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V I N Y L C H L O R I D E

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Dr. W. D. Harris

This report is not intended as a complete treatise on vinyl chloride but is rather designed to acquaint UNIROYAL'S health related personnel with what went on at UNIROYAL in the years when we produced PVC at Painesville and vinyl chloride first, at Painesville and later in the Monochem Plant at Geismar, Louisiana.

U. S. Rubber's Naugatuck Chemical Division grew almost exponentially in the 1940's. Prior to World War I, it had produced sulfuric, nitric and hydrochloric acids for use in the Naugatuck brass and metals industries.

During World War I, shipments of dyestuffs from Europe were cut off by German submarines. Naugatuck Chemical began to manufacture aniline and later various rubber chemicals based on aniline as well as dithiocarbamates and other chemicals developed by The General Laboratories in New York City and later in Passaic, New Jersey.

Synthetic rubber production was started during World War II and agricultural chemical sales began in a very small way at about the same time. During the 40's, research was going on at The General Laboratories and at Naugatuck on various synthetic rubbers and plastics. While we researched our way into

rubber chemicals and agricultural chemicals, management decided that purchase of a plant was the preferred way to enter the rapidly expanding PVC field. The purchase of the Glenn L. Martin PVC Plant at Painesville, Ohio resulted in 1950. This plant, which started production in 1947, initially made its own vinyl chloride monomer by additions of HCl to acetylene. The HCl was purchased under a favorable contract with a neighboring Diamond Alkali Plant. During the 50's and early 60's volume was doubled and redoubled. Production of VC at Painesville stopped after the Monochem Plant came on stream in 1961.

As was true in most companies at this time, we assumed that vinyl chloride was of very low toxicity. In retrospect, the only animal toxicology studies were acute studies aimed at its possible use as an anesthetic. Because of poor performance, fire hazard and toxic side effects, this use did not develop to any appreciable extent. Nevertheless, everyone "knew" that exposure to vinyl chloride gas was not dangerous so long as you didn't get anesthetized. It was inexpensive so most of the research and development effort on PVC was directed at achieving a better product for various end uses. Most monitoring was aimed at preventing fire and explosion hazards, levels approximately 100 times higher than the TLX. Torkelson and coworkers at Dow conducted a six month vapor exposure study at levels

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T. R. Torkelson, F. Oyen, and V. K. Rowe, Am. Ind. Hyg. Assoc. J., 22, 354 (1961)

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from 50 to 500 ppm on rats, dogs and guinea pigs. As a result of these studies, Dow recommended a 50 ppm exposure limit which

they adopted in their own plants. These and other studies are reviewed briefly in Patty and in IARC's Vol. 7 (pages 291-318 (1974)).

Patty's Industrial Hygiene and Toxicology 3rd. ed. Vol. 2B. Toxicology, pages 3537-3542. John Wiley & Sons. New York (1978).

Because most management people in the chemical industry had little experience in the rapidly developing field of industrial toxicology and because of the apparently good health experience among workers heavily exposed to VC, these early warning signals were largely ignored. ACGIH had set a TLV at 200 ppm which remained in effect in 1974. However, OSHA had adopted the 1968 ACGIH level of 500 ppm. These levels were somewhat academic since few companies were equipped to do adequate monitoring of worker exposure before 1974 because VC was considered to be safe at levels prevalent in the industry.

ACROOSTEOLYSIS:

In the early 60's, a problem began to develop in some plants in Europe and primarily at Goodrich in the U. S. (Goodrich and Union Carbide were two of the earliest manufacturers of PVC resins and Goodrich had become by far the largest by the 70's.) The end bone of the fingers became flattened and in some cases virtually disintegrated. The companies set up a study group at MCA and the Institute of Environmental and Industrial Health at the University of Michigan was chosen to conduct an epidemiological study, the results of which were published in Archives of Environmental Health (22,61-73 (1971)).

The problem was confined to workers involved in hand cleaning reactors. Although the study did not prove that vinyl chloride was the cause, it was generally considered to be.

