

QUANTITATIVE RISK ASSESSMENT
FOR
COMMUNITY EXPOSURE TO VINYL CHLORIDE

SUMMARY

Vinyl chloride has produced liver angiosarcoma, a very rare form of cancer, as well as primary cancers at other sites and serious liver damage in workers employed in plants producing vinyl chloride monomer (VCM) and polyvinyl chloride (PVC). People living near these plants are also at some risk of adverse effects due to their exposure to vinyl chloride in the ambient air near the plants. Should the environmentally exposed population be the same size as it is now, and should it remain exposed to current level of vinyl chloride, we estimate that between less than one and ten cases of angiosarcoma of the liver will occur per year due to environmental vinyl chloride exposure. Due to the 15 to 20 year latency time of this disease, cases initiated this year will probably not be diagnosed until 1991 to 1995. In addition we estimate that an equal number of cancers at other primary organ sites are being produced by vinyl chloride each year, bringing the total number of cancer cases to somewhere in the range between 20 and less than one case per year. The successful implementation of the regulations is expected to reduce ambient vinyl chloride levels around plants to about 5 percent of current concentrations, and consequently to reduce the frequency of adverse health effects to 5 percent of the foregoing rates.

These estimates are based on several considerations. From 1970 census data, it was estimated that 4.6 million people live within five miles of the plants affected by these regulations. Standard methods of diffusion modeling showed that the average concentration of vinyl chloride

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over a five mile region surrounding the plants is currently 17 parts per billion. A linear dose-response relationship extrapolated to zero with no threshold dose was assumed for these effects. The estimate of liver angiosarcoma frequency was based on the available animal dose-response information from controlled experiments and on the available information on adverse effects in highly exposed workers in the industry.

The above estimates of the incidence of liver cancer involve a substantial degree of uncertainty. These estimates should be validated by epidemiological studies of neighborhoods around VC plants, not only for liver cancer but other forms of cancer, liver disease, and birth defects. Suggestive evidence for an increased incidence of birth defects has recently been reported. An epidemiological study of the cancer experience around VC plants has been initiated but at least one year will be required to obtain some solid information.

Complete copies of the risk assessment are available from Gary Robinson
EPA Press Office (202) 755-0344.

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Environmental News

Robinson (202) 755-0344

FOR RELEASE AFTER 11:00 A.M. TUESDAY, DECEMBER 16, 1975

EPA PROPOSES AIR POLLUTION STANDARDS FOR VINYL CHLORIDE

Environmental Protection Agency Administrator Russell E. Train today announced proposed limitations on air emissions of vinyl chloride from all existing and new plants in the country that manufacture ethylene dichloride (by the oxy-chlorination process), vinyl chloride, and/or polyvinyl chloride.

"Available data strongly indicate that vinyl chloride causes or contributes to development of angiosarcoma (a rare and fatal form of liver cancer), other cancers, and noncarcinogenic disorders in humans with occupational exposure to vinyl chloride and in animals exposed to the gas in laboratory experiments," Train said. The Department of Labor has adopted worker protection standards. The proposed EPA standards are to protect the general public from atmospheric exposures that result from plant emissions.

The proposed standard would require installation of best available control technology to reduce emissions from all known "point" and "fugitive" emission sources in each plant. Incinerators, solvent absorbers, carbon adsorbers, and process changes can be used to control point source emissions. Fugitive emissions can be controlled by enclosing the sources, capturing the emissions and then venting them to a control device. At

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all plants subject to the standards, the vinyl chloride concentration in exhaust gas emitted from the device that receives fugitive emissions could not exceed 10 ppm. Because vinyl chloride in inplant wastewater is believed to be emitted to the atmosphere, the proposed standard treats inplant wastewater as a fugitive emission source and sets a 10 ppm limitation on the concentration of vinyl chloride allowed in the water. (numerical limitations attached).

The proposed standards would apply to the 17 existing ethylene dichloride-vinyl chloride plants in the U.S., the 41 polyvinyl chloride plants, and new ethylene dichloride-vinyl chloride and polyvinyl chloride plants constructed in the future. The 58 existing sources account for more than 95 percent of annual U.S. emissions of vinyl chloride. The remaining emissions are from miscellaneous sources and approximately 8,000 fabricating plants around the country that use polyvinyl chloride to make plastic products.

EPA has decided not to propose standards for fabricating plants at this time. "An EPA monitoring program conducted at five fabricating plants found little or no vinyl chloride in the surrounding air," Train said. "Furthermore, the proposed EPA standard and the Department of Labor's standard for occupational exposure (promulgated October 4, 1974) will indirectly reduce vinyl chloride emissions from fabricating plants. EPA is currently studying the miscellaneous sources to determine if standards should be proposed for them."

