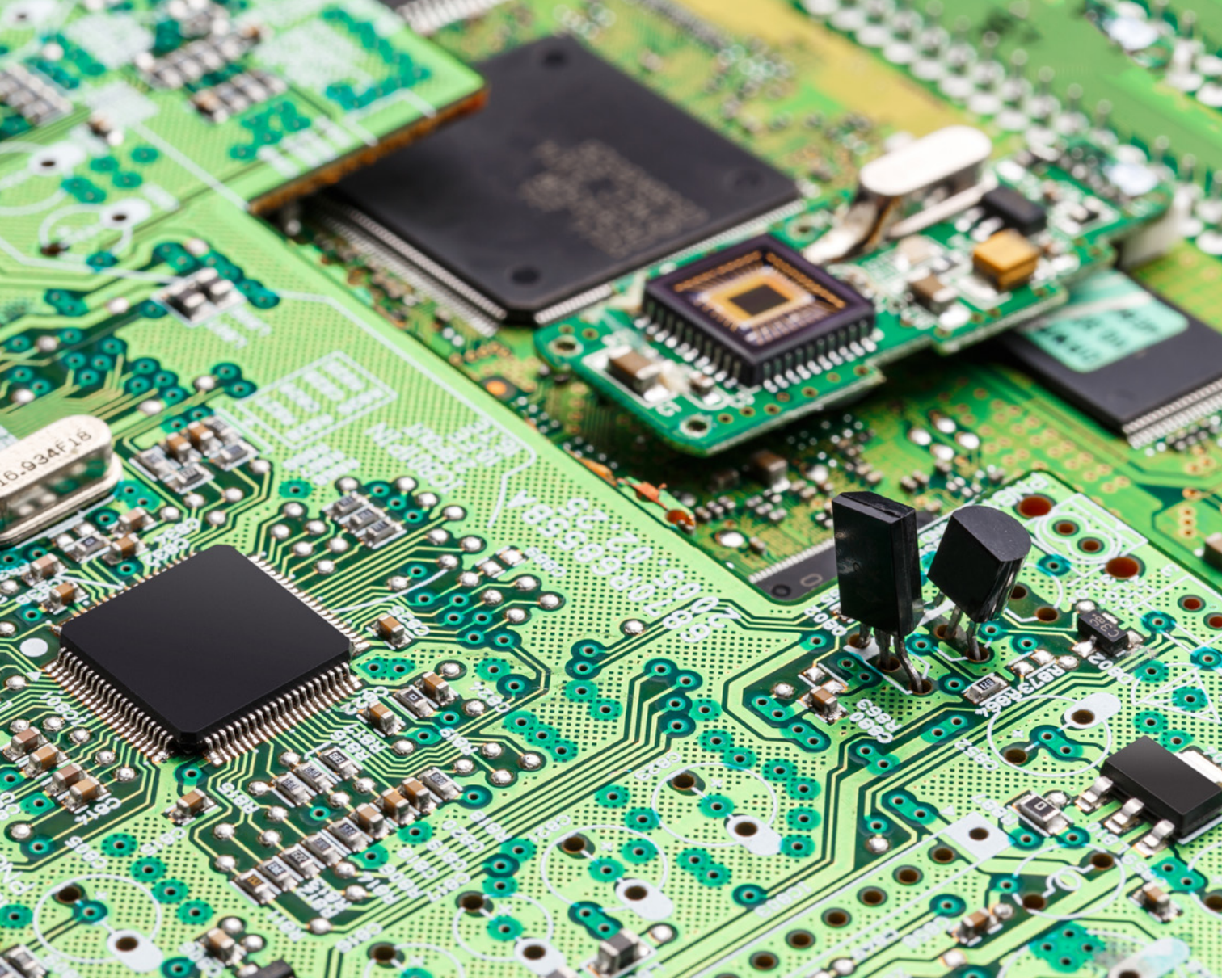


The International Bromine Council

TBBPA in Electrical & Electronic Equipment

An Overview

CONTRIBUTING TO FIRE SAFETY FOR ELECTRICAL & ELECTRONIC EQUIPMENT

Today, we are increasingly reliant on electrical and electronic devices – in our homes, our offices, our cars. The devices are becoming ever more complex and increasingly rely on plastics materials for housings, casings, cables, switches connectors and printed circuit boards. Given their widespread use, it is vital that electrical and electronic equipment are safe.

With an average of over 20 electronic and electrical appliances in homes, most electronic devices now contain printed circuit boards that provide intelligent and interactive functions. With such a large potential fire load, it is essential that the plastic components do not pose a fire risk for homes or consumers during their use, particularly given that electrical devices routinely carry electric currents and thus generate heat as a by-product.

