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

CAS 183658-27-7

Substance Name 2-ethylhexyl-2,3,4,5-tetrabromobenzoate (**TBB**, also EH-TBB)

Toxicity

EPA classified 2-ethylhexyl-2,3,4,5-tetrabromobenzoate (TBB) as a moderate hazard for reproductive, developmental, neurological and repeated dose toxicities [1]. This was based on the observed toxicity of a closely related confidential analog, and studies of commercial mixtures, which contain TBB as a major component. EPA did not release the name or chemical structure of the confidential analog but reported that the lowest-observed-adverse-effect-level (LOAEL) for a rodent study of this compound was 25 mg/kg-d for reproductive toxicity. LOAELs for developmental effects of two commercial mixtures were reported at 100 mg/kg-d for Firemaster® BZ-54 and 1 mg/kg-d for Firemaster® 550 [1].

The latter study involved prenatal exposure in rats and was published by Patisaul et al. 2013 [2]. Pregnant rats exposed to the Firemaster® 550 mixture during gestation and lactation had altered thyroid function and produced offspring were 30–60% heavier by weaning, an effect that persisted into adulthood. Female offspring of treated rats entered puberty sooner and had glucose intolerance and elevated anxiety behaviors in maze testing [2].

Exposure

TBB is an ingredient in common market replacements for PBDEs[1] in flexible polyurethane foam [3]. Approximately 50% of the Firemaster® 550 mixture is TBB and TBPH[1] at a ratio of 4:1 by mass [1, 4]. Past and current national production volume of TBB is withheld as confidential business information [4, 5]. TBB treated foams may be used in many everyday products such as couches, chairs, other upholstered furniture, children's furniture, baby products, office furniture, foam in gymnastic facilities, and auto cushions. TBB may also be present in products made from recycled foam such as carpet backings and pads [4, 6, 7].

TBB has been measured with high frequency in residential indoor dust in studies in the U.S. [8-11] and Canada [12]. It was found in 100% of indoor dust samples from 39 childcare centers in Northern California [13]. Mean levels from these studies ranged from 310 – 1,062 ng/g in indoor dust. Maximum level reported was 75,000 ng/g dust. In a study of North Carolina adults, levels of TBB in hand wipes correlated positively with a metabolite of TBB in urine suggesting that dermal contact with dust or treated surfaces contributed to overall exposure [14]. In another investigation, median concentrations of TBB and TBPH in paired hand wipe samples were 2–3 times higher after gymnastics practice compared to before indicating skin exposure was occurring during collegiate gymnast practice [15].

Metabolites of TBB were detected in urine of toddlers and their mothers in New Jersey and California studies [16, 17]. Levels measured in children tended to be higher than their mothers in both studies. The

[1] PBDE - polybrominated diphenyl ethers; TBPH – bis (2-ethylhexyl) 2,3,4,5-tetra bromophthalate

maximum concentration reported in children's urine reported across both studies was 225 ng/mL. TBB metabolites were also commonly detected in maternal serum (n=102) and breast milk (n=105) collected in a 2008-2009 study in women living in Québec Canada [18].

TBB is classified by EPA as high hazard for persistence and bioaccumulation [1].

References

1. EPA, *Flame Retardants Used in Flexible Polyurethane Foam: An Alternatives Assessment Update*. 2015, Environmental Protection Agency.
2. Patisaul, H.B., et al., *Accumulation and endocrine disrupting effects of the flame retardant mixture Firemaster(R) 550 in rats: an exploratory assessment.* J Biochem Mol Toxicol, 2013. **27**(2): p. 124-36.
3. EPA, *Furniture Flame Retardancy Partnership: Profiles of Chemical Flame-Retardant Alternatives for Low-Density Polyurethane Foam*. 2005, EPA: Washington, D.C. p. 153.
4. EPA, *TSCA Work Plan Chemical Technical Supplement - Use and Exposure of the Brominated Phthalates Cluster (BPC) Chemicals - Brominated Phthalates Cluster Flame Retardants*. 2015, Environmental Protection Agency, Office of Chemical Safety and Pollution Prevention. p. 54.
5. EPA. *Chemical Data Access Tool (CDAT) - Chemical Data Reporting (CDR) information on the production and use of chemicals manufactured or imported into the United States*. 2012 10/15/2015 10/30/2015]; Available from: http://java.epa.gov/oppt_chemical_search/.
6. Stapleton, H.M., et al., *Identification of flame retardants in polyurethane foam collected from baby products.* Environ Sci Technol, 2011. **45**(12): p. 5323-31.
7. La Guardia, M.J. and R.C. Hale, *Halogenated flame-retardant concentrations in settled dust, respirable and inhalable particulates and polyurethane foam at gymnastic training facilities and residences.* Environ Int, 2015. **79**: p. 106-14.
8. Dodson, R.E., et al., *After the PBDE phase-out: a broad suite of flame retardants in repeat house dust samples from California.* Environ Sci Technol, 2012. **46**(24): p. 13056-66.
9. Johnson, P.I., et al., *Associations between brominated flame retardants in house dust and hormone levels in men.* Sci Total Environ, 2013. **445-446**: p. 177-84.
10. Stapleton, H.M., et al., *Alternate and new brominated flame retardants detected in U.S. house dust.* Environ Sci Technol, 2008. **42**(18): p. 6910-6.
11. Brown, F.R., et al., *Levels of non-polybrominated diphenyl ether brominated flame retardants in residential house dust samples and fire station dust samples in California.* Environ Res, 2014. **135**: p. 9-14.
12. Shoeib, M., et al., *Legacy and current-use flame retardants in house dust from Vancouver, Canada.* Environmental Pollution, 2012. **169**(0): p. 175-182.
13. Bradman, A., et al., *Flame retardant exposures in California early childhood education environments.* Chemosphere, 2014. **116**: p. 61-6.
14. Hoffman, K., et al., *Urinary tetrabromobenzoic acid (TBBA) as a biomarker of exposure to the flame retardant mixture Firemaster(R) 550.* Environ Health Perspect, 2014. **122**(9): p. 963-9.
15. Carignan, C.C., et al., *Flame Retardant Exposure among Collegiate United States Gymnasts.* Environmental Science & Technology, 2013. **47**(23): p. 13848-13856.
16. Butt, C.M., et al., *Metabolites of organophosphate flame retardants and 2-ethylhexyl tetrabromobenzoate in urine from paired mothers and toddlers.* Environ Sci Technol, 2014. **48**(17): p. 10432-8.

DRAFT

17. Butt, C.H., K; Chen, A; Lorenzo, A; Congleton, J; Stapleton, HM, *Regional comparison of organophosphate flame retardant (PFR) urinary metabolites and tetrabromobenzoic acid (TBBA) in mother-toddler pairs from California and New Jersey.* Environment International, 2016. **94**: p. 627-34.
18. Zhou, S.N., et al., *Measurements of selected brominated flame retardants in nursing women: implications for human exposure.* Environ Sci Technol, 2014. **48**(15): p. 8873-80.

DRAFT