

For LG Electronics suppliers

# **LG Electronics manual of hazardous substance management in parts and products**

**10<sup>th</sup> edition**

**August 1, 2018**



## Overview

This operation guide provides the LG Electronics standards and requirements for managing hazardous substances to proactively respond to the hazardous substance regulations that are being expanded and strengthened globally with the EU at the center and to secure eco-friendly competitiveness of LG Electronics products.

Based on this guide, all partner companies that have transactions with LG Electronics shall be aware of LG Electronics' eco-friendly policies, comply with the management and operation standards for hazardous substances such as prohibited/restricted substances that cannot be used for products or parts currently in supply, and manage hazardous materials.

We reserve the copyright for this operation guide and do not allow any unauthorized copying or reproduction of it.

Aug. 1, 2018 / 10th Edition

LG Electronics Quality Management Center  
Product Test Lab

### Major revision details

Revision	Date	Details
10th Edition	Aug. 1, 2018	1) Partial change in Article 2 and Article 3 2) Additions and clarification of existing requirements in Article 4 operation and management standards - 4.1 Hazardous substances evidence management standards - 4.2 Hazardous substances inspection management standards 3) Updates in Article 5 Hazardous substances in products and detailed management standards - Related regulations/laws - Updated standards : Pb, Cr(VI), 4 phthalates, etc. - Revised classification of PFOA : Level B-I→ Level A-II 4) Update in Appendix 1. Exemption of EEE in Level A-I - 6(a), (b), (c), 7(a), 7(c)-I, 9(b), 13(a), (b), 24, 34, 39, 41 5) Update in Appendix 3. List of EU BPR Biocidal Substances

## Contents

Clause	Content	Page
<b>Article 1</b>	<b>Objective</b>	<b>3</b>
<b>Article 2</b>	<b>Application scope</b>	<b>3</b>
<b>Article 3</b>	<b>Definition of terms</b>	<b>3</b>
<b>Article 4</b>	<b>Operation and management standards</b>	<b>5</b>
	4.1 The requirement for evidence documents of the substances/materials	5
	4.2 The criteria of hazardous substance inspection	6
<b>Article 5</b>	<b>Hazardous substances in products and detailed management standards</b>	<b>7</b>
	5.1 List of hazardous substance in products and related environmental regulation	7
	5.2 Detailed management standards for hazardous substances (Level A-I, Level A-II, Level B-I)	10
<b>Article 6</b>	<b>Management standards for hazardous substances in packaging materials</b>	<b>19</b>
<b>Article 7</b>	<b>Management standards for hazardous substances in batteries</b>	<b>19</b>
<b>#</b>	<b>Appendix</b>	
	1) Exemptions in electrical and electronic products in Level A-I	20
	2) Examples of substances and its compounds	24
	3) List of biocidal substances in products	39

## Article 1 (Objective)

The objective of this guide is to clarify the hazardous substance management standards to all product and parts suppliers which have transactions with LG Electronics(hereinafter “the Company”), enable them to comply with the global products’ environmental regulations, and contribute to the preservation of the global environment.

## Article 2 (Scope of application)

The guide is applied to all products, parts, raw materials, packaging materials, batteries, etc. supplied by all suppliers who deal with the Company regardless of the sales area.

- 1) All product components (including service parts, packaging materials, batteries, raw materials, and process materials)
- 2) All products for sale
  - Products (in-house) designed, produced, sold, and supplied by the Company
  - Products designed and produced by suppliers but supplied to the market bearing the trademark of the Company (ODM)
  - Products designed by the Company but produced by a supplier and supplied to the market bearing the trademark of the Company (OEM)

## Article 3 (Definition of terms)

### 3.1 Classification of hazardous substances in products

- 1) Level A substance (prohibited/restricted substance)
  - Level A substance is defined as one currently prohibited from use for products by the regional and national regulations. Any intentional use of these substances is prohibited for any item supplied to the Company.
    - ① Level A-I : 10 kinds of prohibited hazardous substances designated by the RoHS Directive
    - ② Level A-II : Substances whose use is restricted by national laws or international agreements other than the RoHS Directive
- 2) Level B substance (voluntary use reduction/substances to observe)
  - Level B substance is defined as one which is suspected to be harmful to humans and the global environment and is expected to gradually become subject to prohibition of use in the future by regulations.
    - ① Level B-I: Substances that are voluntarily replaced within a certain period of time
    - ② Level B-II: Substances that are not currently prohibited for use but are expected to be so in the future

### 3.2 Maximum concentration limit

This means the maximum concentration of hazardous substances in a component’s material that takes into account the impurities that are inevitably contained due to measurement errors of substance analysis equipment or limitations of the current refining technology and manufacturing technology, permitted under the premise that these hazardous substances are not used deliberately in the component.

### 3.3 Contain

This term means the state of a product including a foreign substance regardless of intention as a result of injection, charging, or mixing performed for the purpose of changing certain properties of the product’s components or materials or improving workability.

### 3.4 Impurity

This means a substance which technologies cannot completely remove or are incapable of removing in its natural purification processes or one which is generated from synthesis and cannot be completely removed by the present technologies.

### 3.5 Prohibition

This means that the harmful substances specified by the Company shall not be intentionally included in the materials or components in the manufacturing process. Impurities that are inevitably contained because their complete elimination is impossible due to limitations of the material refining technologies or technical limitations during synthesis shall be managed based on the maximum permissible concentration.

### 3.6 Exemption

Only exemptions acknowledged by EU RoHS or other applicable regulations shall be effective.

The term refers to a harmful substance that is allowed for use during a certain period of time as there is no alternative within the current technology level or there is a possibility of problem occurrence if substituted.

### 3.7 Homogeneous material

It is the minimum constituent unit of a component made of a single material. It is a material having a uniform composition that can no longer be disassembled into different materials by physical disassembling methods such as cutting, pulverizing, and grinding. For example, coating or coated components are not homogeneous and shall be disassembled into individual materials to determine presence of hazardous substances.

### 3.8 HSMS (Hazardous Substances Management System)

The Company's unique IT system for registering and managing the information of substances in parts and products

### 3.9 Material composition table

This is data that provides related information on the constituents of chemical substances in raw materials or homogeneous materials in the products or parts supplied to the Company, CAS No.(EC No.), and content and safety information.

(e.g. Material Safety Data Sheet(MSDS), Mill Sheet, Material Declaration, etc.)

### 3.10 Test report

This is a report issued after a test conducted based on the ISO 17025 international standards at a laboratory certified by a registered institution.

### 3.11 SVHC (Candidate list of Substances of Very High Concern)

It is a substance that poses a concern of a very high risk from carcinogenicity/reproductive toxicity/mutagenic toxicity defined by the EU REACH regulation. If the toxic content exceeds 0.1% based on the part's weight, the information shall be disclosed and reported.

### 3.12 Non-use Certificate for Hazardous Substances (Warranty documents)

It is a certificate provided by a supplier proving that the subject product or part does not include hazardous substances specified by the Company.

### 3.13 Biocidal substance

It refers to a biocidal substance, biocidal product, or biocide-processed product. Only the biocides approved for use by the national regulatory authorities can be manufactured, imported, sold, or distributed.

- Biocidal substances : chemicals, natural substances, or microorganisms(e.g. PHMG, PGH, OIT, etc.) used for the function of removing, detoxifying, or suppressing harmful organisms
- Biocidal products : products of which the primary purpose is to remove harmful organisms or products that produce biocides(e.g. disinfectants, fungicides, preservatives, etc.)
- Treated article : products that treat biocidal substances or biocidal products (e.g. antibacterial filters, preservative-treated wood, etc.) for incidental purposes, such as removal of harmful organisms

## Article 4 (Operation and management standards)

### 4.1 Requirements for evidence documents of hazardous substances/materials

The supplier that deals with the Company shall register references requested by the Company via HSMS for demonstrating whether hazardous substances have been used for all newly approved components and raw materials or currently mass-produced products that will go through 4M. Materials where substance information is not approved via HSMS are prohibited from being warehoused by LG Electronics.

- 1) A RoHS test report shall be submitted during the parts approval stage. Level A-II, Level B-I, or II substance reports shall be submitted when requested by the Company business division.
- 2) The content information (CAS No., composition ratio, etc.) of chemicals in all parts and homogeneous materials shall be registered into HSMS, and evidential documents such as substance composition tables shall be attached.
- 3) Substances that cannot be disclosed for business purposes can be registered as Confidential, but a Declaration of Certificate for the non-use of EU REACH SVHC substances shall be submitted and renewed periodically for SVHC substances which are added twice a year by the EU.
- 4) Information on biocidal materials used for antimicrobial/antiseptic/preservative functions shall not be registered as Confidential Business Information (CBI), where the application details shall be disclosed regardless of their contents.  
Substances that are not approved by the EU, US, or Korean regulatory authorities cannot be used for any purpose.

#### 4.1.1 In the Case of New Approval and 4M Change\*

- 1) Test report on RoHS-regulated substances (within 2 years from the date of report issuance)
  - Detailed analysis reports for non-RoHS substances shall be submitted upon the request of the Company business division (e.g. HBCDD, TCEP, TDCPP, etc.)
- 2) References of substance constituents (substance composition table, etc.)
- 3) Declaration of Certificate for the non-use of hazardous substances
- 4) Samples shall be required upon the request for evaluation by the Company business division
  - \* 4M change : It means that material change/addition/deletion, company change/addition, production site change (in case of material change only)

#### 4.1.2 Periodic Evaluations for Mass-produced Products

- 1) Test results for hazardous substances (e.g. XRF, etc.)
  - 2) Samples shall be required upon the request for evaluation by the Company business division
- ※ Requirements for the references based on the level of hazardous substances