Fire safety standards developed at international and regional level (including the EU) help ensure that electrical and electronic equipment is safe for use.

Chemical flame retardants are widely used to help meet specific standards for electrical and electronic equipment for particular components. Tetrabromobisphenol A[1] - commonly known as TBBPA - serves a vital role in improving the fire safety of virtually all types of electronics as well as civilian and defence communication equipment. This is increasingly important given the miniaturisation of electronics, where more heat is produced within smaller devices.

IT IS ESSENTIAL THAT PLASTIC COMPONENTS DO NOT POSE A FIRE RISK FOR HOMES OR CONSUMERS

1. 2,2 '6,6 '-tetrabromo-4-4 'isopropylidenediphenol, CAS# 79-94-7

PRODUCTION AND USE

TBBPA is the most widely used brominated flame retardant in the world.

More than 90% of TBBPA produced is used in the production of FR4 type printed wired boards. In this application, TBBPA is used as a reactive flame retardant. In other words, it ceases to exist as a free chemical in the final board, becoming an integral part of the polymer matrix used to create the material for manufacturing the FR-4 printed circuit boards.

This approach provides a high-quality flame retardant with no release of TBBPA into the environment. Indeed, once reacted with the resin, the TBBPA ceases to exist as an isolatable product. The chemical reaction at the resin manufacturing stage renders it an integral part of the plastic used to make the printed circuit boards.

The remaining 10% of TBBPA produced is used in engineered plastics[2] in electrical and electronics products, meaning it is added to a polymer resin. These resins are then used to make casings, switches, connectors and other plastic parts used in electronic equipment. This enables those parts to meet the stringent international and EU fire safety standards and ensures the electrical or electronic product is safe for use by consumers. The potential for exposure to TBBPA when it is encapsulated in plastic is very low.

MORE THAN

90%

of TBBPA produced is used in the production of FR-4 type printed circuit boards

THE REMAINING

10%

of TBBPA produced is used in engineered plastics

2. Engineering plastics exhibit higher performance than standard materials, making them ideal for tough engineering applications. Engineering plastics have superior performance in the areas of heat resistance, chemical resistance, impact resistance, fire retardancy and mechanical strength. *Plastics Europe*

REGULATORY STATUS

TBBPA is registered for use in the EU under the Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

It is similarly registered and subject to reviews under other jurisdictions around the world.

In the EU, TBBPA was the subject of an eight-year EU Risk Assessment process during the 2000s.

The European Commission Decision concluding the assessment in 2008 noted that risks are not expected from its intended use and that those risk reduction measures already being applied are considered sufficient.

The data produced for this assessment was subsequently used – along with other data - to prepare the TBBPA REACH registration dossier. TBBPA is currently undergoing a detailed Substance Evaluation under REACH. This process required TBBPA's registrants to conduct additional tests to provide further information on TBBPA; these are due to be completed by 4 January 2021. In the meantime, there have been no new regulatory requirements requested for TBBPA.

In 2018, the European Commission initiated an assessment of TBBPA under the RoHS Directive[3]. This is currently ongoing.

A screening assessment report on TBBPA published in Canada in November 2013 concluded that TBBPA poses a negligible risk to human health and does not require specific regulatory measures.

A SCREENING ASSESSMENT REPORT ON TBBPA PUBLISHED IN CANADA IN NOVEMBER 2013 CONCLUDED THAT TBBPA POSES NEGLIGIBLE RISK TO HUMAN HEALTH

In the US, there are currently no regulatory restrictions on the use of TBBPA. However, in 2019, EPA finalised the designation of 20 high-priority chemicals, and TBBPA is on the list. It is important to note that a chemical being designated as a high-priority does not mean it is high risk. These chemicals will move through the process required by TSCA to evaluate any unreasonable risks that they may present to human health or the environment.

This process will commence in 2020.

3. The RoHS Directive is the Restriction of Hazardous Substances Directive 2002/95/EC, short for Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment, was adopted in February 2003 by the European Union

THE MAJOR APPLICATION OF TBBPA IN ASIA IS IN PRINTED CIRCUIT BOARDS AS A FLAME RETARDANT

The California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) has listed TBBPA as known to the state to cause cancer under the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

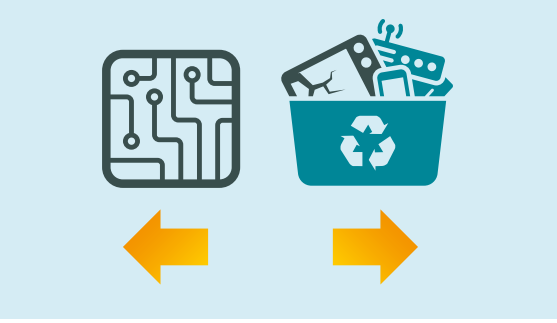
TBBPA use is not subject to any regulatory restriction in Asia. TBBPA is produced by several manufacturers in Japan and in mainland China. Asia's significant use of TBBPA is linked to Taiwan, Korea, mainland China and Japan's dominant electronics industry.

