

Tris(1,3-dichloro-2-propyl) phosphate

Tris(1,3-dichloro-2-propyl) phosphate (also known as chlorinated Tris, TDCP, TDCPP or Fyrol FR-2) is a flame retardant. It is used to treat fabrics and upholstery, and is incorporated into polyurethane foam. Tris(1,3-dichloro-2-propyl) phosphate is a common replacement for pentabromodiphenyl ether (pentaBDE), a fire retardant used in polyurethane foam. The manufacture, processing and distribution in commerce of products containing pentaBDE has been prohibited in California as of June 1, 2006 (California Health and Safety Code section 108922).

Occupational exposures to tris(1,3-dichloro-2-propyl) phosphate may occur through inhalation and dermal contact at workplaces where the chemical or materials treated with the chemical are produced or used. The general population is exposed through the oral, dermal and inhalation routes (NRC, 2000) in homes, offices, and other indoor environments as a result of proximity to and use of consumer products such as upholstered furniture treated with tris(1,3-dichloro-2-propyl) phosphate.

Tris(1,3-dichloro-2-propyl) phosphate passed the animal data screen, underwent a preliminary toxicological evaluation, and is being brought to the Carcinogen Identification Committee for consultation. This is a compilation of the relevant studies identified during the preliminary toxicological evaluation.

Epidemiological data

No cancer epidemiology studies were identified.

Animal carcinogenicity data

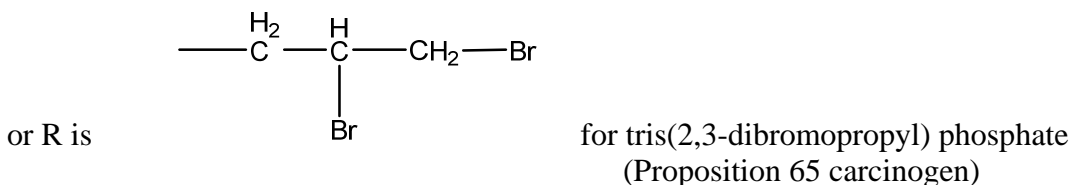
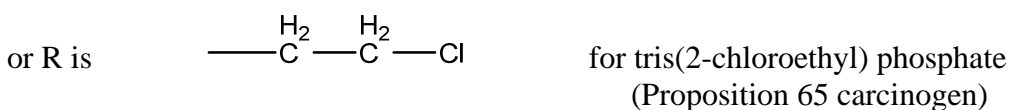
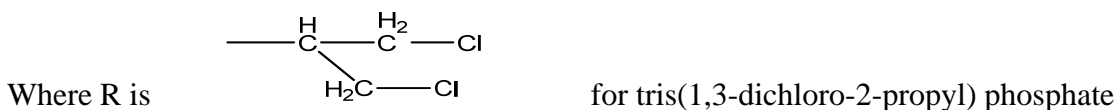
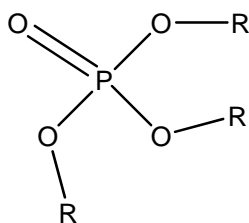
- Two-year diet animal bioassays
 - Sprague-Dawley rats: Freudenthal and Henrich (2000); reviewed in Babich (2006); NRC (2000, pp. 371-372, 377-378); U.S. EPA (2005, pp. 3-1 – 3-2, 3-15 – 3-17)

Other relevant data

- Genotoxicity
 - Summary of effects in experimental systems: Babich (2006, p. 5); NRC (2000) pp. 371-375, Table 16-6, p. 373; U.S. EPA (2005, p. 3-2)
 - Individual study descriptions: U.S. EPA (2005, pp. 3-22 – 3-27)
 - Gold *et al.* (1978)
- Metabolism: Nomeir *et al.* (1981)

- Structure activity considerations
 - Tris(2,3-dibromopropyl) phosphate
 - A flame retardant banned in 1977 by the U.S. Consumer Product Safety Commission for use in children's clothing
 - Carcinogen listed under Proposition 65 since January 1, 1988
 - Tris(2-chloroethyl) phosphate
 - A flame retardant used in plastics and polyurethane foam
 - Carcinogen listed under Proposition 65 since April 1, 1992
 - Structural similarity between tris(1,3-dichloro-2-propyl) phosphate and tris(2,3-dibromopropyl) phosphate: Nomeir *et al.* (1981), Gold *et al.* (1978)

The basic structure of these three structurally similar flame retardants is as follows:



Reviews

- Babich (2006)
- NRC (2000)
- U.S. EPA (2005)

References¹

Babich MA (2006). CPSC [Consumer Product Safety Commission] Staff Preliminary Risk Assessment of Flame Retardant (FR) Chemicals in Upholstered Furniture Foam. U.S. Consumer Product Safety Commission, Bethesda, Maryland, December 21.

Freudenthal RI, Henrich RT (2000). Chronic toxicity and carcinogenic potential of tris-(1,3-dichloro-2-propyl) phosphate in Sprague-Dawley rat. *Inter J Toxicol* **19**:119-125.

Gold MD, Blum A, Ames BN (1978). Another flame retardant, tris-(1,3-dichloro-2-propyl)-phosphate, and its expected metabolites are mutagens. *Science* **200**(4343), 785-787.

National Research Council (NRC) (2000). Toxicological risks of selected flame-retardant chemicals. Subcommittee on Flame Retardant Chemicals, National Research Council, National Academy of Sciences. National Academy Press, Washington, DC.

Nomeir AA, Kato S, Matthews HB (1981). The metabolism and disposition of tris(1,3-dichloro-2-propyl) phosphate (Fyrol FR-2) in the rat. *Toxicol Appl Pharm* **57**:401-413.

U.S. Environmental Protection Agency (U.S. EPA) (2005). Furniture flame retardancy partnership: Environmental profiles of chemical flame-retardant alternatives for low-density polyurethane foam. Volume 2. Chemical hazard reviews. U.S. EPA, Design for the Environment, EPA 742-R-05-002B, September, (<http://www.epa.gov/dfe/pubs/flameret/altrep-v2/altrept-v2-intro.pdf>, accessed July 25, 2008).

¹ Copies of these listed references, as either the abstract, the relevant sections of the publication, or the complete publication, have been provided to members of the Carcinogen Identification Committee. These references have been provided in the order in which they are discussed in this document.