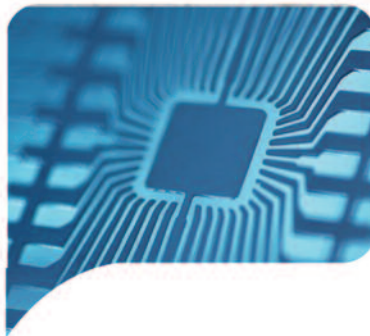


# TBBPA Factsheet

Brominated Flame Retardant  
October 2012



Tetrabromobisphenol A  
for **Printed Circuit Boards**  
and **ABS plastics**

# TBBPA Factsheet

Tetrabromobisphenol A

## > Introduction

**Brominated flame retardants are well recognised as being highly effective flame retardants. TBBPA<sup>1</sup> is the brominated flame retardant with the largest production volume today and is used to improve fire safety, mainly of laminates in electrical and electronic equipment. It is produced in Israel, the United States, Jordan, Japan and China. The use of TBBPA is permitted worldwide.**

## > Applications and Fire Safety

TBBPA contributes to the fire safety of electrical and electronic equipment and installations where printed circuit boards are used, such as consumer electronics (TVs, vacuum cleaners, washing machines), office and communication equipment (copiers, computers, printers, fax machines, radios, etc), automotive, aviation and all entertainment equipment.

In particular, TBBPA provides the necessary ignition resistance to comply with stringent fire safety standards such as UL 94 V0 – a standard for flammability of electronics with circuit boards and plastic materials for parts in devices and appliances.

The main application of TBBPA is in Printed Circuit Boards (PCB) or laminates. It is used in more than 95% of FR-4 printed circuit boards, the most commonly used board in electronic devices. In this application, TBBPA is a reactive flame retardant, in other words, it no longer exists as a free chemical in the final board but forms part of the polymeric backbone of the resin.

TBBPA is also used as an 'additive' flame retardant, mainly in ABS<sup>2</sup> plastic housings.

In addition, TBBPA is used as an intermediate in the production of other brominated flame retardant systems,



derivatives and brominated epoxy oligomers where it is integrated into the resin as well.

## > Health and Environmental Profile

Among the available flame retardants, for the production of printed circuit boards, TBBPA is by far the best researched from a health and environmental point of view as it has undergone an 8-year EU Risk Assessment<sup>3</sup> for the environment and human health. The conclusions of the EU Risk Assessment were published in the EU Official Journal on 18 June 2008 and also confirmed by the SCHER committee (Scientific Committee on Health and Environmental Risks).

In May 2005, the human health part of the Risk Assessment report concluded that TBBPA poses no risk to human health. No health effects were identified and consumer exposures were negligible. In addition, the low levels

of exposure for regional exposure scenarios also revealed no human health concerns. Comparison of the exposure data with data available for repeated exposure toxicity and reproductive toxicity has provided reassurance that there were no issues of potential concern.

This has also been confirmed by a study published by the European Food Safety Authority (EFSA) in December 2011 on the exposure of TBBPA and its derivatives in food<sup>4</sup>. The study looked at 344 food samples from the fish and other seafood food groups and concluded that "current dietary exposure to TBBPA in the European Union does not raise a health concern". EFSA also determined that "additional

exposure, particularly of young children, to TBBPA from house dust is unlikely to raise a health concern".

The Environment part of the Risk Assessment Report was finalised on June 2007. Experts found no risk to the environment when TBBPA is used as a reactive component in printed circuit boards, and a low risk on the environment (water and sediment) when TBBPA is used as an additive to plastics. Potential risk was identified when sludge containing TBBPA is applied to agricultural soil. A Risk Reduction Strategy (RRS) was drafted to address the local risk identified and recommended to reduce emissions only at one ABS compounding site in Europe through the IPPC

(Integrated Pollution Prevention and Control Directive).

In Europe, TBBPA as a substance is classified as H410<sup>5</sup> (very toxic to aquatic species). However, this classification no longer applies when it is reacted into the epoxy resin, as TBBPA becomes one of the building blocks for a different substance.

## > TBBPA in Europe



TBBPA has been registered under REACH in October 2010. REACH is the European Regulation for the Registration, Evaluation, Authorisation and Restriction of Chemical substances, which entered into force on 1 June 2007. The aim of REACH is to improve the protection of human health and the environment through early identification of hazardous properties in chemical substances.

TBBPA is not part of the substances restricted by the RoHS Directive<sup>6</sup>, even following the revision of such Directive in 2010.

