

Carbon Monoxide Poisoning

Carbon monoxide is a common form of poisonous industrial gas, met with in mines, foundries, coke-oven sheds, garages, and houses. Its action 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.

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).

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

ABATEMENT OF ATMOSPHERIC 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 the most serious, limited areas obtain some relief by the use of district heating. The boilers in these plants are of large size designed and operated to burn the fuel without smoke, and some of them are equipped with dust catching devices. The gases of combustion are usually discharged at a much higher level than is possible in the case of buildings that operate their own boiler plants.

SMOKE ABATEMENT

In general, time, temperature and turbulence are the essential requirements for smokeless combustion. Anything that can be done to increase any one of these factors will reduce the quantity of smoke discharged. Especial care must be taken in hand-firing bituminous coals. (See Chapter 27).

Checker or alternate firing, in which the fuel is fired alternately on separate parts of the grate, maintains a higher furnace temperature and thereby decreases the amount of smoke.

Coking and firing, in which the fuel is first fired close to the firing door and the coke pushed back into the furnace just before firing again, produces the same effect. The volatiles as they are distilled thus have to pass over the hot fuel bed where they will be burned if they are mixed with sufficient air and are not cooled too quickly by the heat-absorbing surfaces of the boiler.

Steam or compressed air jets, admitted over the fire, create turbulence in the furnace and bring the volatiles of the fuel more quickly into contact with the air required for combustion. These jets are especially helpful for the first few minutes after each firing. *Frequent firings* of small charges shorten the smoking period and reduce the density. *Thinner*