In Italy, one company retained a Dr. Viola from a local university as its medical adviser. They had asked him to try to develop an animal model to study the acroosteolysis problem. They agreed on a long term vapor exposure study on rats at 30,000 ppm. At this high level, Dr. Viola ran into an unexpected problem -- zymbal gland tumors. All his animals died before the end of the year. He reported the results of his study at a meeting in Houston in 1970. The Environmental Health (not sure of exact title) Committee of MCA, of which UNIROYAL'S Medical Director, Dr. Jack Wolfsie was a member, invited Dr. Viola to meet with them. (I am not sure if this was in New York or Washington.) Initially, Dr. Viola's work was taken rather lightly because the dose was so high that the animals were lethargic and did not live long. It was felt that the dose was so far removed from practical exposure as to be meaningless. Man does not have any organ corresponding to the rat's zymbal gland. However, during the following winters and spring, Dr. Wolfsie and I discussed the problem with each other from time to time and became convinced that the industry should study it further to determine whether a real health problem might exist. UNIROYAL moved its corporate offices from New York to Middlebury about July 1, 1971, and Dr. Wolfsie chose not to move. We were without a medical director until November 1971, when Dr. J. D. Forbes took the position. In the meantime, realizing that we

had lost our contact at MCA, I suggested that I be designated as UNIROYAL'S representative on a VC committee being formed at MCA. In my letter of October 5, 1971, to B. R. Leach, then Plant Manager at UNIROYAL'S PVC plant at Painesville, Ohio, I recommended an industry animal study to determine dose-response relationships and an epidemiological study of VC exposed workers. It is important to realize that at this time we did not know that VC was causing cancer in workers. We were just encouraging a responsible approach. There is always a tendency for others to judge actions based on later knowledge or beliefs.

We did not have a representative at the November 16, 1971, VC meeting at MCA but received the minutes. I attended the December 14 meeting as a guest.

During the Winter and Spring of 1972, a great deal of effort went into securing financial support for the toxicology and epidemiological studies, designing protocols and selecting contractors. We knew that an animal study was most likely in progress in Europe and we wanted to learn as much about that study as possible so that we could design a study which would further extend our and their knowledge. The minutes of the April 20, 1972, meeting listed me as a member and from that time until the closing of our Painesville Plant in late 1975 I was deeply involved.

During the late Summer of 1972, ICI relayed the willingness of the European group to impart information on the European

study if suitable confidential arrangements could be made. George Best's (MCA) letter of September 20, 1972, to R. O. Lindsell of ICI indicated that I would meet with him in England in mid-October. When I called Mr. Lindsell, he said that they would want me to attend their meeting in Milan on October 19, which I did.

My letter of October 20, 1972, to George Best describes my meeting and my visit to Maltoni's office and laboratory. At this meeting the European group advised that they could not give data but they wanted me to understand thoroughly the nature and scope of their study and invited the U. S. group to support studies aimed at rounding out Maltoni's work. They did tell me that the dosage series covered the range from 10,000 to 50 ppm and that they were surprised to find "toxicity as low as 250 ppm". From the comments made and from what I saw at Maltoni's laboratory, I concluded that Maltoni was finding what appeared to be VC caused cancer at levels as low as 250 ppm, but I had no data so could not in good conscience give this information to any government agency. If NIOSH, OSHA, or EPA were given such preliminary information it would have been made public at once (FOI) and Maltoni would have been hounded for details, jeopardizing completion of the study. The industry was subsequently criticized for withholding information, whereas Dr. Duffield of ICI accompanied representatives of our committee in July 1973 and gave such data as was then available to Dr. Marcus Key, head of NIOSH. He expressed appreciation and asked that we keep him informed once the study was completed.

There had been some delay in disclosing data to MCA because of concern over confidentiality on the part of the Europeans.

Upon my return from Italy, I called a meeting of management people at UNIROYAL to alert them to the possibility that VC would be found to be an animal carcinogen and if so, OSHA would be forced to drastically reduce its VC standard (500 ppm) and that it would be necessary to start monitoring workers' exposure. The Painesville Plant Management agreed to undertake the monitoring task with guidance from L. F. Dieringer and me. I also urged management to take a hard look as to whether it would be good business to retrofit the Painesville Plant in view of reactor size and design.

During the late Summer of 1973 we got approval to purchase a Miran infrared analyzer. After it was delivered, C. B. Westerhoff came from Painesville and went with Larry Dieringer and me to S. Norwalk to be instructed in its use. In early January, I took it to Painesville and worked for a couple of days with Westerhoff to get started on monitoring. This is an elegant study instrument. When NIOSH came into the plant, a couple of months later, they were most impressed by the data which was presented to them.