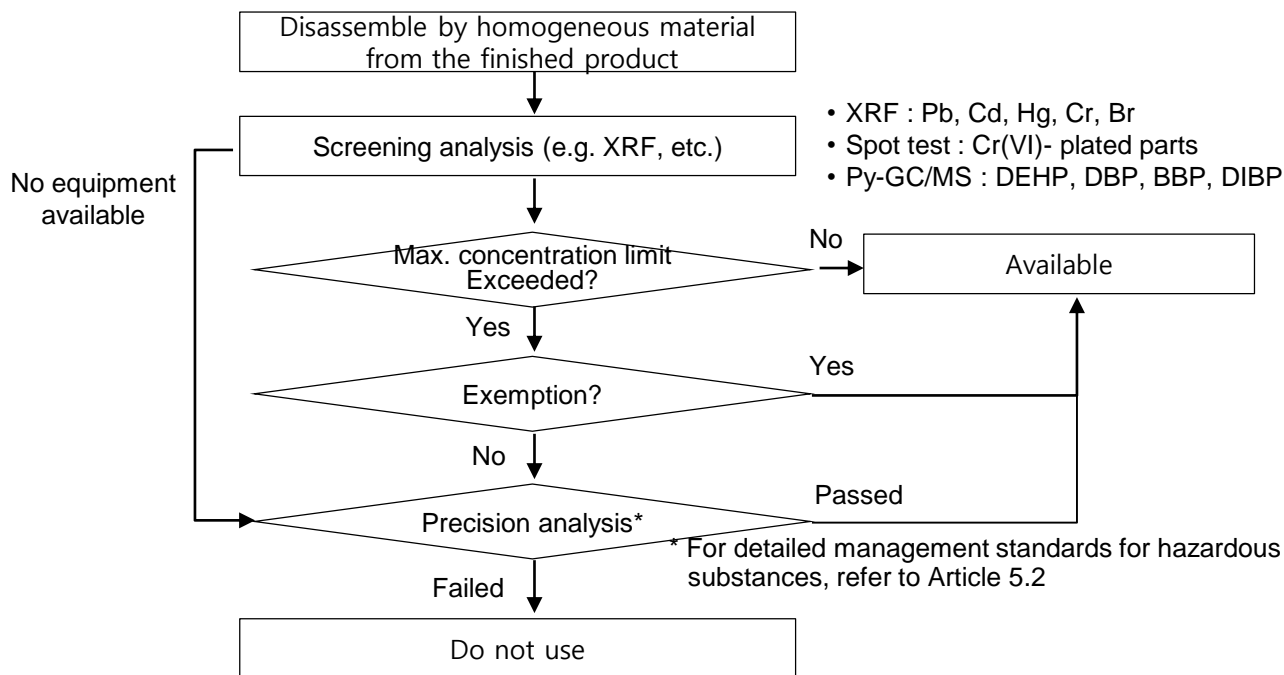
Level	Test Report	References for Material Composition	XRF Test Results
Level A-I	10 substances (Pb, Cd, Hg, Cr(VI), PBBs, PBDEs, DEHP, DBP, BBP, DIBP)	MSDS, Mill Sheet, etc.	5 substances (Pb, Cd, Hg, Cr, Br)
Level A-II, Level B-I / II	In case of request by Biz. Unit		In case of request by Biz. Unit
How to submit	HSMS	HSMS	PU-SCS

- Intentional use of Level A-I / II substances are prohibited, and the substance content shall not exceed the maximum concentration limit even when the substance is contained as an impurity. However, if a substance falls under the cases of exemption, the basis of determination shall be specified and the substance shall be registered as an exception in HSMS.
- Submission requirements for RoHS detailed analysis reports by material
  - ① Pb, Cd, Hg, Cr(VI) : all materials
  - ② PBBs, PBDEs, DEHP, DBP, BBP, DIBP : all materials except metal, metal plating, glass, and ceramic

## 4.2 The criteria of hazardous substance evaluation

- 1) The supplier shall disassemble all product parts into homogeneous material units and conduct a hazardous material evaluation.
- 2) The hazardous substance evaluation targets shall be finished products, and the inspection results for each substance shall meet the managed concentrations of the Company except for the ones that fall into the Appendix 1 exemption. (Refer to 5.2 Detailed management standards for hazardous substances )  
If the Company business division proposes a separate managed concentration, the operation standard of the business division shall take precedence.
  - e.g. Solder on PCB assembly is separated from the PCB board for measurement
- 3) Phthalates such as DEHP, DBP, BBP, and DIBP are not measurable by XRF, and shall be examined and managed by other screening equipment or precise analytical tests.

### 4.2.1 Flow chart of hazardous substances evaluation



### 4.2.2 In the case of exceeding maximum concentration limits

When the maximum concentration limit of hazardous substances set forth in Article 5 (Hazardous substances in products and detailed management standards) is exceeded,

- 1) Any of the 10 restricted substances of RoHS Directive fails the parts approval and import inspection tests, and the applicable part's dealing shall be terminated. The supplier shall prepare and submit an improvement plan and carry out the improvement according to the plan.
- 2) Any intended use of restricted substances (Level A-I and Level A-II) are prohibited, and any proof of such use of the applicable part shall lead to termination of trade.

## Article 5 (Hazardous substances in products and detailed management standards)

This management standards are applied to homogeneous material units in products and parts. The list of managed substances is as follows.

### 5.1 List of hazardous substance in products and related environmental regulation

#### 1) Level A-I substance (prohibited/restricted substance)

Type	Substances	Related regulation
Level A-I	Lead and its compounds	EU RoHS, Battery, Packaging Directive, EU REACH Regulation, EU ELV, China ELV, Korea RoHS, Japan J-MOSS, US/CA SB-20/50, US CPSIA, CA Proposition 65, US CPSC Public Law 110-314
	Cadmium and its compounds	EU RoHS, Battery, Packaging Directive, EU REACH Regulation, EU ELV, China ELV, Korea RoHS, Japan J-MOSS, US/CA SB-20/50, CA Proposition 65
	Mercury and its compounds	EU RoHS, Battery, Packaging Directive, EU REACH Regulation, EU ELV, China ELV, Korea RoHS, Japan J-MOSS, US/CA SB-20/50, CA Proposition 65
	Hexavalent chromium and its compounds	EU RoHS, Battery, Packaging Directive, EU REACH Regulation, EU ELV, China ELV, Korea RoHS, Japan J-MOSS, US/CA SB-20/50, CA Proposition 65
	PBBs (Polybrominated biphenyls)	EU RoHS, EU REACH Regulation, China ELV, Korea RoHS, Japan J-MOSS, US states flame retardant, CA Proposition 65
	PBDEs (Polybrominated diphenyl ethers)	EU RoHS, EU REACH Regulation, China ELV, Korea RoHS, Japan J-MOSS, US states flame retardant, EU POPs Regulation, CA Proposition 65
	DEHP (Bis(2-ethylhexyl) phthalate)	EU RoHS, EU REACH Regulation, CA Proposition 65
	DBP (Dibutyl phthalate)	EU RoHS, EU REACH Regulation, CA Proposition 65
	BBP (Benzyl butyl phthalate)	EU RoHS, EU REACH Regulation, CA Proposition 65
	DIBP (Diisobutyl phthalate)	EU RoHS, EU REACH Regulation, CA Proposition 65



## 2) Level A-II substance (prohibited/restricted substance)

Type	Substances	Related regulation
Level A-II	PCBs (Polychlorinated biphenyls) PCNs (Polychlorinated naphthalenes) PCTs (Polychlorinated terphenyls)	OSPAR Priority Chemicals, EU REACH Regulation, EU POPs Regulation
	SCCP (Short-chain chlorinated paraffin, C10-13)	EU POPs Regulation, OSPAR Priority Chemicals
	PFOS (Perfluorooctane sulfonate)	EU POPs Regulation
	Nickel and its compounds	EU REACH Regulation
	Asbestos	EU REACH Regulation
	Azo compounds	EU REACH Regulation
	Ugilec 121, 141, DBBT	EU REACH Regulation
	Specified organic tin compounds	EU REACH Regulation
	Arsenic and its compounds	EU REACH Regulation
	Ozone layer depleting substances	EU ODC Regulation, Montreal Protocol, Federal IRS Excise Taxes for Ozone Depleting Chemicals
	PAH, Polycyclic aromatic hydrocarbons	EU REACH Regulation, Germany GS mark
	Formaldehydes	ChemG (Germany), Formalin Act (Denmark), California ATCM, US TSCA Title VI
	DMF (Dimethylfumarate)	EU REACH Regulation, Commission decision 2009/251/EC
	VOC, Volatile Organic Compounds	EU REACH Regulation, Health-friendly housing construction standards
	HBCDD (Hexabromocyclododecane)	EU REACH Regulation, Norway Product regulation, Switzerland reduction of risk linked to use of dangerous substances, EU POPs Regulation
	Bisphenol A	EU REACH, France FCM, EU FCM
	TCEP (Tris(2-chloroethyl)phosphate)	Washington D.C. Flame retardant regulation
	TDCPP (Tris(1,3-dichloro-2-propyl)phosphate)	Washington D.C. Flame retardant regulation
	Biocidal substances	EU BPR, US FIFRA, Korea biocidal product regulation
	PFOA (Perfluorooctanoic acid)	Norway Product Regulation, EU REACH Regulation

3) Level B-I substances (voluntary use reduction substances)

Type	Substances
Level B-I	PVC (Poly vinyl chloride)
	Other brominated flame retardants (except PBB, PBDE, HBCDD)
	Other phthalates (except DEHP, DBP, BBP, DIBP)
	Antimony and its compounds
	Beryllium and its compounds
	Other chlorinated flame retardants (except TCEP, TDCPP)

※ LG Electronics can phase out Level B-I substance of each product group according to the phase out program of the relevant business unit..

4) Level B-II substances (substances to observe)

Type	Substances
Level B-I	Cobalt and its compounds including alloy, Selenium and its compounds including alloy, Bismuth and its compounds including alloy, Surfactant (DTDMAC, DODMAC, DSDMAC, DHTDMAC), MCCP (Medium-chained chlorinated paraffin, C14-C17), PCP (Pentachlorophenol), Musk xylene, Green House Gases, EU REACH SVHCs, and California Proposition 65 substances.  Phosphorus flame retardant (Sweden taxation), Radioactive substances

※ REACH SVHC candidates and US Proposition 65 substances are managed separately from these standards because they are continuously added

- How to check the list of regulated substances

① SVHC : <https://echa.europa.eu/candidate-list-table>

② Proposition 65 : <https://oehha.ca.gov/proposition-65/proposition-65-list>

## 5.2 Detailed management standards for hazardous substances

All the part shall be followed the standards as mentioned in ‘Article 5. Hazardous substances in products and detailed management standards’ of this manual. If LG Electronics Division and/or company request that the supplier abide by the division’s or company’s own standard, the supplier shall follow it.

