

Exhibit 13

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STATEMENT OF
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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

ON

PROPOSED PERMANENT STANDARD FOR VINYL CHLORIDE

AT THE
OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION HEARING
U.S. DEPARTMENT OF LABOR
BEFORE ADMINISTRATIVE LAW JUDGE
GORDON J. MYATT

JUNE 25, 1974

DOW 923

STATEMENT ON PROPOSED PERMANENT STANDARD FOR VINYL CHLORIDE

I am Dr. Marcus M. Key, Director of the National Institute for Occupational Safety and Health, a program of the Center for Disease Control, in the Department of Health, Education, and Welfare. Under the Occupational Safety and Health Act of 1970 we have responsibility to "...develop criteria dealing with toxic materials and harmful physical agents and substances which will describe...exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experience." The Institute is also authorized to "develop and establish recommended occupational safety and health standards." Because of the urgency of the vinyl chloride (VC) problem, we have not had time to develop formal criteria for exposure to VC although much of what we present today can serve that purpose. We have, however, recommended to the Occupational Safety and Health Administration (OSHA), Department of Labor (DOL), a recommended work practices standard with environmental monitoring and medical monitoring, and these have served as the basis for the presently proposed OSHA permanent standard for occupational exposure to VC developed under Section 6(b) of the Act. It should be noted that my memorandum of March 11, 1974, transmitting our recommended work practices standard to OSHA made reference to our inability to describe a "safe" exposure level, hence our recommendation was that where any employee is exposed to measurable concentrations of VC as determined by the recommended monitoring method

which has a sensitivity of 1 ppm, he shall be afforded respiratory protection. This does not mean that an "acceptable" level is impossible to define. We have asked the Department of Health, Education, and Welfare Committee to Coordinate Toxicology and Related Programs to define procedures for designing animal studies and to determine the compatibility of the estimated carcinogenic hazard with a socially acceptable risk. These procedures, when developed, should give guidance to experimental design of animal toxicologic studies. In our opinion, the numbers of animals exposed in both the European and American studies have been too small to make statistically valid projections of no effect levels.

The information I will present today is intended to supplement and update NIOSH testimony presented at the February 15, 1974, OSHA Fact-Finding Hearing on Vinyl Chloride. It will cover four areas:

1. Epidemiology and Surveillance
2. Sampling and Analysis
3. Respiratory Protection
4. Exposure Levels

It is hoped that the hearing record can be kept open long enough to enable NIOSH to submit an updated report on current epidemiologic, industrial hygiene, and medical studies. The results of our first industrial hygiene survey will be available in about one month.

1. Epidemiology and Surveillance

On January 22, 1974, the National Institute for Occupational Safety and Health (NIOSH) was informed of three deaths from angiosarcoma of the liver among polyvinyl chloride (PVC) production workers at the B. F. Goodrich plant in Louisville, Kentucky. Since that time, NIOSH has initiated a variety of activities concerned with assessing the extent of the problem and developing information required for effective control of exposure and protection of workers exposed to VC.

Immediately following the report of January 22, NIOSH and its parent agency, the Center for Disease Control (CDC), organized a surveillance network to determine the number and distribution of cases of this rare disease and its relationship to occupational exposure to VC and/or PVC. The detailed results of this activity are shown in attached Table 1. Thus far, 18 cases of angiosarcoma of the liver in PVC production workers and one case in VC monomer production have been confirmed. Thirteen of these cases were reported from the United States and 6 from other countries. All 13 of the U.S. cases and the one from Great Britain have been confirmed histopathologically by the National Institutes of Health. Ten of the U.S. cases are deceased; 3 are living. This distribution of cases from the United States and 4 other countries indicates that we are observing a newly recognized occupational disease associated with exposure to VC, angiosarcoma of the liver. This form of liver cancer has heretofore been quite rare in the general population--only 20 to 30 cases have been reported annually in the U.S. The greater number of occupational cases seen in the U.S. is

probably a reflection of the earlier initiation and greater intensity of surveillance activities here. As regards the distribution in the United States, we have seen that the 13 cases have been reported from a number of plants in different parts of the country. These include 7 cases from the B. F. Goodrich plant at Louisville, Kentucky, 3 cases from the Goodyear plant at Niagara Falls, New York, 2 cases from the Union Carbide plant at South Charleston, West Virginia, and a single case from the Firestone plant at Pottstown, Pennsylvania. Although we are aware of several factors, such as job duties and degree and length of exposure, which may account for differences in occurrence, too little information is available at this time to evaluate such differences.

