

**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 Environmental 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.

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MCA engaged Industrial Bis-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 Balogna. 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.

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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.

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

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