

Fact Sheet Date: NOV 15 1991

**NEW YORK STATE
- HUMAN HEALTH FACT SHEET -**

**Ambient Water Quality Value for
Protection of Sources of Potable Water**

SUBSTANCE: Terbufos

CAS REGISTRY NUMBER: 13071-79-9

AMBIENT WATER QUALITY VALUE: 0.09 ug/L

BASIS: 6 NYCRR 702.5, Non-oncogenic

SUMMARY OF INFORMATION

Terbufos [S-(t-butylthio) methyl-O,O-diethyl-phosphorodithioate] is an organo-phosphorous pesticide used for the control of corn rootworm and other pests infesting corn, beets and sorghum. It has been found in 134 of 2,016 surface water samples, with a maximum concentration of 2.25 ug/L (USEPA, 1988a). Terbufos hydrolyzes rapidly in solution and degrades fairly rapidly in soil (half-life, 10 days) (USEPA, 1988a). It is designated by EPA as having a high potential for leaching into groundwater (USEPA, 1988b).

Pharmacokinetics

Terbufos is well-absorbed from the gastrointestinal tract, distributes quickly to the tissues of the rat and is extensively metabolized. Of a single gavage dose (0.8 mg/kg) of technical terbufos, 83% was excreted in the urine and 3% in the feces after 168 hours (North, 1973 as cited in USEPA, 1988a).

Acute and Chronic Toxicity

Case reports of two small groups of farm workers indicated no significant adverse physiological effects from exposure to terbufos during aerial application or planting. Plasma and red blood cell cholinesterase values in the exposed workers showed no significant differences from pre-exposure or control values (USEPA, 1988a).

Studies of short-term effects in animals demonstrated that cholinesterase inhibition is the most prominent effect of oral exposure to terbufos. Cholinesterase inhibition has been noted in beagle dogs (Berger, 1977; Tegeris Labs, 1987; Morgareidge et al., 1973; Shellenberger, 1986; American Cyanamid, 1986) and rats (Daly et al., 1979; Biodynamics, Inc., 1987; Rapp et al., 1974; McConnell, 1983) after exposure to terbufos in periods ranging from 28 days to 2 years. NOELs were reported ranging from 1.25 ug/kg/day to 120 ug/kg/day (Tegeris Labs, 1987; Shellenberger, 1986). (All as cited in USEPA, 1988a).

Reproductive and Developmental Effects

Smith and Kasner (1972) determined a reproductive LOAEL of 0.05 mg/kg/day, based on an increased percentage of litters with dead offspring compared to controls, in a three-generation study in rats. A NOAEL of 0.0125 mg/kg/day was identified. In two studies of developmental effects as a result of maternal exposure to terbufos, neither rabbit nor rat progeny exhibited abnormalities, except at doses causing maternal toxicity (USEPA, 1988a).

Genotoxicity

No evidence of genotoxic effects has been found in mammalian cell culture tests as a result of exposure to terbufos.

Carcinogenicity

In one long-term bioassay conducted in mice and rats (Rapp et al., 1974) at doses ranging from 0.0125 to 1.2 mg/kg/day, no evidence of tumorigenesis was found. In an 18-month study in mice fed technical terbufos at dietary levels of 0, 0.45, 0.9 and 1.8 mg/kg/day, there was no evidence of oncogenic effect at any dose level. The maximum tolerated dose (MTD) was achieved in the oncogenicity studies (USEPA, 1988c).

DERIVATION OF VALUE

In their review, the EPA selected a NOAEL based on the 28-day feeding study in beagle dogs by Tegeris Labs (1987). In this study dogs were administered terbufos in a corn oil vehicle (capsule) at doses of 1.25, 2.5, 5.0 and 15 ug/kg/day. It is a follow-up study employing the same parameters as the one-year American Cyanamid dog study (1986), with doses ranging from the lowest American Cyanamid dose (15 ug/kg/day) to 1.25 ug/kg/day. The results of the two studies, evaluated together, adequately define the chronic endpoint of ChE activity depression. A plasma cholinesterase (ChE) NOAEL was defined at 1.25 ug/kg/day in the Tegeris Lab (1987) study. The plasma ChE LOAEL was determined to be 2.5 ug/kg/day based on decreased plasma ChE activity in male and female dogs compared to controls (USEPA, 1988c).

In other studies, the ChE NOAEL is either an order of magnitude larger than the NOAEL defined by Tegeris Labs (1987) or a LOAEL, well above the NOAELs, has been defined. For example, Daly et al. (1979) identified a NOAEL an order of magnitude higher, as is also the case in Shellenberger (1986). Rapp et al. (1974) and American Cyanamid (1986) were rejected since these studies identified LOAELS only. Morgareidge et al. (1973) was rejected because there was a higher degree of uncertainty associated with the actual dose consumed by the test animals (USEPA, 1988a).

The study with the lowest NOAEL will be used to provide the greatest degree of protection from effects of terbufos on human health, consistent with procedures in 6NYCRR 702.5. Using the Tegeris (1987) study, a water quality value is calculated according to procedures in 6NYCRR 702.5 on the basis of non-oncogenic effects. Sufficient pharmacokinetic data were not found to use in development of the value.

Step 1: Determination of the ADI

$$\text{ADI} = \frac{1.25 \text{ ug/kg/day}}{(100)} = 0.0125 \text{ ug/kg/day}$$

where:

1.25 ug/kg/day = NOAEL, based on absence of inhibition of cholinesterase in dogs exposed to terbufos for 28 days.

100 = uncertainty factor where results of studies of prolonged human exposure are not available and the results of adequate studies in an appropriate species establishes a NOAEL. The end point of cholinesterase inhibition was not accompanied by any adverse systemic effects (USEPA, 1987) and no oncogenic effects were demonstrated in long-term studies.

Step 2: Determination of the value

$$\frac{0.0125 \text{ ug/kg/day} (70 \text{ kg}) (0.20)}{(2 \text{ L/day})} = 0.09 \text{ ug/L}$$

where:

0.0125 ug/kg/day = ADI

70 kg = assumed body weight of an adult.

2 L/day = assumed daily water consumption of an adult.

20% = assumed relative source contribution from water.

REFERENCES

American Cyanamid. 1986. One-year toxicity study in purebred beagle dogs with AC 92,100. Unpublished data. EPA accession #263678-263680.

6NYCRR, Chapter X, Parts 700-705. Water Quality Regulations. Surface Waters and Groundwater Classifications and Standards.

Tegeris Laboratories. 1987. 28-day oral toxicity study in the dog with AC 92,100. Unpublished study EPA accession #4037401-4037402.

U.S.E.P.A. 1984. Health and Environmental Effects Profile for Terbufos. Environmental and Criteria Assessment Office. Cincinnati, OH. PB88-142807.

U.S.E.P.A. 1987. The Risk Assessment Guidelines of 1986. Office of Health and Environmental Assessment. Washington, D.C. EPA 600/8-87-045.

U.S.E.P.A. 1988a. Terbufos. Health Advisory. Office of Drinking Water. Washington, D.C.

U.S.E.P.A. 1988b. Pesticides included in EPA National Pesticide Survey. Office of Drinking Water. April 14, 1988.

U.S.E.P.A. 1988c. Guidance for the Reregistration of Pesticide Products Containing Terbufos as the Active Ingredient. Office of Pesticides and Toxic Substances. Washington, D.C.

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