

is due to the fact that the combining power of carbon monoxide with the haemoglobin of the red blood corpuscles is about 300 times greater than that of oxygen. Since the resulting stable combination destroys the power of the haemoglobin to unite with oxygen in the lungs and to supply it to the tissues, the effects are due to lack of oxygen, and the symptoms are those of anoxemia, namely, dizziness, headaches, sleepiness, fatigue, and, in extreme cases, paralysis and death. The dangerous saturation level of the blood with carbon monoxide is about 50 per cent. Even as little as 0.07 per cent in the air will render, in half an hour, one quarter of the red corpuscles incapable of uniting with oxygen. One to two parts per 10,000 parts of air is set as a safe limit of pollution which may be breathed for a long time without producing perceptible symptoms.

Silicosis

Silicosis is a chronic disease of the lungs which results from the local physio-chemical action of hydrated silica upon the pulmonary tissue, causing progressive lymphatic fibrosis, and rendering the tissue susceptible to tuberculosis. The disease is slow in evolution, requiring usually a number of years of exposure. It occurs principally among granite workers, sand blasters, metal miners, metal polishers, potters, and mill-stone workers.

Lead Poisoning

Lead poisoning is the most insidious and most common of all industrial diseases. It occurs principally among lead workers and smelters, lead miners, potters, painters, typesetters, stereotypers, plumbers, and workers with glass, gold and silver. Lead, in practically all forms, is a cumulative poison which is absorbed by way of the blood stream, chiefly from the respiratory tract, but also from the digestive tract and from the skin. The effect may be either an acute or chronic poisoning. The principal symptoms are colic, constipation, anemia, headache, anorexia, a bluish line along the edges of the gums, rheumatic pains, and, in extreme conditions, paralysis, blindness, insanity, and death.

It has been found⁶ that 2 mg per day is the smallest dose, by inhalation, which in the course of years may result in lead poisoning. Regular inhalation during the usual working hours of air containing less than 0.2 mg of lead per cubic meter does not seem to produce serious lead poisoning in individuals of representative industrial groups⁷.

Prevention

The prevention of industrial hazards from dusts and poisonous gases is largely a ventilation problem consisting of keeping the impurities in air down to a safe concentration. As yet there are no generally accepted standards on which to base the design of the ventilation equipment. Approximate data on the toxicity of various gases and fumes met with in industrial establishments are given in Table 1. Column 5, giving the maximum allowable concentrations for prolonged exposures, was compiled from experiments in which most exposures lasted not more than a

week, and it is reasonable to assume that over more prolonged exposures such concentrations would cause pernicious effects.

Much is known concerning the physiological and pathological effects induced by various types and concentrations of atmospheric pollutants. In the absence of an accepted standard for safe breathing, and because of the slow, cumulative effects of certain kinds of air contaminants, the best procedure is the periodic medical examination of individuals, and the

TABLE 1. TOXICITY OF GASES AND FUMES IN PARTS PER 10,000 PARTS OF AIR^a

VAPOR OR GAS	RAPIDLY FATAL	MAXIMUM CONCENTRATION FOR FROM 1/2 TO 1 HOUR	MAXIMUM CONCENTRATION FOR 1 HOUR	MAXIMUM ALLOWABLE FOR PROLONGED EXPOSURE
Carbon monoxide.....	40	15-20	10	1
Carbon dioxide.....	800-1000	-----	-----	-----
Hydrocyanic acid.....	30	1 1/2	1/2	1/2
Ammonia.....	50-100	25	3	1
Hydrochloric acid gas.....	10-20	1/2	-----	1/10
Chlorine.....	10	1/2	-----	1/100
Hydrofluoric acid gas.....	2	1/10	-----	1/100
Sulphur dioxide.....	4-5	1/2-1	-----	1/10
Hydrogen sulphide.....	10-30	5-7	2-3	1
Carbon bisulphide.....	-----	11	5	1/2
Phosphene.....	20	4-6	1-2	-----
Arsine.....	2 1/2	1/2	1/2	-----
Phosgene.....	Over 1/4	1/4	-----	1/100
Nitrous fumes.....	2 1/2-7 1/2	1-1 1/2	-----	1/2
Benzene.....	190	-----	31-47	1 1/2-3
Toluene and xylene.....	190	-----	31-47	-----
Aniline.....	-----	-----	1-1 1/2	1/10
Nitrobenzene.....	-----	-----	1/100	1/500
Petrol.....	243	100-220	-----	-----
Carbon tetrachloride.....	480	240	40	16
Chloroform.....	250	140	50	2
Tetrachlorethane.....	73	-----	-----	1 1/2
Trichlorethylene.....	370	-----	-----	-----
Methyl chloride.....	1500-3000	200-400	70	5-10
Methyl bromide.....	200-400	20-40	10	2
Lead vapor.....	-----	-----	-----	5-6

^aOriginal data compiled by Y. Henderson and H. Haggard. (See *Noxious Gases*, 1927.) Data revised by T. M. Legge. (See *Lessons Learned from Industrial Gases and Fumes*, Institute of Chemistry of Great Britain and Ireland, London, 1930.)

routine measurement and study of the concentration and the physical and chemical characteristics of the dusts to which those individuals are exposed.

ABATEMENT OF SMOKE AND AIR POLLUTION

Successful abatement of atmospheric pollution requires the combined efforts of the combustion engineer, the public health officer, and the public itself. The complete electrification of industry and railroads, and the separation of industrial and residential communities would aid materially in the effective solution of the problem.

In the large cities where the nuisance from smoke, dust and cinders is

⁶Lead Poisoning, by Thomas Morrison Legge (*Journal Royal Society Arts*, 1929, Vol. 77, p. 1023).

⁷What is a Dangerous Quantity of Lead Dust in Air, by C. M. Salls (*Industrial Hygiene Bulletin*, New York State Department of Labor, 1925).