On January 19, Dr. Mac Roy Gasgue, Medical Director of Olin, Dr. Richard Kociba, Pathologist at Dow and Dr. Theodore Torkelson, Toxicologist at Dow, met with the European group and

received preliminary results. They were as well impressed as I had been. Dr. Duffield of ICI attended our meeting on January 30, 1973.

The next several months were devoted to developing detailed protocols and negotiations with Industrial Bio-Test for the animal (rat, mice, hamster) study and selecting a contractor for the epidemiological studies. Tabershaw-Cooper were chosen for the epidemiological study. This study was announced on June 28, 1973, and got underway promptly. It is unfortunate that Industrial Bio-Test which had had a good reputation over-expanded and never completed the animal study, although, we did get some preliminary results. Part of the money was recovered. The Tabershaw-Cooper study was completed and an update is currently underway by Environmental Health Associates. There is no question but that VC caused angiosarcoma. This study will seek to find whether other malignancies such as brain tumor are elevated.

It has been interesting to me that my recommendation not to go ahead with the Industrial Bio-Test study and to support Maltoni was vetoed by Goodrich. They are the company which has had most of the acroosteolysis and angiosarcoma. In recent years, they have really worked at improving their toxicology, industrial hygiene and medical capability and their image.

On January 22, 1974, Goodrich informed NIOSH that three deaths due to angiosarcoma of the liver had occurred at their Louisville PVC Plant. Since this was one of the main cancers,

Maltoni found in his animals, the odds were overwhelming that VC was the cause. This started a process which was unprecedented in the U.S. and probably in the world. In January 30, 1974, Federal Register, OSHA began a fact finding procedure which included both written and oral comments, the latter before an administrative law judge beginning on February 15. This process gave everyone from scientist to laborer and general hell raisers a chance to say his piece. Scientific meetings, literature reviews and industry meetings blossomed everywhere. My files are extensive during this period and I have not tried to summarize them.

On April 5, 1974, OSHA published an Emergency Temporary Standard for VC of 50 ppm. This automatically locked them into a six month schedule to issue a final standard.

UNIROYAL presented its testimony concerning the proposed standard on June 21. It is interesting to review what we said at that time. It has held up very well in the light of subsequent findings. Although we suggested a 25 ppm standard, OSHA set the limit at 1 ppm. We will never know for sure whether any lives have been saved by this low level.

The final report by Tabershaw-Cooper was submitted on May 3, 1974, but was revised several times as careful study by committee members enabled the authors to clarify certain issues and further records were found by Union Carbide. This enlarged the cohort. The real final report issued on January 1978. By

this time, Tabershaw-Cooper had been purchased by Equitable Environmental Health, Inc. (Their report is filed in a separate folder in my vinyl chloride toxicology file with a yellow label, "Equitable Epidemiol".) In addition to the angiosarcoma, brain tumors were in excess (12 vs. 5.9 expected). A great deal has been made of the brain tumor data but at this time we really don't know whether this is a real effect or a chance variation. Hopefully, the updated study will be more definitive.

While the OSHA law is good in principle, it was written by labor oriented people from the standpoint that industry is not concerned about health and safety and will do nothing to protect the worker unless forced too. OSHA felt pressured to act quickly. While labor was pushing hard for a "non-detectable" level of exposure, we in industry advised that a finite measurable low level was essential if the standard were to be enforceable. OSHA issued its final standard on October 24, 1974, [F.R. 39(194)35890-35898 incl.]. The main features included:

1 ppm TWA permissible exposure limit.

0.5" action level.

Monitoring above action level.

Regulated areas.

Medical program including at least annual physical exams including history, blood parameters, etc.

EPA issued its regulation on VC as a Hazardous Air Pollutant on October 21, 1976. This standard has not affected UNIROYAL

because we stopped production of PVC prior to this.

AIHA published its revised "Hygienic Guide" in February 1978 and set a TLV of 5 ppm that year.

In the period following the announcement of angiosarcoma at Goodrich, VC and PVC manufacturers reviewed medical records and checked pathology of liver cancers. Cases of angiosarcoma were reported to NIOSH. For a time, NIOSH compiled this information and made it widely available during the standards development stage but dropped it shortly thereafter. A few pertinent documents are listed below:

Compilation dated June 25, 1974, Table I listed 15 U.S. cases and 1 Swedish.

Letter dated January 22, 1975, from Dr. Lloyd of OSHA to Dr. Torkelson and appended Tables.

My letter of August 12, 1976, to Torkelson developed the rolling average concept and showed that VC induced angiosarcoma was not increasing after 1968. I could not justify spending a great deal of time on VC because we had dropped out of the business.

