500 ppm. The deadly gas can be smelled only when it reaches the dangerous concentration of 2,000 ppm.

In 1961, Dow Chemical, one of the major producers of polyvinyl chloride, made a startling discovery. Laboratory animals exposed to 100 ppm of vinyl chloride had developed liver damage. The company immediately reduced worker exposure in its plants to 50 ppm. Unfortunately, the Dow findings, like the previous Russian and European studies, were generally ignored. Instead, the growing chemical industry continued to base its unofficial standards on the results of an earlier Yale University study which claimed that 500 ppm was a safe level.

During the 1960s, B.F. Goodrich workers who manually cleaned vinyl chloride reactors developed a bone disease called acroosteolysis, which caused their fingertips to degenerate. After a 3-year study, scientists at the University of Michigan recommended a 50 ppm ceiling for vinyl chloride exposure, but, once again, the recommendation for lower levels was ignored. In place of a restriction, Goodrich developed the Hydraulic Reactor Cleaner, a device which eliminated most of the polyvinyl chloride residue that remained in the reactors once the conversion was accomplished. This advancement was supposed to reduce the number of times workers were required to enter the vessels for cleaning and also reduced the time needed for each cleaning.

At an international cancer symposium in Houston during July 1970, Dr. P. Viola of Milan, Italy, released his dramatic finding that high levels of vinyl chloride in the air caused test animals to develop malignant tumors. In 1972, the American Conference of Governmental Industrial Hygienists lowered its standard to 200 ppm, although existing federal recommendations remained at an unofficial, unenforced 500 ppm.

In January 1973, Dr. Cesare Maltoni of the Italian Institute of Oncology in Bologna informed a visiting American delegation from the Manufacturing Chemists Association that he had found malignant tumors, including angiosarcoma, in the livers of rats exposed to levels of vinyl chloride as low as 250 ppm, half the unenforced U.S. standard in existence at the time. Maltoni's finding was the first scientific link between vinyl chloride and angiosarcoma, a rare form of liver cancer that is always fatal in human beings.

The Manufacturing Chemists Association agreed with the European vinyl chloride producers, co-sponsors of Maltoni's research, that the discovery should be kept confidential in order "to minimize unwarranted speculation." Although a briefing on the Maltoni study was held on July 17, 1973, between the MCA and a delegation from the National Institute for Occupational Safety and Health (NIOSH), the fatal link between vinyl chloride and angiosarcoma was not revealed to the NIOSH officials. Later, in testimony before a U.S. Senate subcommittee, Dr. Marcus Key, NIOSH director at the time of the briefing, claimed that the chemical industry had been "less than candid" about the European studies. In fact, it was not until 6 months after the briefing that the federal government finally learned what the American and European chemical industries had known for a year.

Once Maltoni made his morbid discovery, Goodrich privately began to respond in mid-1973 by quietly establishing a 50 ppm exposure ceiling and by initiating liver function tests for all employees involved in the manufacture of polyvinyl chloride. That spring, a Goodrich employee at the Louisville plant died of angiosarcoma. Linking this death to the recent Maltoni finding, Dr. John L. Creech, plant physician, discovered that 3 workers had died of angiosarcoma within the previous 2 years. He also noticed that all three of the stricken employees had worked cleaning the interiors of the reactor vessels that convert vinyl chloride gas into plastic. For extended periods of time, the victims had inhaled high levels of vinyl chloride gas left in the vessels.

The results of the Goodrich liver function tests confirmed Dr. Creech's fear. They revealed that 23 of 271 workers at the Louisville plant had abnormal livers, including 6 who had incurable angiosarcoma. Dr. Creech believed that the rare form of liver cancer was discovered first at the Louisville plant because it is one of the oldest polyvinyl chloride producers in the country, in operation since 1940, and therefore had exposed its workers to vinyl chloride longer than any other. The men whose deaths from angiosarcoma became known in 1974 had worked with vinyl chloride an average of 18 years before they developed the disease.

