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INTERNAL CORRESPONDENCE

VC Research 514

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R. N. WHEELER, JR.

Dear John,

Please find the enclosed chronological reconstruction of the VCM story.

I think your people might find it of interest, especially Russ Hanna.

Best Regards,

A.J. Benson
A.J. Benson

Encl.

AJB/dz

UCC 070579

VINYLCHLORIDE - A REVIEW OF THE ENVIRONMENTAL AND HEALTH ASPECTS

The interest for environmental questions has been low in the medical practice, legislation and research.

Other subjects and risk-factors have priority - like tobacco - smoking, physical activity, food, and alcoholic consumption.

Cancer-tumour researches are following other routes. The ^{at}ministration of picture of the importance of public health is remarkable in the many cases of reported exposure at accidents.

Particularly surprising is the chronology concerning the vinylchloride. The author has studied the available literature and is giving a summary of the contents of importance, in order to guide the purpose and methods in the theoretical and applied toxicology in order to serve the prevention of environment risks in the industry-history.

The Vinylchloride started to be used commercially in the end of 1930. In Sweden 1945. The yearly production in the total world is about 11 mill. tons 1974.

The increase has been about 15%/year during the last five years. 99% of the V C M was used for production of P V C, about 1% was used as propellant in aerosols (Levison 1974).

The Swedish Institute of Health and Safety has followed the line taken by OSHA in USA over exposure to V C M, and has reduced the standard from 20 ppm to 1 ppm with a maximum of 5 ppm average for 15 min. periods.

Below is a review of the essential articles on the toxicological data of V C M after the beginning of its commercial use. The acute toxic effects, of narcotic character and fire hazards are not involved.

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Chronological survey

1949. Tribbitt and collaborators published a report about respiration-organ, circulation-organ, and liver change of workers in a vinylchloride-PVC-plant.

1950. This above article is summerized in Chemical Abstracts.

1957. Filatova and collaborators reported about "chronical angioneurosis" in vinylchloride - PVC-production even at exposition-levels of 4 - 20 ppm. A summary is reported the same year in Chemical Abstracts.

1961. Torkelson and collaborators are publishing Dow Chemicals' tests on rats showing liverparenchymal changes at 500-200 ppm and an increase of the liver-weight at 100 ppm. Dow Chemical accept this and choose 50 ppm as threshold-value for their own part.

1963. Suici and collaborators report of neurasteni, Raynaud, sclerodermia, and hepatomegaly among vinylchloride - PVC - workers.

1964. This year Dr Ward in Louisville reports liver-injuries on a worker at BF Goodrich (vinylchloride-PVC) as an industrial injury. This man died 1973 in hemangiosarcoma (Levison 1974).

1965. Fuschin is the first one to report in writing about acroosteolysis. The following years similar reports are published from Belgian, England, France and USA. (Cordier and others 1966; Levison 1974).

1969. Schottel publishes a vinylchloride-bibliography and presents an action-program based on the seriousness in the vinylchloride-reports about neurologic, nephritic, acroosteolytic, and sclerodermal symptoms and liver-change.

1970. Viola reports at the Xth International Cancer Congress about zymbalgland-tumours at 30 000 ppm on rats. Published in Cancer Research 1971.

1971. Maltoni (Bologna) begins his animal-tests with vinylchloride.

1972. Maltoni finds zymbalgland-tumours but also nephroblastoma and liver-angiosarcoma on rats at 250 p.p.m. He reports these observations (Maltoni 1974) to his principals - four European plastic-plants and Manufacturing Chemical Association (MCA) in U.S.A.

1973. At the Second International Symposium on Cancer Detection and Prevention, in Bologna in April 1973, Maltoni reports in a public speech Maltoni 1973 the mentioned statements. On third of July a meeting is taking place between the federal NIOSH, MCA, and Chemical Industry-representatives in U.S.A. Maltoni's results and epidemiology for involved industry-branches are discussed. Marsteller and collaborators (1973) publish a report on hepatomegaly, splenomegaly, trombocytopeny, and acroosteolysis among vinyl-chloride-PVC-workers. The report is based on careful studies with help of among other things peritoneoscopy.

1974. On the twenty-second of January Goodrich Chemical, U.S.A., report to NIOSH and others, that among their employees in the vinyl-chloride-PVC-production they have retrospectively found three angiosarcoma.

O S H A arrange on the 15th of February a "hearing" where Maltoni and collaborators appear.