The average age at death for the PVC production workers was 48.5 years which is about 7 years younger than the average age at death from liver cancer in the male population of the United States. The estimated latent period for this disease based on the experience of the 18 PVC production workers is on the order of 20 years. This is consistent with observations on other occupational cancers with latencies varying between 15 and 25 years.

Within the past two weeks, we have also identified two deaths from angiosarcoma of the liver in men employed at plants utilizing PVC to fabricate other products. A summary of the surveillance activities in Connecticut, which led to the discovery of these cases, is given in the CDC Morbidity and Mortality Report for the week ending June 22, 1974.

Although we have accelerated our efforts to identify and evaluate the cases of angiosarcoma of the liver, it will be several months before we can expect to complete this activity.

The evidence accumulated to date on the cancer experience of the polymerization workers, along with the evidence of induction of the same unique tumor in two animal species exposed to VC down to and including 50 ppm, is convincing evidence that these liver tumors resulted from exposure to VC.

During the course of NIOSH/CDC surveillance and epidemiological activities of the past several months, we have become aware of other possible health effects of exposure to VC. Of major importance among these is a disabling liver fibrosis. This condition independent of angiosarcoma has been noted in workers from one of the United States plants and has been observed in almost a third of the men working in one of the German plants. This condition has also been noted in most of the U.S. cases of angiosarcoma of the liver associated with PVC production. It is not yet known whether the fibrosis is a precursor of angiosarcoma of the liver or to what extent it occurs among workers exposed to VC. Clinical descriptions of several of the U.S. cases of angiosarcoma and of hepatic fibrosis are given in the CDC Morbidity and Mortality Report for the week ending February 9, 1974, and in an article by Falk, Creech, Heath, Johnson and Key to be published soon in the Journal of the American Medical Association.

According to an industry sponsored mortality survey of U.S. polymerization workers, this population shows a deficit in overall mortality when compared to the U.S. male population. Yet to be determined is the significance of the report of cancers other than angiosarcoma of the liver which appear to be related to estimated exposure.

As part of its surveillance activities, NIOSH has compiled an extensive bibliography of the world literature on VC (Appendix I) to provide guidance to the Department of Labor, other government agencies and investigators throughout the world who are concerned with this problem.

A NIOSH mortality study is presently underway at 5 PVC production plants, and a medical cross-section survey of current and former polymerization workers and controls is being designed jointly by NIOSH and CDC.

The objectives of the cohort mortality study are 1) to compare the mortality of individuals who have worked in VC plants with that of the general populations; 2) to compare mortality patterns within the population of VC workers, based upon estimated occupational exposure and time since first exposure; and 3) to compare mortality among VC workers with the mortality of other occupational groups. The most time consuming step, vital status ascertainment, is expected to be 85% completed by the end of the summer and totally completed by December on all plants except one.

The major purposes of the medical survey are 1) to determine those diagnostic laboratory procedures best suited for detection of liver disease

among workers at VC polymerization plants; 2) to identify as completely as possible those workers or former workers with liver abnormalities so that they may be referred for appropriate medical evaluation and therapy; and 3) to identify other medical illnesses conceivably related to VC exposure.

2. Sampling and Analysis

The field sampling and analysis method for VC previously recommended by NIOSH with a sensitivity of 1 ppm, required the use of a 250 cc glass gas sampling tube, and subsequent analysis by gas chromatography. Subsequent research by NIOSH has indicated that alternatively a charcoal tube can be used for collection of VC which permits the collection of integrated personal samples. We recognize that gas chromatographic procedures are now available with a sensitivity of several parts per billion, but it should be realized that laboratory instrument conditions are seldom practicable for field use. NIOSH research is continuing in this important area of sampling and analysis.

3. Evaluation of Respiratory Protection

Questions regarding the effectiveness of cartridge and canister type respirators led NIOSH to evaluate the performance of approved respirator organic vapor cartridges and canisters against VC.