### 5.2.1 Level A-I

#### 1) Pb, Lead and its compounds

Regulated parts and materials		Maximum concentration limit
All parts		800 mg/kg
Surface parts or accessible parts thereof which may be placed in the mouth by children		500 mg/kg
All parts of children’s product coming into contact with the skin		90 mg/kg
Application	rubber hardener, pigment, paint and varnish, lubricant, plastic stabilizer, battery material, free cutting brass/optics materials, soldering, rubber vulcanizing agent, derivative bon steel, material, resin stabilizer, plating material, alloy element, resin additives etc.	
Harmful effect	the central nerve damage, joint weakening, high blood pressure, brain damage, sterility and miscarriage, sperm reducing by tissue damage	
Test method	EN 62321:2009, IEC 62321-5:2013, CPSC-CH-E1003-09.1, CPSC-CH-E1001-08.1, CPSC-CH-E1002-08.1	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

#### 2) Cd, Cadmium and its compounds

Regulated parts and materials		Maximum concentration limit
All parts		80 mg/kg
Application	pigment, corrosion-resisting surface treatment, electric/electronic materials, optics materials, stabilizer, plating material, resin pigment, fluorescent material for optical glass, electrode, soldering materials, electrical contacts	
Harmful effect	stomach cramps, the kidney damage, high blood pressure, serum ferritin reducing, the central nerve and brain damage	
Test method	EN 62321:2009, IEC 62321-5:2013	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

#### 3) Hg, Mercury and its compounds

Regulated parts and materials		Maximum concentration limit
Interior and exterior plastic, paint and varnish, ink, coating/soldering, wattmeter, electrical contacts (relay, switch, sensor)		800 mg/kg
Application	fluorescent material, electrical contacts material, pigment, anti-corrosion preparation, high efficiency illuminant, antibiosis treatment	
Harmful effect	vomiting, wheal, eye spasm, the kidney and brain damage, visually handicap, loss of eyesight, failing of memory	
Test method	EN 62321:2009, IEC 62321-4:2013	
Test equipment	ICP-AES/OES, AAS, ICP-MS, TD-AAS, CV-AAS/AFS	

## 4) Cr(VI), Hexavalent chromium and its compounds

Regulated parts and materials		Maximum concentration limit
① Plastic, rubber, painting, ink, non-plating parts as metal/plastic coating <sup>1)</sup>		800 mg/kg
② Chrome surface treatment parts (Screw, Bolt, Nut, plate etc.) and electroplating <sup>2)</sup>		Negative (Precision analysis result < 0.1 µg/cm <sup>2</sup> )
③ Skin-contact natural leather and leather products		The total dry weight < 3 mg/kg
④ Soluble Cr(VI) of the cement		The total dry weight ≤ 2 mg/kg
Application	paints, pigment, ink, catalyzer, plating, corrosion protection surface treatment, dyes, pigment desiccant, surface treatment, chromate treatment, adhesion improvement for pigment	
Harmful effect	sniff, sneeze, nose bleeding, tumor, convulsions, asthma, lung cancer, the kidney and liver damage, sudden death	
Test method	EN 62321:2009, IEC 62321-7-1:2015 (metal), IEC 62321-7-2:2017	
Test equipment	ICP-AES/OES, AAS, ICP-MS, TD-AAS, CV-AAS/AFS	

1) If total Cr (measured by ICP or AAS) could not be detected, that data can be the Cr(VI) data.

2) Hexavalent chromium cannot intentionally be used for all components with a chromated surface including electroplated ones.

## 5) PBBs (Polybrominated biphenyls)

Regulated parts and materials		Maximum concentration limit
All plastic and polymer (Rubber, tape, etc.)		800 mg/kg
Application	Flame retardants	
Harmful effect	Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage	
Test method	EN 62321:2009, IEC 62321-6:2015	
Test equipment	GC-MS, GC-ECD	

## 6) PBDEs (Polybrominated diphenylethers)

Regulated parts and materials		Maximum concentration limit
All plastic and polymer (Rubber, tape, etc.)		800 mg/kg
Application	Flame retardants	
Harmful effect	Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage	
Test method	EN 62321:2009, IEC 62321-6:2015	
Test equipment	GC-MS, GC-ECD	

## 7) DEHP (Bis(2-ethylhexyl) phthalate)

Regulated parts and materials		Maximum concentration limit
All parts (except metal, metal plating, glass, ceramic)		800 mg/kg
Application	Plasticizers used to soften plastics	
Harmful effect	Endocrine disturbance, damage the liver, lungs, and reproductive system	
Test method	KS M 1991, ASTM D 3421, EPA 8061A, IEC 62321-8:2017	
Test equipment	GC-MS, Py/TD-GC-MS, LC-MS	

8) DBP (Dibutyl phthalate)

Regulated parts and materials		Maximum concentration limit
All parts (except metal, metal plating, glass, ceramic)		800 mg/kg
Application	Plasticizer, resistance chip paste, coating adhesive, equipment cleaner, etc.	
Harmful effect	Endocrine disturbance, damage the liver, lungs, and reproductive system	
Test method	KS M 1991, ASTM D 3421, EPA 8061A, IEC 62321-8:2017	
Test equipment	GC-MS, Py/TD-GC-MS, LC-MS	

9) BBP (Benzyl butyl phthalate)

Regulated parts and materials		Maximum concentration limit
All parts (except metal, metal plating, glass, ceramic)		800 mg/kg
Application	Plasticizer, coating adhesive, synthetic leather, etc.	
Harmful effect	Endocrine disturbance, damage the liver, lungs, and reproductive system	
Test method	KS M 1991, ASTM D 3421, EPA 8061A, IEC 62321-8:2017	
Test equipment	GC-MS, Py/TD-GC-MS, LC-MS	

10) DIBP (Diisobutyl phthalate)

Regulated parts and materials		Maximum concentration limit
All parts (except metal, metal plating, glass, ceramic)		800 mg/kg
Application	Plasticizer, coating adhesive, synthetic leather, etc.	
Harmful effect	Endocrine disturbance, damage the liver, lungs, and reproductive system	
Test method	KS M 1991, ASTM D 3421, EPA 8061A, IEC 62321-8:2017	
Test equipment	GC-MS, Py/TD-GC-MS, LC-MS	

5.2.2 Level A-II

1) PCBs (Polychlorinated biphenyls), PCNs (Polychlorinated Naphthalenes), PCTs (Polychlorinated Terphenyls)

Regulated parts and materials		Maximum concentration limit
All parts		50 mg/kg
Application	- plasticizer for insulating oil, specific lubricant, insulating properties, and heat-resisting insulation of transformer/condenser/paper condenser - machine oil, copy paper as heat medium, which need heat like 200~400°C - flame retardant pigment, Chlorinated Rubber pigment, pigment (weatherproofed, polish, insulation), printing ink	
Harmful effect	Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage	
Test method	EPA 8082 etc.	
Test equipment	GC-MS	

## 2) SCCP (Short-chain chlorinated paraffin, C10-C13)

Regulated parts and materials		Maximum concentration limit
All parts and material (except metal, glass)		1,000 mg/kg
Application	PVC plasticizer, flame retardant	
Harmful effect	Cancer-causing, possible to generate dioxin by incineration	
Test method	EPA 3540C, 3550C, Solvent Extraction	
Test equipment	GC-MS	

## 3) PFOS (Perfluorooctane sulfonate)

Regulated parts and materials		Maximum concentration limit
Substance and Preparation		50 mg/kg
Article / Assembly and parts		1,000 mg/kg
Textiles, coating material		1 µg/m <sup>2</sup>
Application	Carpet, textiles, leather, paper packaging, Metal plating, Fire fighting foam	
Harmful effect	High persistent, Bioaccumulative, toxicity for mammalia	
Test method	Solvent Extraction	
Test equipment	LC-MS	

※ Excluded : photoresist or antireflective coating for photo plate process, mist suppressants for non-decorative chrome plating

## 4) Nickel and its compounds

Regulated parts and materials		Maximum concentration limit
Surface-treated parts and exterior metal parts among parts that prolonged contact with skin (ex: ear or headphone, handle, belt, mobile phone, etc.)		0.5 µg -Ni/cm <sup>2</sup> per week
Application	Coating or alloy compounds, surface treatment(coating), bottom layer coating of parts, protecting coating, accessory coating	
Harmful effect	Allergy stimuli	
Test method	EN 1811, EN 12471, EN 12472	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

## 5) Asbestos

Regulated parts and materials		Maximum concentration limit
Fire-resistant, lagging materials, heat insulator, electric insulator, etc.		Not Detected
Application	Asbestos fibers, insulator, packing material, abrasive material, heat insulating material, fireproof material	
Harmful effect	Lung cancer, Asbestosis	
Test method	NIOSH 9000, NIOSH 9002, NIOSH 7402 etc.	
Test equipment	XRD, PLM, TEM	

## 6) Azo compounds

Regulated parts and materials		Maximum concentration limit
Leather or textile which are intended to come into direct and prolonged contact with the skin (ex : belt, leather strap, earphone, headphone, shoulder pad, etc.)		30 mg/kg
Application	Paint, pigment, coloring agent for textiles and leather etc.	
Harmful effect	Azo dyes is absorbed into human body through sweat, and then body enzyme decomposes azo dyes, and the decomposed azo dyes produces aromatic amine compounds which are carcinogenic substance	
Test method	CEN ISO/TS 17234 (Leather), EN 14362-1-2 (Textile)	
Test equipment	GC-MS	

## 7) Ugilec 121, 141, DBBT

Regulated parts and materials		Maximum concentration limit
All parts		Not Detected
Application	Transformer insulating oil, plasticizers, lubricants and excavators	
Harmful effect	In product persistent, dioxin, since the 1990s a number of discontinued	
Test method	EPA 3540C, Solvent Extraction	
Test equipment	GC-MS	

## 8) Organic tin compounds (TBT/TPT/DBT/DOT etc.)

Regulated parts and materials		Maximum concentration limit
All parts		1,000 mg/kg
Application	PVC stabilizer, antioxidant, antifungal, antipollution, Painting, ink, sterilizer, antiseptic, Antifoulant biocides	
Harmful effect	Obstacle destruction of the ecosystem of the wild, carcinogens etc.	
Test method	DIN 17353, DIN 38407, KS K 0737 etc.	
Test equipment	GC-MS	

## 9) Arsenic and its compounds

Regulated parts and materials		Maximum concentration limit
All parts		100 mg/kg
Application	Paint, ink, sterilizer, wood preservative	
Harmful effect	Vomiting, skin browning/blackening, red blood cell reducing, loss of appetite, enlarged spleen, dry eruption	
Test method	EPA 3052, EPA 3050B, EN 1122 etc.	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

※ Excluded : semiconductor, module glass, magnetic filter, copper foil and battery

## 10) ODC (Ozone layer depleting substances)

Regulated parts and materials		Maximum concentration limit
All parts		Not Detected
Application	refrigerant, foaming agent, digestive, detergent	
Test method	EPA5021A, EPA 8260B, PNNL-16813	
Test equipment	GC-MS, GC-ECD, Headspace	

## 11) PAHs (Polycyclic aromatic hydrocarbons)

Regulated parts and materials		Maximum concentration limit
Rubber or plastic components that come into direct as well as prolonged or short-term repetitive contact with the human skin (black polymer)		Each substance : 1 mg/kg (children product : 0.5 mg/kg)
Application	Cable, Plug, Plastic shaft, Plastic package, Strange smell plastic etc.	
Harmful effect	DNA change, harmful , mutation, cancer	
Test method	EPA 8100, EPA 3540C/8270D, ISO 187287 etc.	
Test equipment	GC-MS	

※ 8 PAHs on REACH restriction : Benzo[a]pyrene, Benzo[e]pyrene, Benzo[a]anthracene, Chrysen, Benzo[b]fluoranthene, Benzo[j]fluoranthene, Benzo[k]fluoranthene, Dibenzo[a,h]anthracene

## 12) Formaldehydes

Regulated parts and materials		Maximum concentration limit
Composite wood product	HWPW (Hardwood Plywood)	0.05 mg/kg
	PB (Particleboard)	0.09 mg/kg
	MDF (Medium Density Fiberboard)	0.11 mg/kg
	Thin MDF (more less 8 mm)	0.13 mg/kg
	Laminated product	0.05 mg/kg
Other product and parts (adhesive, vinyl, tape etc.)		0.1 mg/kg or 0.15 mg/m <sup>3</sup>
Built-in household products		0.03 mg/m <sup>3</sup>
Application	Adhesives, sterilizer, antiseptic, coating agent	
Harmful effect	Cancer-causing, promoting cancer-causing, atopic dermatitis, allergy	
Test method	VDA275, DIN53315, ISO 16000 – Chamber, KS X ISO/IEC 28360 (emission)	
Test equipment	HPLC-UV, UV-VIS	

