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CHLORACNE FROM AN UNUSUAL EXPOSURE TO ARCLOR

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The first outbreak of acne-like lesions due to high boiling chlorinated compounds in industry in this country was noted by Schwartz [1] in 1936. Subsequently, during World War II, various reports of acne-like lesions in workers exposed to certain chlorinated naphthalenes and diphenyls followed. Collier [2] reported 12 cases of chloracne of the face in workers exposed to the fumes or dust of chlorinated naphthalene and one fatal case due to acute yellow atrophy of the liver. Fifty-five cases of acne-form dermatitis were reported by Kelley [3] in 200 persons exposed to chlorinated naphthalene (Halowax). Good and Pensky [4] described 52 cases in electricians, who handled the cold-finished product for the most part. In none of their cases was systemic involvement found. Schwartz's report [5] concerned the involvement of electricians, who installed and stripped wires in ships during the war. The chlorinated naphthalene, which was impregnated into the asbestos and wrapped around the wire as insulation, flaked off in the stripping process. In the cases described, two months elapsed before the appearance of the chloracne of the face. There was no systemic involvement. Peck, [6] Cranch, [7] and Greenburg [8] discuss the chlorinated naphthalenes and chlorinated diphenyls, the appearance of the dermatological lesions, their value in industry, and precautions in handling these chemicals.

The value of the chlorinated naphthalenes and diphenyls in industry is due primarily to their resistance to water and alkali, high insulating value (high dielectric constant) thermoplasticity, chemical stability, and flame resistance, as described by various writers [9].

The characteristic lesions of chloracne are pinhead to pea-sized pale straw-colored cysts formed by the plugging of the orifices of the sebaceous glands, resulting in retention of the secretion and in the keratinization of the lining membrane. Comedones are present but are not a striking feature. In nearly every worker exposed sufficiently to these chlorinated compounds for a few months these lesions will develop. The exposure may be either to fumes from the hot material

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or to the solid material on continued contact. Repeated or continuous contact is essential. Lesions have not been reported after short or infrequent exposures. Vesiculoerythematous eruptions, as seen in acute eczematous contact-type dermatitis and simple erythematous eruptions with pruritus, have also been described. [2a]

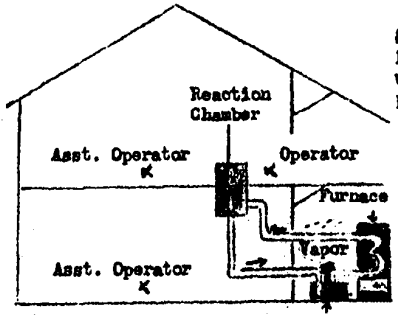
This paper reports the development of lesions of chloracne in seven workers employed in a chemical plant concerned with organic chemical production.

HISTORY OF EXPOSURE

A chemical company had for some months been using molten salt at 350 F as a medium for supplying accurately controlled quantities of heat to a large jacketed reaction chamber. Because of the dangers of solidification of the salt in the return line, as well as the corrosion problem, it was decided to use a chlorinated diphenyl (Aroclor) as the heat exchange material. The same apparatus was used. This included an oil-fired furnace containing the heating coils, a steel pipe supply line to the reaction chamber, a return line to a large sump pump and an outflow line from the sump to the furnace (see figure). The reservoir for the sump pump had a capacity of about 400 gal. (about 1,680 litres.)

The chemical product, designated as organic acid A, was manufactured with the use of molten salt for heat exchange from January to December, 1949. At that time, chlorinated diphenyl was substituted as a heat exchange material. It was soon apparent that under certain conditions there was slight leakage of vapors from a number of places, particularly around the cover of the sump, and also from all gasketed connections in the system. Because of the known toxicity of these substances, the assistance of the Bureau of Industrial Hygiene, Connecticut State Department of Health, was sought and received. A field study under conditions of obvious vapor leakage was said to have shown negligible air concentrations of the chlorinated diphenyls in the actual breathing zones of the workers. In this study, which was four months prior to the dermatological findings reported here, the air concentration of chlorinated diphenyls was reported by the bureau to be 0.1 mg. per cubic meter of air. The recommended maximum allowable concentration is 1.0 mg. per cubic meter. The figure shows that most of the leakage was at points outside the building but under a roof. No one worked regularly at the points of leakage. Nevertheless, repeated attempts were made to control vapor leakage without complete success. This operation continued for 19

months without incident or recognition of skin or other manifestations of exposure to chlorinated diphenyls. Each employee had a complete physical examination by an internist prior to working in this environment.



Schematic drawing of the heat exchange system in which the chlorinated diphenyl was used and the points at which workers were exposed to fumes.