Four makes of organic vapor cartridges and 4 makes of organic vapor gas mask canisters were tested against various concentrations of VC at a

flow rate consistent with a moderately heavy work rate. The effect of relative humidity on service life was also investigated.

These tests show a cartridge life, based on 10% break-through, to be 40 to 75 minutes at 50 ppm, 50% relative humidity, depending upon the manufacturer. Also canister life at 100 ppm, 50% relative humidity, was shown to range from 200 to 350 minutes again depending on the manufacturer. It should be noted that the service life decreases as the ambient relative humidity increases.

Gas mask, face piece leakage is typically 1% of the ambient concentration. At 100 ppm ambient concentration, 1 ppm leakage could be expected. Because the odor threshold of VC is considerably higher, a worker would have no indication as to whether he is or is not being adequately protected. Therefore, it is the position of NIOSH that the only suitable respiratory protection devices for VC are supplied air respirators or positive pressure self-contained breathing apparatus.

4. Exposure Levels

The industrial hygiene activities conducted by NIOSH have been directed at determining present and past worker exposure to VC and other liver toxins, and work practices, and control procedures utilized to reduce and eliminate such exposures. These investigations have involved VC production plants, VC polymerization and copolymerization plants and PVC processing (fabricating) plants (i.e., compounding, extrusion molding, calendaring, thermoforming,

binding, foams, fibers, and plastisol operations).

Walk-through surveys of one VC plant and 7 PVC plants have been conducted to date. Air sampling surveys for VC have been conducted in 7 PVC fabrication plants and the data herein presented. Also, a detailed industrial hygiene survey of one PVC plant has been conducted but results will not be available until next month.

Polymerization Plants

The walk-through surveys of the polymerization plants were conducted to determine which plants would be selected for the detailed industrial hygiene surveys from which the documentation of worker exposures would be obtained. Process information, plant layouts, air sampling data collected by the plant, work practices and control procedures were noted and obtained during the walk-through surveys. The criteria for selection of the 7 plants were based primarily on the needs of the overall epidemiological study. These criteria required that the plants (1) were in operation for at least 15 years; (2) had a large worker population; (3) were located in States where vital statistics could easily be obtained; and (4) have an "in-house" medical program.

The polymerization plants observed during the walk-through surveys used the suspension, emulsion, and solvent processes. The only process not observed to date is the bulk process. The one plant (from the initially selected 7) where a detailed industrial hygiene survey has been conducted was selected because of its age (39 years of production), the fact that it is one of only two plants using the solvent process to product PVC, and cases of angiosarcoma of the liver in employees of the plant have been reported.

In the first and second quarter of FY'75, NIOSH will conduct detailed industrial hygiene surveys in at least 3 additional polymerization plants. They will be selected from the 6 remaining plants where walk-through surveys were conducted and from other plants that utilize the bulk process to give a cross-section of the different processes utilized by polymerize VC.

Based on the walk-through surveys of the 7 plants and the one detailed industrial hygiene survey, a brief summary of NIOSH observations is presented in Table 2. This table presents the major sources of VC releases within the PVC plants and work practices and control procedures that can be utilized to reduce and/or eliminate these emissions.

VC (Monomer) Production Plants

The VC plant that was visited on a walk-through survey used the ethylene oxychlorination process. No plant using the acetylene process has been visited. Due to a limitation of personnel and time, it was decided that further detailed surveys of VC plants would be done under contract. This survey will be completed in June 1975 and will consist of documenting the previously mentioned exposure data, etc. for VC plants based on detailed industrial hygiene surveys of at least 3 plants that will be selected to be representative of the industry.

Based on the walk-through survey of the VC plant, a brief summary of the NIOSH observations about the major sources of VC releases within VC plants and work practices and control procedures that can be utilized to reduce and/or eliminate these emissions is presented in Table 3.

Fabrication Plants

The air sampling surveys of 7 PVC fabrication plants were conducted at the following operations: extrusion, thermoforming, calendering and plastisol processing. In general, any process involving the heating and/or mixing of PVC resin can result in the release of VC.

