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.

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 last 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. Based on the Maltoni study, the industry was already hard at work tightening up plants and reducing exposure. On April 5, 1974 a temporary emergency standard for exposure to vinyl chloride was issued, specifying 50 parts per million as the maximum allowable concentration. This temporary standard was superseded by a permanent standard, effective January 1, 1975 with a permissible exposure limit of 1 part per million averaged over an 8 hour period.

Our Monochem vinyl chloride monomer plant and Painesville PVC polymerization plants have undertaken extensive occupational health programs to determine the extent of exposure and institute control measures to comply with the OSHA regulations. Unfortunately, the further high expenditures required at the Painesville Plant to meet the requirements of the standard that go into effect in 1976, and the recent proposed EPA emission standard, have lead to a decision to close the plant. Thus far, no angiosarcoma has been found in either plant.

The Environmental Protection Agency proposed emission regulations for vinyl chloride which Mr. Russell Train, EPA Administrator, addressed himself in his statement of December 16, 1975, will effect mainly the vinyl chloride monomer and polyvinyl chloride polymerizations operations.

At the time of promulgation of the vinyl chloride standards, our domestic fabrication plants used polyvinyl chloride resins which may have contained upwards of 0.1% of unreacted vinyl chloride. Through process modifications and application of control measures, PVC manufacturers have reduced the amount of residual or unreacted vinyl chloride in PVC to less than 10 ppm. With such small PVC residuals, it is highly unlikely that the proposed EPA emission regulations will have any effect on the fabrication plants.

A continuing monitoring program carried out at Uniroyal plants using PVC has shown that employees exposure levels are well below the 1 ppm OSHA permissible exposure limit. In fact, at most operations, no vinyl chloride was detectable within the sensitivity limits of present available methods of analysis.