In October 2019, Korea classified TBBPA (CAS no 79-94-7) as Carcinogen Category 1 and added it to the List of Toxic Substances under the Chemicals Control Act.

The major application of TBBPA in Asia is in printed circuit boards as a flame retardant (more than 80% of the total use), either in FR-4 resins used to produce printed circuit board laminates or as a building material for brominated epoxy oligomers and polymers.

END OF LIFE TREATMENT OF ELECTRICAL AND ELECTRONIC EQUIPMENT CONTAINING TBBPA

At the end of its useful life, all electrical and electronic equipment must be properly and safely collected and treated in regulated facilities. In the EU, the disposal of such products is regulated by the Waste Electrical & Electronic Equipment (WEEE) Directive[4] and its associated WEEE CEN Standards[5], developed to enable WEEE recyclers to safely handle and process electrical and electronic equipment waste.



TBBPA is chemically bound within the plastic used for the printed circuit boards in electrical and electronic equipment. It is also contained in engineered plastics in equipment, such as casings and connectors. In the process of recycling electrical and electronic equipment, printed circuit boards are removed at an early stage, along with other non-ferrous metals and sent to metal processors to recover the copper and other precious group metals. During the metal recovery process, the plastic structure containing the metals is consumed as energy. The chemically bound TBBPA is thus destroyed in the process.

Plastics containing TBBPA that has been added to the polymer mix are treated according to the specific WEEE CEN standards for plastics containing brominated flame retardants (BFRs). Even although TBBPA is not a restricted substance, the separate treatment of BFR-containing plastics is designed to ensure that plastics with restricted BFRs such as HBCD, DecaBDE or OctaBDE are removed from the material loop.

In 2018, an assessment of the impact of TBBPA on end-of-life operations was conducted for BSEF by the Fraunhofer Institute[6]. This noted that:

"Overall, the evaluation came to the conclusion that, since under controlled conditions, no risk has been identified for humans or the environment during waste treatment and in general no negative impact on waste management was determined..."

4 The Waste Electrical and Electronic Equipment (WEEE) Directive is the European Community Directive 2012/19/EU on WEEE which, together with the RoHS Directive 2011/65/EU, became European Law in February 2003.

5. CEN standards - The European standards, developed in support of the WEEE Directive, cover all product categories and address the collection, transport and treatment, including preparation for reuse of the WEEE.

6. Fraunhofer Institute - "Assessment of TBBPA (tetrabromobisphenol A) according to the "Methodology for Identification and Assessment of Substances for Inclusion in the List of Restricted Substances (Annex III) under the RoHS2 Directive". Dr Susanne Hesse, Dr Axel Wibbertmann, Dr Stefan Hahn, updated in August 2018 by Dr Axel Wibbertmann and Dr Stefan Hahn

SUMMARY

01

TBBPA is a sustainable and important flame retardant substance.

02

The major TBBPA producers are committed to generating information, as science develops, that supports and reassures regulators and stakeholders of TBBPA's safety in its intended uses.

03

TBBPA in its intended uses, applications and at the end of life of products where it has been used, does not present a risk to human health or the environment.

Devices such as computers will have their printed circuit boards removed in order to recover the precious metals they contain. As part of this process, the rest of the printed circuit boards will be disposed of safely.

TBBPA in electrical and electronic equipment plastic parts is treated in accordance with the relevant WEEE Directive and related CEN standards.

ABOUT BROMINE

Bromine is an element with the chemical symbol is Br. It is part of the halogen group of the periodic table. In its pure form, bromine is a reddish-brown liquid at room temperature, however it is never found in its elemental form in nature. Most commonly, it is found as part of inorganic compounds, known as bromides and in natural bromo-organic compounds. These are found in soils, salts, air and seawater

ABOUT BSEF

BSEF – the International Bromine Council, represents the major global bromine producers. Since 1997, the organisation has been working to foster knowledge on the uses and benefits of bromine-based solutions.

BSEF strongly believes in science and innovation. Through investments in research and development BSEF members create robust bromine-based technologies meeting the needs of society.

Visit **www.bsef.org** and follow BSEF on Twitter **@BromineInfo** for the latest news and information.

BSEF The International Bromine Council

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