Code Numbers: CAS 944-22-9 RTECS TA5950000 UN 2783

DOT Designation: —

Synonyms: Dyfonate®; ENT 25796.

Potential Exposure: Those involved in the manufacture (A-32), formulation and application of this insecticide.

Permissible Exposure Limit in Air: There is no Federal standard but ACGIH (1983/84) has adopted a TWA value of 0.1 mg/m^3 with the notation "skin" indicating the possibility of skin absorption.

Permissible Concentration in Water: No criteria set.

Harmful Effects and Symptoms: There seems to be no data available on human exposure but feeding experiments with both male and female rats for 13 weeks showed no effects at levels as high as 31.6 ppm; only moderate inhibition of serum and red blood cell cholinesterase activity was noted at 100 ppm (A-34).

Disposal Method Suggested: This phosphono compound is reported to be satisfactorily decomposed by hypochlorite (A-32).

FORMALDEHYDE

- Carcinogen (Animal Suspected) (7), (Potential Occupational) (9) (12)
- Hazardous substance (EPA)
- Hazardous waste (EPA)

Description: HCHO, formaldehyde, is a colorless, pungent gas. It is sold in aqueous solution containing 30 to 50% formaldehyde and from 0 to 15% methanol, which is added to prevent polymerization.

Code Numbers: CAS 50-00-0 RTECS LP8925000 UN 2209 (or 1198)

DOT Designation: Combustible liquid.

Synonyms: Oxomethane; oxymethylene; methylene oxide; formic aldehyde; methyl aldehyde. Formaldehyde solution: formalin.

Potential Exposure: Formaldehyde has found wide industrial usage as a fungicide, germicide, and in disinfectants and embalming fluids. It is also used in the manufacture of artificial silk and textiles, latex, phenol, urea, thiourea and melamine resins, dyes, and inks, cellulose esters and other organic molecules, mirrors, and explosives. It is also used in the paper, photographic, and furniture industries. It is an intermediate in drug manufacture (A-41) and is a pesticide intermediate (A-32).

Human exposure to HCHO is principally through inhalation and skin absorption or less frequently by ingestion. Most of the HCHO production in the United States is from methanol in closed automated process systems. Exposure potential during transportation and storage is likely to be minimal. Estimated emission levels from production plants range from 0.0004 to 2,500 μg/m^3 with a median exposure of 0.01 μg/m^3. EPA estimates that 27.7 million people living within 12.5 miles of point sources may be exposed to low levels. NIOSH estimates that 8,000 workers are potentially exposed to HCHO during direct production. In addition, pathologists and histology technicians represent a high exposure group. The National Occupational Hazard Survey estimates that 57,000

full-time and 1.7 million part-time employees may be exposed to HCHO, and OSHA estimates the number of workers exposed as 2.6 million.

Most consumers are exposed to formaldehyde through its use in construction materials, wood products, textiles, home furnishings, paper, cosmetics, and pharmaceuticals. The ambient air levels in the United States, ranging from about 0.001 to 0.030 ppm, expose the entire 220 million population. Two subpopulations have been identified as having particularly high potential for HCHO exposure: 2.2 million residents of mobile homes containing particle board and plywood have an average exposure of 0.4 ppm HCHO, and 1.7 million persons living in conventional homes insulated with urea-formaldehyde foam have a potential average exposure of 0.12 ppm. Inadvertent production of formaldehyde from combustion sources also may contribute to these exposures. An estimated 159 million persons are potentially exposed to ambient air concentrations at maximum 0.25 $\mu g/m^3$ levels of HCHO. Automobiles alone emit 610 million pounds of HCHO each year. HCHO has a short half-life in air, however, because it is degraded by photochemical processes.

Incompatibilities: Strong oxidizers, strong alkalies, acids; phenols; urea.

Permissible Exposure Limits in Air: The Federal standard is 3 ppm determined as a TWA. The acceptable ceiling concentration is 5 ppm with an acceptable maximum peak above this value of 10 ppm for a maximum duration of 30 minutes. ACGIH has adopted a TLV of 2 ppm (3 mg/m^3) as a ceiling value but has set no STEL value. ACGIH has indicated an intended change as of 1983/84 to a TWA of 1.0 ppm (1.5 mg/m^3) and an STEL of 2.0 ppm (3 mg/m^3) with the notation that formaldehyde is "an industrial substance suspect of carcinogenic potential for man." NIOSH has recommended (2) a ceiling of 0.8 ppm (1.2 mg/m^3) for any 30-minute sampling period. The IDLH level is 100 ppm.

Determination in Air: Adsorption on alumina, elution with aqueous methanol, reaction with chromotropic acid in sulfuric acid, spectrophotometric determination (A-10). Polarography may also be employed (A-10).

Permissible Concentration in Water: No criteria set, but EPA (A-37) has suggested a permissible ambient goal of 41.4 $\mu g/\ell$ based on health effects.

Routes of Entry: Inhalation, ingestion, skin and eye contact.

Harmful Effects and Symptoms: *Local* – Formaldehyde gas may cause severe irritation to the mucous membranes of the respiratory tract and eyes. The aqueous solution splashed in the eyes may cause eye burns. Urticaria has been reported following inhalation of gas. Repeated exposure to formaldehyde may cause dermatitis either from irritation or allergy.

Systemic – Systemic intoxication is unlikely to occur since intense irritation of upper respiratory passages compels workers to leave areas of exposure. If workers do inhale high concentrations of formaldehyde, coughing, difficulty in breathing, and pulmonary edema may occur. Ingestion, though usually not occurring in industrial experience, may cause severe irritation of the mouth, throat, and stomach. Formaldehyde has been found to be mutagenic in a variety of tests.

While a full evaluation of the carcinogenicity of formaldehyde vapor must await completion of studies at the Chemical Industry Institute of Toxicology, evidence presented to date demonstrates that inhalation of formaldehyde results in a high incidence of nasal cancers in rats (7).

Points of Attack: Respiratory system, lungs, eyes, skin.

Medical Surveillance: Consider the skin, eyes, and respiratory tract in any preplacement or periodic examination, especially if the patient has a history of allergies.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, flush with water promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Prevention of intoxication may be easily accomplished by supplying adequate ventilation and protective clothing. Barrier creams may also be helpful. In areas of high vapor concentration, full protective face masks with air supply is needed, as well as protective clothing. Wear appropriate clothing to prevent any reasonable probability of skin contact. Wear eye protection to prevent any possibility of eye contact. Employees should wash immediately when skin is wet or contaminated. Remove nonimpervious clothing immediately if wet or contaminated. Provide emergency showers and eyewash.

Respirator Selection:

50 ppm: CCROVF/GMOV/SAF/SCBAF
100 ppm: SAF:PD,PP,CF
Escape: GMOV/SCBA

Disposal Method Suggested: Incineration. Also, formaldehyde may be recovered from wastewaters (A-58).

References

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(6) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 3,* No. 3, 71-76, New York, Van Nostrand Reinhold Co. (1983).
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(8) See Reference (A-60).
(9) National Institute for Occupational Safety and Health, *Formaldehyde: Evidence of Carcinogenicity,* Current Intelligence Bulletin No. 34, DHHS (NIOSH) Publication No. 81-111, Cincinnati, Ohio (April 15, 1981).
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(12) U.S. Environmental Protection Agency, 49 FR 21870 (May 23, 1984).
(13) Clary, J.J., Gibson, J.E. and Waritz, R.S., *Formaldehyde Toxicology, Epidemiology, Mechanisms,* New York, Marcel Dekker, Inc. (1983).