Rose Kaminski's (NIOSH) letter to orkelson asking for information.

Torkelson's letter to Dr. John Stafford of ICI dated April 1, 1977.

Torkelson's letter to Stafford, March 29, 1977. He gives latest NIOSH data and includes an update of my August 12, 1976 letter.

Minutes of January 11, 1978, Item 9.0 Torkelson mentions international registry

of angiosarcoma cases being developed by Dr. John Stafford of ICI.

NIOSH update JOM 20:429-428 (1978).

Torkelson updated my earlier figures 9/20/78 -- Same results.

Angiocarcoma. J. Stafford Worldwide Summaries:

1. 5/1/80
2. 1/20/82
3. 8/25/82
4. 1/17/84

During 1978 and 1979, we became concerned that we had not received a final report on IBT's animal studies. When a careful audit established that it would be impossible to get a reliable report, MCA asked for a return of part of the money. As indicated in CMA letter of November 8, 1980, we agreed to accept $110,000. The meeting of 3/18/80, attached to Dr. Shah's letter of 3/19/80 summarizes this problem. This is further summarized in my letter of 3/31/80 to B. R. Leach. (See also EPL Report, dated 5/14/80 and Bob West Associates, Inc. Report received 5/20/80.

In 1979, plans were started for an epidemiological update. A pre-publication release of a study by the Consumer Product Safety Commission was dated April 1, 1979. Rats and mice were exposed for one hour to 50, 500, 5000 and 50,000 ppm of VC. The data muddied the water but in the long run didn't

change things much. Comments by Dr. Jessie Norris of Dow attached to T. R. Torkelson's letter of November 8, 1979, critiques this study. Maltoni considered it a ridiculous waste of time.

The vinyl chloride experience was a vast educational experience for:

> The General Public - Became more aware of OSHA, NIOSH and Toxicology.
>
> Management - Became more aware that chronic effects can be serious even though acute toxicity is low. OSHA has to be reckoned with.
>
> Scientist - Got a better insight into the kinds of data needed to thoroughly evaluate toxicity. Still can't quantify relationship between animal and human toxicity.
>
> Regulatory Bodies - Gained experience in working with industry groups and began to understand that industry is concerned and wants to protect its workers.
>
> Industry Groups - Learned to work more creatively and honestly with regulatory agencies.

Because of the long time from exposure till death from cancer, we will not be entirely clear of the VC problem until early in the next century. Fortunately, UNIROYAL has not had a case of angiosarcoma. On the basis of numbers of workers involved, we might expect one or two cases by the time all those exposed to VC have died.

August 1, 1984

CHRONOLOGY OF DEVELOPMENTS
IN
THE VINYL CHLORIDE PROBLEM

Prior to the 1960's vinyl chloride monomer (VC) was considered a very safe chemical. At that time there was no legal exposure limit but the American Conference of Governmental Industrial Hygienists recommended that the time weighted average not exceed 500 ppm. In other words, they believed that daily exposure at this level for a normal working lifetime would do no harm to workers health. These recommendations are reviewed annually.

In 1961 the Dow Chemical Company reported on an animal study which showed some health effects on animals at this level and recommended that it be reduced and shortly thereafter 500 ppm was set as a "ceiling" limit, i.e., exposure over a 15 minute period should not exceed this level.

In the mid-60's a few American and European PVC manufacturers found an occasional worker who had a peculiar problem of bone degeneration in the finger tips known as acroosteolysis. A study of this condition was carried out at Michigan State funded by companies working through the Manufacturing Chemists Association. This problem seemed to be confined to workers who were in the vessel cleaning crews in PVC plants. Careful examination of workers in our own Painesville PVC plant as well as in one of our plants which used large amounts of PVC, uncovered no acroosteolysis.

Following the bone degeneration problem, the Threshold Limit Value Committee, ACGIH, lowered the exposure limit to 200 ppm. Professor Viola in Italy undertook at this time an animal study in which he exposed rats to air containing 30,000 ppm of vinyl chloride several hours per day, 5 days per week for a year. In addition to some bone problems, he produced various tumors. However, the scientific community did not at first consider this experiment to be relevant to plant operating conditions. At this time, there was no knowledge of cancer having occurred in humans exposed to vinyl chloride workers.