By no means was the vinyl chloride problem confined to the Louisville plant or to a rare form of liver cancer. In Niagara Falls, New York, Local 8-277 of the Oil, Chemical, and Atomic Workers International Union requested Dr. Irving Selikoff, director of environmental medicine at Mt. Sinai School of Medicine, to send a research team to examine the workers of the Goodrich plant there for any possible ill effects. Of 348 workers whose lung function was studied, 58 percent showed significant obstruction of the airways. This obstruction was found in a large percentage of non-smokers as well as smokers.

Even more frightening than the discovery of vinyl chloride as a carcinogen was the potential extent of the threat of this dangerous substance. In August 1974, Dr. Joseph Wagoner, director of field studies at NIOSH, announced that initial studies had found that death from liver cancer among workers exposed to large amounts of vinyl chloride occurred 12 times more frequently than would normally be expected. Some 6,500 workers in 51 American plants and even more in Europe are involved in the production of vinyl chloride (1,500 workers in 14 plants) and polyvinyl chloride (5,000 in 39 plants). In addition, tens of thousands of American workers participate in the conversion of these raw materials into countless finished products, not to mention the hundreds of millions of consumers in all industrialized societies who are exposed to these products daily.

Between 1961 and 1976, vinyl chloride was responsible for at least 48 deaths from angiosarcoma around the world. In 1974 alone, 15 cases of angiosarcoma had been discovered. Most of the victims worked for some time as reactor cleaners. However, others did not. Within weeks after the Louisville discovery, West German officials reported six cases of the disease among workers in a plant that manufactured finished polyvinyl chloride floor tiles. In Connecticut, health authorities documented the liver cancer deaths of two persons, one who only had handled finished polyvinyl chloride products, the other an accountant at the plant! These discoveries indicated the catastrophic possibility that angiosarcoma threatened the hundreds of thousands of workers who converted PVC into thousands of industrial and consumer products.

Even worse is the possible risk of angiosarcoma to the general public from the thousands of widely used consumer products made from polyvinyl chloride and from the 300 million pounds of vinyl chloride that is lost each year into the environment. For example, in January 1974, public alarm was aroused when a 62-year-old woman in Niagara Falls, New York, died from angiosarcoma. For nearly 30 years, she lived 4 blocks downwind from the Goodrich plant, which had manufactured polyvinyl chloride since 1946.

If the danger of vinyl chloride causing a rare form of liver cancer is not disturbing enough, there is growing evidence that the substance might cause both genetic damage and birth defects among workers and their families. Referring to recent lab tests in the United States and Sweden, Dr. Selikoff warned that vinyl chloride "may affect the strands of material that carry the continuity of the human race from generation to generation."

In 1975, Dr. Peter Infante of the Ohio Health Department underlined Selikoff's concern by reporting that birth defects were higher in three communities with PVC plants than the average for the state. Writing in the British journal, *The Lancet*, Infante revealed that the rate of stillbirths and miscarriages increased two to three times among the wives of vinyl chloride workers when compared to a control group whose husbands were not exposed to vinyl chloride. Other studies conducted by Ralph Nader's Health Research Group, NIOSH, and the Center for Disease Control confirmed a higher rate of miscarriages and stillbirths among wives of vinyl chloride workers, most likely because the chemical causes sperm cell damage in their husbands.

In addition to angiosarcoma and sperm cell damage, other health risks linked to vinyl chloride have been found. Dr. Wagoner of NIOSH also reported that a study of 352 deaths of vinyl chloride workers around the country showed that exposure to the substance might increase the risk of cancer in the respiratory system, the digestive system, the blood-forming tissues, the brain, and the central nervous system.

The plastic era—now about 35 years old—is just coming of age in terms of latent period for the onset of disease among exposed persons . . . The workers are the 'canaries.' They give us hints of what we might find in the population at large.