A compilation of NIOSH's air sampling survey data from 7 PVC fabrication plants is presented in Table 4. Table 5 summarizes the environmental findings from our studies in PVC fabrication plants. Breathing zone samples, that is, actual measured exposures to VC, ranged from 0.3 to 12 ppm with a mean of 3 ppm; and estimated time weighted average (TWA) exposures were approximately 2 ppm. The latter estimate was made by combining "Breathing Zone" samples with "Area" samples.

Peak levels of at least 300 ppm were measured in the PVC fabrication plants. However, extended exposures to such concentrations are quite improbable, since these levels exist only at "contamination sources" rather than at normal work sites. Maintenance and repair workers, however, may be exposed to such levels.

Further data will be available when the aforementioned contract study is completed.

NIOSH's recommended work practices standard was meant originally to be applied to the manufacture of synthetic polymer from VC. In view of the finding of appreciable concentrations of VC in fabrication operations and the reports of angiosarcoma in monomer production and in secondary manufacture, we recommend that exposure to this carcinogen be controlled whenever it is encountered in the workplace.

June 25, 1974

TABLE 1

CONFIRMED CASES OF LIVER ANGIOSARCOMA AMONG WORKERS EXPOSED
TO VINYL CHLORIDE OR POLYVINYL CHLORIDE

COUNTRY	CASE #	BIRTH DATE	1st VC or PVC EXPOSURE	DX ANGIO- SARCOMA	AGE AT DX	YRS 1st EXP TO DX	TOT YRS EXP	DATE OF DEATH
VC MONOMER PRODUCTION WORKERS								
Sweden	02	11-27-11	00-00-45	05-15-72	61	27	23	08-16-72
POLYMERIZATION WORKERS								
United States	01	00-00-22	12-09-48	03-00-71	49	22	16	03-03-73
United States	02	00-00-34	11-15-55	05-00-70	36	14	13	09-28-71
United States	03	00-00-15	11-28-45	12-00-73	58	28	28	12-19-73
United States	04	00-00-24	07-06-52	08-00-67	43	15	15	01-07-68
United States	05	00-00-12	06-19-44	04-00-64	52	20	18	04-09-64
United States	06	00-00-29	01-17-62	02-00-74	45	12	12	ALIVE
United States	07	05-03-22	08-00-44	00-00-68	45	24	18	03-23-68
United States	08	05-06-20	10-07-46	08-00-61	41	15	15	08-29-61
United States	09	00-00-31	05-28-45	03-01-74	43	29	17	ALIVE
United States	10	08-16-13	06-00-51	05-00-68	55	17	17	05-10-68
United States	11	05-27-09	10-14-46	03-00-70	61	23	23	03-16-70
United States	12	11-17-18	09-13-49	05-00-69	50	20	15	05-02-69
United States	13	12-01-21	08-19-44	05-00-74	53	30	30	ALIVE
W. Germany	01	07-26-31	10-14-57	00-00-71	40	14	14	12-14-71
W. Germany	02	06-04-30	10-01-57	00-00-69	39	11	11	01-25-69
Great Britain	01	00-00-01	00-00-46	12-00-72	71	26	20	12-00-72
Norway	01	12-23-15	03-00-50	12-20-71	56	22	21	01-04-72
Sweden	01	06-23-27	08-14-51	02-00-70	43	19	18	10-20-70
COMPOUNDERS, FABRICATORS, ETC								
United States	14	00-00-13	08-18-38	06-00-73	60	36	00	07-03-73
United States	15	00-00-25	00-00-00	07-00-72	47	00	00	02-15-73

