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Last updated by Toxipedia in 2011.

Chlorinated Tris (TDCPP)

Overview

Chlorinated Tris (TDCPP) is a flame retardant currently used in many applications including polyurethane foam found in upholstered furniture (#1). Although banned from use in children's pajamas in the 1970s due its mutagenic properties, chlorinated Tris remains in household furniture and baby products (#2, #3, #5). It can escape from foam and attach to house dust or remain in the air. Common names for chlorinated Tris include Fryol FR 2 and Antiblaze 195 (#4).

Chemical Description

Chlorinated Tris, or Tris (1,3-dichloro-2-propyl) phosphate is a chlorinated phosphate ester (#1). It is a colorless, viscous liquid at temperatures greater than 27 degrees C (#4).

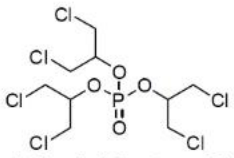

Figure 1. Chemical Structure of TDCPP.

(#1)

Use

Chlorinated Tris in an additive flame retardant, meaning that is not chemically bound to products and can escape over time. TDCPP is used in both soft and rigid polyurethane foam, as well as in plastics, resins, and some fabric backings (#4). In a study conducted in 2011, chlorinated Tris was the most common flame retardant found in baby products with foam. Products intended for children with chlorinated Tris included car seats, baby changing pads, and baby carriers (#5).

History

Chlorinated Tris has been in use since the 1960s, but its use has increased following the 2006 ban on the common flame retardant PentaPBDE (#1). Chlorinated Tris was banned from use in children's pajamas in 1977 when it was found to be mutagenic, but remains in use as a foam additive. In 1997, global production per year of chlorinated Tris was 8000 tonnes (#4). Flame retardants of all types are frequently used in the United States, in part due to California's strict flammability standard described in Technical Bulletin 117, which requires foam to withstand direct flame for 12 seconds (#7). Recently, concerns have been raised about the safety of chlorinated Tris due to its prevalence in furniture and

especially in baby products (#5). In 2011, California added TDCPP to the Proposition 65 list of suspected carcinogens (#6).

Routes of Exposure and Metabolism

Over time, TDCPP escapes from the furniture foam and attaches to dust in homes. The dust lands on household surfaces including toys and food, which is easily ingested. Young children are the most likely to be exposed because of their tendency to put their toys and hands into their mouths and ingest dust (#17). Studies have shown that TDCPP can be detected in the air as well, making inhalation another possible route of exposure (#8, #9, #10, #17). It is also possible to be exposed to chlorinated Tris by touching exposed foam and it is known that TDCPP can be absorbed through the skin (#2, #11). TDCPP is metabolized by humans into several metabolites that have been detected in urine and semen (#12, #13).

Human Health Effects

No human studies have been conducted, but evidence suggests that TDCPP may impact fertility by influencing hormone levels and semen quality in men (#14). According to studies conducted in rats, chlorinated Tris is associated with increased tumor rates in kidneys and testes, some of which were cancerous (#15). A recently published study found that TDCPP was a neurotoxin to brain cells, and was just a toxic and in some cases more toxic than the insecticide Chlorpyrifos (#16). In an assessment conducted by the Consumer Product and Safety Commission, chlorinated Tris poses a threat to human health (#17).

Environmental Effects

TDCPP has been detected in aquatic environments (#18)

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