The Directive on Waste of Electrical & Electronic Equipment<sup>7</sup> (WEEE) aims to reduce the amount of waste being produced by encouraging re-use, recycling and recovery. The Directive requires that plastics

For waste management, several studies have demonstrated that TBBPA is fully compatible with integrated waste management concepts used today to recycle various parts of the printed circuit boards. Because of its chemical structure, TBBPA has very low potential for formation of significant levels of dioxins/furans during recycling.

containing brominated flame retardants, including TBBPA, and printed wire boards greater than 10 cm<sup>2</sup> are given separate treatment from other collected WEEE. These requirements have not changed with the WEEE Directive recast adopted in 2012. In addition, technical studies and legal reviews<sup>8</sup> demonstrate that TBBPA is compatible with the Directive and its objective to directly include plastic waste with brominated flame retardants in integrated waste management systems (such as incineration, mechanical recycling, energy recovery systems) without the need to separate these plastics from other collected plastics.

Furthermore, trials have demonstrated that printed wire board waste can be handled on a large scale in metal smelter plants without leading to any environmental health or safety concerns.

TBBPA is part, among other substances, of an EU initiative to

evaluate potential endocrine disrupting effects. EU scientific experts have reported initial results showing “no major endocrine effects”<sup>9</sup> from TBBPA. As a brominated flame retardant, TBBPA is covered by the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. OSPAR has updated the Background document for TBBPA in 2011 to reflect the latest findings from the VECAP report.



<sup>1</sup> CAS number: 79-94-7

<sup>2</sup> ABS Plastics: Acrylonitrile-butadiene-styrene plastics used in a large number of applications: e.g. Plastic casing for TVs and other electronic devices

<sup>3</sup> TBBPA EU Risk Assessment report for Health & the Environment can be found at: <http://ecb.jrc.it>

<sup>4</sup> See EFSA Scientific Opinion on Tetrabromobisphenol A (TBBPA) and its derivatives in food at: <http://www.efsa.europa.eu/en/efsajournal/doc/2477.pdf>

<sup>5</sup> As per Regulation EC 1272/2008 the classification titles changed for substances as of 1 December 2010, the former category 3 (R50/53) is renamed category 2 (H410). The regulatory status of a category 2 classification for reproductive toxicity today is the same as that of a category 3 classification prior to 1 December 2010.

<sup>6</sup> Directive 2002/95/EC of the European Parliament and of the Council - 27 January 2003 – on the restriction of the use of certain hazardous substances in electrical & electronic equipment

<sup>7</sup> Directive 2002/96/EC of the European Parliament and of the Council - 27 January 2003 – waste electrical and electronic equipment (WEEE)

<sup>8</sup> See Ebfrp position paper at: <http://www.bsef.com/newsmanager/newstemplate.php?id=186>

<sup>9</sup> Brominated flame retardants in environmentally relevant test setup, FIRE project, CREDO Research Cluster, January 2006

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## > TBBPA in Asia

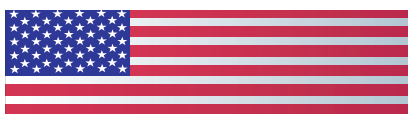


The use of TBBPA is not subject to any regulatory restriction in Asia. TBBPA is produced by several manufacturers in Japan and in China.

Asia's significant use of TBBPA is linked to a dominant electronics industry in Taiwan, Korea, China and Japan. The major application of TBBPA in Asia is as a reactive flame retardant (more than 80% of the total use) in either FR-4 resins to produce PCB laminates, or as a building material for brominated

epoxy oligomers and polymers. In Japan, the government has recognised that TBBPA is not bioaccumulative or toxic to human health. Tests conducted by authorities have demonstrated that the chemical is safe and that there is no need for further tests to be conducted.

## > TBBPA in the United States



In the US, TBBPA is developed by two producing companies and it is allowed for use without any restrictions. TBBPA is listed as a SARA 313 substance and therefore manufacturers, users and processors may need to report TBBPA released into the environment to the US Environmental

Protection Agency each year. The BSEF members making and importing TBBPA inform all of their customers of this reporting requirement on an annual basis.

Currently, the US Environmental Protection Agency (EPA) is running a "Design for the Environment" programme for Printed Circuit Boards, a voluntary programme working with industry and other

interested parties. It aims to develop information on the environmental and human health impacts, the performance, as well as the potential costs of alternative technologies and approaches for PCB manufacture. In Canada, Health Canada and Environment Canada are working on a risk assessment for TBBPA. A first draft of this assessment may be released in end 2012 or early 2013.

## > BSEF Emissions Reduction Programme

VECAP (the Voluntary Emissions Control Action Programme) is a proactive product stewardship initiative established by the brominated flame retardant industry. The objective of VECAP is to control emission levels of TBBPA in air, water and sediment and to handle any waste produced during industrial usage.

Data on TBBPA from the 2011 Voluntary Emission's Control Action Programme (VECAP) reports zero land emissions for the total volume



surveyed and almost no air and water emissions. The VECAP survey

covers 92% of the total volume of TBBPA sold in Europe.

For further information on Brominated Flame Retardants, please visit:

[www.bsef.com](http://www.bsef.com)

BSEF is the international organisation of the bromine chemical industry, whose remit is to inform stakeholders and commission science on brominated chemicals such as flame retardants