In May of 1970 Viola presented a paper in Dallas at the 10th International Cancer Congress. The MCA Enivronmental Health Committee invited him to meet with them and to explain his study and explore more carefully his thoughts on the subject. The feeling developed that we should carry out a more definitive animal study and, in addition, should carry out a careful epidemiological study of the workers exposed, all under the auspices of MCA. A careful appraisal of the problem indicated that to be meaningful an epidemiological study should cover the whole U.S. vinyl chloride industry as no one company had enough workers exposed long enough to get statistically significant data.

MCA engaged Industrial Bio-Test Laboratory to undertake the animal study at Decatur, Illinois. Tabershaw-Cooper was engaged to do the epidemiological study based solely on death records. These studies got underway in the summer of 1973.

Concurrent with the beginning of the MCA studies, we became aware that a European group was also carrying out an animal study. By October 1972 our toxicologist, Dr. Walter Harris, met with this group in Milan and saw the work being carried on by Prof. Cesare Maltoni at Bologna. He and others who later visited Maltoni were greatly impressed with the careful and thorough work which he was doing. At this time, we did not receive any data on cancer incidence.

By mid-1973, some preliminary data was obtained from Maltoni which indicated that VC did indeed cause cancer in rats at much lower concentrations than that used by Viola. A major type of tumor observed was angiosarcoma, a cancer of the blood vessels at the liver. The MCA committee decided that NIOSH should be acquainted with all that was going on and one of the European group accompanied the MCA team which briefed Dr. Marcus Key, Director of NIOSH in July 1973. The epidemiological study was pushed as rapidly as possible.

It was not until late January 1974 that anyone had observed any human cancer thought to be caused by VC exposure. This was in Goodrich's Louisville PVC plant. Goodrich immediately notified state and federal authorities. NIOSH and OSHA moved rapidly to explore the need for emergency action to protect employees. The MCA group is cooperating fully. Based on the Maltoni study, the industry was already hard at work tightening up plants and reducing exposure.

It has now been revealed by OSHA that a Temporary Emergency Standard on vinyl chloride exposure will be issued and will specify 50 ppm as the maximum allowable concentration. Lower limits will be proposed for the permanent standard.

Our Painesville PVC plant had submitted the proper records to the Tabershaw-Cooper study group before Goodrich discovered angiosarcoma. A NIOSH medical and industrial hygiene team has visited Painesville and has looked carefully at the health records of our Painesville employees. Thus far no angiosarcoma has been found. Five cases have been studied with particular attention. Two were deaths, one from cancer of the colon and one from alcoholic cirrhosis. Two cases were of disability retirement status both diagnosed as alcoholic cirrhosis. A fifth case was a terminated employee known now to have alcoholic cirrhosis. The URW is actively participating in the Painesville investigations under the provisions of the Joint Occupational Health Agreement and through their industrial hygienist, L. Beliczky. The University of North Carolina group will also participate in this study in some capacity.

Our Monochem Plant at Geismar, Louisiana has manufactured vinyl chloride monomer for 13 years. This is an outdoor plant with 200 employees, only 16 of whom are exposed to low levels of vinyl chloride. An OSHA team has already visited this plant. It is not expected that this plant will have much difficulty in complying with the proposed OSHA standard. Based on present knowledge, we would not expect low level exposures experienced at this plant to generate significant health problems.

Our Painesville plant in operation about 27 years has approximately 250 people who are exposed to varying degrees of vinyl chloride monomer. Further medical studies will be conducted to determine what, if any, significant health problems may exist in the work force. In the meantime, we have been monitoring the plant in order to define the steps needed to be taken to reduce exposure to the minimum. While we have already made some changes to reduce exposure, some of the others may involve engineering design, purchase and installation of equipment. All details involved in meeting the requirements of the new health standard are under study at this time.

Several of our domestic plants use Polyvinyl Chloride Resin which may contain upwards of 0.1% of unreacted vinyl chloride. We are in the process of monitoring the various operations to determine whether any changes will be necessary in these plants in order to meet the more stringent health requirements. We know that exposure levels are much lower than in the polyvinyl chloride operations. However, they could exceed levels prescribed under the new proposed permanent OSHA standard. Approximately 500 employees are involved in these particular operations. URW will be active participants in the investigations that will ultimately take place at some of these operations. Again, current medical knowledge would not indicate the development of serious health problems in these employees who may have been exposed to very low levels of vinyl chloride.

Although the rules have not been promulgated with regard to discharge of VC to the community air, this area is being explored with EPA and our technical people are taking part in these discussions. It is too early to know just what the final outcome will be.