Note: '00' indicates unknown date

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Table 2

MAJOR VINYL CHLORIDE EMISSION SOURCES IN POLYVINYL CHLORIDE
POLYMERIZATION AND COPOLYMERIZATION PLANTS

<u>Sources of Vinyl Chloride Emissions</u>	<u>Work Practices and Control Procedures That Can Be Utilized to Reduce And/Or Eliminate the Emissions</u>
1. Polymerization reactor cleaning	a. Reduction in the frequency of cleaning b. Automate cleaning process c. Maximize purging of reactor before and during employee entry into reactor d. Employee use of air supplied respirators (type prescribed by OSHA) when cleaning reactors
2. Venting vinyl chloride from processing equipment internally within the plant	Repipe vented vinyl chloride emissions to a recovery system or completely remove vinyl chloride from vented air prior to release
3. Quality control sampling of process	a. Redesign sampling points to eliminate excess pipe downstream of sampling valves in order to reduce the amount of vinyl chloride lost after sampling b. Employee collecting sample should wear air supplied respirator as prescribed by OSHA
4. Process leaks from such things as pumps, valves, flanges, gaskets, etc.	a. Use direct reading vinyl chloride sampling device on a routine basis for early detection of process leaks b. Change pump seals, agitator packing, etc. to designs better suited to prevent leaks
5. Tank car loading and unloading	a. Eliminate vinyl chloride that is exhausted while loading and unloading tank cars by piping changes and venting to recovery system or completely removing vinyl chloride from vented air prior to release b. Employee use of air supplied respirators (type prescribed by OSHA) while connection and disconnecting lines

Table 2 (Continued)

- | | |
|---|--|
| 6. Vinyl chloride monomer filter changing | a. Reduce frequency of monomer filter changing
b. Employee use of air supplied respirator (type prescribed by OSHA) while changing or cleaning filter |
| 7. Polyvinyl chloride waste disposal | Properly cover all polyvinyl chloride waste barrels, drums, bins, etc. |
| 8. Packaging (bagging and drumming of polyvinyl chloride) | a. Improve local exhaust ventilation at bagging and drumming stations to reduce polyvinyl chloride dust and vinyl chloride gas emissions
b. Clean baghouses and other control devices frequently to insure top efficiency of ventilation system
c. Employee use of air supplied respirators (type prescribed by OSHA) while cleaning baghouse. |

Table 3
MAJOR VINYL CHLORIDE EMISSION SOURCES IN VINYL CHLORIDE MONOMER
PRODUCTION PLANTS

Sources of Vinyl Chloride Emissions	Work Practices and Control Procedures That Can Be Utilized to Reduce And/Or Eliminate the Emissions
1. Tank car loading and unloading	a. Eliminate vinyl chloride that is exhausted while loading and unloading tank cars by piping changes and venting to recovery system or completely removing vinyl chloride from vented air prior to release b. Employee use of air supplied respirators (type prescribed by OSHA) while connecting and disconnecting lines
2. Quality control sampling of process	a. Redesign sampling points to eliminate excess pipe downstream of sampling valves in order to reduce the amount of vinyl chloride lost after sampling b. Employee collecting sample should wear air supplied respirator as prescribed by OSHA
3. Process leaks from such things as pumps, valves, flanges, gaskets, etc.	a. Use direct reading vinyl chloride sampling device on a routine basis for early detection of process leaks b. Change pump seals, agitator packing, etc. to designs better suited to prevent leaks

Table 4

Exposure Levels of Vinyl Chloride in PVC Fabrication
Plants NIOSH Data (summary of 7 Plants)

Fabrication Product	Type Resin	Location and Operations	Conc. PPM	Results Summary
A. Operators' Breathing Zone Samples (measured exposures)				
1. film	paste	over mixing vessel, dumping bags	2	Max. = 12 PPM
2. film	20 mil film	packing table, behind cutter	0.3	Min. = <0.3
3. film	12 mil film	packing table, behind cutter	0.3	Median = 0.3
4. flex. sheet	suspension	film sealing, operator's position	12	Mean = 3
5. molded products	comped. cubes	molding machine operator	<0.3	> 1 PPM=2/5=40%
B. Area Samples (probable exposures)				
1. molded products	comped cubes	trimming table 8 feet from mold machine	<0.3	Max. = 8 PPM
2. " "	" "	4 inches from cutter outlet	<0.3	Min. = <0.3
3. " "	" "	12 inches from cutter outlet	<0.3	Median = 0.3
4. " "	" "	24 inches from cutter outlet	<0.3	Mean = 1.2
5. " "	" "	22 inches above hopper	<0.3	> 1 PPM= 1/11=9%
6. film	20 mil film	work station near press	0.5	
7. " "	12 mil film	side of heater section	0.3	
8. molded products	comped cubes	extruder line, next to cutter	0.4	
9. film	suspension	mixing area- operation shut down	0.8	
10. " "	suspension	mixing area - operation shut down	<4	
11. " "	suspension	film sealing unit at operator's position	8	
C. Source Samples (possible exposures)				
1. raw material	paste	withdrawing sample from bag	10	Max. = 340 PPM
2. " "	suspension	" " " "	340	Min. = <0.3
3. " "	comped cubes	" " " "	<3	Median = <1
4. " "	paste	" " " "	1	Mean = 18
5. " "	paste	" " " "	2	> 1 PPM=10/21=48%
6. " "	paste	" " " "	<1	
7. film	paste	withdrawing sample from oven	1	
8. film	paste	6 inches from feed pan on a film coater	<0.3	
9. molded products	comped cubes	1 foot above injection molder (4 samples at this spot)	<0.3	
10. " "	" "	1 inch above injection molder (2 samples at this spot)	0.3	
11. film	20 mil film	near intake to press	0.5	
12. " "	12 mil film	above inlet to heating section	0.7	
13. mold strip	comped cubes	12 inches from extruder die head	<0.3	
14. " "	" "	feed hopper	<0.3	