As of June 1975, the National Cancer Institute had confirmed 27 cases of angiosarcoma among workers with a history of occupational exposure to vinyl chloride. Fifteen cases have been confirmed in the United States, 12 in Europe and Canada.

In laboratory experiments where mice, hamsters and rats were forced to inhale vinyl chloride, angiosarcoma was produced, as well as other liver disorders and cancers of the brain, lungs, kidneys, and mammary glands. In two experiments, involving rats and mice, exposures of 50 parts vinyl chloride per million parts air (50 ppm) produced angiosarcoma. Fifty ppm is the lowest exposure level for which studies have been completed thus far.

An EPA monitoring program indicates that people living in the immediate vicinity of ethylene dichloride-vinyl chloride and polyvinyl chloride plants are generally exposed to an average daily vinyl chloride concentration of less than one part per million. Some 24-hour concentrations range between one and three parts per million, with occasional peak exposures as high as 33 ppm. EPA estimates that there

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are 4.6 million people living within five miles of existing ethylene dichloride-vinyl chloride and polyvinyl chloride plants. The proposed emission standards will reduce vinyl chloride emissions by more than 90 percent from uncontrolled levels with a corresponding improvement in air quality.

"Although there are no dose-response data and thus no proof of adverse effects on man at the concentrations of vinyl chloride now found in the air near these plants, the long latency period between exposure to carcinogens and the occurrence of observable effects makes it prudent to reduce exposure levels as much as we can," Train said. "By taking steps now to reduce emissions, we will be able to reduce substantially the risk that severe illness and death will occur in the future as a result of present and prolonged community exposure to vinyl chloride."

The latent period between human exposure to low levels of vinyl chloride and the occurrence of cancer is believed to be about 20 years or more. Train noted that vinyl chloride production 15 to 20 years ago was 10 percent of what it is today.

Plants would have to meet the proposed standard within 90 days after final promulgation of the regulations. Waivers of up to two years may be granted by the Administrator if, according to the Clean Air Act, he finds that the time "is necessary for the installation of controls, and that steps will be taken during the period of waiver to assure that the health of persons will be protected from imminent endangerment."

Today's proposal was made under the "hazardous air pollutant" section of the Clean Air Act. Under the Act, a hazardous air pollutant is one for which "no ambient air quality standard is applicable and which in the judgment of the EPA Administrator may cause or contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness."

A "Standard Support and Environmental Impact Statement" prepared by EPA accompanies the proposed standard. In it, EPA estimates that the total cost for existing plants to install the equipment to meet the standard is \$198 million, of which \$15 million is for ethylene dichloride-vinyl chloride plants and \$183 million is for polyvinyl chloride plants. EPA estimates that these plants will have to spend \$70 million per year to maintain the required emission levels.

Plants would also be required to meet water effluent standards by 1983. The cost of installing equipment to meet the water effluent limitations is estimated to be \$83 million. Operating costs would be about \$17 million.

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EPA estimates that the price of polyv would rise by approximately 7.3 percent standard. This increase is estimated to average maximum 3.5 percent consumer price manufactured from PVC resins.

EPA has scheduled public hearings on the proposal for February 3 and 4, 1976. Copies of the proposal, the support document (which contains the inflation impact statement), and a "Scientific and Technical Assessment Report on Vinyl Chloride and Polyvinyl Chloride" may be obtained from Mr. Don R. Goodwin (MD-13), Director, Emission Standards and Engineering Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. Phone: (919) 688-8146. Written comments on the proposal should be submitted in triplicate to the same address.

Vinyl chloride is the fourth substance to be designated as a "hazardous air pollutant" by EPA. The Agency published emission standards for asbestos, beryllium and mercury on April 6, 1973.

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NUMERICAL LIMITATIONS

The proposed standard pertains to ethylene dichloride only when it is produced by oxychlorination of ethylene. Vinyl chloride (VC) emissions from each oxychlorination reactor in ethylene dichloride-vinyl chloride plants would be limited to 0.02 kilograms per 100 kilograms ethylene dichloride product. The VC concentration in exhaust gases from any equipment used in the formation or purification of ethylene dichloride or vinyl chloride would be limited to 10 ppm, except in the case of an emergency relief valve discharge.

