

St. Louis

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Rushon (3) Airmail

AROCLORS - TOXICITY

I have your note of December 28, 1931 asking about literature references relating to the toxicity of Aroclors. Here are those I have been able to pick up by reviewing the journals and textbooks in the St. Louis Library:

- (1) American Journal of Public Health 26, 586 (1936) June
- (2) * Journal American Medical Association 122, 158 (1935)
- (3) * Journal Ind. Hygiene & Toxicology 19, 253 (1937)
- (4) * " " " " 20, 244 (1938)
- (5) * " " " " 21, 29 (1939)
- (6) * " " " " 22, 152 (1940)
- (7) * " " " " 22, 251 (1940)
- (8) Industrial Medicine, 2, 426 (1939)
- (9) " " " " 12, 240 (1945)
- (10) * Arch. Dermatol. & Syph. 33, 1022 (1936) June
- (11) * " " " " 34, 730 (1938)
- (12) * New York State Jour. Med. 34, 899 (1934)
- (13) Proc. Soc. Experimental Biology & Medicine 35, 115 (1936)
- (14) American Jour. Hygiene, 27, 19 (1938)
- (15) Industrial Bulletin, Div. Ind. Hyg., N.Y. Dept. Labour, 21, 30 (1940)
- (16) " " " " 22, 10 (1940)
- (17) " " " " 22, 404 (1940)
- (18) Pennsylvania Dept. of Labor Special Bulletin, No. 43, 1935
- (19) State of California, Dept. Ind. Relations, "Minutes of Accident Committee, Nov. 30."
- (20) * Schwartz & Kaplan "Occupational Diseases of the Skin," Lea & Febiger, 1935.
- (21) * Fairhall, "Industrial Toxicology," Williams & Wilkins, Baltimore
- (22) * Leinen & Flury "Toxicologie u. Hygiene der technischen Lebensmittel," Springer 1935
- (23) * Johnstone "Occupational Diseases," W.B. Saunders Co., Philadelphia & London 1941.
- (24) * International Labour Office, Geneva, Occupation & Health Supplement, "Industrial Health in Maritime."
- (25) * Jacobs, "Solvents," Edwards: Solvents", Interscience Publisher, Inc. New York 1941.
- (26) * Industrial Hygiene & Toxicology, Interscience Publisher Inc., New York & London, 1940-2.
- (27) * Wilkins, Chemistry of Industrial Toxicology, Wiley, Chapman & Hall, London 1930.

Those marked * have been available in the Monsanto St. Louis Library, and I have briefly looked through them, naturally finding a lot of repetition. Unfortunately, many of the writers have dealt with chlorophthalene and chlorodiphenyls under the same heading, and have not always

made it clear which group they were discussing. Further, many grades and varieties of chlorophthalene and chlorodiphenyls have come under consideration.

References 5 and 9 appeared to give the best review of the information, so I am sending you full photostat copies of them, but I give also some abstracts of any of the other available references which appeared to contain anything new or especially important. Please let me know if you would like full copies of any of the articles listed. Even if the originals are not in the St. Louis library, I believe we could get photostat copies.

Summarizing I should say that most troubles arise from people using the waxy products, especially where the materials have been heated as in the soldering etc. of electrical components insulated with the waxes. Diphenyl is liable to contain styrene, and the chlorino derivatives of this impurity appear to be more harmful than the pure chlorodiphenyls. Exposure to the technical materials can give rise to skin troubles, and slowly to liver troubles, but with a fair standard of cleanliness we should easily keep out of trouble.

ABSTRACTS

- (3) Journal Industrial Hygiene & Toxicology, 19, 283 (1937).

Animal experiments. Vapor and in food. App. for Göttern. in air. Slow liver damage. Mainly chlorophthalenes. CO_2 adds to the effect.

- (18) Filkins, "Industrial Medicine", Vol. 8, (1938), page 428

"We once took some samples for pentachlorophthalene in a plant where two deaths had occurred, apparently caused by exposure to fumes of this material. We found a concentration of between 1 and 2 mg per cu m of air, and from that we could state that concentrations of 2 mg or over were unsafe, but we could not say that below 1 mg or 0.5 or even 0.1 mg was safe."

- (20) "Occupational Diseases of the Skin", Schwartz & Fildes, pp 363-

Schwartz, Jour. Pub. Health, 25, 585-592, June 25, reported that nearly all the workers examined in the U.S. who were exposed to the

- (20) Fumes of the chloronaphthalenes and diphenyls for any length of time, were found to have a comedone acne-like condition of the skin. Jones & Alden, Arch. Dermat. & Syph., 33, 1022-1034, June/36, reported a similar condition among workers with the chlorodiphenyls. p.355. The workers who handle the hot chlorodiphenyls (in manufacture), and chlorinate the diphenyl, especially the operation in which the crude chlorodiphenyls are redistilled to remove impurities, are affected with an acne comedone condition of the skin similar to that of workers who handle chloronaphthalene, or are exposed to the fumes. The fumes of both these compounds, as well as prolonged contact with the solid substance first cause comedones on the parts exposed to the action. When they penetrate or soil the clothing they cause lesions on the covered parts. ---- The lesions begin as small comedones or as blind cysts, and develop into hard cyst-like elevations some of which go on to suppuration. The lesions occur in the follicles, resemble the comedones and pustules of acne vulgaris, and often leave scars.