## 13) DMF (Dimethylfumarate)

Regulated parts and materials		Maximum concentration limit
All parts (leather, insecticide treatment in wrapped fiber product or shall protection agent)		Not Detected
Application	leather, insecticide treatment in wrapped fiber product, protection agent	
Harmful effect	easily passing skin due to strong fat-solubility, strong stimulus into eyes etc.	
Test method	EPA 3540C, Solvent Extraction	
Test equipment	GC-MS	



14) VOC (Volatile Organic Compound)

Regulated parts and materials		Maximum concentration limit
Adhesive, paint		Toluene, Benzene : 1,000 mg/kg
Built-in household products		Total VOC : 4 mg/m <sup>3</sup>
Application	solvent etc.	
Harmful effect	Atopic dermatitis, allergy, head ache, lethargic	
Test method	EPA 5012 A etc. (Toluene, Benzene), KS X ISO/IEC 28360 (emission for TVOC, Formaldehyde)	
Test equipment	Headspace-GC-MS	

15) HBCDD (Hexaboromocyclododecane)

Regulated parts and materials		Maximum concentration limit
EPS packaging/parts, HIPS, etc		80 mg/kg
Application	Flame retardants of polystyrene material etc.	
Harmful effect	Atmospheric pollution, cancer etc.	
Test method	EPA 3540C, EPA 3550B etc.	
Test equipment	GC-MS, GC-ECD	

16) BPA (Bisphenol A)

Regulated parts and materials		Maximum concentration limit
PC(polycarbonate) material of food contact parts and epoxy resin of varnish and coating materials		0.05 mg/kg
Thermal paper		200 mg/kg
Application	vinyl chloride stabilizer, antioxidant	
Harmful effect	Endocrine, nerve developmental disability	
Test method	Food standard 6, EPA 3540C, Solvent Extraction	
Test equipment	GC-MS, LC-MS, HPLC	

17) TCEP (Tris(2-chloroethyl)phosphate)

Regulated parts and materials		Maximum concentration limit
Children's products and all parts		1,000 mg/kg
Application	Flame retardants of polyurethane, coating product etc.	
Test method	Carcinogenic, mutagenic and toxic to reproduction etc.	
Test equipment	EPA 3540C, EPA 3550B etc.	

18) TDCPP (Tris(1,3-dichloro-2-propyl)phosphate)

Regulated parts and materials		Maximum concentration limit
Children's products and all parts		1,000 mg/kg
Application	Flame retardants of polyurethane, coating product etc.	
Test method	Carcinogenic, mutagenic and toxic to reproduction etc.	
Test equipment	EPA 3540C, EPA 3550B etc.	

19) Biocidal substances

Regulated parts and materials		Maximum concentration limit
Biocidal substance, biocidal product, treated product (antibacterial, sterilizing, preservative, disinfectant)		Not allowed for use except for approved/authorized use
Application	Product's self-protection and anti-microbial/sterilization functions such as elimination, control, and detoxification of harmful organisms	
Harmful effect	Carcinogenic, mutagenic and toxic to reproduction, deformity, death etc.	
Test method	EN71, ISO13365 etc.	
Test equipment	HPLC-UV, LC-MS	

20) PFOA (Perfluorooctyl acid)

Regulated parts and materials		Maximum concentration limit
All parts		0.025 mg/kg (25 ppb)
Application	Coating agents, water/oil-repellent agents, semiconductor cleaning agents	
Harmful effect	High persistent, Bioaccumulative, toxicity for mammalia etc.	
Test method	Solvent Extraction	
Test equipment	LC-MS	

5.2.3 Level B-I

1) PVC (Poly vinyl chloride)

Regulated parts and materials		Maximum concentration limit
All parts		Not detected
Application	Insulation, poly vinyl electric wire, tube, power supply code etc.	
Harmful effect	- plasticizer, stabilizer, filler, lubricant, and coloring agent are used on processing stage, and there are lots of hazardous substances which can cause nervous system damage, immune system abnormal condition, Peripheral Vascular abnormal condition, liver cancer - lots of hydrogen chloride could be occurred by pyrolyzing PVC	
Test method	KS 0210 etc.	
Test equipment	Beilstein-Test or FT-IR	

## 2) Other bromated flame retardants (except PBBs, PBDEs, HBCDD)

Regulated parts and materials		Maximum concentration limit
All parts including flame retardant		900 mg/kg (Total Br)
Application	Plastic as PCB	
Harmful effect	EU regulated as potential hazardous substance, Possible to be decomposed into Endocrine disruptor etc.	
Test method	EPA 3540C, EPA 3550B etc. (Total Br : IEC62321-3-2:2013, EN 50267-2-2, ASTM D 7359, KS M 0180:2009, EN 14582 etc.)	
Test equipment	GC-MS, GE-ECD (Total Br : Combustion-IC, Oxygen Bomb-IC)	

※ MC has managed the Total-Br instead of bromated flame retardants.

## 3) Other phthalates (except DEHP, DBP, BBP, DIBP)

Regulated parts and materials		Maximum concentration limit
All parts (except metal, metal plating, glass, ceramic)		1,000 mg/kg
Application	Plasticizer to be soften plastic	
Harmful effect	lung, heart, blood harmful, deformed birth, genital generation repression etc.	
Test method	KS M 1991, ASTM D 3421 etc.	
Test equipment	GC-MS	

## 4) Antimony and its compounds

Regulated parts and materials		Maximum concentration limit
All parts including flame retardant		1,000 mg/kg
Application	pigment, dye, catalyzer, flame retardant, stabilization, optical lens, solder, ink	
Harmful effect	pneumoconiosis, physiology problem, premature birth, abortion	
Test method	EPA 3052, EPA 3050B etc.	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

※ Exemption : Antimony, which is used for the attribute of flame-retardant except phase-out.

## 5) Beryllium and its compounds, including alloy

Regulated parts and materials		Maximum concentration limit
All parts		BeO : Not detected Others : 1,000 mg/kg
Application	Ceramic materials, alloy, catalyzer, electrodes, molds, electrical contacts, spring materials, connectors etc.	
Harmful effect	carcinogenity, mutagenicity, toxicity for reproduction etc.	
Test method	EPA 3052, EPA 3050B etc.	
Test equipment	ICP-AES/OES, AAS, ICP-MS	

※ Exemption : Be alloy using the connector for specific performance

6) Other chlorinated flame retardants (except TCEP, TDCPP)

Regulated parts and materials		Maximum concentration limit
All parts that is plastic material		900 mg/kg (Total Cl)
Application	Plastic as PCB	
Harmful effect	EU regulated as potential hazardous substance, Possible to be decomposed into Endocrine disruptor	
Test method	KS M 1991, Solvent Extraction 등 (Total Cl analysis : IEC62321-3-2:2013, ASTM D 7359, KS M 0180:2009, EN 14582 etc.)	
Test equipment	GC-MS, AQF-IC, Oxygen Bomb-IC	

※ MC has managed the Total-Cl instead of chlorinated flame retardants.

**Article 6 (Management standards for hazardous substances in packaging materials)**

Management shall be in accordance with the EU Packaging Directive 94/62/EC. Any hazardous substance for which no separate standards are provided shall be covered by the management standards in Sections 5.2.1~5.2.3. The labeling shall be in accordance with the standards of the business division.

Regulated parts and materials	Maximum concentration limit
Packaging materials for all products on market	Pb + Cd + Hg + Cr(VI) < 100 mg/kg HBCDD (EPS foam) < 80 mg/kg

※ Excluded : Packaging materials made from lead crystal glass, packaging materials discarded from the product process

**Article 7 (Management standards for hazardous substances in batteries)**

Management shall be in accordance with the EU Battery Directive 2006/66/EC. Any hazardous substance for which no separate standards are provided shall be covered by the management standards in Sections 5.2.1~5.2.3. The labeling shall be in accordance with the standards of the business division.

Regulated parts and materials		Maximum concentration limit
Cd and its compounds	All batteries	20 mg/kg
Hg and its compounds	Cylindrical zinc-carbon, alkaline-manganese battery	1 mg/kg
	Others	5 mg/kg

※ This is the Maximum concentration limit for the battery cell. For homogeneous materials apart from cells such as circuit parts, follow the 5.2.1 Clause.

**Appendix 1 (Exemptions in electrical and electronic products of Level A-I)**

Exemption		Scope and dates of applicability	
1	Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):	-	
1(a)	For general lighting purposes < 30 W: 5 mg	Expires on 31 Dec. 2011; 3,5 mg may be used per burner after 31 Dec. 2011 until 31 Dec. 2012; 2,5 mg shall be used per burner after 31 Dec. 2012	
1(b)	For general lighting purposes ≥ 30 W and < 50 W: 5 mg	Expires on 31 Dec. 2011; 3,5 mg may be used per burner after 31 Dec. 2011.	
1(c)	For general lighting purposes ≥ 50 W and ≤ 150 W: 5 mg	-	
1(d)	For general lighting purposes ≥ 150 W: 15 mg	-	
1(e)	For general lighting purposes with circular or square structural shape and tube diameter <17 mm	No limitation of use until 31 Dec. 2011; 7 mg may be used per burner after 31 Dec. 2011.	
1(f)	For special purposes: 5 mg	-	
1(g)	For general lighting purposes < 30 W with a lifetime equal or above 20 000 h: 3,5 mg	-	
2(a)	Mercury in double-capped linear fluorescent lamps for general lighting purposes not exceeding (per lamp):	-	
2(a)(1)	Tri-band phosphor with normal lifetime and a tube diameter > 9 mm (e.g. T2): 5 mg	Expires on 31 Dec. 2011; 4 mg may be used per lamp after 31 Dec. 2011.	
2(a)(2)	Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≥ 17 mm (e.g. T5): 5 mg	Expires on 31 Dec. 2011; 3 mg may be used per lamp after 31 Dec. 2011.	
2(a)(3)	Tri-band phosphor with normal lifetime and a tube diameter ≥ 17 mm and ≤ 28 mm (e.g. T8): 5 mg	Expires on 31 Dec. 2011; 3,5 mg may be used per lamp after 31 Dec. 2011.	
2(a)(4)	Tri-band phosphor with normal lifetime and a tube diameter > 28 mm (e.g. T12): 5 mg	Expires on 31 Dec. 2012; 3,5 mg may be used per lamp after 31 Dec. 2012.	
2(a)(5)	Tri-band phosphor with long lifetime( ≥ 25 000 h): 8 mg	Expires on 31 Dec. 2011; 5 mg may be used per lamp after 31 Dec. 2011.	
2(b)	Mercury in other fluorescent lamps not exceeding (per lamp):	-	
2(b)(1)	Linear halophosphate lamps with tube > 28 mm (e.g. T10 and T12): 10 mg	Expires on 13 April 2012	
2(b)(2)	Non-linear halophosphate lamps (all diameters): 15 mg	Expires on 13 April 2016	
2(b)(3)	Non-linear tri-band phosphor lamps with tube diameter > 17 mm (e.g. T9)	No limitation of use until 31 Dec. 2011; 15 mg may be used per lamp after 31 Dec. 2011	
2(b)(4)	Lamps for other general lighting and special purposes (e.g. induction lamps)	No limitation of use until 31 Dec. 2011; 15 mg may be used per lamp after 31 Dec. 2011	
3	Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for special purposes not exceeding (per lamp):	-	
3(a)	Short length (≥ 500 mm)	No limitation of use until 31 Dec. 2011; 3,5 mg may be used per lamp after 31 Dec. 2011	
3(b)	Medium length (> 500 mm and < 1 500 mm)	No limitation of use until 31 Dec. 2011; 5 mg may be used per lamp after 31 Dec. 2011	
3(c)	Long length (> 1 500 mm)	No limitation of use until 31 Dec. 2011; 13 mg may be used per lamp after 31 Dec. 2011	
4(a)	Mercury in other low pressure discharge lamps (per lamp)	No limitation of use until 31 Dec. 2011; 15 mg may be used per lamp after 31 Dec. 2011	

