

## **Annex XV report**

# **PROPOSAL FOR IDENTIFICATION OF A SUBSTANCE OF VERY HIGH CONCERN ON THE BASIS OF THE CRITERIA SET OUT IN REACH ARTICLE 57**

**Substance Name:** 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol (Tetrabromobisphenol-A;  
TBBPA)

**EC Number:** 201-236-9

**CAS Number:** 79-94-7

**Submitted by:** Norwegian Environment Agency

**Date:** August 2022

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## ABBREVIATIONS

ATP: Adaption to Technical Progress  
CLP: Classification, labelling and packaging, Regulation (EC) No 1272/2008  
EFSA: European Food Safety Authority  
ERC: Environmental release category  
OSH: Occupational Safety and Health  
PC: Product category  
PROC: Process category  
RAC: Risk Assessment Committee  
RoHS: Restriction of Hazardous Substances in Electrical and Electronic Equipment  
SU: Sector of use  
SVHC: Substance of very high concern  
TBBPA: 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol  
TBBPS: Tetrabromobisphenol S

## **PROPOSAL FOR IDENTIFICATION OF A SUBSTANCE OF VERY HIGH CONCERN ON THE BASIS OF THE CRITERIA SET OUT IN REACH ARTICLE 57**

**Substance name:** 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol

**EC number:** 201-236-9

**CAS number:** 79-94-7

- The substance is proposed to be identified as a substance meeting the criteria of Article 57 (a) of Regulation (EC) No 1907/2006 (REACH) owing to its classification in the hazard class carcinogenicity category 1B.<sup>1</sup>

### **Summary of how the substance meets the criteria set out in Article 57 of the REACH Regulation**

The Risk Assessment Committee (RAC) adopted its opinion on the proposal for harmonised classification and labelling (CLH) of 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol on 16 September 2021 and the substance is included in the draft 21<sup>st</sup> ATP to CLP. Once adopted, the resulting entry will be listed in Regulation (EC) No 1272/2008 in Annex VI, part 3, Table 4 (the list of harmonised classification and labelling of hazardous substances) and classified in the hazard class carcinogenicity category 1B (hazard statement H350: "May cause cancer").

Therefore, this classification of the substance in Regulation (EC) No 1272/2008 shows that it meets the criteria for classification in the hazard class:

- Carcinogenicity category 1B in accordance with Article 57 (a) of REACH.

**Registration dossiers submitted for the substance:** Yes

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<sup>1</sup> Classification in accordance with section 3.6 of Annex I to Regulation (EC) No 1272/2008.

## PART I

### Justification

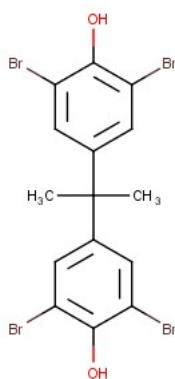
#### 1. Identity of the substance and physical and chemical properties

##### 1.1 Name and other identifiers of the substance

**Table 1: Substance identity**

<b>EC number:</b>	201-236-9
<b>EC name:</b>	2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol
<b>CAS number (in the EC inventory):</b>	79-94-7
<b>CAS number:</b>	79-94-7
<b>IUPAC name:</b>	2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol
<b>Index number in Annex VI of the CLP Regulation</b>	604-074-00-0
<b>Molecular formula:</b>	C <sub>15</sub> H <sub>12</sub> Br <sub>4</sub> O <sub>2</sub>
<b>Molecular weight range:</b>	543.9 g/mol
<b>Synonyms:</b>	Tetrabromobisphenol A; 2,2-Bis(3,5-dibromo-4-hydroxyphenyl)propane; 2,2-bis(4-hydroxy-3,5-dibromophenyl)propane; 4,4'-isopropylidenebis(2,6-dibromophenol); 4,4'-(1-methylethylidene)bis(2,6-dibromophenol); 2,2',6,6'-tetrabromobisphenol A; 3,3',5,5'-tetrabromobisphenol A; 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol; Tetrabromodiphenylpropane; TBBPA; TBBP-A

##### Structural formula:



## 1.2 Composition of the substance

**Name:** 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol

**Description:** organic

**Substance type:** mono-constituent

**Table 2: Constituents other than impurities/additives**

Constituents	Typical concentration
2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol; tetrabromobisphenol-A EC no: 201-236-9 CAS no: 79-94-7	≥80% w/w

## 1.3 Identity and composition of degradation products/metabolites relevant for the SVHC assessment

Not relevant for the identification of the substance as SVHC in accordance with Article 57(a) of the REACH Regulation.