3/27/74

D. E. Dudrow
W. D. Harris, Ph. D

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3/27/74

D. E. Dudrow
W. D. Harris, Ph. D

WDH

RECEIVED

PAINESVILLE AIR SAMPLING PROGRAM.

Summary of Results to Date

APR 21 1973

MEDICAL DEPARTMENT

A program to sample and analyze the atmosphere in the working areas of the plant where employees might be exposed to monomer vapors was begun in December, 1972, using sampling equipment brought to Painesville by Dr. U. D. Harris. Purchase of our own sampling equipment and new chromatograph columns has, with the assistance of sampling by the Process Engineers, resulted in a more detailed survey of atmospheric composition. The data are presented in the attached table.

Due to priority given to a THF sampling program for the past several months, the chromatograph has not been available much of the time to run analyses for vinyl chloride in the atmosphere. It is planned that a second chromatograph will be purchased to allow each instrument to be dedicated to a single use. This will avoid the excessive changeover time currently encountered when switching from one column to another.

Also tabulated below are data obtained on vapor samples in and around certain pieces of equipment where explosive mixtures might develop. This work was done at the request of the Vinyl Chloride Safety Association. The lower explosive limit for vinyl chloride is 4% by volume or 82,500 ppm by weight in air.

None of the areas sampled showed any danger from reaching the lower explosive limit.

The TLV for vinyl chloride was exceeded in only one area where personnel work. That was inside an SD reactor during cleaning. This result cannot be said to be typical. Other areas over the 200 ppm TLV were tank and dryer exhaust streams where personnel are not located.

The TLV for vinyl acetate was grossly exceeded in the area around the Derrick screen while running Marvinol 56. As is the case with reactor cleaning, however, personnel are in this atmosphere for a relatively short time.

The TLV for THF was also greatly exceeded in the area around the Rototherm and again this is not an area normally populated.

C. B. WESTERHOFF

CBW:rwp
Attachment

CC: BRL WSH CHK MAH RCW HCJ GJH RLK REH CJU JDP
Dr. U. D. Harris - Oxford

	SAMPLE LOCATION	DATE	VINYL CHLORIDE ppm	VINYL ACETATE ppm	THF ppm
SD Reactor,	Approx. five feet from open manhole	12/13/72	22.0		
		12/13/72	183.8		
		2/15/73	30.6		
SD Reactor,	Approx. six inches from open manhole	12/13/72	64.5		
		2/15/73	20Δ1		
SD Reactor,	Three feet inside after jetting and air purging	5/10/73	18		
SD Reactor,	Three feet inside after jetting and air purging during manual cleaning	12/13/72	5075		
		5/10/73	42		
SD Reactor,	Three feet inside after manual cleaning	5/10/73	47		
SD Process,	Composite air on second floor	2/27/73	<1		
SD Process,	Composite air on first floor	2/27/73	<1		
SD Slurry Tank, (Fan Running)	One foot above open manhole	4/10/73	2		
		4/11/73	3		
SD Slurry Tank, (Fan Running)	One foot inside open manhole West	4/13/73	858		
	" West	4/19/73	1577		
		4/19/73	15		
SD Centrifuge,	Composite in area	4/10/73	4		
		4/11/73	2		
		4/13/73	2		
SD Dryer,	Inside exhaust duct	4/ 9/73	184		
		4/10/73	219		
		4/13/73	210		
SD Bagger	Four feet above spout	4/11/73	8		
		4/13/73	12		
		4/19/73	9		
Plastisol Reactor,	At open manhole after jet flush - Marvinol-56	3/16/73	0	0	
Bowen II Derrick,	3 Feet North of	3/15/73	43	739	
	" " " " (line shut down)	4/ 6/73	<1	<1	
Bowen II Bagger,	One foot South of	3/15/73	1	0	
Rototherm,	Two feet North of	3/20/73	26		1196

*lower explosive limit = 50,800 ppm

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Swenson blend tank exhaust	4/24/73	3
	4/24/73	198
	4/25/73	<1
Swenson dryer exhaust	4/30/73	12
	4/30/73	11
	5/ 1/73	8
Williams Slurry tank exhaust	4/24/73	438
	4/24/73	<1
	4/26/73	5338
Williams centrifuge, at open cover	4/24/73	11
	4/24/73	16
	4/25/73	85
Williams Hill dryer exhaust	4/24/73	144
	4/24/73	47
	4/25/73	8

URL 23201

CEJ:vp

With the advent of the Occupational Safety and Health Administration, industry in the United States entered a new era of awareness about possible harmful effects from excessive exposure to chemicals.

