

2016 Children's Safe Products - Reporting Rule update
Draft Chemical Evaluation

CAS 126-73-8

Substance Name Tri-n-butyl phosphate or Tributyl phosphate (**TNBP** or TBP)

Toxicity

According to the European Chemicals Agency (ECHA) TNBP is suspected to cause cancer and is a category 2 cancer hazard [1]. TNBP caused dose-related increases in the incidence and severity of urinary bladder tumors in male and female rats with dietary exposure for two years [2]. Male mice with chronic dietary exposure developed liver tumors [3]. The American Conference of Governmental Industrial Hygienists (ACGIH) classified TNBP as a confirmed animal carcinogen with unknown relevance to humans [4].

The US Agency for Toxic Substances and Disease Registry (ATSDR) evaluated available toxicity data for TNBP and developed human health screening values [3]. Acute oral exposure guidelines were based on reduced weight gain in rats dosed during pregnancy. The lowest-observed-adverse-effect-level (LOAEL) for this maternal effect was 125 mg/kg-day [3]. No observable birth defects in fetuses were observed at gestation day 20 at this dose. Higher oral doses in subacute rat testing caused neurological signs and symptoms, changes in liver and spleen weights, and degenerative changes in the testes (Laham et al. 1983 and Noda et al. 1994 as cited in ATSDR review [3]). Urinary bladder hyperplasia was the most sensitive effect observed in three oral rat studies of longer duration (Arnold et al. 1997, FMC 1985, Tyl et al. 1997 reviewed in ATSDR [3]). ATSDR selected the study by Arnold et al. 1997, with a LOAEL of 33 mg/kg/d, to derive human screening levels for both intermediate and chronic duration [3]. ATSDR's human health screening value for TNBP is 0.08 mg/kg-day for intermediate and chronic exposures [3].

In vitro tests show that TNBP, but not its metabolite di-n-butyl phosphate (DNBP), may act as an antagonist for androgen and the glucocorticoid nuclear receptors [4, 5]. Neither TNBP nor its metabolite DNBP had an effect on estrogen receptors *in vitro* [5, 6].

Exposure

TNBP is mainly used as an additive in fire-resistant aircraft hydraulic fluids and as a plasticizer for cellulose esters, lacquers, plastics, and vinyl resins [4]. It may be present in floor finish, floor wax, paints and glues. It also has a number of industrial applications [3]. U.S. national volume production was reported to be 8,877,744 pounds/year in 2012 [7].

TNBP has been measured in indoor dust and air in U.S. and European studies [8-12]. Maximum level reported was 7,100 ng/g in house dust [10]. Two European studies included air measurements and found TNBP more commonly in indoor air than in dust at homes and daycare centers [8, 11]. Recent residential sampling in Norway by Xu et al. reported 98% detection in residential indoor air with a median of 14 ng/m³ and a maximum detection of 119 ng/m³ [11]. Inhalation exposure was the predominant route of estimated human residential exposure [11].

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Biomonitoring studies indicate that TNBP is making its way into people bodies. Dodson et al., measured metabolites of TNBP in urine from adults in Northern California [13]. Fromme et al., reported slightly higher mean levels of TNBP urinary metabolite in a population of 312 children attending 63 German day care centers [8]. TNBP has been detected in breast milk samples from Sweden and several Asian counties [14, 15]. TNBP was recently measured directly in blood of 237 adults in a Chinese study [16]. The median level reported was 37.8 ng/mL, which was much higher than the other organophosphorus flame retardants measured.

There is some evidence of TNBP in the U.S. diet, drinking water and ambient air. TNBP has been found at low parts per billion levels in cereal products including baby food in the U.S. [3, 4, 17]. Focazio et al., 2008, detected TNBP in a study of 74 public drinking water systems from 25 states and Puerto Rico. TNBP was detected in 8.1% of the samples with a maximum of 0.74 µg/L as cited in [3]. TNBP was detected in 100% of urban air samples from the Great Lakes area with an average concentration of 150-250 pg/m³. Lower air concentrations (average of 34 pg/m³) were detected at remote locations [4].

References

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