Hg

**Appendix 1 (Exemptions in electrical and electronic products of Level A-I)**

Exemption		Scope and dates of applicability	
4(b)	Mercury in High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner) in lamps with improved colour rendering index Ra > 60:	-	Hg
4(b)-I	P < 155 W	No limitation of use until 31 Dec. 2011; 30 mg may be used per burner after 31 Dec. 2011	
4(b)-II	155 W < P < 405 W	No limitation of use until 31 Dec. 2011; 40 mg may be used per burner after 31 Dec. 2011	
4(b)-III	P > 405 W	No limitation of use until 31 Dec. 2011; 40 mg may be used per burner after 31 Dec. 2011	
4(c)	Mercury in other High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner):	-	
4(c)-I	P ≤ 155 W	No limitation of use until 31 Dec. 2011; 25 mg may be used per burner after 31 Dec. 2011	
4(c)-II	155 W < P ≤ 405 W	No limitation of use until 31 Dec. 2011; 30 mg may be used per burner after 31 Dec. 2011	
4(c)-III	P > 405 W	No limitation of use until 31 Dec. 2011; 40 mg may be used per burner after 31 Dec. 2011	
4(d)	Mercury in High Pressure Mercury (vapour) lamps (HPMV)	Expires on 13 April 2015	
4(e)	Mercury in metal halide lamps (MH)	-	
4(f)	Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex	-	
4(g)	Mercury in hand crafted luminous discharge tubes used for signs, decorative or architectural and specialist lighting and light-artwork, where the mercury content shall be limited as follows: (a) 20 mg per electrode pair + 0,3 mg per tube length in cm, but not more than 80 mg, for outdoor applications and indoor applications exposed to temperatures below 20 °C; (b) 15 mg per electrode pair + 0,24 mg per tube length in cm, but not more than 80 mg, for all other indoor applications.	Expires on 31 Dec. 2018	
5(a)	Lead in glass of cathode ray tubes	Expires on 21 July 2016	
5(b)	Lead in glass of fluorescent tubes not exceeding 0,2 % by weight	-	
6(a)	Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0,35 % lead by weight	Expires on 30 June 2019	
6(a)-I	Lead as an alloying element in steel for machining purposes containing up to 0,35 % lead by weight and in batch hot dip galvanised steel components containing up to 0,2 % lead by weight	Expires on 21 July 2021	

**Appendix 1 (Exemptions in electrical and electronic products of Level A-I)**

Exemption		Scope and dates of applicability	
6(b)	Lead as an alloying element in aluminium containing up to 0,4 % lead by weight	Expires on 30 June 2019	Pb
6(b)-I	Lead as an alloying element in aluminium containing up to 0,4 % lead by weight, provided it stems from lead-bearing aluminium scrap recycling	Expires on 21 July 2021	
6(b)-II	Lead as an alloying element in aluminium for machining purposes with a lead content up to 0,4 % by weight	Expires on 18 May 2021	
6(c)	Copper alloy containing up to 4 % lead by weight	Expires on 21 July 2021	
7(a)	Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)	Expires on 21 July 2021	
7(b)	Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission, and network management for telecommunications	Expires on 21 July 2016	
7(c)-I	Electrical and electronic components containing lead in a glass or ceramic other than dielectric ceramic in capacitors, e.g. piezoelectric devices, or in a glass or ceramic matrix compound	Expires on 21 July 2021	
7(c)-II	Lead in dielectric ceramic in capacitors for a rated voltage of 125 V AC or 250 V DC or higher	-	
7(c)-III	Lead in dielectric ceramic in capacitors for a rated voltage of less than 125 V AC or 250 V DC	Expires on 1 Jan. 2013 and after that date may be used in spare parts for EEE placed on the market before 1 Jan. 2013	
7(c)-IV	Lead in PZT based dielectric ceramic materials for capacitors being part of integrated circuits or discrete semiconductors	-	
8(a)	Cadmium and its compounds in one shot pellet type thermal cut-offs	Expires on 1 Jan. 2012 and after that date may be used in spare parts for EEE placed on the market before 1 Jan. 2012	Cd
8(b)	Cadmium and its compounds in electrical contacts	-	
9	Hexavalent chromium as an anticorrosion agent of the carbon steel cooling system in absorption refrigerators up to 0,75 % by weight in the cooling solution	-	Cr(VI)
9(b)	Cadmium and its compounds in one shot pellet type thermal cut-offs	Expires on 5 July 2018	Pb
9(b)-I	Lead in bearing shells and bushes for refrigerant-containing hermetic scroll compressors with a stated electrical power input equal or below 9 kW for heating, ventilation, air conditioning and refrigeration (HVACR) applications	Expires on 21 July 2019	
11(a)	Lead used in C-press compliant pin connector systems	May be used in spare parts for EEE placed on the market before 24 Sep. 2010	
11(b)	Lead used in other than C-press compliant pin connector systems	Expires on 1 Jan. 2013 and after that date may be used in spare parts for EEE placed on the market before 1 Jan. 2013	

**Appendix 1 (Exemptions in electrical and electronic products of Level A-I)**

Exemption		Scope and dates of applicability	
12	Lead as a coating material for the thermal conduction module C-ring	May be used in spare parts for EEE placed on the market before 24 Sep. 2010	Pb
13(a)	Lead in white glasses used for optical applications	Expires on 21 July 2021	
13(b)	Cadmium and lead in filter glasses and glasses used for reflectance standards	Expires on 5 July 2018	Cd, Pb
13(b)-I	Lead in ion coloured optical filter glass types	Expires on 21 July 2021	
13(b)-II	Cadmium in striking optical filter glass types; excluding applications falling under point 39 of this Annex	Expires on 21 July 2021	
13(b)-III	Cadmium and lead in glazes used for reflectance standards	Expires on 21 July 2021	
14	Lead in solders consisting of more than two elements for the connection between the pins and the package of microprocessors with a lead content of more than 80 % and less than 85 % by weight	Expired on 1 Jan. 2011 and after that date may be used in spare parts for EEE placed on the market before 1 Jan. 2011	
15	Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages		
16	Lead in linear incandescent lamps with silicate coated tubes	Expires on 1 Sep. 2013	
17	Lead halide as radiant agent in high intensity discharge (HID) lamps used for professional reprography applications	Expires on 21 July 2016	
18(a)	Lead as activator in the fluorescent powder (1 % lead by weight or less) of discharge lamps when used as speciality lamps for diazoprinting reprography, lithography, insect traps, photochemical and curing processes containing phosphors such as SMS ((Sr,Ba) 2 MgSi 2 O 7 :Pb)	Expired on 1 Jan. 2011	Pb
18(b)	Lead as activator in the fluorescent powder (1 % lead by weight or less) of discharge lamps when used as sun tanning lamps containing phosphors such as BSP (BaSi 2 O 5 :Pb)		
19	Lead with PbBiSn-Hg and PbInSn-Hg in specific compositions as main amalgam and with PbSn-Hg as auxiliary amalgam in very compact energy saving lamps (ESL)	Expires on 1 June 2011	
20	Lead oxide in glass used for bonding front and rear substrates of flat fluorescent lamps used for Liquid Crystal Displays (LCDs)	Expires on 1 June 2011	
21	Lead and cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses		Cd, Pb
23	Lead in finishes of fine pitch components other than connectors with a pitch of 0,65 mm and less	May be used in spare parts for EEE placed on the market before 24 Sep. 2010	Pb
24	Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors	Expires on 21 July 2021	
25	Lead oxide in surface conduction electron emitter displays (SED) used in structural elements, notably in the seal frit and frit ring	Expires on 21 July 2016	



**Appendix 1 (Exemptions in electrical and electronic products of Level A-I)**

Exemption		Scope and dates of applicability	
26	Lead oxide in the glass envelope of black light blue lamps	Expires on 1 June 2011	Pb
27	Lead alloys as solder for transducers used in high-powered (designated to operate for several hours at acoustic power levels of 125 dB SPL and above) loudspeakers	Expired on 24 Sep. 2010	
29	Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC ( 1 )		
30	Cadmium alloys as electrical/mechanical solder joints to electrical conductors located directly on the voice coil in transducers used in high-powered loudspeakers with sound pressure levels of 100 dB (A) and more	Expires on 21 July 2016	Cd
31	Lead in soldering materials in mercury free flat fluorescent lamps (which, e.g. are used for liquid crystal displays, design or industrial lighting)	Expires on 21 July 2016	Pb
32	Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes		
33	Lead in solders for the soldering of thin copper wires of 100 µm diameter and less in power transformers	Expires on 21 July 2016	
34	Lead in cermet-based trimmer potentiometer elements	Expires on 21 July 2021	
36	Mercury used as a cathode sputtering inhibitor in DC plasma displays with a content up to 30 mg per display	Expired on 1 July 2010	Hg
37	Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body		Pb
38	Cadmium and cadmium oxide in thick film pastes used on aluminium bonded beryllium oxide	Expires on 21 July 2016	Cd
39	Cadmium in colour converting II-VI LEDs (< 10 µg Cd per mm <sup>2</sup> of light-emitting area) for use in solid state illumination or display systems	Expires on 01 Nov. 2018	
39(a)	Cadmium selenide in downshifting cadmium-based semiconductor nanocrystal quantum dots for use in display lighting applications (< 0,2 µg Cd per mm <sup>2</sup> of display screen area)	-	
40	Cadmium in photoresistors for analogue optocouplers	Expires on 31 Dec. 2013	
41	Lead in solders and termination finishes of electrical and electronic components and finishes of printed circuit boards used in ignition modules and other electrical and electronic engine control systems, which for technical reasons shall be mounted directly on or in the crankcase or cylinder of hand-held combustion engines (classes SH:1, SH:2, SH:3 of Directive 97/68/EC of the European Parliament and of the Council ( 2 ))	-	Pb

