

FACT sheet

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Brominated Flame Retardant

TBBPA

Tetrabromobisphenol A

**for Printed Wire Boards
and ABS plastics**

> Introduction

Brominated flame retardants are well recognized as being highly effective flame retardants. TBBPA¹ 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 wire boards are used, such as consumer electronics (such as 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 wire boards and plastic materials for parts in devices and appliances.

■ The main application of TBBPA is in Printed Wire Boards (PWB) or laminates. It is used in more than 95% of FR-4 printed wiring 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 ABS² plastic housings.

■ In addition, TBBPA is used as an intermediate in the production of other

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



> Health and Environmental Profile



■ The EU Risk Assessment³ and WHO assessment⁴ have established that TBBPA presents no risk to human health. European Union studies have shown that

exposure to TBBPA from consumer products is insignificant, or not detectable, depending on the application. The EU environment Risk Assessment identified no risk to the environment when TBBPA is used in reactive applications such as printed wire boards.

■ The product has been found in limited biota and sediment samples from locations which are linked to industrial emissions sites.

■ In Europe, TBBPA as a substance is classified as R50/53 (very toxic to aquatic species). However, this classification no longer applies when it is reacted into the PCB resin, as TBBPA becomes one of the building

blocks for a different substance, which is the polymer used for the PCB.

■ 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 wire boards. Because of its chemical structure, TBBPA has very low potential for formation of significant levels of dioxins/furans during recycling.

■ Among the available flame retardants for the production of printed wire boards, TBBPA is by far the best researched from a health and environmental point of view.

¹ CAS number: 79-94-7

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

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

⁴ World Health Organisation International Programme on Chemical Safety (IPCS): Environmental Health Criteria 172 : Tetrabromobisphenol A and Derivatives, 1995

TBBPA has undergone an EU Risk Assessment for the Environment and Human Health. The conclusions of the EU Risk Assessment were published in the EU Official Journal on 18 June 2008.

■ In May 2005, the human health part of the Risk Assessment report concluded that TBBPA posed 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.

■ 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 wire 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 IPPC (Integrated Pollution Prevention and Control Directive). The issue at this site was resolved.

■ In 2006 industry initiated a Voluntary Emissions Control Action Programme (VECAP) with users. To date, all additive users in Europe have joined VECAP and are reducing emissions. There are no legislative restrictions on the use of TBBPA in Europe.

> TBBPA in Europe



■ TBBPA is not part of the substances restricted by the RoHS Directive⁵, though currently under review in the context of the revision of the directive. On 3 December 2008, the European Commission released a text for the revision of the RoHS and did not add any new substances. The proposed text lists four substances in a new Annex for priority review at a later stage but TBBPA is not included.

■ The Directive on Waste of Electrical & Electronic Equipment⁶ (WEEE) aims to reduce the amount of waste being produced by encouraging re-use, recycling and recovery. The Directive requires that plastics containing brominated flame retardants, including TBBPA, and printed wire boards greater than 10 cm² are given separate treatment from other collected

WEEE. However, technical studies and legal reviews⁷ 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.

■ REACH is the new 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. In common with most other chemicals, TBBPA is being registered under REACH. Since commercial TBBPA has already been subject to advanced testing under the EU Risk Assessments process (see section above for conclusions), the dossier preparation required under REACH has, in large part, already been carried out.

■ 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" from TBBPA. As a BFR, TBBPA is covered by the OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic. OSPAR will aim to update its background documents on TBBPA to reflect the conclusions of the European Risk Assessment and the VECAP report.

⁵ 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

⁶ Directive 2002/96/EC of the European Parliament and of the Council - 27 January 2003 – waste electrical and electronic equipment (WEEE)

⁷ See Ebfrip position paper at: <http://www.bsef.com/newsmanager/newstemplate.php?id=186>

⁸ <http://www.credocluster.info/fire.html> and latest newsletter of January 2006: <http://www.credocluster.info/docs/newsletter/credonews5.pdf>.

> 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 recognized 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 allowed usage 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 Wire 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 by the end of 2010 or early 2011.

> 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.

■ One of the aims of VECAP is to work with downstream users of TBBPA to implement the programme's objective. To date, 89% of TBBPA additive and reactive customers in Europe are committed to VECAP to control their emissions, which means 17 of 23 sites. The 2009 VECAP



Progress report shows very positive results and highlights the high level of implementation of the VECAP best practices. There has been a clear change in the potential

emissions levels in air, water and land. This has been aided by further identification by the VECAP team of new potential sources of emissions, which have been addressed.

For further information on Brominated Flame Retardants, please visit:

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