Table 5

Summary of Exposure Levels to Vinyl Chloride in
PVC Fabrication Plants

1. Film and Molded Products (NIOSH Data)	Gas Concentrations-PPM(A)				
	Max.	Min.	Median	Mean	>1 PPM(B)
a. Operator Breathing Zone	12	<0.3 (C)	0.3	3	2/5=40%
b. Area Samples	8	<0.3	0.3	1.2	1/11=9%
c. Source Samples	340	<0.3	<1	18	10/21=48%
(A) PPM = parts of gas per million parts of air mixture (B) > = greater than (C) < = less than					

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Epidemiologic Notes and Reports - Angiosarcoma of
Liver - Connecticut
page 210, continued on page 216

EPIDEMIOLOGIC NOTES AND REPORTS
ANGIOSARCOMA OF THE LIVER - Connecticut

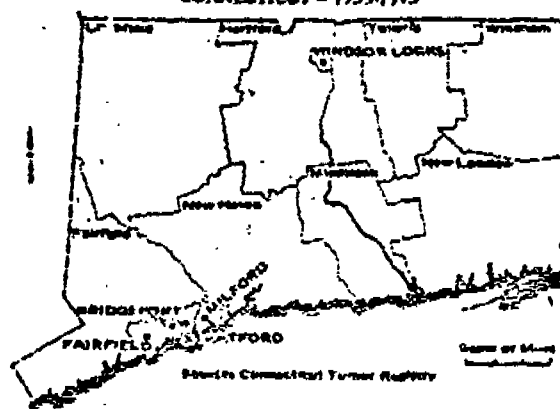
From January 1935 through December 1973, 8 cases of angiosarcoma of the liver were reported to the Connecticut Tumor Registry; the diagnosis of hepatic angiosarcoma has been confirmed in 6 of these cases by pathologists at the National Cancer Institute.

One case was diagnosed in 1950, 1 in 1967, and 4 in 1972 and 1973. The 1950 case occurred in a resident of north-central Connecticut, while the 5 more recent cases were found in residents of 4 closely adjacent communities in the southwestern portion of the state (Figure 1).

Two of the patients appear to have had occupational exposure to polyvinyl chloride (PVC). One, a 47-year-old man diagnosed in January 1973, had been employed for the 10 preceding years as an accountant in a factory which produces vinyl sheets and processes PVC resins; it is reported that he frequently visited the production area of the plant. Another patient, a 61-year-old man diagnosed in June 1973, had worked from 1933 through 1971 in an electrical products manufacturing concern, and from 1958 through 1963 he had operated

(Continued on back page)

Figure 1
CASES OF ANGIOSARCOMA OF THE LIVER
BY PLACE OF RESIDENCE
CONNECTICUT - 1935-1973



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ANGIOSARCOMA - Continued

machinery there which applied plastics containing PVC to wires as insulating material.

Another 2 patients who had no occupational exposure to PVC had been long-time residents of the Bridgeport-Stamford area. One of these was a 75-year-old man, diagnosed in 1972, who had lived his entire life within 2 miles of the electrical products factory mentioned above. He had worked as a firefighter from 1917 to 1942, as a metal worker from 1942 to 1944, and as a corset cutter from 1944 until his retirement in 1961; additionally he had a history of chronic alcohol ingestion. The other resident was an 85-year-old woman, a housewife and retired cook, who was diagnosed in December 1973. She had lived for 35 years within 1/2 mile of the vinyl products plant.

