

ELEMENTS OF INDUSTRIAL TOXICOLOGY

malin with the skin can be largely prevented by protective clothing and by water insoluble protective creams. Splashes of the liquid should be washed off immediately. Breathing of the vapor should be prevented by enclosure and ventilation of processes.

See Industrial Data Sheet 342 and *Hygienic Guide*

Formic acid is commonly shipped as a concentrated solution in glass carboys. The acid is a strong reducing agent and the vapor is flammable. It should not be stored in the immediate vicinity of oxidizing substances.

The acid is irritating to the skin, forming blisters which continue to spread even after the acid has been removed from the skin—an effect similar to that produced by ant and bee venom, which contain formic acid.

Gasoline varies in composition, but is commonly a petroleum fraction containing hexanes, heptanes, and octanes with varying amounts of unsaturated, cyclic, and aromatic compounds. A cracked gasoline may contain 50 per cent or more of compounds other than the saturated aliphatic hydrocarbons.

If the gasoline consists of saturated and unsaturated aliphatic compounds and cyclic compounds, it will be a narcotic and an irritant to the mucous membranes. The main toxic action will be depression of the central nervous system with symptoms of giddiness, dizziness, hilarity, and headache not unlike an alcoholic intoxication. Mild symptoms of this sort are apt to be produced by relatively short exposures to concentrations of 500 to 750 ppm of this kind of gasoline. In addition, mild blood changes, neuritis, and neurasthenias have been reported.

If the gasoline is made from a crude oil containing 40 per cent or more of aromatics or is enriched in aromatics by the refining process, the toxicity may be substantially higher.

The tetraethyl lead content of gasoline is low enough to make any lead exposures from ordinary handling and dispensing of gasoline in garages and filling stations negligible. Tetraethyl lead can however present a toxic hazard by inhalation and absorption through the skin when entry is made into tanks and other confined spaces that have contained leaded gasoline. See

Lead (on page 40-38) and *Hygienic Guide*

Germanium, one of the less common metals which have some industrial uses, is employed particularly in the electronics industry for diodes and transistors. It appears to be a relatively inert metal and has not been reported as the cause of any occupational diseases in man.

In animal experiments, the LD₅₀ for rats by intraperitoneal injection was about 750 mg/kg of body weight when germanium oxide was buffered to near the neutral point. Food containing 1,000 ppm or water containing 100 ppm was fatal to half of the young rats. Repeated sublethal doses produced some tolerance to a subsequent lethal dose, but the tolerance declined substantially in six weeks.

Graphite has been repeatedly reported to produce a pneumoconiosis in workers in mines, mills, and electrode plants. Several investigators have done autopsies on men who died from graphite pneumoconiosis and found their lungs to contain fibrous masses with central necrosis, in addition to emphysema and general fibrosis around the blood vessels and lymph channels. The typical X-ray patterns start with a milary "snow-storm" effect and progress to a pattern of sharply defined masses of various sizes in each lobe.

Halogenated hydrocarbons—see also the individual compounds—as used in industry are potent anesthetics and more or less toxic. On exposure to high concentrations the most common symptoms are nausea, vomiting, diarrhea, headache, and unconsciousness.

If unconsciousness occurs, it may be followed by sudden death due to fibrillation of the heart or respiratory failure, as has frequently been observed in the medical use of these compounds. After exposure to amounts which are large but not sufficient to produce sudden death, there may be severe kidney and liver damage eventually leading to death.

The most common halogenated hydrocarbons, arranged in the order of increasingly acute toxicity, are vinyl chloride, methyl chloride, ethyl chloride, ethylene dichloride, ethyl bromide, carbon tetrachloride, dichloromethane, methyl chloroform, trichloroethylene, methyl bromide, tetrachloroethylene, pentachloroethane, and tetrachloroethane.