N I O S H suggest on the 11th of March "no detectable level" of 1 ppm as threshold-values.

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O S H A choose on the 5th of April 50 ppm as "tentative interim standard".

On the 23rd of April The Swedish Board of Industrial Safety issue a temporary direction of 20 ppm as a threshold value.

On the 10th to 11th of May The New York Academy of Sciences arrange a two-day conference only about vinylchloride-PVC. On this occasion a comprehensive bibliography is distributed covering 130 references (Office of Occupational Health 1974). Maltoni (1974) and MCA report independently about angiosarcoma on rats and mice now also at 50 ppm.

Maltoni also points on the transplacental effect on rats.

O S H A present at the same time a suggestion about "no detectable level" (= 1 ppm) as threshold-value.

During the summer 1974 there are hearings in Washington (4000 pages official record). Industry-representatives describe imaginable occupying losses and state that it is economically impossible to go down to the values suggested by N I O S H and O S H A (compare for instance Hasting, President of the American Plastic-Industry Federation 1974).

Rannug and collaborators at the Wallenberg Laboratory in Sthlm publish a report describing vinylmutagenicity after metabolic activation on Salmonella typhimurium.

In October 1974 29 angiosarcomas are known. Two of these derive from Sweden and have been identified. The first case 1970 and later 1972 diagnosed as liver-cancer.

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It is to a high degree justified to ask, why the growing amount of information about the different serious injuries, particularly from the last 10-year period, not before 1974 is taken into a systematic consideration among the people concerned with the company preservation of health.

With a few exceptions, only some companies have sporadic medical examinations. Technical measurement has been rare and concentrated on high exposition levels. Information about eventual hygienical injuries has rarely been given to the employees.

- 4.) The detection of angiosarcoma (and other tumours) during the Seventies, first on animals, later in man, points on some alarming phenomena in the industry concerned:

- a) Maltonis carefully planned experiments are financed by the industry. He has now informed that his test-results preliminary were given only to his principals.

The plastic-industry, like others, who are handling chemicals ought to have been obliged to toxicologically value their chemicals and continuously follow up eventual symptoms related to the working-process.

The present system is senseless and creates suspiciousness and delays the health-preventions for the exposed people. A demand is therefore a clear insight into the industry-financed toxicological research and information of an independent research centre.

- b) The views and procedures behind the determination of the threshold values, particularly concerning cancerogenic substances must be rechecked.

Still in many cases an unscientific attitude seems to be dominating, namely that a dose-response analysis could lead to a confirmation of non-tumour, producing exposition limits even for verifiable cancerogenic substances. It is evident to-day that cancer-developing substances, alone or with co-factors, exert an influence which can not be foreseen by mathematic models. (EPSTEIN 1974).

If values above nil of economical reasons are chosen, the cancer risk for the exposed individuals must clearly be declared. The magnitude of this risk must be estimated and clearly stated. A judgement of this character has in reality always taken place, but outwards-even in the Swedish threshold limit value list 1974, (The National Swedish Board of Industrial Safety) it is understood that the values are strictly based on hygienic-scientific judgement. However, in practice are every limit value economical-hygienic (and often influenced by measuring methods) but the involved components has not been separately declared.

There are reasons to believe that the to-day limits can be looked upon as a series of retreat where often an overpowering published proof, in a few cases has led to an adequate determination of the threshold limit values, i.e. Vinylchloride.

5.) Testing of chemicals in working environment includes systematic errors.

Furthermore, there is a lack of international coordination.

All the chemical and animal tests together with the clinical and epidemiological tests are suffering from serious weaknesses. As regards the epidemiology, the results are unclear since a well define series of observations during 30-40 years is required to forecast the risk of cancer.

On the first of October G. E. H. A. decide that the threshold value should be 1 ppm valid from January 1975.

On the 18th of October the Swedish Board of Industrial Safety agree on the same limit valid from the same date.

REFLECTIONS

The chronology gives reason for the following reflections:

- 1.) Chemical relatively alarming results concerning vinylchloride have been available since 1949 - 1950 and in increased extensiveness since 1957. Both these Russian reports were immediately referred to in Chemical Abstracts.
- 2.) That Forkelson's and collaborator's report of 1961 about vinyl-toxicity in animal-tests was not observed to full extent and did not lead to a decrease of the threshold value - in spite of the report culminating in such a recommendation - must be considered as an annoying negligence from responsible people involved. The report seems not to have been the inspiration to any toxicological research.
- 3.) During the Sixties a growing amount of reports were published about clinical changes during the handling of vinylchloride-Raynaud, acroosteolysis, sclerodermi, hepatomegali. These reports complete the Russian reports. Even if these studies contained little information about exposition-levels the amount and nature of physiological changes ought to have led to an intensified research and a review of the regulations with the background of the fast growing vinylchloride-PVC-industry.