Dr. Irving Selikoff

Given the magnitude of the vinyl chloride threat to our society, how have the various sectors responded to such a serious

and complicated problem? Immediately responding to Dr. Creech's discovery in Louisville, teams from NIOSH, Goodrich, and the Manufacturing Chemists Association began intensive studies of thousands of vinyl chloride workers in order to determine the nature, extent, and cause of illness among them. The Occupational Safety and Health Administration declared an occupational health emergency, giving vinyl chloride the highest priority among known hazardous substances.

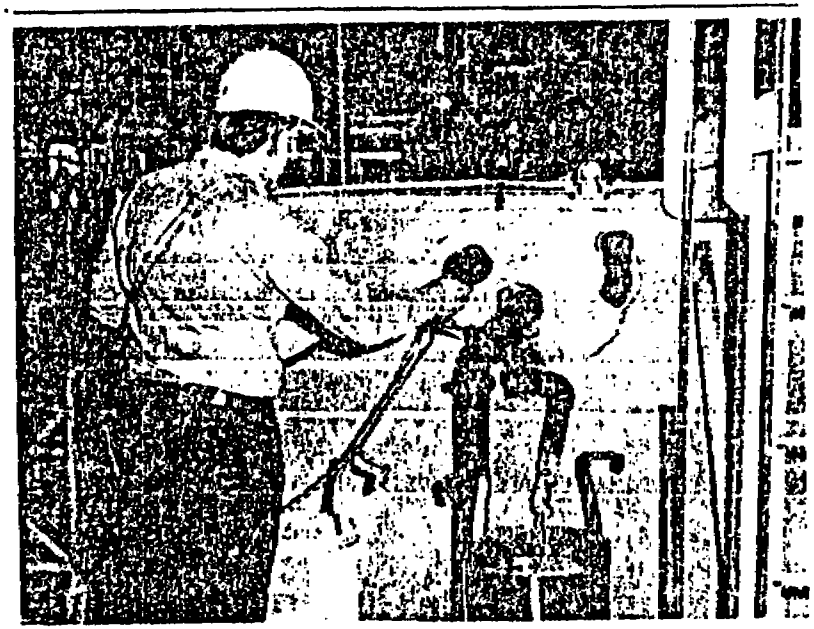
On April 5, 1974, OSHA established an emergency temporary ceiling prohibiting exposure levels of vinyl chloride greater than 50 ppm. Only 2 weeks later, an independent lab, Industrial Bio-Test, announced that 2 mice exposed to vinyl chloride levels of 50 ppm had developed angiosarcoma of the liver!

Without delay, OSHA proposed a permanent regulation on May 10 of "no detectable" worker exposure to vinyl chloride. The proposed regulation also would have required all workers in polymerization areas to wear self-contained breathing apparatus, and in some operations, completely impervious suits. Industry was quick to respond, almost unanimously, that OSHA's "no detectable level" standard could not be met.

Taking the skepticism of industry seriously, OSHA changed its "no detectable level" standard to a ceiling of 1 ppm on a time-weighted average for 8 hours, with a 5 ppm ceiling for 15-minute intervals. In place of the self-contained respirators, OSHA prescribed more practical respirators and face masks. Workers were required to wear the apparatus only if levels exceeded 25 ppm at any given time. Beginning on April 1, 1976, workers have been required to wear respirators for levels that exceed the 1 ppm regulation. At the conclusion of the permanent standard, OSHA clearly defined its purpose and its priorities:

We cannot wait until indisputable answers to these questions are available because lives of employees are at stake. Therefore, we have had to exercise our best judgment on the basis of the best available evidence. These judgments have required a balancing process in which the overriding consideration has been the protection of employees.

In addition to OSHA, at least three other regulatory agencies have responded to the harsh reality that vinyl chloride causes cancer in human beings. In 1973, the Food and Drug Administration banned the use of polyvinyl chloride liquor



Vinyl chloride regulations have changed since this photograph was taken in early 1974. Under OSHA's emergency temporary standard then in effect, this safety inspector checking for leaks near a reactor in a polyvinyl chloride plant was not required to wear protection, since vinyl chloride levels were apparently under 50 ppm. The meter on his portable analyzer appears to be registering about 30 ppm of vinyl chloride in the air. Under the current permanent standard, he would be required to wear an air-supplied respirator.

bottles when traces of vinyl chloride were found in the liquor. On August 28, 1975, the FDA proposed a ban on packaging food and drug items such as luncheon meats, salad dressing, vegetable oil, and mouthwash in rigid or semi-rigid polyvinyl chloride because the plastic has the potential for causing cancer.