## 1.4 Identity and composition of structurally related substances (used in a grouping or read-across approach)

Not relevant for the identification of the substance as SVHC in accordance with Article 57(a) of the REACH Regulation.

## 1.5 Physicochemical properties

Not relevant for the identification of the substance as SVHC in accordance with Article 57 (a) of the REACH Regulation.

## 2. Harmonised classification and labelling

The Risk Assessment Committee (RAC) adopted its opinion on the proposal for harmonised classification and labelling (CLH) of 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol on 16 September 2021 and the substance is included in the draft 21st ATP to CLP. Once adopted, the resulting entry will be listed in Regulation (EC) No 1272/2008 in Annex VI, part 3, Table 3.1 (the list of harmonised classification and labelling of hazardous substances) and classified in the hazard class carcinogenicity category 1B (hazard statement H350: "May cause cancer").

**Table 3: Classification and labelling in accordance with the CLP Regulation (Regulation (EC) 1272/2008) from the RAC opinion (RAC, 2021)**

Index No	Chemical name	EC No	CAS No	Classification		Labelling			Spec. Conc. Limits, M-factors and ATEs <sup>2</sup>	Notes
				Hazard Class and Category Code(s)	Hazard statement code(s)	Pictogram, Signal Word Code(s)	Hazard statement code(s)	Suppl. Hazard statement code(s)		
604-074-00-0	2,2',6,6'-tetrabromo-4,4'-isopropylidene diphenol; tetrabromobisphenol-A	201-236-9	79-94-7	Carc. 1B Aquatic Acute 1 Aquatic Chronic 1	H350 H400 H410	GHS08 GHS09 Dgr	H350 H410			

## 3. Environmental fate properties

Not relevant for the identification of the substance as SVHC in accordance with Article 57 (a) of the REACH Regulation.

## 4. Human health hazard assessment

Please see section 2 (Harmonised classification and labelling).

## 5. Environmental hazard assessment

Not relevant for the identification of the substance as SVHC in accordance with Article 57 (a) of the REACH Regulation.

<sup>2</sup> Acute Toxicity Estimate

## **6. Conclusions on the SVHC Properties**

### **6.1 CMR assessment**

The Risk Assessment Committee (RAC) adopted its opinion on the proposal for harmonised classification and labelling (CLH) of 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol on 16 September 2021 and the substance is included in the draft 21<sup>st</sup> ATP to CLP. Once adopted, the resulting entry will be listed in Regulation (EC) No 1272/2008 in Annex VI, part 3, Table 3.1 (the list of harmonised classification and labelling of hazardous substances) and classified in the hazard class carcinogenicity category 1B (hazard statement H350: "May cause cancer").

Therefore, this classification of the substance in Regulation (EC) No 1272/2008 shows that it meets the criteria for classification in the hazard class:

- carcinogenicity category 1B in accordance with Article 57 (a) of REACH.

### **6.2 PBT and vPvB assessment**

Not relevant for the identification of the substance as SVHC in accordance with Article 57 (a) of the REACH Regulation.

### **6.3 Assessment under Article 57(f)**

Not relevant for the identification of the substance as SVHC in accordance with Article 57(a) of the REACH Regulation.



## Part II

### 7. Registration and C&L notification status

#### 7.1 Registration status

**Table 4 Registration status**

From the ECHA dissemination site <sup>3</sup>	
Registrations	<input checked="" type="checkbox"/> Full registration(s) (Art. 10) <input type="checkbox"/> Intermediate registration(s) (Art. 17 and/or 18)

#### 7.2 CLP notification status

**Table 5: CLP notifications**

	CLP Notifications <sup>4</sup>
Number of aggregated notifications	12
Total number of notifiers	714

### 8. Total tonnage of the substance

**Table 6: Tonnage status**

Total tonnage band for the registered substance (excluding the volume registered under Art 17 or Art 18) <sup>3</sup>	≥ 10 000 to < 100 000 t/pa
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### 9. Information on uses of the substance

Tetrabromobisphenol-A (TBBPA) is a brominated flame retardant commonly used in epoxy coated circuit boards (Cannon et al., 2019), printed circuit boards, paper, and textiles (Dunnick et al., 2017). TBBPA has the largest worldwide production of any brominated flame retardant (Knudsen et al., 2014), with a global production volume over 100 000 tons per year in 2004

<sup>3</sup> <https://echa.europa.eu/registration-dossier/-/registered-dossier/14760/1/2> (accessed 04.04.2022)

<sup>4</sup> C&L Inventory database, <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/72824> (accessed 04.04.2022)

(IARC, 2018). The International Bromine Council (BSEF) has also stated that TBBPA is the most widely used brominated flame retardant in the world<sup>5</sup>.

