MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

July 16, 2003

TO: 10, 10'-oxybisphenoxarsine oxide (CAS # 58-36-6)

FROM: Gary Butterfield

SUBJECT: Screening level for 10, 10'-oxybisphenoxarsine oxide

10, 10'-Oxybisphenoxarsine oxide is a water insoluble, white, odorless powder with a vapor pressure of 2x10e-7 mmHg at 25C, and a molecular weight of 502 g/mol. This material is used as a disinfectant, bacteriostat and fungicide in plastic products, industrial adhesives, textiles, and resin/latex/polymer emulsions. 10, 10'-Oxybisphenoxarsine oxide is also commonly known as 10,10'-bis(phenoxyarsinyl) oxide, OBPA, DID 47, vinyzene, and phenoxarsine oxide.

The chemical is a pesticide, registered with U.S. Environmental Protection Agency (EPA) for that use. As the pesticide regulating authority, EPA has access to many unpublished studies. The 1993 Registration Eligibility Document (RED) for this chemical has summarized many of these studies.

The following references or databases were searched to identify data to determine the screening level: U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS), National Institute for Occupational Safety and Health (NIOSH) Registry for Toxic Effects of Chemical Substances (RTECS), American Conference of Governmental and Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs), Michigan Department of Environmental Quality (DEQ) library, International Agency for Research on Cancer (IARC) Monographs, Chemical Abstract Service (CAS) Online (1968 - January 2003), National Library of Medicine (NLM) - Toxline, and National Toxicology Program (NTP) Status Report. The CAS and NLM on-line literature searches were conducted on January 7, 2003.

Because the complex 10, 10'-oxybisphenoxarsine oxide molecule contains an arsenic atom, data were evaluated to determine the potential for metabolism allowing the release of inorganic arsenic. Inorganic arsenic is a concern due to its known carcinogenic effects. There also was some concern for environmental accumulation of inorganic arsenic following release of this organic arsenic compound. Very little information on metabolism or environmental fate of 10, 10'-oxybisphenoxarsine oxide was located during the literature searches.

EPA's RED does not address environmental fate concerns because 10,10'-oxybisphenoxarsine oxide is processed in enclosed processes into plastics so that no free chemical is available to be released to the environment.

The Agency for Toxic Substances and Disease Registry (or ATSDR) (1998), while not addressing this specific compound, does review some general information on organic arsenic compounds. ATSDR says that organic arsenic compounds are quite stable. They don't break down to inorganic arsenic, and are generally less toxic than inorganic arsenic compounds.

Several agencies have standards for inorganic arsenic, including U.S. Environmental Protection Agency (EPA), American Conference of Governmental and Industrial Hygienists (ACGIH), and National Institute for Occupational Safety and Health (NIOSH), to mention a few. However, those standards apply only to inorganic forms and not to the organic forms of arsenic compounds. Lacking any available evidence that organic arsenic and particularly this specific chemical (OBPA) breaks down or is metabolized to inorganic arsenic, the screening level was developed using data for OBPA only, and not inorganic arsenic.

There was very little toxicity data found from the literature search. Acute oral toxicity studies are the only available published data for this chemical. Schafer et al (1972, 1983 and 1985) report the LD50 in wild birds, either redwing blackbirds or house sparrows. The LD50s from Schafer's bird studies are similar to the LD50 values in mammals (rats and guinea pigs) reported by Ballantyne (1978).

Ballantyne determined the oral LD50 in male Wistar rats and male Hartley guinea pigs. Groups of 10 animals were administered one of seven dose levels. The LD50 was determined via probit analysis. The rat LD50 was reported to be 40 mg/kg, while the guinea pig LD50 was 24 mg/kg. Ballantyne also reported some acute inhalation data for groups of five male guinea pigs that were exposed to various concentrations of aerosols (69 to 271 mg/m^3) for various durations (from 30 to 120 minutes). Based on these studies, the author reported a time weighted-lethal concentration of 12830 $mg\text{-}min/m^3$. However, it is somewhat questionable as to how this value can be used in determining a screening level as the methodology provided in the rules utilizes either a one- or four-hour LC50. If a one-hour LC50 value is used ($(12830mg\text{-}min/m^3)/(60min)=214mg/m^3$) because that is the approximate length of the exposures in this study, the resultant ITSL is approximately the same as the one calculated from the oral LD50. Therefore, there is little difference in which acute value is used to calculate the ITSL.

It should be noted that there is also a very brief description of a 30-day rat and guinea pig inhalation toxicity study reported in Ballantyne. The study was conducted at one concentration with 25 rats and 25 guinea pigs exposed for five hours a day for 30 consecutive days. The cumulative exposure was reported to be 14530 $mg\text{-}min/m^3$ (converts to 1.6 mg/m^3 as follows: $(14530mg\text{-}min/m^3)/(30day \times 300min/day) = 1.6\ mg/m^3$). Half of the animals were sacrificed at the end of the exposure and half following a four-month recovery period. Animals sacrificed at the end of exposure had mild to moderate alveolar capillary congestion, and few small intra-alveolar hemorrhages. Rat livers had mild to moderate increases in portal tract mono-nuclear cells - the hepatocytes were normal. At the end of four-month recovery, all animals were found to be normal. Because so few details were provided in this study's summary, and only a single dose level was used, this study was considered inadequate for determining the ITSL.

The acute oral study LD50 for guinea pigs of 24 mg/kg reported by Ballantyne (1978) provides the best basis for the screening level. The ITSL can be calculated by the equation from R232(1)(h) as follows.

$$ITSL = \frac{(24\ mg/kg)}{500 \times 100 \times 40 \times 0.167} \times \frac{1\ kg}{0.46\ m^3} = 0.2\ ug/m^3 \text{ annual average}$$

Where the default inhalation rate for guinea pigs of 0.46 m^3/kg was used in the above calculation.

References

ATSDR. 1998. Toxicological profile for arsenic.

Ballantyne. 1978. The comparative short-term mammalian toxicology of phenarsazine oxide and phenoxarsine oxide. Toxicology 10: 341-361.

EPA. 1993. 10, 10'-Oxybisphenoxarsine oxide registration eligibility document. EPA-738-F-93-003.

Schafer. 1972. The acute oral toxicity of 369 pesticidal, pharmaceutical and other chemicals to wild birds. Toxicology and Applied Pharmacology 21:315-330.

Schafer et al. 1983. The acute oral toxicity, repellency, and hazard potential of 998 chemicals to one or more species of wild and domestic birds. Arch. Environ. Contam. Toxicol. 12:355-382.

Schafer and Bowles. 1985. Acute oral toxicity and repellency of 933 chemicals to house and deer mice. Arch. Environ. Contam. Toxicol. 14:111-129.