MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

_____

INTEROFFICE COMMUNICATION

_____

TO: File for BDTP [2-(2H-Benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)-phenol] (CAS # 25973-55-1)

FROM: Doreen Lehner, Toxics Unit, Air Quality Division

DATE: May 6, 2014

SUBJECT: Screening Level for BDTP [2-(2H-Benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)-phenol] (CAS # 25973-55-1)

The initial threshold screening level (ITSL) for BDTP (CAS # 25973-55-1) is 5.3 µg/m^3 with an annual averaging time.

2-(2H-Benzotriazol-2-yl)-4,6-bis(1,1-dimethylpropyl)-phenol (BDTP; also known as 2-(3,5-di-tert-amyl-2-hydroxyphenyl)benzotriazole, DitPe-BZT, and Tinuvin 328) is a phenolic benzotriazole. It is a solid at room temperature with a melting point of 80-83°C and a molecular weight of 351.49 g/mol. BDTP is used as a raw material in the production of UV light absorbers in automotive and industrial coatings, rubber, paints, plastics, and electrical and electronic products (NTP, 2011).

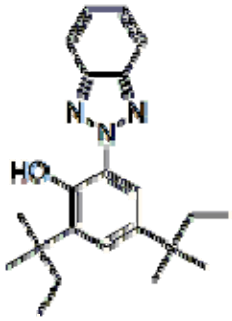

Figure 1. Structure of BDTP

A literature review was conducted to determine an initial threshold screening level (ITSL). The following references and databases were searched to derive the above screening level: CCD, United States Environmental Protection Agency (US EPA) Integrated Risk Information System (IRIS), National Institute for Occupational Safety and Health (NIOSH), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values and Biological Exposure Indices (TLV/BEI) 2012 guide, National Toxicology Program (NTP) Study Database, International Agency for Research on Cancer (IARC), Acute Database, Chemical Abstract Service (CAS) Online (searched 5/2/14), National Library of Medicine (NLM)-online, EPA

Aggregated Computational Toxicology Resource (ACToR) Database, US EPA TSCATS database, and Hazardous Substances Data Bank (HSDB).

Beagle dogs (3/sex/group) were administered BDTP in the diet at 0, 15, 30, 60, 120, or 240 mg/kg-bw/day daily for 90 days. “Decreases in body weight and food consumption were evident in the high-dose group animals. Males were more sensitive than females with mortality of one male dog in the highest dose group. The liver was reported to be the primary target organ for toxicity” (EPA, 2009). Anemia was noted in animals from the 120 and 240 mg/kg dose groups and shriveled erythrocytes appeared in the blood films of the 30, 60 120, and 240 mg/kg dose groups; this phenomenon was dose dependent and more pronounced in the male dogs than in the female dogs. Slight changes in blood chemistry parameters which included increased serum bilirubin levels, gamma glutamyl transpeptidase (GTP), glutamyl oxalacetic transaminase (GOT) and alkaline phosphatase activity (NTIS, 1988). “In males, decreases in testes, prostrate and epididymal weights at the two highest doses. In females, body weight and uterus weight was decreased in the three highest dose groups. Increased liver weights associated with liver damage including icterus (jaundice) were observed upon gross and histopathological examination in a few dogs in the 120 and 240 mg/kg-bw/day dose groups” (EPA, 2009). Microscopically, fatty degeneration of hepatocytes, presence of protein globules in the cytoplasm, Kupffer cell hyperplasia and centrilobular cholestasis were seen in all dose groups (NTIS, 1988). “It was reported that the kidneys also exhibited toxicity, but no details were provided. In higher dose groups, some animals showed atrophy of uterus, abnormal spermiogenesis and atrophy of the prostate” (EPA, 2009). The LOAEL for this study is 15 mg/kg-bw/day due to liver protein globules in the cytoplasm.

A 90-day study is the minimum length of study needed to develop an RfD. The EPA (1993) uses the following equation to determine an RfD from a NOAEL:

$$RfD\ {}^{mg}/_{kg/day} = \frac{LOAEL\ {}^{mg}/_{kg/day}}{UF_H \times UF_A \times UF_S \times UF_L \times UF_D}$$

Where:

UF = The uncertainty factor used to account for differences between the available data and the possible effects in the human population, usually expressed as factors of 10.

UF_H = Uncertainty factor used to account for the variation in sensitivity among individuals of the human population.
UF_A = Uncertainty factor used to account for the extrapolation from animal data to humans.
UF_S = Uncertainty factor used to account for the extrapolation from less than chronic NOAELs to chronic NOAELs.
UF_L = Uncertainty factor used to account for the extrapolation from a LOAEL to a NOAEL.
UF_D = Uncertainty factor associated with extrapolation when the database is incomplete.

The LOAEL from the beagle study of 15 mg/kg-bw/day can be used as an RfD using the above equation gives:

$$RfD\ {}^{mg}/_{kg/day} = \frac{15\ {}^{mg}/_{kg/day}}{10\ \times 10\ \times 10\ \times 10\ \times 1} = \frac{15\ {}^{mg}/_{kg/day}}{10{,}000} = 0.0015\ {}^{mg}/_{kg/day}$$

Rule 232(1)(b) uses an oral RfD to determine an ITSL using the following equation:

$$ITSL = oral\ RfD\ \times \frac{70\ kg}{20 m^3}$$

Where 70 kg is the default body weight for an average human and 20 m^3 is used to define the minute volume (default ventilation rate) for an average human. Taking the oral RfD, which was determined to be 0.0015 mg/kg/day above, this leads to the following equation:

$$ITSL = 0.0015\ {}^{mg}/_{kg/day} \times \frac{70\ kg}{20 m^3} = 0.00525\ {}^{mg}/_{m^3} = 5.3\ {}^{\mu g}/_{m^3}$$

Therefore the ITSL is 5.3 µg/m^3. According to Rule 232(2)(b) a 24-hour averaging time period should be used, but as this ITSL is based on a 90-day study it is appropriate to utilize a longer averaging time, which would be an annual averaging time. The ITSL for BDTP is 5.3 µg/m^3 based on an annual averaging time.

References:

APCR. 2014. Air Pollution Control Rules, Promulgated pursuant to Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, Michigan Department of Environmental Quality. 1994, Act 451, as amended (NREPA).

EPA. 1993. Reference Dose (RfD): Description and Use in Health Risk Assessments. Background Document 1A. March 15, 1993. Available online at: http://www.epa.gov/iris/rfd.htm

EPA. 2009. Screening-Level Hazard Characterization Sponsored Chemicals Phenolic Benzotriazoles Category. US EPA Hazard Characterization Document. September, 2009. Available online at:

NTIS. OTS0516611. 1988. National Technical Information Service. Springfield, VA 22161. Four Toxicity Studies on Tinuvin 328 (CAS No. 25973-55-1) with cover letter dated 091388.

NTP. 2011. Phenolic Benzotriazoles. Chad Blustone, PhD., DABT, National Institute of Environmental Health Sciences. NTP Board of Scientific Counselors Meeting. December 15, 2011. Powerpoint presentation available online at: http://ntp.niehs.nih.gov/ntp/about_ntp/bsc/2011/december/presentations/6_blystone_pbzt.pdf

DL:lh