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INDUSTRIAL POISONS IN THE UNITED STATES

BY

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pupils contracted and muscles rigid. Later there was free sweating and muscular twitching. The man lived 16 days, with fever, sweating, tremors and rigidity of the muscles, occasional convulsions, ataxia and aphasia.

As to the quantity of HCN which is dangerous to life, opinions have changed since the experience gained during the war. Lehmann says it is not true, as was formerly supposed, that this gas is more dangerous to man than to lower forms of life, rather the contrary. Kobert, writing in 1902, had said that 0.3 part per 1,000 of air would quickly kill both men and animals, but Katz and Longfellow (9) quote Kohn-Alrest as saying that 1.0 part per 1,000 cannot be breathed for many minutes. In experiments with rats made by the United States Public Health Service 1.0 part per 1,000 killed in ten minutes, 0.5 part failed to kill in that time, and 0.1 seemed to be safe for rats. Men at rest stood 0.25 part per 1,000 for two minutes, and 0.375 for a minute and a half without dizziness. Even 0.5 was endured for one minute without injury. They believe a degree of tolerance to the gas is acquired. For fumigation, they advised sending an experienced man into an atmosphere shown by test not to contain more than 0.1 per million parts of air, but carrying a gas mask with him. If no mask is available the gas in the air should be below that limit of concentration. The test recommended is described in an article by Katz and Longfellow.

Schnellen (10) tested the effect of measured doses of hydrocyanic acid vapors on cats. He found that exposure to 0.3 and 0.4 part per 1000 of air for three or four hours had no effect, but as soon as the amount of the vapor was raised to 0.5 grave symptoms appeared after an hour and a half, such as deep respiration, increased salivation, dilatation of the pupils, cramp and vomiting. If the animal is kept in this atmosphere for a period of from two and a half to five hours, he dies, and if the proportion of the vapor is raised to 1.2 or 1.5 per 1000 death occurs within thirty minutes, accompanied by the foregoing symptoms. In calculating the amount of hydrocyanic acid necessary to destroy life, the dose is found to vary from 1 to 5 mg. for each kilogram of body weight of the animal. For man it is calculated that 60 mg. would be the minimal lethal dose, or from 0.8 to 1.0 mg. for each kilogram of body weight.

A large number of fatalities from the use of hydrocyanic acid in fumigation have been reported since the war in the daily press, but the records of the Public Health Service cover only those which have occurred in the fumigation of vessels under the supervision of that service, together with one in a building in New Orleans during a plague eradication campaign. Their records, for which I am indebted to Acting Surgeon General White, show that in February, 1916, there were three deaths, then none till 1920, and between June, 1920, and July, 1923, there were 18, but four of these

were in stowaways. The man who died in New Orleans had not followed instructions to open the building from the outside, and then wait till it was fully aired before entering. Instead, he tried to pass through it from the roof to the lower floor, but was overcome by the gas and died before he could be rescued.

The indiscriminate use of this very dangerous gas by persons quite unfamiliar with it led to the accidental death in Cleveland of four persons who inhaled hydrocyanic acid gas with which a restaurant under their apartment was being fumigated. As a result, the city of Cleveland has passed an ordinance forbidding an unlicensed person from using deadly gases for fumigation purposes and providing a substantial bond for fumigation operators.

Koelsch (11), in 1920, discussed this new problem in public health. He says that hydrocyanic acid has been used in the United States for fumigation since 1886, but only recently in Germany. Its introduction has brought a new responsibility to the industrial hygienist because it endangers not only the persons who go back to the disinfected rooms but the men who carry out the disinfection. The usual method in Germany is to bring about the evolution of hydrocyanic acid fumes by means of dilute sulphuric acid and sodium cyanid. The gas begins to come off immediately, so that great precautions must be taken. The disinfectors are instructed to drop the package of sodium cyanid, paper and all, into the acid, and run. In a building of several stories the disinfection must begin at the top story and in the room farthest from the stairway. After the doors are closed they must be sealed and warning signs placed on the outside. The action of the gas is complete in two hours, but usually the building is left overnight. The doors and windows must be opened from the outside, and when this is impossible an oxygen helmet must be used. From half an hour to two hours' ventilation is long enough for the disappearance of the gas, but the apparatus in which it has been generated must be removed with great care, as was shown by the first fatal case of poisoning from this source in Germany, reported in 1917. Two men went in to carry out the receptacle in which the gas had been produced. As they lifted it, an unchanged portion of sodium cyanid was brought in contact with the acid and the fumes that developed poisoned the workman who was carrying the rear handles of the apparatus. He died in a short time.

Fühner (7) tells of 100 soldiers who put on deloused clothing too soon, before they had had sufficient airing, and all were poisoned, ten losing consciousness, but none of them suffering any permanent effect. He tells also of an accident in Essen in some Krupp workmen's barracks which had been treated with the gas and then imperfectly aired. Ten men died from the fumes, and five were comatose, but revived. It is possible that HCN plays a more im-