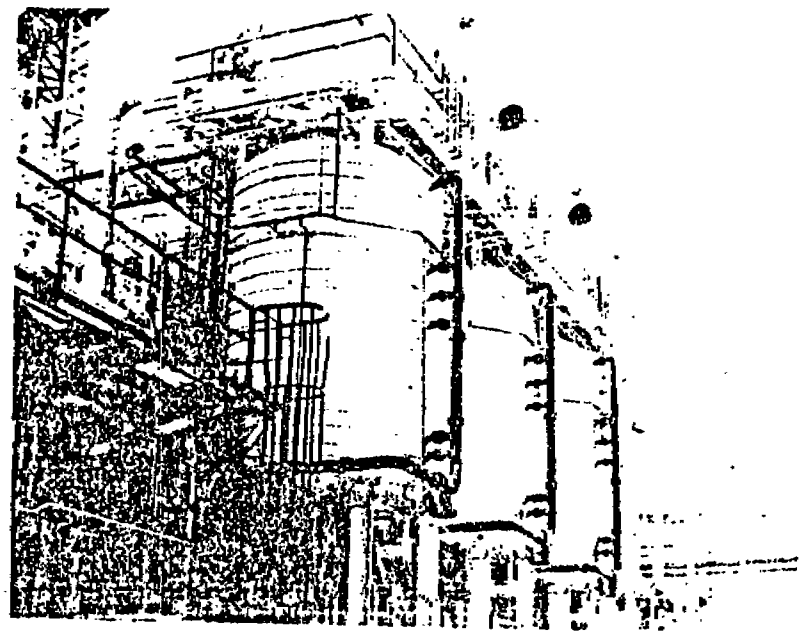
Acting on a petition by Nader's Health Research Group in April 1974, the FDA recalled a total of 49 products, mostly hair sprays, that contained vinyl chloride as an aerosol propellent. At approximately the same time, the EPA issued a rare emergency order to halt the sale of 28 pesticide sprays containing vinyl chloride.

In December 1975, the EPA proposed to cut by 90 percent the amount of cancer-causing vinyl chloride gas to which 1.6 million people are exposed in 58 different factory areas. Russell Train, EPA administrator, said the cost to plants that produce vinyl chloride, ethylene dichloride, and polyvinyl

chloride will total $198 million, with $70 million needed each year to maintain control. The plants would also be required to reduce the amount of vinyl chloride in water discharged at an added estimated cost of $83 million.

Even though the polyvinyl chloride industry delayed its response to the Maltoni findings for as long as a year, many large manufacturers did not hesitate in responding to Dr. Creech's discovery that vinyl chloride is a carcinogen. Goodrich's own corporate directive was to reduce the levels of vinyl chloride to "as low as possible as soon as possible." The company claimed to have launched in 1974 "the largest research, development, and engineering project in its history," involving $42 million over a 3-year period and more than 130 scientists and engineers. The development of reliable area monitoring systems and feasible respirators was especially problematic.

When OSHA announced its permanent regulation of "no detectable" worker exposure to vinyl chloride in 1975, the plastics industry responded that such a limitation was medically unnecessary, technologically infeasible, and would lead to the loss of as many as 2.2 million jobs. Dow Chemical, however, had already managed to reduce levels of vinyl chloride to 10 ppm even before the 50 ppm limit was terminated. But the industry continued to press for relaxation of the OSHA regulations, contending that plastics production in the United States would be forced to shut down, not only throwing millions out of work but causing sales losses as high as $65 to $90 billion.



