

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

**CAS** 1330-78-5

**Substance Name** Tricresyl phosphate (TCP)

### Toxicity

Tricresyl phosphate (TCP) is classified by EPA as high hazard for reproductive and repeated dose toxicity, and a moderate hazard for developmental and neurological toxicity [1].

Endocrine organs appear to be sensitive to TCP toxicity. Studies carried out by the National Toxicology Program (NTP) in 1994 showed that long-term oral exposure (13 weeks and 104 weeks) to TCP, induced adrenal gland and ovarian lesions in rats and adrenal and liver lesions in mice. The lowest-observed-adverse-effect-level (LOAEL) was 7 mg/kg-day for ovarian lesions in female rats in a 2-year bioassay [2, 3]. TCP was not carcinogenic in NTP oral bioassays in rats and mice [2]. The TCP used in the NTP studies was a mixed isomer preparation of 79% tricresyl phosphate esters consisting of 21% tri-*m*-cresyl phosphate, 4% tri-*p*-cresyl phosphate, <1% tri-*o*-cresyl phosphate, and other unidentified tricresyl phosphate esters [2].

At higher doses, TCP reduced fertility and survival of offspring in rodents [2]. Aside from impacts on female ovaries mentioned above, TCP caused a dose-dependent increase in abnormal sperm morphology, reduced sperm concentration, and atrophy of seminiferous tubules in male rodents. TCP reduced the number of litters produced and pups/litter especially when males were treated. It also increased pup mortality postnatally [2, 4, 5]. LOAELs ranged from 63-400 mg/kg-day for these reproductive and developmental effects [1].

NTP studies demonstrated that TCP is neurotoxic to rodents exposed by gavage for 13 weeks to commercial TCP mixtures (with less than 0.1% *ortho* TCP isomer). Briefly, TCP caused neuropathy (axonal degeneration in the spinal cord and sciatic nerve) in rats and mice. The LOAEL was 100 mg/kg-d for neurological lesions in male mice [1, 3]. The *ortho* isomer is reportedly kept to <1% of commercial TCP mixtures [1] because it is a known neurotoxic agent in people. In the early 1930s an outbreak of delayed neuropathy and paralysis in the United States was traced to tri-*o*-cresyl phosphate that had been added to Jamaican ginger extract and ingested as an alternative alcoholic drink during prohibition [6].

### Exposure

Commercial TCP is composed of a mixture of methylated triphenyl phosphate isomers with an unspecified amount of methyl substitution<sup>1</sup> including tri-*meta*-cresylphosphate (CAS no. 563-04-2), tri-*para*-cresylphosphate (CAS no. 78-32-0), and tri-*ortho*-cresylphosphate (CAS no. 78-30-8). TCP is often used as a flame retardant and plasticizer in PVC, cellulosic polymers, thermoplastics and synthetic rubber. It may be added to polyurethane foam as a flame retardant. It also is a flame retardant additive for industrial lubricants such as hydraulic and brake fluids, and in photographic film [1, 2, 7]. The NTP

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<sup>1</sup> Other isomers that might also be present in the TCP mixture include the ortho-ortho-meta (oom), ortho-ortho-para (oop), omm, omp, opp, mmp, and mpp isomers (Van der Veen et al. 2012; reference 14)

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

report indicated it was used in back-coatings for upholstery fabric [3]. U.S. national volume production was reported to be one million to ten million pounds/year in 2012 [8].

TCP has been measured in 100% dust samples in two North American studies of house dust [9, 10]. The largest study sampled 134 urban Canadian homes and reported mean dust concentrations of 990-2600 ng/g depending on the method. Maximum reported dust concentration was 75,000 ng/g dust [10].

TCP has not been widely measured in biomonitoring studies of the general population or children. All three known isomers of TCP were measured but not detected in urine of German children or indoor dust in multiple German day care centers [11]. TCP was detected at low levels in breast milk from Swedish women (median was 0.28 ng/g lipid; maximum was 3.7 ng/g lipid) [12]. Median levels in Asian women were similar but the maximum detected level in breast milk (85 ng/g lipid) was much higher in this population [13].

TCP has a high bioconcentration factor (BCF) of  $8.56 \times 10^3$  meaning that it is likely to partition to fish and sediments if released into waterways. Potential for TCP bioaccumulation may be low however. Three fish species cleared this compound after exposure ceased. TCP degraded within five days in river water, and 7.5 hours in sewage sludge in other studies [5, 14]. Rats also are able to excrete TCP in urine, feces, and expired air.

### References

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

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