## Appendix 2 (Examples of substances and its compounds)

### 1) Lead and its compounds

Name	Chemical symbol	CAS No.
Lead	Pb	7439-92-1
Lead(II) carbonate	PbCO <sub>3</sub>	598-63-0
Lead(IV) oxide	PbO <sub>2</sub>	1309-60-0
Lead(II,IV) oxide	Pb <sub>3</sub> O <sub>4</sub>	1314-41-6
Lead(II) sulfide	PbS	1314-87-0
Lead azide	Pb(N <sub>3</sub> ) <sub>2</sub>	13424-46-9
Lead(II) oxide	PbO	1317-36-8
Lead(II) fluoride	PbF <sub>2</sub>	7783-46-2
Lead(II) chloride	PbCl <sub>2</sub>	7758-95-4
Lead(IV) chloride	PbCl <sub>4</sub>	13463-30-4
Lead(II) carbonate basic	2PbCO <sub>3</sub>	1319-46-6
Lead(II) iodide	PbI <sub>2</sub>	10101-63-0
Lead hydroxycarbonate	(PbCO <sub>3</sub> ) <sub>2</sub> Pb(OH) <sub>2</sub>	1344-36-1
Lead(II) cyanide	Pb(CN) <sub>2</sub>	592-05-2
Lead(II) fluoroborate	Pb(BF <sub>4</sub> ) <sub>2</sub>	13814-96-5
Lead(II) fluosilicate	PbSiF <sub>6</sub>	25808-74-6
Lead(II) sulfate	PbSO <sub>4</sub>	7446-14-2
Lead(II) phosphate	Pb <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	7446-27-7
Lead thiocyanate	Pb(SCN) <sub>2</sub>	592-87-0
Lead(II) chromate	PbCrO <sub>4</sub>	7758-97-6
Lead(II) titanate	PbTiO <sub>3</sub>	12060-00-3
Lead(II) acetate, trihydrate	Pb(CH <sub>3</sub> COO) <sub>2</sub> · 3H <sub>2</sub> O	6080-56-4
Lead(II) acetate	Pb(CH <sub>3</sub> COO) <sub>2</sub>	301-04-2
Lead(II) metaborate	Pb(BO <sub>2</sub> ) <sub>2</sub> · H <sub>2</sub> O	10214-39-8
Lead metasilicate	PbSiO <sub>3</sub>	11120-22-2
Lead silicate	H <sub>2</sub> O <sub>3</sub> Si.xPb	22569-74-0
Lead antimonite	Pb(SbO <sub>4</sub> ) <sub>3</sub>	13510-89-9
Lead hydrogen arsenate	PbHAsO <sub>4</sub>	7784-40-9
Lead(II) arsenite	Pb(AsO <sub>2</sub> ) <sub>2</sub>	10031-13-7
Lead(IV) acetate / Lead tetraacetate	Pb(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>4</sub> / C <sub>8</sub> H <sub>12</sub> O <sub>8</sub> Pb	546-67-8
Sulphuric acid, lead salt	PbSO <sub>4</sub>	15739-80-7
Lead sulfate, tribasic	Pb <sub>4</sub> SO <sub>7</sub> / PbSO <sub>4</sub> (PbO) <sub>3</sub>	12202-17-4
Lead nitrate	Pb(NO <sub>3</sub> ) <sub>2</sub>	10099-74-8
Lead sulfochromate yellow	-	1344-37-2
Lead oxide sulfate	Pb <sub>2</sub> O(SO <sub>4</sub> )	12036-76-9
Lead molybdate	PbMoO <sub>4</sub>	10190-55-3
Tetramethyl lead	Pb(CH <sub>3</sub> ) <sub>4</sub>	75-74-1
Tetraethyl lead	Pb(C <sub>2</sub> H <sub>5</sub> ) <sub>4</sub>	78-00-2
Lead selenide	PbSe	12069-00-0
Lead perchlorate ClHO4.1/2Pb	Pb(ClHO <sub>4</sub> ) <sub>2</sub>	13637-76-8
Lead distearate	C <sub>36</sub> H <sub>70</sub> O <sub>4</sub> Pb	1072-35-1
Lead stearate (stearic acid, lead salt)	C <sub>36</sub> H <sub>70</sub> O <sub>4</sub> Pb	7428-48-0
Lead stearate, dibasic	2PbO / Pb(C <sub>17</sub> H <sub>35</sub> COO) <sub>2</sub>	56189-09-4
Other lead compounds	-	-

## Appendix 2 (Examples of substances and its compounds)

### 2) Cadmium and its compounds

Name	Chemical symbol	CAS No.
Cadmium	Cd	7440-43-9
Cadmium oxide	CdO	1306-19-0
Cadmium sulfide	CdS	1306-23-6
Cadmium zinc sulfide yellow	-	8048-07-5
Cadmium carbonate	CdCO <sub>3</sub>	513-78-0
Cadmium chloride	CdCl <sub>2</sub>	10108-64-2
Cadmium sulfate	CdSO <sub>4</sub>	10124-36-4
Cadmium nitrate	Cd(NO <sub>3</sub> ) <sub>2</sub>	10325-94-7
Cadmium nitrate tetrahydrate	Cd(NO <sub>3</sub> ) <sub>2</sub> 4H <sub>2</sub> O	10022-68-1
Cadmium stearate	Cd(C <sub>18</sub> H <sub>35</sub> O <sub>2</sub> ) <sub>2</sub>	2223-93-0
Other cadmium compounds	-	-

### 3) Mercury and its compounds

Name	Chemical symbol	CAS No.
Mercury	Hg	7439-97-6
Mercury(I) chloride	Hg <sub>2</sub> Cl <sub>2</sub>	10112-91-1
Mercury(II) chloride	HgCl <sub>2</sub>	7487-94-7
Mercury(I) oxide	Hg <sub>2</sub> O	15829-53-5
Mercury(II) oxide	HgO	21908-53-2
Mercury(II) nitrate	Hg(NO <sub>3</sub> ) <sub>2</sub>	10045-94-0
Mercury(I) sulfate	Hg <sub>2</sub> (SO <sub>4</sub> ) <sub>4</sub>	7783-35-9
Mercury(II) fulminate	Hg(CNO) <sub>2</sub>	628-86-4
Mercury(II) acetate	Hg(CH <sub>3</sub> COO) <sub>2</sub>	1600-27-7
Methylmercury salts	CH <sub>3</sub> HgX (X: halogen)	-
Ethylmercury salts	C <sub>2</sub> H <sub>5</sub> HgX	-
Propylmercury salts	C <sub>3</sub> H <sub>7</sub> HgX	-
Methoxyethyl-mercury salts	CH <sub>3</sub> OC <sub>2</sub> H <sub>4</sub> HgX	-
Diphenylmercury	(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> Hg	587-85-9
Dialkylmercury	R <sub>2</sub> Hg(R: alkyl group)	-
Phenylmercury nitrate	C <sub>6</sub> H <sub>5</sub> HgNO <sub>3</sub>	55-68-5
Other mercury compounds	-	-

## Appendix 2 (Examples of substances and its compounds)

### 4) Hexavalent chromium and its compounds

Name	Chemical symbol	CAS No.
Sodium dichromate	$\text{Na}_2\text{Cr}_2\text{O}_7$	10588-01-9
Sodium dichromate, dihydrate	$\text{Na}_2\text{Cr}_2\text{H}_2\text{O}_7$	7789-12-0
Chromium(VI) oxide / Chromium trioxide	$\text{CrO}_3$	1333-82-0
Calcium chromate	$\text{CaCrO}_4$	13765-19-0
Lead(II) chromate	$\text{PbCrO}_4$	7758-97-6
Potassium dichromate	$\text{K}_2\text{Cr}_2\text{O}_7$	7778-50-9
Potassium chromate	$\text{K}_2\text{CrO}_7$	7789-00-6
Lithium chromate	$\text{Li}_2\text{CrO}_4$	14307-35-8
Sodium chromate	$\text{Na}_2\text{CrO}_4$	7775-11-03
Potassium chlorochromate	$\text{K}[\text{CrO}_3\text{Cl}]$	16037-50-6
Ammonium chromate	$(\text{NH}_4)_2\text{CrO}_4$	7788-98-9
Copper chromate	$\text{CuCrO}_4$	13548-42-0
Magnesium chromate	$\text{MgCrO}_4$	13423-61-5
Strontium chromate	$\text{SrCrO}_4$	7789-06-02
Barium chromate	$\text{BaCrO}_4$	10294-40-3
Lead chromate (orange color)	$\text{PbCrO}_4$	1344-38-3
Lead chromate (yellow color)	$\text{PbCrO}_4 + \text{PbSO}_4$	1344-37-2
Dichromium zinc tetraoxide	$\text{Cr}_2\text{O}_4\text{Zn}$	12018-19-8
Zinc chromate	$\text{ZnCrO}_4$	13530-65-9
Zinc dichromate	$\text{ZnCr}_2\text{H}_2\text{O}_7$	14018-95-2
Ammonium dichromate	$(\text{NH}_4)_2\text{Cr}_2\text{O}_7$	7789-09-05
Calcium dichromate	$\text{CaCr}_2\text{O}_7$	14307-33-6
Dichromic acid	$\text{H}_2\text{Cr}_2\text{O}_7$	13530-68-2
Copper chromite	$\text{CuCrO}_3$	12053-18-8
Other hexavalent chromium compounds	-	-

### 5) PBBs (Polybrominated biphenyls)

Name	Chemical symbol	CAS No.
Polybrominated biphenyl (PBB)	$\text{C}_{12}\text{HXBr}_{(10-X)}$	67774-32-7
2-bromodiphenyl	$\text{C}_{12}\text{H}_9\text{Br}$	2502-07-5
3-bromodiphenyl	$\text{C}_{12}\text{H}_9\text{Br}$	2113-57-7
4-bromodiphenyl	$\text{C}_{12}\text{H}_9\text{Br}$	92-66-0
4,4'-Dibromodiphenyl	$\text{C}_{12}\text{H}_8\text{Br}_2$	92-86-4
3,4,5-Tribromodiphenyl	$\text{C}_{12}\text{H}_7\text{Br}_3$	115245-08-4
2,4,6-Tribromodiphenyl	$\text{C}_{12}\text{H}_7\text{Br}_3$	59080-33-0
3,3',4,4',-tetrabromobiphenyl	$\text{C}_{12}\text{H}_6\text{Br}_4$	77102-82-0
2,2',4,5',-tetrabromobiphenyl	$\text{C}_{12}\text{H}_6\text{Br}_4$	60044-24-8
2,2',4,5',6-pentabromobiphenyl	$\text{C}_{12}\text{H}_5\text{Br}_5$	59080-39-6
3,3',4,4',5,5'-Hexabromodiphenyl	$\text{C}_{12}\text{H}_4\text{Br}_6$	60044-26-0
2,2',4,4',5,5'-Hexabromodiphenyl	$\text{C}_{12}\text{H}_4\text{Br}_6$	59080-40-9
2,2',3,3',4,5',6,6'-Octabromodiphenyl	$\text{C}_{12}\text{H}_2\text{Br}_8$	119264-60-7
2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl	$\text{C}_{12}\text{Br}_{10}$	13654-09-6
Other PBBs compounds	-	-