At polyvinyl chloride plants, atmospheric emissions of VC from reactors would be limited to 10 ppm, except in the case of emergency relief valve discharges. Vinyl chloride concentrations in closed reactors would have to be reduced before the tanks could be opened for cleaning or for any other purpose. VC concentrations in exhaust gases from strippers (equipment that strips vinyl chloride monomer from polyvinyl chloride resins) would be limited to 10 ppm, as would emissions from containers for mixing, weighing and holding. VC concentrations in emissions from monomer recovery systems would also be limited to 10 ppm for each source. VC emissions from process equipment following the stripping operations in the manufacture of dispersion resins would be limited to 0.2 kg per 100 kg product, and in the manufacture of all other resins to 0.04 kg/100 kg product. One way in which these emission limits can be attained is by reducing the residual vinyl chloride monomer in

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dispersion resin to 2000 ppm or less and in all other resins to 400 ppm or less during the stripping operation.

At ethylene dichloride-vinyl chloride, and polyvinyl chloride plants, fugitive emissions of VC would be limited. Fugitive sources include relief valves, loading and unloading lines, slip guages, pumps, compressors, agitators, sample flasks and inprocess wastewater.

Plants Affected by Proposed Regulations

<u>Producing Company</u>	<u>Plant Location</u>
1. Air Products, Inc.	Calvert City, Kentucky
2. Air Products, Inc.	Pensacola, Florida
3. Allied Chemical Co.	Baton Rouge, Louisiana
4. Allied Chemical Corp.	Geismar, Louisiana
5. B.F. Goodrich Co.	Calvert City, Kentucky
6. B.F. Goodrich Co.	Avon Lake, Ohio
7. B.F. Goodrich Co.	Henry, Illinois
8. B.F. Goodrich Co.	Long Beach, California
9. B.F. Goodrich Co.	Louisville, Kentucky
10. B.F. Goodrich Co.	Pedricktown, New Jersey
11. Borden, Inc.	Illioopolis, Illinois
12. Borden, Inc.	Leominster, Massachusetts
13. Continental Oil Co.	Aberdeen, Mississippi
14. Continental Oil Co.	Oklahoma City, Oklahoma
15. Continental Oil Co.	Lake Charles, Louisiana
16. Continental Oil Co.	Westlake, Louisiana
17. Diamond Shamrock Corp.	Delaware City, Delaware
18. Diamond Shamrock Corp.	Deer Park, Texas
19. Dow Chemical Co.	Midland, Michigan
20. Dow Chemical Co.	Freeport, Texas
21. Dow Chemical Co.	Oyster Creek, Texas
22. Dow Chemical Co.	Plaquemine, Louisiana
23. Ethyl Corp.	Baton Rouge, Louisiana
24. Ethyl Corp.	Houston, Texas
25. Firestone Tire Co.	Perryville, Maryland
26. Firestone Tire Co.	Pottstown, Pennsylvania
27. General Tire Co.	Ashtabula, Ohio
28. Georgia-Pacific Corp.	Plaquemine, Louisiana
29. Pittsburgh Plate Glass Co.	Lake Charles, Louisiana
30. Goodyear Tire Co.	Niagara Falls, New York
31. Goodyear Tire Co.	Plaquemine, Louisiana
32. Great American Chemical Corp.	Fitchburg, Massachusetts
33. Jennat Corporation	Torrance, California
34. Jennat Corporation	Tucker, Georgia
35. Jennat Corporation	Somerset, New Jersey
36. Keysor-Century Corp.	Saugus, California
37. Monochem, Inc.	Geismar, Louisiana
38. Monsanto Co.	Springfield, Massachusetts
39. Occidental Petroleum Corp.	Burlington, New Jersey
40. Occidental Petroleum Corp.	Hicksville, New York
41. Pantasote Co.	Passaic, New Jersey
42. Pantasote Co.	Point Pleasant, West Virginia
43. Pittsburgh Plate Glass Co.	Guayanilla, Puerto Rico
44. Robintech, Inc.	Painesville, Ohio
45. Shell Oil Co.	Deer Park, Texas

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<u>Producing Company</u>	<u>Plant Location</u>
46. Shell Oil Co.	Norco, Louisiana
47. Shintech, Inc.	Freeport, Texas
48. Stauffer Chemical Co.	Long Beach, California
49. Stauffer Chemical Co.	Delaware City, Delaware
50. Tenneco, Inc.	Houston, Texas
51. Tenneco Chemicals, Inc.	Burlington, New Jersey
52. Tenneco Chemicals, Inc.	Flemington, New Jersey
53. Tenneco Chemicals, Inc.	Pasadena, Texas
54. Union Carbide Corp.	Taft, Louisiana
55. Union Carbide Corp.	Texas City, Texas
56. Union Carbide Corp.	South Charleston, West Virginia
57. Uniroyal, Inc.	Painesville, Ohio
58. Vulcan	Geismar, Louisiana