- (22) Toxicologie und Hygiene der technischen Lösungsmittel, K.B.Lohmann & P. Pilsky

Springer, Berlin, 1938, p.144, discusses chlorinated naphthalenes, and states:

"In America several cases of acute yellow atrophy of the liver have occurred (Drinker & co-workers 1937). Possibly, however, here other toxic effects have taken part, especially in work with volatile chlorinated hydrocarbons etc. Of special interest is the observation that the effect of alcohol and carbon tetrachloride is increased by these materials. Chlorinated diphenyl acts still more strongly than the naphthalene derivatives.

- (25) Acute Toxicity: Solvents, Interscience Publishers Inc., N.Y. 1941, p.489

Probable safe concentration limits of exposure: chlorodiphenyls 1.0 mg per cu. m. (State of California Dept. Ind. Relations "Minutes Ind. Accident Committee", Nov/39) also Kikins, Ind. Med. 8 486 (1939). Swadlow, Drinker et al, Journal Industrial Hygiene & Toxicology 23, 251 (1940).

- (23) Occupational Diseases, Johnstone, W.B.Saunders Co., Philadelphia & London, 1941.

Diagnosis - Signs & Symptoms

A common reaction to exposure to these chlorinated naphthalenes and diphenyls is an acneiform skin eruption which is rather characteristic.

- (23) Systemic reactions are not frequently reported, and are not well understood by the general profession. Animal experimentation would indicate damage to the liver, especially if there had been previous liver damage. Drinker, Warren et al, J. Ind. Hygiene & Toxicology, 19, 883-311, Sept/47.

Several pages of medical history follow, but all referring to chloronaphthalene. Warning not to employ people with liver troubles, or history of jaundice, typhoid etc.

Do not expose workers to chloroform or avertin anaesthetics. Treatment suggested for skin and liver defects.

- (24) International Labour Office, Geneva, Occupation & Health Department, Industrial Health in War-time

Mr. Chief Inspector of Factories report, 1938, makes first mention of toxic jaundice with chloronaphthalene. German authors described "poison disease" resembling chloroform in people exposed to chloronaphthalene in first world war factories.

Greenburg, Mayers & Smith, Jour. Ind. Hygiene & Toxicology, 21, Feb. 1939, pp 29-38, describe toxic jaundice from chloronaphthalene, also Mayers & Smith Industrial Bulletin (New York, Dept. of Labor, Vol. 21, No. 1, Jan. 1942, pp 30-33).

Ibid. Vol. 22, No. 2, Feb/43, pp 80-81, deals with cases of chloroform and toxic jaundice from chloronaphthalene and chlorodiphenyls.

Ref. B.M.J., June 6/42, Vol. 1, pp 691-692, Molotchik & Robertson -- chloronaphthalene.

- (26) Industrial Hygiene & Toxicology, Interscience Publisher Inc., N.Y. & London, 1943-49, p. 1004.

Chloroform from chloronaphthalene & chlorodiphenyl. Toxicity increases with increasing Cl content. 100 mg/10 ccm air maximal permissible limit for trichloronaphthalene. 10 mg for tetrachloro.

Skin effects are in the form of acne which is more widely distributed on the body than osseous acne.

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- (27) Chemistry of Industrial Toxicology, Kikine, Wiley, Chapman & Hall, London, 1936.

Ref. Drinker, J. Ind. Hyg. & Tox., 21, 193 (1939). Toxicity not related to Cl content. No evidence of toxicity up to 10.5 mg/ccm (very irritating at this) soldering etc. Earlier reference to triphenyls.

Determination of Chlorohydrocarbons in Air

I notice (Jour. Ind. Hygiene & Toxicology 1938, Abstracts, p.62) a reference to "Air Hygiene Foundation of America Inc., Eng. Service Bulletin #2, pt 3, March 1938" (Pittsburg) for a method of determining the concentration of chlorohydrocarbons in air. The air is drawn through a heated silica tube to liberate the chlorine as HCl, then the HCl absorbed as soda solution and its amount determined in the usual way.

See also Journal Industrial Hygiene & Toxicology 19, 204 (1937).

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My enquiry into the subject originated in Mr. Haywood's question about the precautions thought necessary over here in the control laboratory work with Arsenic, and I was able to answer in my letters of Dec.3 and 11/31. I feel that I should have been wiser in stopping there, and that it might have been better to refer the later question to Dr. Kelly, who must have been over the ground. However, I will not do this unless you wish me to, because I know you yourself are normally closely in touch with him.

H. Mather

12/29/41

I have taken another look at reference 22. The original German says:

"Von besonderem Interesse ist die Feststellung dass durch diese Stoffe auch die Wirkung von Tetrachlorkohlenstoff und von Alkohol gesteigert wird."

which I have translated as:

"Of especial interest is the observation that the effect of alcohol and carbon tetrachloride is increased by these materials". The authors, however, were discussing Drinker's article; my reference (3), and Drinker says clearly enough, page 283, "Carbon tetrachloride adds to the toxicity of chlorophthalenes and allied compounds", and on page 299 he repeats the statement and warns against using carbon tetrachloride as a solvent in the application of these stains.