

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

March 26, 2009

TO: File for Dibutyl Tin Dilaurate (CAS No. 77-58-7)

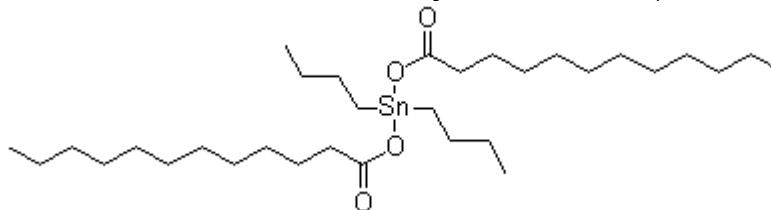
FROM: Michael Depa, Toxics Unit, Air Quality Division

SUBJECT: Development of the Screening Level

The initial threshold screening level (ITSL) for dibutyl tin dilaurate is 5 µg/m³ (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- March 2009), 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) for dibutyl tin dilaurate. Both the ACGIH and NIOSH have established Occupational Exposure Limits (OELs). The ACGIH TLV and NIOSH Reference Exposure Limit (REL) for organic tin compounds are 0.1 mg/m³, as tin. The molecular weight is 631.65 g, and the molecular formula is C₃₂H₆₄O₄Sn. The melting point is 22-24°C. Dibutyl tin dilaurate is water soluble and is expected to be a yellow oily liquid or waxy crystal at standard temperature and pressure. The vapor pressure is 3x10⁻¹⁰ mmHg at 25°C. The molecular structure is shown in Figure 1.

Figure 1. Molecular Structure of Dibutyl Tin Dilaurate (ChemBlink, 2009)



Background Information

According to Material Safety Data Sheets (MSDS) obtained on-line, dibutyl tin dilaurate is used as a catalyst in the production of polyurethane. Dibutyl tin dilaurate is covalently bonded to four organic compounds; 2 butyl groups and 2 lauric acid groups. Lauric acid (C₁₂H₂₃COOH; dodecanoic acid) is a saturated fatty acid. Lauric acid is found in human milk (5.8% of total fat) and cow's milk (2.2%), and goat's milk (4.5%).

Basis of the ACGIH TLV

The ACGIH discussed the TLV recommendation. ACGIH (2001) used oral organotin data to support its TLV. ACGIH stated,

A TLV-TWA [time weighted average] of 0.1 mg/m³, measured as tin, is recommended for organotin compounds to minimize the potential for adverse effects on immune function and the CNS [Central Nervous System]. A TLV-STEL [Short Term Exposure Limit] of 0.2 mg/m³, as tin, is also recommended to minimize acute symptoms such as eye and respiratory tract irritation, headaches, and nausea. Based on an exposure of 0.1 mg/m³, a 70-kg worker breathing 10 m³ of air per 8 hr workday and assuming complete retention of the inhaled dose, would receive a daily exposure of 14.3 µg tin per kg body weight of an organotin compound.

ACGIH continues,

The LOELs [Lowest Observable Effect Levels] for the most critical organ sites in rats, the cellular immune system and CNS, are 0.15 and 0.23 mg tin/kg body weight/day.

It can be inferred from these statements that there is a margin of safety of 10 between the LOEL of 0.15 mg tin/kg body weight and the dose-adjusted TLV of 14.3 µg tin/kg body weight (using 10 m³ air breathed per day for a 70 kg adult worker).

Discussion and Derivation of the Screening Level

Both the ACGIH and the NIOSH occupational exposure levels for organotin compounds are set at 0.1 mg/m³, as tin. In order to derive an occupational exposure level specific for dibutyl tin dilaurate, the amount of tin per molecule needs to be determined. The molecular weight for dibutyl tin dilaurate is 631.65 g and the molecular weight for tin is 118.71.

$$\text{TLV for dibutyl tin dilaurate} = \text{TLV for organotin, as tin} \times \frac{\text{mol. weight of dibutyl tin dilaurate}}{\text{mol. weight of tin}}$$

$$\text{TLV for dibutyl tin dilaurate} = 0.1 \text{ mg/m}^3, \text{ as tin} \times \frac{631.65 \text{ g}}{118.71 \text{ g}}$$

$$\text{TLV for dibutyl tin dilaurate} = 0.1 \text{ mg/m}^3, \text{ as tin} \times 5.32$$

$$\text{TLV for dibutyl tin dilaurate} = 0.1 \text{ mg/m}^3, \text{ as tin} \times 5.32$$

$$\text{TLV for dibutyl tin dilaurate} = 0.53 \text{ mg/m}^3$$

Finally, Rule 232(1)c was used to calculate the screening level.

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

$$\text{ITSL} = (0.53 \text{ mg/m}^3)/100$$

$$\text{ITSL} = 0.0053 \text{ mg/m}^3$$

$$\text{ITSL} = 5 \text{ } \mu\text{g/m}^3 \text{ (8-hr averaging time)}$$

The initial threshold screening level (ITSL) for dibutyl tin dilaurate is 5 µg/m³ with an 8-hr averaging time.

References

ACGIH. 2001. Documentation of threshold limit values (TLVs) and biological exposure indices (BEI). American Conference of Governmental Industrial Hygienists. Cincinnati, OH, 45240-1634.

ChemBlink, 2009. <http://www.chemblink.com/products/77-58-7.htm>