There was no history of occupational or of potential community exposure to PVC for the 2 remaining patients. One was a housewife in north-central Connecticut, the other an unemployed, disabled man with chronic alcoholism who had moved to Connecticut from New York City 4 months before his diagnosis in May 1973. None of the 6 confirmed patients had known exposure to thorium dioxide (1) or to arsenical compounds (2), 2 materials known specifically to induce angiosarcoma of the liver in men. By history, none had extensive exposure to aerosol sprays. None had a past history of hepatitis. Two had histories of alcoholism, as noted, but none are known to have taken other potentially hepatotoxic drugs or medications.

(Reported by Barbara W. Christine, M.D., Chief, Chronic Disease Control Section, Harold S. Barrett, M.D., Deputy Commissioner of Health, and Douglas S. Lloyd, M.D., Commissioner of Health, Connecticut State Department of Health; the National Institute of Occupational Safety and Health, and the Cancer and Birth Defects Division, Bureau of Epidemiology, CDC.)

Editorial Note

Recent reports (3,4) have described 13 cases of angiosarcoma of the liver among men employed in the synthesis of

PVC from vinyl chloride monomer (VCM). There is evidence to suggest that VCM may have been the cause of hepatic angiosarcoma in these cases (5,6). In the present series 2 cases of hepatic angiosarcoma are described in men who had no known exposure to VCM, but who did work with PVC. While these findings establish no causal connection between exposure to PVC and angiosarcoma of the liver, they do raise the possibility of such a relationship. Further study throughout the nation will be needed to define the possible risk factors in persons who have worked with PVC.

The additional finding in this study of angiosarcoma of the liver in 2 persons who had no occupational exposure to vinyl chloride, but who may have had community exposure, is also worrisome but again establishes no causal connection. It might be expected on the basis of data from the Third National Cancer Survey that approximately 4 cases of angiosarcoma of the liver would occur in Connecticut in a 10-year period and that approximately 11.6 cases would occur in the 4 previously mentioned communities in southern Connecticut during the same interval. Epidemiologic investigation of additional cases of hepatic angiosarcoma that may be found to have had possible community exposure to vinyl chloride will be necessary to clarify the significance of these cases.

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Ark Path - Arkhis Patologii (Archives of Pathology)
Arch Derm - Archives of Dermatology
Arch I H and Occ Med - Archives of Industrial Hygiene and Occupational Medicine
AIAAJ - American Industrial Hygiene Association Journal
Biochem J - Biochemical Journal (England)
Br Med J Bul - British Medical Journal Bulletin
Br J Derm - British Journal of Dermatology
Br J Ind Med - British Journal of Industrial Medicine
Bull of Hyg - Bulletin of Hygiene
C.A. - Chemical Abstracts
Can Med Assoc J - Canadian Medical Association Journal
Chem Eng - Chemical Engineering
Clin Chem - Clinical Chemistry
Env Res - Environmental Research
Farmakol Toksikol - Farmakologiya i Toksikologiya (Moscow)
Gaz Woda - Gaz, Woda i Technika Sanitarna (Polish)
Gig Sanit - Gig i Sanit (USSR)
Gig Truda - Gigiena Truda i Professionlnye Zabollevaniya (USSR)
Hyg and Sanit - Hygiene and Sanitation (USSR)
J Chem Eng Data - Journal of Chemical and Engineering Data
J Occ Med - Journal of Occupational Medicine
J Pharm Sci - Journal of Pharmaceutical Sciences
J NCI - Journal of the National Cancer Institute
J App Chem - Journal of Applied Chemistry
JAMA - Journal of the American Medical Association
JMA Georgia - Journal of the Medical Association of Georgia
Lancet - The Lancet (British)
Labor Pyg and Occ Dis - Labor Hygiene and Occupational Diseases (USSR)
Med Lav - Medico Lavoro (Milan)
NE J Med - New England Journal of Medicine
T & AP - Toxicology and Applied Pharmacology
Vrach Delo - Vrachebnoe Delo

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