In a recent report developed under RoHS (RoHS Annex II Dossier for TBBPA Restriction proposal for substances in electrical and electronic equipment under RoHS), the use of TBBPA in electrical and electronic equipment (EEE) placed on the market, is reported as following: "*The primary use of TBBP-A is as a precursor in the production of brominated epoxy resins that function as reactively flame-retarded substrate in printed wiring boards (PWB). It is also used as an additive flame retardant in thermoplastic EEE components, for example housings that consist of ABS plastic. The most recent available data (2014) on proportions for the different types of application indicate that ~90 % of TBBP-A are used for the production of FR4 PWB in form of a reactive flame retardant, while only 10 % are used as an additive flame retardant. However, according to Fraunhofer ITEM IPA, Wibbertmann & Hahn (2018), the available literature data on uses varies widely (~70-90 % reactive use)*" (European Commission, 2021). More details on the global market are available in the same report (European Commission, 2021)

According to information available in ECHAs dissemination site and presented in the table below, TBBPA is used by consumers, in articles, by professional workers (widespread uses), in formulation or re-packing and at industrial sites. It is mainly used as intermediate and in polymers, and in flame retardant polymer articles.

**Table 7: Uses**

	<b>Use(s)</b>	<b>Registered use</b> <i>(If not, specify the source of the information)</i>	<b>Use likely to be in the scope of Authorisation</b>
<b>Uses as intermediate</b>		Yes	No
<b>Formulation or repacking</b>	<b>Use as a reactive intermediate in manufacture of polymer resin</b> ERC: 3, 5, 6c PROC: 0, 1, 2, 3, 4, 5, 8a, 8b, 9, 15 PC: 0, 19, 32	Yes	No
	<b>Use as an additive in the manufacture of polymer resin</b> ERC: 3, 4, 5 PROC: 0, 4, 5, 8a, 8b, 9, 12, 14 PC: 32		Yes
<b>Uses at industrial sites</b>	<b>Use as a reactive intermediate in manufacture of polymer resin</b> ERC: 0, 3, 5, 6c, PROC: 0, 1, 2, 3, 4, 5, 8a, 8b, 9, 15 PC: 0, 19, 32 SU: 0, 8, 10, 12	Yes	No

<sup>5</sup> Digital brochure from BSEF on 27 Jul 2020 "TBBPA in Electrical & Electronic Equipment": <https://www.bsef.com/publications/tbbpa-in-electrical-electronic-equipment/>

	<p><b>Use as an additive un the manufacture of polymer resin</b>  ERC: 3, 4, 5  PROC: 0, 4, 5, 8a, 8b, 9, 12, 14  PC: 32  SU:0, 10, 12</p> <p><b>Manufacture of polymer articles from polymer resins containing additive flame retardant</b>  ERC: 5, 6d  PROC: 0, 4, 5, 6, 7, 8a, 8b, 9, 10, 13, 14, 15, 21, 24  PC: 0, 32  SU: 12, 16, 17</p> <p><b>Waste stage</b>  ERC: 4  PROC: 0  PC: 32  SU: 12</p> <p><b>Use in the manufacture of polymer resin</b>  ERC: 5  PROC: 4, 5, 8a, 8b, 9, 12  PC: 32  SU: 12</p>		<p>Yes</p> <p>Yes</p> <p>No</p> <p>Yes</p>
<b>Uses by professional workers</b>	<p><b>Professional and consumer use of flame retardant polymer articles</b>  ERC: 10a, 11a  PROC: 21  SU: 19</p>	Yes	Yes
<b>Consumer uses</b>	<p><b>Professional and consumer use of flame retardant polymer articles</b>  ERC: 10a, 11a  PC: 32</p> <p><b>Waste stage – Disposal to landfill</b>  ERC: 9b  PC: 32</p>	Yes	<p>Yes</p> <p>No</p>
<b>Article service life</b>	<p><b>Professional use of flame retardant polymer articles</b>  AC: 2, 13  ERC: 10a, 11a  PROC: 0</p> <p><b>Consumer use of flame retardant polymer articles</b>  AC: 2, 13  ERC: 10a, 11a</p> <p><b>Professional and consumer use of flame retardant polymer articles</b>  AC: 2, 13  ERC: 10a, 11a  PROC: 21</p>	Yes	<p>No</p> <p>No</p> <p>No</p>

	<p><b>Manufacture of polymer articles from polymer resins containing additive flame retardants</b>  AC: 2, 13  ERC: 5, 6d, 12a  PROC: 0, 14, 21, 24</p>		<p>Yes</p>
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## 10. Information on structure of the supply chain

No information available.

