

References contd:

- COOPER WC. (1981) Epidemiologic study of vinyl chloride workers: mortality through December 31, 1972. Environ Hlth Perspect. 41, 101-106.
- CREECH JL & JOHNSON MN. (1974) Angiosarcoma of liver in the manufacture of polyvinyl chloride. J Occup Med, 16, 150-151.
- DALDERUP LM, FRENI SC, BRAS G, BRONCKHURST FB. (1976) Angiosarcoma of the liver. Lancet, 1, 246.
- DOWNS TD, STALLONES RA, FRANKOWSKI RF, LABARTHE DR. (1977) Vinyl chloride, birth defects, and fetal wastage: a critical review. Report to the Society of Plastic Industries, Inc. (unpublished)
- DUCK BW, CARTER JT, COOMBES EJ. (1975) Mortality study of workers in a polyvinylchloride production plant. Lancet, 2, 1197-1199.
- ELINDER CG, PERSHAGEN G. (1978) Pilot study concerning the mortality in Njurunda Community. Swedish Nature Conservancy Board. (cited by Barr, 1981)
- ENVIRONMENTAL HEALTH ASSOCIATES (1986) An update of an epidemiological study of vinyl chloride workers 1942-82. Final report to the Chemical Manufacturers Association. Environmental Health Associates, Oakland, California.
- ENVIRONMENTAL PROTECTION AGENCY (1975) Standard support document and environmental impact statement: emission standard for vinyl chloride. EPA 450/2-75-009. Environmental Protection Agency, Washington.
- EQUITABLE ENVIRONMENTAL HEALTH (1978) Epidemiological study of vinyl chloride workers: final report to Manufacturing Chemists Association. Equitable Environmental Health, Rockville, Maryland.
- FALK H, TELLES MC, ISHAK KG, THOMAS LB, POPPER H. (1979) Epidemiology of thorotrast-induced hepatic angiosarcomas. Environ Res, 18, 65-73.

References contd:

- LAPLANCHE A, CLAVEL F, CONTASSOT J-C, LANOUZIERE C. (1987) Exposure to vinyl chloride monomer: report on a cohort study. Institut Gustave Roussy (to be published).
- LILIS R, ANDERSON H, MILLER A, SELIKOFF I. (1976) Pulmonary changes among vinyl chloride polymerisation workers. Chest, 2 (Suppl.), 299-305.
- LLOYD MH, GAULD S, COPLAND L, SOUTAR CA. (1985) Epidemiological study of lung function of workers at a factory manufacturing polyvinyl chloride. Brit J Industr Med, 41, 328-333.
- MACMAHON, B. (1977) Vinyl chloride and human reproduction. Report to Chemical Manufacturers Association. (unpublished)
- MALTONI C, CILIBERTI A, GIANNI L, CHIECO P. (1974) Vinyl chloride carcinogenesis: current results and perspectives. Med Lav, 65, 421-444.
- MALTONI C. & LEFEMINE G. (1975) Carcinogenicity bioassays of vinyl chloride: current results. Ann NY Acad Sci, 246, 195-218.
- MALTONI C, LEFEMINE G, CILIBERTI A, COTTI G, CARRETTI D. (1984) Experimental research on vinyl chloride carcinogenesis. Archives of Research on Industrial Carcinogenesis, Vol. 2. Eds. Maltoni C. & Mahlman MA. Princeton Scientific Publishers, Princeton.
- MARSTELLER HJ, DELBACH WK, MULLER R, GEDIGK P. (1975) Unusual splenomegalic liver disease as evidenced by peritoneoscopy and guided liver biopsy among polyvinyl chloride production workers. Ann NY Acad Sci, 246, 95-134.
- MARSTELLER HJ, DELBACH WK, MULLER R, JUHE S, LANGE CE, ROHNER HG, VELTMAN G. (1973) Chronisch-toxische Leberschäden bei Arbeitern in der PVC-Produktion. Dtsch Med Wochenschr, 98, 2311-2314.

References contd:

- SARIC M, KULCAR Z, ZORICA M, GELIC J. (1976) Malignant tumors of the liver and lungs in an area with a PVC industry. Environ Hlth Perspect, 17, 189-92.
- SOUTAR CA. (1980) Epidemiological study of respiratory diseases in workers exposed to polyvinyl chloride dust. Thorax, 35, 644-652.
- TABERSHAW IR. & GAFFEY WR. (1974) Mortality study of workers in the manufacture of vinyl chloride and its polymers. J Occup Med, 16, 509-518.
- THERIAULT G. & ALLARD P. (1981) Cancer mortality of a group of Canadian workers exposed to vinylchloride monomer. J Occup Med, 23, 671-676.
- TURNER CA, PAYNE AP & BUSHBY ER. (1984) Determination of Ambient Levels of Vinyl Chloride Monomer (VCM) around Manufacturers in the UK. Part 7, 1984. Warren Spring Laboratory, Department of Trade and Industry, Stevenage.
- VIOLA PL, BIGOTTI A, CAPUTO A. (1971) Oncogenic response of rat skin, lungs, and bones to vinyl chloride. Cancer Res, 31, 516-519.
- WAXWEILER RJ, STRINGER W, WAGONER JK, JONES J, FALK H, CARTER C. (1976) Neoplastic risk among workers exposed to vinyl chloride. Ann NY Acad Sci, 271, 40-48.