This does not mean industry was negligent prior to OSHA. In fact, many companies have had excellent programs in this area for years. Others, however, did not. Furthermore, the long-term subtle effects of some chemicals in this relatively young industry are only now coming to light.

Nevertheless, once industry becomes aware of a problem, it has an obligation to take action for the future.

Vinyl Chloride fits into this category. Because it is so widely used, this chemical has received much attention lately. While one can argue the details of the proposed standards (see February, 1975 issue) everyone recognizes that the primary goal is to protect the worker from any serious health hazard.

In the following paragraphs Uniroyal discloses the program being implemented in its plants that manufacture and process vinyl chloride. This does not imply that this is a perfect program or the best in the industry, of which Uniroyal represents only a small segment. What is intended is a picture of how industry has developed a program by following five basic steps:

(1) Recognition of a hazard.

(2) Careful monitoring to locate sources of exposure.

(3) Reducing exposure to lowest possible extent.

(4) Frequent monitoring to insure that the plant is operating under optimum conditions.

(5) Careful physical exams with special emphasis on tests believed to be indicative of possible exposure effects.

All of the above recognize that we are still learning and that further changes may be necessary from time to time.

* * * * * *

The Uniroyal program began almost immediately after B.F. Goodrich announced that vinyl chloride might be the cause of angiosarcoma, a rare liver cancer found in some of its employees.

At first, all areas of Uniroyal's vinyl chloride plants underwent extensive monitoring with a continuous infrared monitor equipped with a chart recorder. Once a source of exposure was identified, technicians and engineers immediately tried to reduce or eliminate emissions.

In some instances, the solution was simply fixing or replacing a leaky valve. Other spots required better ventilation, such as removing wall sections or installing fans to increase circulation.

Major engineering changes have taken place in cleaning the vessels where vinyl chloride is converted into polyvinyl chloride. Traditionally, this has been the area of highest concentration of fumes.

Since some vinyl chloride escapes polymerization, steps have been taken to reduce these vapors before the vessel is opened. The insides are steamed down, washed out and aired with high-pressure water hoses and vacuum pumps.

Compensation carriers
PVC suppliers
Reputable consultant laboratory.

The attached Vinyl Chloride Fact Sheet is a summary compiled by L. F. Dieringer, Corporate Industrial Hygienist, Uniroyal Inc., Oxford Management and Research Center, Middlebury, CT.

This has been submitted for publication by Dr. Walter D. Harris, Chairman, Health Committee, Rubber and Plastics Section.

FACT SHEET — Rubber And Plastics Section

Vinyl Chloride

in the Federal Register

On October 4, OSHA published a standard on vinyl chloride. This fact sheet is specifically designed for use by small PVC fabricators who presumably have very low vinyl chloride concentrations.

The first step is to carefully monitor worker exposure by pulling a measured volume of air through a charcoal tube or pumping it into a plastic bag and analyzing in a gas chromatograph. If eight-hour time weighted average levels are less than 0.5 ppm, the standard does not apply so long as there is no change likely to result in higher exposure. If exposure is higher than 0.5 ppm, study the whole standard carefully in light of your operation. An outline of the essential features follows:

1. Scope and Applications

   1910.93q-(a)(2) - The standard is applicable to the manufacture, reaction, packaging, storage, handling or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride.

2. Permissible Exposure Limit

   (c)(1) and (c)(2) - The standard sets an exposure limit of 1 part per million over any 8-hour period (time-weighted average), and a ceiling of 5 parts per million averaged over any period not exceeding 15 minutes.

3. Action Level

   (b)(1) - Provides for an "action level" of 0.5 ppm TWA, one-half of the permissible exposure limit. Where initial monitoring indicates vinyl chloride exposures are between 0.5 and 1.0 ppm, fabricators are required to do more extensive monitoring and have a medical surveillance program for employees so exposed. Where monitoring demonstrates no employee is exposed in excess of 0.5 ppm TWA, employers are exempt from monitoring and medical surveillance, unless there is a production process or control change, which may result in an increase in the release of vinyl chloride.

4. Monitoring

   (d)(1) - An initial monitoring program is required to determine whether any employee exposure is above the action level.