The company health service must increase the control of exhibited individuals and be aware of the limits of its methods.

The human beings must not be test subjects where other possibilities are available. The valuable preventive work has probably instead its preponderance of power outside the companies health services in the form of biological tests, mutagenic tests and similar tests.

A collaboration-work must start on this subject, and it has to be repeated, that the industry has to be enjoined to test all substances and compounds the individual could be exposed to.

LITTERATUR

CORDIER J M, FIEVEZ C, LÉFÈVRE M J, SEVRIN A:

Acro-ostéolyse et lésion cutanées associées chez ceux ouvriers affectés au nettoyage d'autoclaves. Cah Méd Travail 4: 14 1966.

EPSTEIN S S: Environmental determinants of human cancer. Cancer Res 34:2425-2435 1974.

FILATOVA V S, GRONBERG E S: Sanitary-hygienic working conditions in the production of PVC resins and measures for improving these conditions. Gig Sanit 1:38-42 1957.

HARDING R: 1: Current Developments Section. Washington: The Bureau of National Affairs Inc 123: A-8-9 1974.

LEVINSON C: Work Hazard: Vinyl Chloride. Genève: ICF 1974.

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MALTONI G: Occupational carcinogenesis. Preprint of International Congress Series 322. Excerpta Medica 1974.

- Föredrag vid Working Group on Vinyl Chloride and Poly-vinyl Chloride, New York 10-11 May 1974. Ann NY Acad Sci to be publ - Carcinogenicity Bio-Assays of Vinyl Chloride: Plan, Current Results, and Perspectives. Bologna Oct 17 1974. Presenterat vid ICF, Genève 1974.

MARSTELLAR H J, LELBACH W K, MULLER R, JUHE S, LANGE C E, ROHNER H G, VELTMAN G: Chronisch-toxische Leberschäden bei Arbeitern der PVC-Produktion. Dtsch Med Wochenschr 98: 2311-2314 1973.

MONSON R R, PETERS J M, JOHNSON M N: Proportional mortality among vinyl chloride workers. Lancet i: 397-398 1974.

OLIN R: Vinylklorid-sjukdomen. Läkartidningen 71: 1500 1974.

PONTÉN J: Experimentell cancerforskning 1969-1971, Cancer 2: 11-22 1972.

PUSCHING G A: Sov Med 28: 132-135 1965.

RANNUG U, JOHANSSON A, RAMEL C, WACHTMEISTER C A: The mutagenicity of vinyl chloride after metabolic activation. Ambio 3 (5): 194-197 1974.

SCHOTTEK W: Zur Toxikologie des Vinyl-chlorides. Chem Techn 21: 708-711 1969.

SUICIU I, DREJMAN J, VALASKI M: Etude des maladies dues au chlorure de vinyle. Med Lav 58: 261-271 1967.

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TORKELSON T R, OYEN F, ROWE V K: The toxicity of vinyl chloride as determined by repeated exposure of laboratory animals.

Am Ind Hyg Assoc J 22: 354-361 1961.

TRIBUKH S R, TIKHOMIROVA S V L, KOSLOV L A: Working conditions and measures for their improvement in production and use of vinyl chloride plastics. Gig Sanit 10: 38-44 1949.

- - Sammandrag i Chem Abstr 44: 1743 1950.

VIOLA P L: Cancerogenic effect of vinyl chloride. Föredrag vid Xth Int Cancer Congress, Houston 1970.

BISOTTI A, CAPUTO A: Oncogenic response of rat skin, lungs and bones to vinyl chloride. Cancer Res 31: 516-522 1971.

Arbeterskyddsstyrelsens meddelanden. Nedbringande av expositionen för vinylklorid. 1974: 30

Arbeterskyddsstyrelsen: Hygieniska gränsvärden. Okt 1974.

Federal Register. Department of Labor: Exposure to Vinyl Chloride. 39: 194 Oct 4 1974.

Office of Occupational Health Surveillance and Biometrics, NIOSH: A bibliography on vinyl chloride. Stencil 1974.