## 11. Additional information

### 11.1 Substances with similar hazard and use profiles on the Candidate List

There are several bisphenols and brominated flame retardants in the Candidate List, however there are no other brominated bisphenols in the Candidate List, so no relevant information is available.

### 11.2 Alternatives

Alternatives are described in the section on alternatives in the RoHS Annex II dossier for TBBPA (European Commission, 2021): *"the discussion on alternatives addresses the two application areas - reactive applications in printed wiring boards (PWBs) and additive applications in plastic housings. In relation to epoxy resins (reactive use of TBBP-A in PWBs), it is understood that industry is actively investigating substitution strategies for brominated flame retardants. The stakeholder contributions to support this study mention that halogen-free PWB laminate materials were available. However, no concrete alternatives are proposed as they would not have all necessary safety approvals and greater percentages of the substitutes would be required within the products. In addition, ASD<sup>6</sup> states that "the substitutes are unlikely to perform sufficiently well when subjected to heat and vibration in high-stress environments" and TMC<sup>7</sup> points out that "they do not exist for all applications, especially in high-frequency circuitry."*

*Nonetheless, the most successful and already applied alternatives to TBBP-A in PWBs are phosphorus compounds like DOPO (9,10-Dihydro-9-oxa-10-phosphaphenanthrene-10-oxide), polyphosphates or metal phosphinates, from time to time in combination with inorganic synergists like ATH<sup>8</sup> or silica, bound to epoxy resins. Concerning DOPO, moderate human health concern is assumed but this compound and its derivatives are expected to be highly environmental persistent. Commonly used substitutes for TBBP-A in housings for EEE (additive use) also include halogen free organic phosphorus compounds. The human health hazards of the organophosphate esters are estimated to be lower than those of TBBP-A though some substitution candidates still meet the PBT criteria regarding the environmental risks. In this area elimination is also possible*

<sup>6</sup> AeroSpace and Defence Industries Association of Europe (ASD)

<sup>7</sup> Test and Measurement Coalition

<sup>8</sup> Aluminium trihydroxide (ATH)

*through the substitution of polymers such as ABS<sup>9</sup> and HIPS<sup>10</sup> with polymers such as PC<sup>11</sup> and PPE<sup>12</sup>."*

Tetrabromobisphenol S (TBBPS) was introduced into the market as a substitute to tetrabromobisphenol A (TBBPA) (Barańska et al., 2022). TBBPS is not registered under REACH<sup>13</sup>

### 11.3 Existing EU legislation

From 1 March 2021, the use of halogenated flame retardants is not allowed in the enclosure and stand of electronic displays (halogenated flame retardant means a flame retardant that contains any halogen). The legal basis for the ban can be found in the Commission Regulation (EU) 2019/2021 of 1 October 2019 laying down ecodesign requirements for electronic displays pursuant to the Ecodesign Directive (2009/125/EC of the European Parliament and of the Council). The ban was questioned by The International Bromine Council (BSEF) which filed a legal challenge against the European Commission (Case T-113/20<sup>14</sup>). The European Court of Justice has rejected this challenge. At the same time, under the Sustainable Products Initiative, the Commission has proposed to widen the scope of the Ecodesign directive beyond energy related products and make it applicable to the broadest possible range of products (see the proposed Ecodesign for Sustainable Products Regulation, ESPR<sup>15</sup>).

The Directive 2011/65/EU (RoHS 2) lays down rules on the restriction of the use of hazardous substances in electrical and electronic equipment in the EU.

DG Environment requested a study to support the review of the list of restricted substances under RoHS 2 (pack 15; reported in European Commission, 2021). TBBPA was assessed as part of the study with a view of its possible future restriction.

The adoption by the European Commission of a delegated act for adding tetrabromobisphenol A in the list of restricted substances under RoHS is planned for the fourth quarter of 2022. (European Commission, 2022). According to EU Issue Tracker the work on the assessment is now temporarily on hold (in newsletter, 3 June 2022<sup>16</sup>).

The adoption of a harmonised classification under CLP in the hazard class carcinogenicity category 1B will trigger risk management measures under other pieces of EU legislations, e.g. the Occupational Safety and Health (OSH) Framework Directive and the Waste Framework Directive.

For references to REACH and CLP, see EU (2006; 2007; 2008 and 2009).