B.F. Goodrich has developed new equipment and processes to reduce vinyl chloride emissions, such as this new polymerization reactor at its Louisville plant. *B.F. Goodrich Company*

The predictions of the plastics industry proved false. Instead of an industry-wide shutdown, there are at least four new vinyl chloride producers in existence since OSHA's "no detectable level" standard went into effect. The cost of industry compliance with the standard has been about $300 million, but the business continues to grow and grow. The price of plastic products to consumers did not rise nearly as much as industry predicted.

In early 1975, Goodrich announced that vinyl chloride in the work atmosphere at all of its plants had been reduced to 5 ppm. It reported the following technological developments in combating vinyl chloride exposure levels:

- It could produce PVC resins containing less than 1 ppm of residual vinyl chloride.
- Newly developed technology allowed for removing, recovering, and recycling nearly all vinyl chloride in the atmosphere.
- "Clean reactor" technology helped eliminate the need to enter reactors, except for maintenance. Respirators fed from external air protected workers upon entry to reactors.
- Leakages have been stemmed and new ventilation systems have been installed. New air-monitoring equipment has been purchased and measurements of the air are taken 24 hours a day.

By December 1975, Goodrich announced that it had succeeded in controlling worker exposure to vinyl chloride, reporting that levels in all plants averaged from 1 to 3 ppm. Although the company expects no new cases of angiosarcoma to develop since the levels were successfully reduced, officials predict that new cases of the disease will occur as a result of earlier worker exposure to high levels of vinyl chloride. The latent period between a victim's first exposure to vinyl chloride and the development of cancer can be as long as 30 years. Also in

1975, John D. Ong, President of Goodrich, believed that regulations on vinyl chloride exposure for workers who process PVC into finished products would not be required because the levels of unconverted vinyl chloride in the plastic resin (less than 1 ppm) were so low that exposure of those workers would be practically nil.

What has society gained from the tragic vinyl chloride affair? At least one expert, Dr. Selikoff, sees some benefit from the experience:

It was a success for science in having defined the problem; success for labor in the rapid mobilization of concern; success for government in urgently collecting data, evaluating it, and translating it into necessary regulations; and success for industry in preparing the necessary engineering controls to minimize or eliminate the hazard.

Despite these successes, however, many unresolved questions about vinyl chloride remain. Can workers be completely confident that they are now safe from such a potentially dangerous substance? Even if vinyl chloride is undetectable in finished products today, how can we be certain that levels will remain as low after the passing of time, under certain atmospheric or climatic conditions, and during certain chemical combinations or changes? Research has already found that the deadly gas not only causes angiosarcoma and sperm-cell damage but also increases the risk of cancer in other vital organs and systems. Why should anyone, least of all vinyl chloride workers, rest comfortably knowing that the finished products made from such a dangerous substance constantly surround us?

The threat of vinyl chloride cannot be forgotten or underestimated. Science, industry, government, labor, the media, and organizations like the Health Research Group have fulfilled certain responsibilities by contributing their energy and resources to deal with a very serious problem. They must continue in their efforts. Above all, the American public, expecially those who are exposed to vinyl chloride in the most direct and prolonged way, have a right to be informed about all future developments that relate to this dangerous substance.

Frank Wiener is a free-lance writer.

Black Lung: The Struggle to Help its Victims

Lorin Kerr, M.D.

At work, coal miners are covered with dust. It's in their hair, their clothes, and their skin. It gets between their teeth and they swallow it. They suck so much of it into their lungs that, until they die, they never stop spitting up coal dust. Some cough so hard, they wonder if they have any lungs left. Gradually the miners notice they are getting short of breath when they walk up hills. On the job they must stop work to catch their breath. Then, just walking across the room at home is an effort. For all too many of them, severe shortness of breath leads to total incapacity for work, and eventually premature death. Coal mine dust is a killer, though death comes slowly.

For centuries, coal was dug out of surface outcroppings and shallow mines. In Britain, this began about 1234. There was little dust and so there were no dusty lungs. This began to change in the eighteenth century, however, with the advent of

Black lung victimizes more than one out of three coal miners.