

## 38—Industrial Toxicology

**Ethyl silicate** (ethyl orthosilicate) is a moderately volatile liquid used as a waterproofing and weatherproofing agent for masonry and ceramic objects. It has a sharp odor and is irritating to the eyes, nose, and throat at high concentrations. In animal experiments it has produced lung and kidney injury as its main toxic effects.

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**Fluorides** in the form of the soluble inorganic salts which can hydrolyze to form free hydrogen fluoride in contact with the tissue are severely irritating, and many of them can produce skin burns which are both extensive and painful. The less soluble inorganic salts are not irritating but may produce a type of chronic poisoning by long-continued inhalation. The fluoride ion tends to accumulate in the skeleton. Softening of the bone has been considerably more of a problem with cattle exposed to fluorides than it has been with people so exposed.

According to one investigation, the use of welding rods with fluorides in the coating does not introduce a hazardous amount of fluoride into the general air of the welding shop. Under the welder's helmet, the concentration varied widely. For limits of fluoride concentrations in drinking water, see Table 20-B in Chapter 20, "Industrial Sanitation and Personnel Facilities."

**Fluorine** is a yellow, highly reactive gas that combines with water or moisture in the air to form hydrogen fluoride, and, possibly oxygen fluoride, which is more toxic than fluorine. Fluorine's health hazard is designated as extra hazardous for acute exposure and high for chronic exposure.

Too few industrial exposures to fluorine have been evaluated to recommend specific first aid procedures. However, removal of the victim from the contaminated area and administration of 100 percent oxygen to relieve respiratory distress are advisable.

**Fluorotrichloromethane** (trichloromonofluoromethane, Refrigerant-11) has about the same toxicity as dichlorodifluoromethane.

**Formaldehyde** is a colorless pungent gas, usually furnished as a solution containing 37

percent by weight of formaldehyde and a small quantity of methyl alcohol as a preservative. Both the gas and this solution (formalin) have a pronounced irritant effect upon the skin. Prolonged contact with dilute formalin will cause the fingernails to become scaly and brittle and the nail matrix to become thick and inflamed.

Formaldehyde gas is extremely irritating to the respiratory system in concentrations of 50 ppm in air. If the concentration is high, the gas may penetrate to the lungs and produce bronchial inflammation and edema, likely followed by pneumonia.

Contact of liquid formaldehyde or formalin 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.

**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.

**Furfural.** The irritating properties of furfural, which become uncomfortable at 20 to 50 ppm, probably preclude voluntary exposures which might lead to significant injury.

The information presented in the literature is conflicting regarding the toxicity of furfural vapor. One report concludes that the physiologic effects of the vapor were relatively mild and similar to that of butyl alcohol. Another report describes numbness of tongue and mucous membranes of the mouth, absence of taste sense, and difficulties in breathing which were experienced in workers in a furfural plant where there was inadequate ventilation. In a more recent report it was stated that in refining operations and in the synthetic resin industry (where large amounts of furfural have been used), only occasional reports of individual sensitivity were observed.