

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

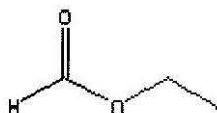
TO: File for Ethyl Formate (CAS No. 109-94-4)  
FROM: Michael Depa, Toxics Unit, Air Quality Division  
SUBJECT: Development of the Screening Level  
DATE: September 11, 2007

The initial threshold screening level (ITSL) for ethyl formate is 3000  $\mu\text{g}/\text{m}^3$  (8-hr averaging time).

The following references or databases were searched to identify data to determine the screening level: Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS), the Registry of Toxic Effects of Chemical Substances (RTECS), the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV), National Institute of Occupational Safety and Health (NIOSH) Pocket Guide to Hazardous Chemicals, Environmental Protection Bureau Library, International Agency for Research on Cancer (IARC) Monographs, Chemical Abstract Service (CAS) Online (1967- August, 2007), National Library of Medicine (NLM), Health Effects Assessment Summary Tables (HEAST), and National Toxicology Program (NTP) Status Report.

The EPA has not established a reference concentration (RfC) or reference dose (RfD) for ethyl formate. NIOSH has not established an Occupational Exposure Limit (OEL) for ethyl formate; however, the ACGIH established a TLV of 303  $\text{mg}/\text{m}^3$  (100 ppm). The molecular weight is 74.08g, and the molecular formula is  $\text{HCOOCH}_2\text{-CH}_3$ . The molecular structure is pictured in Figure 1. The melting point is  $-81\text{ }^\circ\text{C}$ , and the boiling point is  $54\text{ }^\circ\text{C}$ . The vapor pressure is 194 mmHg at  $20\text{ }^\circ\text{C}$ . Ethyl formate is moderately water soluble. The physical state is a liquid. Extremely flammable. Eye, skin and respiratory irritant. (physical/chemical data reference: ACGIH, 1991) May act as a narcotic.

**Figure 1. Molecular Structure of Ethyl Formate (CAS No. 109-4-9)**



**Summary of the ACGIH TLV Documentation for Ethyl Formate**

Used as flavor for lemonades and essences, and as a fungicide for cereals and dried fruits. Acute effects in animals include eye irritation and salivation at 5000 ppm. Rats exposed for 4-hours to 8000 ppm died, but survived at 4000 ppm. Causes depression of the central nervous system leading to death from circulatory and respiratory failure, but without the convulsions and coma associated with lethal doses of methyl formate. In a study published in 1931 from Germany, it was stated that human exposure to 330 ppm ethyl formate resulted in a slight irritation of the eyes and a rapidly increasing nasal irritation. Given the solubility of ethyl formate

in water, it is expected to have a high blood-air distribution coefficient. The ACGIH TLV Committee recommended a TLV of 100 ppm to prevent eye and nasal irritation.

### **Animal Studies**

In an oral dosing study in Osborne-Mendel rats, groups of 10 male and female rats were fed diets of 1000, 2500, or 10,000 ppm ethyl formate for 17-weeks (Hagan et al., 1967). Organs were weighed, as well as inspected macro- and microscopically. The authors reported no effects at all dose levels.

### **Derivation of Screening Level**

The oral dosing study performed by Hagan et al. (1967), was determined to be inadequate to use to develop a screening level based on lack of detail in the results of pathology endpoints and the conclusion that the oral to inhalation route extrapolation of toxicity would not adequately account for eye irritation and respiratory effects. The TLV was determined to be adequate because the TLV level was three times lower than concentrations shown to cause irritation effects and because it was based on human exposures via the inhalation route.

The Initial Threshold Screening Level (ITSL) is derived from the ACGIH TLV (an occupational exposure limit or OEL) according to Rule 232(1)(c) as follows:

$$\text{ITSL} = \text{OEL}/100$$

$$\text{ITSL} = (303 \text{ mg/m}^3)/100$$

$$\text{ITSL} = 3.03 \text{ mg/m}^3 \text{ or } 3000 \text{ } \mu\text{g/m}^3$$

The ITSL for ethyl formate is 3000  $\mu\text{g/m}^3$  with an 8-hr averaging time.

### **References**

ACGIH. 1991. Threshold Limit Values and Biological Exposure Indexes. Ethyl Formate. Vol. 1. pages 633-634. American Conference of Governmental and Industrial Hygienists, Inc. Cincinnati, OH.

Hagan EC, Hansen WH, Fitzhugh OG, Jenner PM, Jones WI, Taylor JM, Long EL, Nelson AA, Brouwer JB. 1967. Food flavorings and compounds of related structure. II. Subacute and chronic toxicity. Food and Cosmetics Toxicology. 5(2): 141-157.

MD:LH