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(d)(2)(ii) Quarterly monitoring is required for employees exposed at levels greater than the action level but not exceeding the permissible level

(d)(2)(i) - Monthly monitoring is required where employee exposure is in excess of the permissible exposure limit.

5. Regulated Area

(e)(1)(i) and (e)(1)(ii) - Defines regulated area as area where VC or PVC manufactured, reacted, repackaged, stored, handled or used; and vinyl chloride concentrations exceed the permissible exposure limit.

(e)(2) - Access to regulated area limited to authorized persons. A daily roster required for such persons entering this area.

6. Method of Compliance

(f)(1) and (f)(2) - Where feasible engineering and work practice controls will reduce exposures below the permissible levels, they must be instituted. Where such controls will not reduce exposure below the permissible limit, they must nonetheless be implemented to reduce exposures to the lowest practicable level and be supplemented by the use of respirators to provide the necessary protection.

(f)(3) - A plan for achieving control by engineering and work practices where hazardous exposures occur, must be drawn up, be updated at least every six months, and be made available upon request to OSHA and NIOSH representatives.

7. Respiratory Protection

(g)(1) - Until January 1, 1976, where exposures are not in excess of a 25 ppm ceiling, each employer must provide each employee with an appropriate respirator. However, employees whose exposure does not exceed 25 ppm, may decline to use the respirator, in which case the employer is not obligated to require its use. During this period, each employee who chooses not to wear a respirator shall be informed at least quarterly of the hazards of vinyl chloride and the purpose, proper use and limitations of respirators.

(g)(3) - Where respirators are used a respiratory protection program meeting the requirements of 1910.134 must be established.

(g)(4) - Specifies types of respirator depending on vinyl chloride concentration:

Not over 10 ppm - Type C supplied air respirator, demand type, with half face piece or chemical cartridge respirator with organic vapor cartridge providing a service life of at least one hour.

Not over 25 ppm - Powered air-purifying respirator with hood, helmet and full or half face piece or gas mask, either of which provide a service life of four hours.

(g)(6)(i) - Where air purifying respirators are used, canisters or cartridges must be replaced prior to expiration of their service life or the end of the shift in which they are first used.

(g)(6)(ii) - Where air purifying respirators are used a continuous monitoring and alarm system must be provided where concentrations could reasonably exceed the allowable concentration for the respirator in use.

8. Training

(j) - Requires that employees engaged in vinyl chloride or polyvinyl chloride work be made aware of the carcinogenic hazard, emergency procedures, need for monitoring, proper use of respiratory equipment, and purpose of medical surveillance.

9. Medical Surveillance

(k) - Describes the medical surveillance program required for employees exposed to vinyl chloride if their exposure exceeds the action level.

(k)(2) - Examinations are required every six months for each employee employed in vinyl chloride or polyvinyl chloride manufacturing and annually for all others.

(k)(4) - A statement of each employee's suitability for continued exposure to vinyl chloride including use of protection equipment and respirators, shall be obtained from the examining physician after each examination. A copy of this statement must be given to the employee.

(k)(5) - Employees whose health would be materially impaired by continued exposure, must be withdrawn from possible contact with vinyl chloride.

10. Signs and Labels

(l)(1) - Entrances to regulated areas must be posted with legible signs:

CANCER - SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

11. Records

(m)(2) - Requires that records of monitoring, medical records and authorized personnel rosters, be made available upon request for examination and copying to authorized representatives of OSHA and NIOSH.

Describes what information is required in the monitoring record. Specifies that monitoring records and daily roster sheet of authorized personnel must be maintained for at least 30 years, and additionally that medical records must be maintained for an employee's employment plus 20 years or 30 years, whichever is longer.

(m)(4) - States that employees or their designated representative shall be provided access to examine and copy records of required monitoring.

(m)(6) - States that upon written request of any employee, a copy of his medical record must be furnished to any physician designated by the employee.

12. Reports

(n)(1) - Requires that not later than one month after establishment of a regulated area, the OSHA Area Director must be provided information as to the address and location of each establishment having one or more regulated areas, and the number of employees in each regulated area during normal operations.

(n)(2) - Within 10 working days of monitoring which discloses that an employee has been exposed, without regard to the use of respirators in excess of the permissible limit, each such employee must be notified in writing of his exposure measurements and the steps being taken to reduce the exposure to within the limit.

13. Effective Date

The provisions of the vinyl chloride standard becomes effective January 1, 1975.