### 11.4 Previous assessments by other authorities/ongoing regulatory activities

ECHA: The Assessment of Regulatory needs on Tetrabromobisphenol A (TBBPA) and its derivatives that was published in December 2021 (ECHA, 2021)

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<sup>9</sup> Acrylonitrile Butadiene Styrene

<sup>10</sup> High impact polystyrene

<sup>11</sup> Polycarbonate

<sup>12</sup> Polyphenylenether

<sup>13</sup> Infocard accessed 9 August 2022 <https://echa.europa.eu/en/substance-information/-/substanceinfo/100.049.575>

<sup>14</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A62020TN0113>

<sup>15</sup> [https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation\\_en](https://environment.ec.europa.eu/publications/proposal-ecodesign-sustainable-products-regulation_en)

<sup>16</sup> Newsletter from EU Issue Tracker: [RoHS II Directive \(Pack 15\): Work Temporarily on Hold](#)

RoHS: TBBPA has been assessed in a study to support the review of the list of restricted substances under RoHS 2 (pack 15) (reported in European Commission, 2021).

EFSA: Scientific Opinion on Tetrabromobisphenol A (TBBPA) and its derivatives in food (EFSA, 2011)

The ongoing substance evaluation for TBBPA to clarify ED and PBT/vPvB properties. Link to ECHA: [Substance evaluation - CoRAP - ECHA \(europa.eu\)](https://echa.europa.eu/substance-information/-/substanceinfo/?inchi=C12H10Br4O2)

Existing substances: EU RAR TBBPA (2008)

## REFERENCES

### References for Part I

Committee for Risk Assessment (RAC). Opinion proposing harmonised classification and labelling at EU level of 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol; tetrabromobisphenol-A. 16 September 2021. Available at <https://echa.europa.eu/documents/10162/ec6d02f7-6724-02c9-91e5-ea7beade2b31>

### References for Part II

Barańska A. et al. (2022): Genotoxic Mechanism of Action of TBBPA, TBBPS and Selected Bromophenols in Human Peripheral Blood Mononuclear Cells. *Frontiers in Immunology*. Vol 13. DOI=10.3389/fimmu.2022.869741

Cannon RE, Trexler AW, Knudsen GA, Evans RA, Birnbaum LS: Tetrabromobisphenol A (TBBPA) alters ABC transport at the blood-brain barrier. *Toxicol. Sci.*: 169(2): 475-484 (2019)

Dunnick JK, Morgan DL, Elmore SA, Gerrish K, Pandiri A, Ton TV, Shockley KR, Merrick BA: Tetrabromobisphenol A activates the hepatic interferon pathway in rats. *Toxicol Lett.* 2017 January 15; 266: 32-41

ECHA (2021): The Assessment of Regulatory needs on Tetrabromobisphenol A (TBBPA) and its derivatives. [b0921e14-e68c-d1ef-c104-0895411e4cf4 \(europa.eu\)](https://echa.europa.eu/b0921e14-e68c-d1ef-c104-0895411e4cf4)

EFSA (2011): EFSA Panel on Contaminants in the Food Chain (CONTAM): Scientific Opinion on Tetrabromobisphenol A (TBBPA) and its derivatives in food. *EFSA Journal* 2011;9(12):2477

EU (2006). Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC. *Official Journal of the European Union*, L396: 1-849.

EU (2007). Corrigendum to Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC. *Official Journal of the European Union*, L136: 3-280.

EU (2008). Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packing of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. *Official Journal of the European Union*, L353: 1-1355.

EU (2009). Regulation (EC) No 552/2009 of 22 June 2009 amending Regulation (EC) No 1907/2006 as regards of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annex XVII. *Official Journal of the European Union*, L164: 7-31.

- EU RAR TBBPA (2008): United Kingdom (TBBPA) (2008). RISK ASSESSMENT of 2,2',6,6'-TETRABROMO-4,4'-ISOPROPYLIDENE DIPHENOL. Environment Agency Chemicals Assessment Section United Kingdom. Report date: 2008-01-29.
- European Commission (2022) Have your say [Hazardous substances in electrical and electronic equipment – list of restricted substances \(update\) \(europa.eu\)](https://ec.europa.eu/chemicals/eu-chemicals-restriction-revision/)
- European Commission (2021), Directorate-General for Environment, Köhler, A., Baron, Y., Gensch, C., et al., Study to support the review of the list of restricted substances and to assess a new exemption request under RoHS 2 (Pack 15): final report, Publications Office, 2021, <https://data.europa.eu/doi/10.2779/47125>
- Knudsen GA, Sanders JM, Sadik AM, Birnbaum LS (2014). Disposition and kinetics of tetrabromobisphenol A in female Wistar Han rats. *Toxicol Rev*, 1:214–23.
- IARC (2018) Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 115 Some Industrial Chemicals, pp. 247-end