An operator making organic acid A ("operator", figure) was sent to one of us because of acute contact dermatitis of the face. In addition to the contact-type of dermatitis, there were noted pinhead straw-colored cysts and comedones on both cheeks and forehead. A diagnosis of chloracne was made, and the source of exposure was determined. Examination of other workers in this working environment uncovered six additional cases. In all the face was involved especially the cheeks circumorbitally, the forehead, ears, and in one case the mastoid region. All employees were examined carefully by an internist. The seven employees in whom chloracne had developed had liver function tests performed. Tests included direct and total bilirubin determinations and 24 and 48 hour cephalin flocculation, thymol turbidity, and alkaline phosphatase determinations. Six of the subjects had completely normal test results. One employee had borderline cephalin flocculation and thymol turbidity. Thirteen months later repeated liver function tests showed an unchanged cephalin flocculation and improved thymol turbidity. Results of complete blood cell counts and urinalysis were normal in all instances. All had normal blood pressures with no other clinical evidence of any chlorinated diphenyl toxicity.

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After the recognition of these cases of chloracne, all but one of the gasketed joints in the heat exchange system, including the cover of the sump, were welded together. A hand hole 6" (15 cm.) in diameter was left with a gasketed cover so that the system could be drained or filled when necessary. After that time no vapours were visible, and the odor of chlorinated diphenyls was barely detectable in the immediate vicinity of the sump pump. Continued careful observation of workers has revealed no new cases of chloracne.

COMMENT

The unusual feature of this outbreak of dermatitis was the long period of exposure before any cases were recognised. The sudden recognition of seven cases after exposure up to 19 months was due to the especially careful examination of the skin of all exposed employees after discovery of the first case. Of 14 men exposed or potentially exposed to the vapors of chlorinated diphenyls, 7 presented clinical evidence of chloracne. There was not a very good correlation between the apparent degree of exposure and the development of signs of disease. For example, a foreman, an assistant foreman, and a plant superintendent whose duties would appear to have exposed them only incidentally to the toxic agent had mild to moderate signs. The mean length of exposure of those in whom signs developed was 14.3 months and of those who did not show signs was 11.4 months, but there was considerable overlap, with chloracne developing in one worker after only 5 months in contrast to another who showed no signs even after 19 months' exposure to vapors. Since the manifestations were exclusively on exposed areas of the skin, it appears that the vapors were deposited directly on exposed skin and did not go through the clothing. The nature of each factor determining the appearance or non-appearance of lesions is not clear. Skin pigmentation may be a factor. Three of the workers were Negroes, and none of them had chloracne. No correlation with perspiration could be made, but all cases were discovered toward the end of the summer.

Prevention consisted of controlling the leakage of vapors. The fact that tests of the air, even in the presence of vapors, showed only negligible amounts of chorinated hydrocarbons indicates that this type of intermittent but fairly long continued 'mild' exposure is not innocuous. The low concentration of the chlorinated diphenyl in the air might account for the fact that lesions developed in only 50% of those involved.

SUMMARY

Seven cases of mild to moderate chloracne of the face and head occurred among 14 chemical operators exposed from 5 to 19 months intermittently to small concentrations of the vapors of a chlorinated diphenyl (Aroclor). Leakage of these vapours from a heat exchange system occurred

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chiefly outdoors, but chloracne was observed among men working inside the adjacent building. In all cases the condition cleared up after treatment. Control of vapors by welding all joints in the heat exchange system prevented recurrences.

REFERENCES:

From the departments of public health and internal medicine, Yale University School of Medicine.

Associate Professor of Occupational Medicine, Department of Public Health (Dr. Meigs), Assistant Clinical Professor of Dermatology, Department of Internal Medicine (Dr. Alborn), and Assistant Clinical Professor of Medicine, Department of Internal Medicine (Dr. Martin), Yale University School of Medicine.

1. Schwartz, L.: Dermatitis from Synthetic Resins and Waxes, Am.J.Pub. Health 26 : 586 (June) 1936.

2. Collier, E: Poisoning by Chlorinated Naphthalene, Lancet 1 : 72 (Jan. 16) 1943.

3. Kelley, E.F.: Acne from Synthetic Wax (Halowax), Urol. & Cutan. Rev. 47 : 238 (April 1) 1943.

4. Good, C.K. and Pensky M,: Halowax Acne ("Cable Rash"): Cutaneous Eruption in Marine Electricians Due to Certain Chlorinated Naphthalenes and Diphenyls, Arch. Dermat. & Syph. 48 : 251 (Sept.) 1943.

5. Schwartz, L.: Outbreak of Halowax Acne ("Cable Rash") Among Electricians J.A.M.A. 122 : 158 (May 15) 1943.

6. Peck, S.M.: Dermatitis from Cutting Oils, Solvents and Dielectrics, Including Chloracne, J.A.M.A. 125 : 190 (May 20) 1944.

7. Cranch, A.G.: Chlorinated Compounds: Precautions in Handling. Indust. Med. 13 : 110 (Jan.) 1944.

8. Greenburg, L.: Chlorinated Naphthalenes and Diphenyls, Indust. Med. 12 : 520 (Aug.) 1943.

9a. Mayers, M.R., and Silverberg, M.G.: Skin Conditions Resulting from Exposure to Certain Chlorinated Hydrocarbons, J. Indust. Hyg. & Toxicol. 20 : 244 (March) 1938. (b) Schwartz[5] (c) Greenburg [8].

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