## Appendix 2 (Examples of substances and its compounds)

### 6) PBDEs (Polybrominated diphenylethers)

Name	Chemical symbol	CAS No.
Polybrominated diphenyl ether(PBDE) Polybrominated diphenyl oxide(PBDO) Polybrominated byphenyl ethers(PBBE)	$C_{12}H_{(10-x)}Br_xO$	-
4-Bromophenyldiphenyl ether	$C_{12}H_9BrO$	101-55-3
4,4'-Dibromodiphenyl ether	$C_{12}H_8Br_2O$	2050-47-7
Tribromodiphenyl ether	$C_{12}H_7Br_3O$	49690-94-0
Tetrabromodiphenyl ether	$C_{12}H_6Br_4O$	40088-47-9
Pentabromodiphenyl ether	$C_{12}H_5Br_5O$	32534-81-9
Hexabromodiphenyl ether	$C_{12}H_4Br_6O$	36483-60-0
Heptabromodiphenyl ether	$C_{12}H_3Br_7O$	68928-80-3
Octabromodiphenyl ether	$C_{12}H_2Br_8O$	32536-52-0
Nonabromodiphenyl ether	$C_{12}HBr_9O$	63936-56-1
Decabromodiphenyl ether	$C_{12}Br_{10}O$	1163-19-5
Other PBDEs compounds	-	-

### 7) Polychlorinated biphenyls (PCBs), Polychlorinated Naphthalenes (PCNs), Polychlorinated Terphenyls (PCTs)

Name	Chemical symbol	CAS No.
Polychlorinated biphenyls (PCBs)	$C_{12}H_{10-x}Cl_x$	1336-36-3
Polychlorinated terphenyls (PCTs)	$C_{18}H_{14-x}Cl_x$	61788-33-8
Polychlorinated naphthalenes (PCNs)	$C_{10}H_{8-x}Cl_x$	70776-03-3
Trichloronaphthalene	$C_{10}H_5Cl_3$	1321-65-9
Tetrachloronaphthalene	$C_{10}H_4Cl_4$	1335-88-2
Pentachloronaphthalene	$C_{10}H_3Cl_5$	1321-64-8
Octachloronaphthalene	$C_{10}Cl_8$	2234-13-1
Other PCBs, PCNs, PCTs compounds	-	-

### 8) SCCP (Short Chain Chlorinated Paraffin, C10-13)

Name	Chemical symbol	CAS No.
Short-chain chlorinated paraffine (C10~13)	-	85535-84-8

## Appendix 2 (Examples of substances and its compounds)

### 9) PFOS (Perfluorooctane sulfonate)

Name	Chemical symbol	CAS No.
Ammonium heptadecafluorooctane sulfonate	$C_8H_4F_{17}NO_3S$	29081-56-9
Heptadecafluoro-1-octanesulfonic acid, compound with diethanolamine	$C_{12}H_{12}F_{17}NO_5S$	70225-14-8
Lithium perfluorooctane sulfonate	$C_8F_{17}LiO_3S$	29457-72-5
Heptadecafluorooctane sulfonic acid	$C_8HF_{17}O_3S$	1763-23-1
Potassium perfluorooctane sulfonate	$C_8F_{17}KO_3S$	2795-39-3
Perfluorooctane sulfonyl fluoride		307-35-7
Other PFOS compounds	-	-

### 10) Nickel and its compounds

Name	Chemical symbol	CAS No.
Nickel	Ni	7440-02-0
Nickel(II) oxide	NiO	1313-99-1
Nickel sulfate	$NiSO_4$	7786-81-4
Nickel carbonate	$NiCO_3$	3333-67-3
Nickel chloride	$NiCl_2$	7718-54-9
Dinickel trioxide	$Ni_2O_3$	1314-06-3
Nickel dihydroxide	$NiH_2O_2$	12054-48-7
Nickel acetate	$NiC_4H_6O_4$	373-02-4
Nickel carbonyl	$Ni(CO)_4$	13463-39-3
Other nickel compounds	-	-

### 11) Asbestos

Name	Chemical symbol	CAS No.
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	77536-66-4
Amosite	$(Mg,Fe)_7Si_8O_{22}(OH)_2$	12172-73-5
Anthophyllite	$(Mg,Fe)_7Si_8O_{22}(OH)_2$	77536-67-5
Chrysotile	$Mg_3Si_2O_5(OH)_4$	12001-29-5
Crocidolite	$Na_2F_5Si_8O_{22}(OH)_2$	12001-28-4
Tremolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	77536-68-6

## Appendix 2 (Examples of substances and its compounds)

### 12) Azo compounds

Name	Chemical symbol	CAS No.
2,4,5-Trimethylaniline	$C_9H_{13}N$	137-17-7
2,4-Diaminoanisole	$C_7H_{10}N_2O$	615-05-4
2,4-Toluediamine	$C_7H_{10}N_2$	95-80-7
2-Amino-4-nitrotoluene	$C_7H_8N_2O_2$	99-55-8
2-Naphthylamine	$C_{10}H_9N$	91-59-8
3,3'-Dichlorobenzidine	$C_{12}H_{10}Cl_2N_2$	91-94-1
3,3'-Dimethoxybenzidine	$C_{14}H_{16}N_2O_2$	119-90-4
3,3'-Dimethyl-4,4'diaminodiphenylmethane	$C_{15}H_{18}N_2$	838-88-0
3,3'-Dimethylbenzidine	$C_{14}H_{16}N_2$	119-93-7
4,4'-Diaminodiphenylmethane	$C_{13}H_{14}N_2$	101-77-9
4,4'-Methylene-bis-(2-chloraniline)	$C_{13}H_{12}Cl_2N_2$	101-14-4
4,4'-Oxydianiline	$C_{12}H_{12}N_2O$	101-80-4
4,4'-Thiodianiline	$C_{12}H_{12}N_2S$	139-65-1
4-amino azobenzene	$C_{12}H_{11}N_3$	60-09-3
4-Aminodiphenyl	$C_{12}H_{11}N$	92-67-1
4-Chloro-o-toluidine	$C_7H_8ClN$	95-69-2
Benzidine	$C_{12}H_{12}N_2$	92-87-5
o-Aminoazotoluene	$C_{14}H_{15}N_3$	97-56-3
o-anisidine	$C_7H_9NO$	90-04-0
o-Toluidine	$C_7H_9N$	95-53-4
p-Chloroaniline	$C_6H_6ClN$	106-47-8
p-Cresidine	$C_8H_{11}NO$	120-71-8

### 13) Ugilec 121, 141, DBBT

Name	Chemical symbol	CAS No.
DBBT (Monomethyl dibromo diphenyl methane)	$C_{14}H_{12}Br_2$	99688-47-8
Ugilec 121 (Monomethyl dichloro diphenyl methane)	$C_{14}H_{12}Cl_2$	81161-70-8
Ugilec 141 (Monomethyl tetrachloro diphenyl methane)	$C_{14}H_{10}Cl_4$	76253-60-6

## Appendix 2 (Examples of substances and its compounds)

### 14) Organic tin compounds

Name	Chemical symbol	CAS No.
Bis(tri-n-butyltin) oxide	$O(Sn(C_4H_9)_3)_2$	56-35-9
Tributyltin(TBT)	$(C_4H_9)_3Sn$	56573-85-4
Triphenyltin (TPT)	$(C_6H_5)_3Sn$	668-34-8
Tributyltin bromide	$(C_4H_9)_3SnBr$	1461-23-0
Triphenyltin N,N'-dimethyldithiocarbamate	$(C_6H_5)_3Sn(CH_3)_2NCS_2$	1803-12-9
Triphenyltin fluoride	$(C_6H_5)_3SnF$	379-52-2
Triphenyltin acetate	$(C_6H_5)_3SnOCOCH_3$	900-95-8
Triphenyltin chloride	$(C_6H_5)_3SnCl$	639-58-7
Triphenyltin hydroxide	$(C_6H_5)_3SnOH$	76-87-9
Triphenyltin fatty acid salts (C=9~11)	-	47672-31-1
Triphenyltin chloroacetate	$(C_6H_5)_3SnOCOCH_2Cl$	7094-94-2
Tributyltin methacrylate	$(C_4H_9)_3SnC_4H_5O_2$	2155-70-6, 18380-71-7
Bis(tributyltin) fumarate	$C_2H_2(COO)_2((C_4H_9)_3Sn)_2$	6454-35-9
Tributyltin fluoride	$(C_4H_9)_3SnF$	1983-10-4
Bis(tributyltin) 2,3-dibromosuccinate	$((C_4H_9)_3Sn)_2C_2H_2(Br)_2(COO)_2$	31732-71-5
Tributyltin acetate	$(C_4H_9)_3SnOCOCH_3$	56-36-0
Tributyltin laurate	$(C_4H_9)_3SnC_{12}H_{23}O_2$	3090-36-6
Bis(tributyltin) phthalate	$C_6H_4(COO)_2((C_4H_9)_3Sn)_2$	4782-29-0
Copolymer of alkyl acrylate, methyl methacrylate and tributyltin methacrylate (alkyl; C=8)	-	-
Tributyltin sulfamate	$(C_4H_9)_3SnSO_3NH_2$	6517-25-5
Bis(tributyltin) maleate	$C_2H_2(COO)_2((C_4H_9)_3Sn)_2$	14275-57-1
Tributyltin chloride	$(C_4H_9)_3SnCl$	1461-22-9
Mixture of tributyltin cyclopentane-carboxylate and its analogs (Tributyltin rosin salts)	$(C_4H_9)_3SnSO_3C_5H_9$	26239-64-5
Tributyltin naphthennate	$(C_4H_9)_3Sn(C_{10}H_8)$	85409-17-2
Dibutyltin	$C_8H_{20}Sn$	1002-53-5
Diocetyl tin	$C_{16}H_{36}Sn$	15231-44-4
Dibutyltin X	$C_8H_{20}SnX$	-
Diocetyl tin X	$C_{16}H_{36}SnX$	-
Other organotin compounds	-	-



