



TENNECO CHEMICALS
(COMPANY)

INTEROFFICE COMMUNICATION

TO: FILES
FOR:
FROM: D. R. KECK
RE: QUANTITATIVE RISK ASSESSMENT FOR
COMMUNITY EXPOSURE TO VINYL CHLORIDE MONOMER

DATE: March 30, 1976

7-10-76
revised up to 10/76
copy to [unclear]

SUMMARY

A report entitled "Quantitative Risk Assessment for Community Exposure to Vinyl Chloride Monomer," dated December 5, 1975, authored by Messrs. Arnold M. Kuzmack and Robert E. McGaughy of the United States Environmental Protection Agency in Washington, D. C., has been reviewed and the logic of this report has been extended to the Tenneco Chemicals' expanded polyvinyl chloride plant at Pasadena. The EPA report predicts an average of 5.5 cases of liver angiosarcoma per year among 4,600,000 people living within a five mile radius of existing VCM and PVC plants, based on 1973 production and population figures. The report further predicts a 95% reduction after the proposed EPA regulations are promulgated and the requirements of the regulation are implemented by the various plants. Application of the same calculation methods to the estimated population within five miles of the Tenneco plant indicates that the proposed emissions from the Tenneco plant will result in a concentration of vinyl chloride monomer in the atmosphere so low that only 0.00055 cases of liver angiosarcoma per year are predicted. This would amount to one case about every 1,800 years.

DISCUSSION

The Quantitative Risk Assessment Report was reviewed very carefully. By the admission of the authors, it is conservative. The EPA authors have used conservative linear modeling to extrapolate the expected frequencies at trace concentrations of VCM from animal test data and limited statistics on human cases of liver angiosarcoma. This results in extrapolation from data above 50 parts per million on test animals and human cases to concentrations of less than 1/1000 of 50 parts per million, or less than 50 parts per billion. Their conclusion (page ii of executive summary and page 5 of full report) is that exposure to vinyl chloride monomer would cause 0.071 cases of liver angiosarcoma and 0.15 cases of all types of cancer per million people per year per part per billion of continuous exposure. It should be recognized that the mathematics of the program leading to this conclusion prevents the calculation of zero cases. They further estimate a distribution of 4.6 million humans living within five miles of existing plants are exposed to 17 parts per billion on an average basis (page 1 of report and appendix "A"). The number of cases per year, therefore, is calculated as $0.071 \times 4.6 \times 17 = 5.5$. On page 7 of the full report it is noted that EPA regulations will reduce vinyl chloride emissions by 95%. This will reduce the concentration the 4.6 million people are exposed to from 17 parts per billion to 0.85 parts per billion and the estimated number of cases of angiosarcoma per year would be reduced from 5.5 to 0.27. The concentrations and population distribution used in the assessment report are summarized on Table I, attached.

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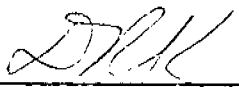
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Tenneco Inc. has the computer programs used by the EPA in their determination of dispersion of VCM around the PVC and VCM plants. These models and average annual weather data from the United States Weather Bureau at Hobby Airport in Houston were used to predict the dispersion of vinyl chloride from Tenneco's plant within a five mile radius. The emissions from the Tenneco plant are based on the expanded plant when meeting EPA requirements. The concentrations at various points in a square 50,000 feet by 50,000 feet, with the Tenneco plant approximately at the center, were computed. A computerized printout of concentrations in parts per billion was obtained and referred to a map of the area. The map is in sufficient detail that the location of populated areas can be determined and the concentrations of VCM in those areas, provided by the computer, can be used to calculate an estimated average exposure of people within a five mile range. Table I also presents these calculations. They indicate an annual average exposure of 0.06 parts per billion, which is a reduction of 93% below the post EPA average from all plants in the country, and approximately 1/1,000,000 of the 50 parts per million concentration test data. The calculated number of cases of angiosarcoma based on an area population of 131,474 from the EPA report and a distribution around the Tenneco plant obtained by inspection of the area map is 0.00055 cases per year. The calculation is $0.071 \times 0.132 \times 0.06 = 0.00055$ cases per year assignable to the Tenneco Chemicals plant. This calculates to be one case about every 1,800 years.

Inasmuch as the EPA report is, by admission of the authors, very conservative, the above calculated frequencies of angiosarcoma cases attributable to the Tenneco plant are also conservative. Further conservatism is evident; the animal and human data to which the linear programming was applied indicate that the only known cases of liver angiosarcoma among humans were among people who were exposed to concentrations averaging at least 200 to 500 parts per million over a number of years (page D-3 of the assessment report). Animal test data presented in the report indicate that animals exposed to 50 or more parts per million of VCM contacted liver angiosarcoma (section B of report).

While Tenneco is not presuming to establish the tolerance of the human system for vinyl chloride monomer, the extrapolation of the present test and statistical data to levels of a fraction of one part per billion, or 1/1,000,000 of the level observed to cause cancer in one test animal, does suggest that the near zero risk calculated by the linear method could be considered zero risk for the population surrounding the Tenneco plant.


D. R. Keck

DRK:wm

Attachment

cc: ✓ Mr. W. P. Anderson
Mr. L. W. Feldcamp
Mr. R. L. Churchwell
Mr. C. E. Crain

TABLE I

QUANTITATIVE RISK ASSESSMENT FOR COMMUNITY EXPOSURE TO VINYL CHLORIDE

A. <u>NATIONAL*</u>		<u>Year of 1973</u>	<u>Post EPA</u>
PVC Losses		4%	0.2%
<u>Population Distribution</u>		<u>Conc.</u> <u>ppb</u>	<u>Conc.</u> <u>ppb</u>
0 - 1/2 Mile	34,000	323	16.2
1/2 - 1 Mile	228,000	57	2.8
1 - 3 Miles	2,013,000	15	0.75
3 - 5 Miles	<u>3,439,000</u>	5.7	0.28
Weighted Total 0 - 5 Miles	5,714,000		
Actual Total 0 - 5 Miles	4,600,000		
Weighted Ave. 0 - 5 Miles		17	0.85
Calculated Cases Angiosarcoma/Year Based on Linear Dosage: 0.071/MM/ppb*			
0.071 x 4.6 x 17 =		5.5	0.27
Calculated years between cases		0.184	3.7
B. <u>TENNECO CHEMICALS PLANT</u>		<u>Expanded Plant; Post EPA</u>	
<u>Population Distribution</u>		<u>Conc.</u> <u>ppb</u>	
0 - 1/2 Mile	0		
1/2 - 1 Mile	0		
1 - 2 Miles	2,000	0.141	
2 - 3 Miles	8,000	0.119	
3 - 4 Miles	40,000	0.068	
4 - 5 Miles	<u>81,474</u>	<u>0.049</u>	
Actual Total 0 - 5 Miles	131,474		
Weighted Ave. 0 - 5 Miles		0.060	
Calculated Cases Angiosarcoma/Year*			
0.071 x 0.132 x 0.06 =	0.00055		
Calculated years between cases	1,800		

* Based on Quantitative Risk Assessment for Community Exposure to Vinyl Chloride," Arnold M. Kuzmack and Robert E. McGaughy, U.S. EPA, Wash. D.C. 20460, Dec. 5, 1975.