Table 2
 NUMBERS OF DEATHS FROM NON-MALIGNANT AND ALL CAUSES:
 FOUR STUDIES

Cause of death	USA	UK	Canada	Italy
	Obs*/Exp	Obs/Exp	Obs/Exp	Obs/Exp
Benign & other unspecified tumours	4/5.08	-	-	0/0.5
Cerebrovascular disease	75/91.93	-	-	-
Ischaemic heart disease	521/597.73	276/288	25/31.67	19/27.4
Other circulatory disease	157/123.55	105/141		
Bronchitis**	44/22.83	36/44	6/3.21	3/5.0
Pneumonia	16/31.94	40/61		
Other respiratory disease	15/32.84	-	-	-
Cirrhosis of liver	37/56.06	5/5	+4/3.85	4/5.2
Other digestive disease	27/39.52	-		3/2.7
Disease of genito-urinary system	11/20.41	-	-	-
Other diseases	67/115.68	43/76	++2/5.40	2/7.0
Suicide	49/52.78	40/50	2/10.58	1/0.9
Accidents & other violence	130/173.19			4/7.7
All non-malignant causes	1153/1363.54	545/665	39/54.76	36/56.4
All causes	1536/1705.27	780/894	59/71.07	66/77.5

* See footnote to Table 1

**Emphysema in US data

+ Includes 2 certified as cirrhosis of the liver which proved to be angiosarcoma of liver

++ Includes 1 cause unknown

Table 4
MORTALITY FROM VARIOUS CANCERS IN VINYL CHLORIDE WORKERS
IN 49 PLANTS IN 4 STUDIES

Source of Information	Type of cancer	No. of deaths		SMR
		Observed	Expected	
1,2,3,4	Cancer of mouth and pharynx	18	16.57	109
1,2,3,4	" " digestive system (other than liver)	125	154.59	81
1,2,3,4	" " respiratory system	223	229.36	97
1,2,4	" " lung	211	214.09	99
1,2,3,4	" " genito-urinary system	70	62.81	111
2,4	Melanoma	2	1.94	-
1,2,3	Cancer of brain	29	19.54	148
2	" " thyroid	2	0.43	-
1,2,3,4	" " lymphatic and haemato- poietic system	57	50.87	112
1,2,3,4	Other cancers	83	63.24	131
1,2,3,4	All cancers other than liver	609	599.35	102

- 1 US study
- 2 UK study
- 3 Canadian study
- 4 Italian study

Table 6
MORTALITY FROM LUNG CANCER IN THE US AND UK SERIES
BY CHARACTERISTICS RELEVANT TO AN OCCUPATIONAL HAZARD

Data characteristic	No. of deaths in category				SMR category	
	1		2		1	2
	*Obs.	Exp.	Obs.	Exp.		
Observed 20 yrs or more after first employment (1), others (2)	114	113.96	85	93.83	100	91
Employed 10 yrs or more in USA (1), others in USA (2)	55	52.45	63	63.44	105	99
Employed before 1956 in UK (1), others in UK (2)	52	51.39	29	40.50	101	72
Ever employed as autoclave worker in UK (1), others in UK (2)	16	17.08	65	74.82	94	87

*See footnote to Table 1 for observed deaths in USA.

Table 8
MORTALITY FROM CHRONIC OBSTRUCTIVE LUNG DISEASE*
BY CHARACTERISTICS RELEVANT TO AN OCCUPATIONAL HAZARD

Data characteristic	No. of deaths in category				SMR category	
	1		2		1	2
	Obs.	Exp.	Obs.	Exp.		
Observed 20 yrs or more after first employment in USA (1), others in USA (2)	30	15.8	11	7.0	190	157
Employed 10 years or more in USA (1), others in USA (2)	16	10.9	25	12.0	147	208
Employed before 1956 in UK (1), others in UK (2)	26	30.17	10	13.60	86	74
+ Ever employed as autoclave worker in UK (1), others in UK (2)	3	6.55	33	37.22	46	89

*Described as emphysema in US study and bronchitis in UK study.

+ Men ever employed as a bagger or drier, which would have caused the greatest occupational exposure to PVC dust, experienced 1 death from 'bronchitis' against 4.98 expected.

CMA 009706