## Appendix 2 (Examples of substances and its compounds)

### 15) Arsenic and its compounds

Name	Chemical symbol	CAS No.
ARSENIC	As	7440-38-2
TRIETHYL ARSENATE	C <sub>6</sub> H <sub>15</sub> AsO <sub>4</sub>	15606-95-8
ARSENIC ACID DISODIUM SALT, HEPTAHYDRATE	AsH <sub>15</sub> Na <sub>2</sub> O <sub>11</sub>	10048-95-0
ARSENIC ACID, CALCIUM SALT	As <sub>2</sub> Ca <sub>3</sub> O <sub>8</sub>	7778-44-1
ARSENIC ACID, COPPER SALT	As <sub>2</sub> Cu <sub>3</sub> O <sub>8</sub>	10103-61-4
ARSENIC ACID, DIAMMONIUM SALT	AsH <sub>9</sub> N <sub>2</sub> O <sub>4</sub>	7784-44-3
ARSENIC ACID, LEAD SALT	AsHO <sub>4</sub> Pb	7784-40-9
ARSENIC ACID, MAGNESIUM SALT	As <sub>2</sub> Mg <sub>3</sub> O <sub>8</sub>	10103-50-1
ARSENIC PENTOXIDE	As <sub>2</sub> O <sub>5</sub>	1303-28-2
ARSENIC TRICHLORIDE	AsCl <sub>3</sub>	7784-34-1
ARSENIC TRIHYDRIDE	AsH <sub>3</sub>	7784-42-1
ARSENIC TRIOXIDE	As <sub>2</sub> O <sub>3</sub>	1327-53-3
ARSENIOUS ACID, COPPER (II) SALT	AsCuHO <sub>3</sub>	10290-12-7
GALLIUM ARSENIDE	AsGa	1303-00-0
ARSENIOUS ACID, POTASSIUM SALT	AsKO <sub>2</sub>	10124-50-2

### 16) ODCs (Ozone layer depleting substances)

Name	Chemical symbol	CAS No.
Chloroform	CHCl <sub>3</sub>	67-66-3
1,1,2 Trichloroethane	C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub>	79-00-5
1,1,2,2 Tetrachloroethane	C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub>	79-34-5
1,1,1,2 Tetrachloroethane	C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub>	630-20-6
Pentachloroethane	C <sub>2</sub> HCl <sub>5</sub>	76-01-7
1,1 Dichloroethylene	C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	75-35-4
CFC 11	CCl <sub>3</sub> F	75-69-4
CFC 111	C <sub>2</sub> Cl <sub>5</sub> F	354-56-3
CFC 112	C <sub>2</sub> Cl <sub>4</sub> F <sub>2</sub>	76-12-0, 28605-74-5
CFC 113	C <sub>2</sub> Cl <sub>3</sub> F <sub>3</sub>	76-13-1
CFC 114	C <sub>2</sub> Cl <sub>2</sub> F <sub>4</sub>	76-14-2, 1320-37-2
CFC 115	C <sub>2</sub> ClF <sub>5</sub>	76-15-3
CFC 12	CCl <sub>2</sub> F <sub>2</sub>	75-71-8
CFC 13	CClF <sub>3</sub>	75-72-9
CFC 211	C <sub>3</sub> Cl <sub>7</sub> F	422-78-6, 135401-87-5
CFC 212	C <sub>3</sub> Cl <sub>6</sub> F <sub>2</sub>	3182-26-1
CFC 213	C <sub>3</sub> Cl <sub>5</sub> F <sub>3</sub>	2354-06-5
CFC 214	C <sub>3</sub> Cl <sub>4</sub> F <sub>4</sub>	2268-46-4
CFC 215	C <sub>3</sub> Cl <sub>3</sub> F <sub>5</sub>	1652-81-9

## Appendix 2 (Examples of substances and its compounds)

### 16) ODCs (Ozone layer depleting substances)

Name	Chemical symbol	CAS No.
CFC 216	$C_3Cl_2F_6$	661-97-2
CFC 217	$C_3ClF_7$	422-86-6
Halon 1211	$CBrClF_2$	353-59-3
Halon 1301	$CBrF_3$	75-63-8
Halon 2402	$C_2Br_2F_4$	124-73-2
bromochloromethane	$CH_2BrCl$	74-97-5
HBFC-121B4	$C_2HFBr_4$	306-80-9
HBFC-122B3	$C_2HF_2Br_3$	-
HBFC-123B2	$C_2HF_3Br_2$	354-04-1
HBFC-124B1	$C_2HF_4Br$	-
HBFC-131B3	$C_2H_2FBr_3$	-
HBFC-132B2	$C_2H_2F_2Br_2$	75-82-1
HBFC-141B2	$C_2H_3FBr_2$	358-97-4
HBFC-133B1	$C_2H_2F_3Br$	-
HBFC-142B1	$C_2H_3F_2Br$	-
HBFC-151B1	$C_2H_4FBr$	762-49-2
HBFC-21B2	$CHFBr_2$	-
HBFC-221B6	$C_3HFBr_6$	-
HBFC-222B5	$C_3HF_2Br_5$	-
HBFC-223B4	$C_3HF_3Br_4$	-
HBFC-224B3	$C_3HF_4Br_3$	-
HBFC-226B1	$C_3HF_6Br$	-
HBFC-225B2	$C_3HF_5Br_2$	431-78-7
HBFC-22B1	$CHF_2Br$	-
HBFC-231B5	$C_3H_2FBr_5$	-
HBFC-232B4	$C_3H_2F_2Br_4$	-
HBFC-233B3	$C_3H_2F_3Br_3$	
HBFC-234B2	$C_3H_2F_4Br_2$	-
HBFC-235B1	$C_3H_2F_5Br$	460-88-8
HBFC-242B3	$C_3H_3F_2Br_3$	70192-80-2
HBFC-241B4	$C_3H_3FBr_4$	-
HBFC-243B2	$C_3H_3F_3Br_2$	70192-83-5
HBFC-244B1	$C_3H_3F_4Br$	679-84-5
HBFC-251B3	$C_3H_4FBr_3$	75372-14-1
HBFC-253B1	$C_3H_4F_3Br$	421-46-5
HBFC-252B2	$C_3H_4F_2Br_2$	460-25-3
HBFC-261B2	$C_3H_5FBr_2$	51584-26-0
HBFC-262B1	$C_3H_5F_2Br$	-
HBFC-31B1	$CH_2FBr$	-
HBFC-271B1	$C_3H_6FBr$	352-91-0
HCFC-31	$CH_2FCl$	373-52-4
HCFC-121	$C_2HFCl_4$	354-14-3
HCFC-122	$C_2HF_2Cl_3$	354-21-2
HCFC-123	$C_2HF_3Cl_2$	306-83-2
HCFC-124	$C_2HF_4Cl$	2837-89-0

## Appendix 2 (Examples of substances and its compounds)

### 16) ODCs (Ozone layer depleting substances)

Name	Chemical symbol	CAS No.
HCFC-131	$C_2H_2FCl_3$	134237-34-6
HCFC-132	$C_2H_2F_2Cl_2$	25915-78-0
HCFC-133	$C_2H_2F_3Cl$	75-88-7
HCFC-141	$C_2H_3FCl_2$	25167-88-8
HCFC-141b	$C_2H_3FCl_2$	1717-00-6
HCFC-142	$C_2H_3F_2Cl$	25497-29-4
HCFC-142b	$CH_3CF_2Cl$	75-68-3
HCFC-151	$C_2H_4FCI$	1615-75-4
HCFC-21	$CHFCl_2$	75-43-4
HCFC-22	$CHF_2Cl$	75-45-6
HCFC-221	$C_3HFCl_6$	134237-35-7
HCFC-222	$C_3HF_2Cl_5$	134237-36-8
HCFC-223	$C_3HF_3Cl_4$	34237-37-9
HCFC-224	$C_3HF_4Cl_3$	134237-38-0
HCFC-225	$C_3HF_5Cl_2$	128903-21-9
HCFC-225ca	$CF_3CF_2CHCl_2$	422-56-0
HCFC-225cb	$CF_2ClCF_2CHClF$	507-55-1
HCFC-226	$C_3HF_6Cl$	134308-72-8
HCFC-231	$C_3H_2FCl_5$	134190-48-0
HCFC-232	$C_3H_2F_2Cl_4$	134237-39-1
HCFC-233	$C_3H_2F_3Cl_3$	134237-40-4
HCFC-234	$C_3H_2F_4Cl_2$	127564-83-4
HCFC-235	$C_3H_2F_5Cl$	134237-41-5
HCFC-241	$C_3H_3FCl_4$	134190-49-1
HCFC-242	$C_3H_3F_2Cl_3$	134237-42-6
HCFC-243	$C_3H_3F_3Cl_2$	134237-43-7
HCFC-244	$C_3H_3F_4Cl$	134190-50-4
HCFC-251	$C_3H_4FCl_3$	134190-51-5
HCFC-252	$C_3H_4F_2Cl_2$	134190-52-6
HCFC-253	$C_3H_4F_3Cl$	134237-44-8
HCFC-261	$C_3H_5FCl_2$	134237-45-9
HCFC-262	$C_3H_5F_2Cl$	134190-53-7
HCFC-271	$C_3H_6FCI$	134190-54-8
methyl bromide	$CH_3Br$	74-83-9
1,1,1-trichloroethane	$C_2H_3Cl_3$	71-55-6
Carbon tetrachloride	$CCl_4$	56-23-5
Trichloroethylene	$C_2HCl_3$	79-01-06
sulfur hexafluoride	$F_6S$	2551-62-4
HFCs	-	-
PFCs	-	-

## Appendix 2 (Examples of substances and its compounds)

### 17) PAHs (Polycyclic aromatic hydrocarbons)

Name	Chemical symbol	CAS No.
NAPHTHALENE	C <sub>10</sub> H <sub>8</sub>	91-20-3
ACENAPHTHYLENE	C <sub>12</sub> H <sub>8</sub>	208-96-8
ACENAPHTHENE	C <sub>12</sub> H <sub>8</sub>	83-32-9
FLUORENE	C <sub>13</sub> H <sub>10</sub>	86-73-7
PHENANTHRENE	C <sub>14</sub> H <sub>10</sub>	85-01-8
ANTHRACENE	C <sub>14</sub> H <sub>10</sub>	120-12-7
FLUORANTHENE	C <sub>16</sub> H <sub>10</sub>	206-44-0
INDENO[c,d]PYRENE	C <sub>22</sub> H <sub>12</sub>	193-39-5
PYRENE	C <sub>16</sub> H <sub>10</sub>	129-00-0
BENZO[g,h,i]PERYLENE	C <sub>22</sub> H <sub>12</sub>	129-24-2
Benzo(a)pyrene(BaP)	C <sub>20</sub> H <sub>12</sub>	50-32-8
Benzo(e)pyrene(BeP)	C <sub>20</sub> H <sub>12</sub>	192-97-2
Benzoanthracenepyrene(BaA)	C <sub>18</sub> H <sub>12</sub>	56-55-3
Chrysen	C <sub>18</sub> H <sub>12</sub>	218-01-9
Benzofluoranthene(BbFA)	C <sub>20</sub> H <sub>12</sub>	205-99-2
Benzofluoranthene(BjFA)	C <sub>20</sub> H <sub>12</sub>	205-82-3
Benzofluoranthene(BkFA)	C <sub>20</sub> H <sub>12</sub>	207-08-9
Dibenzoanthracene(DBAaH)	C <sub>22</sub> H <sub>14</sub>	53-70-3

### 18) Formaldehydes

Name	Chemical symbol	CAS No.
Formaldehyde	HCHO	50-00-0

### 19) DMF (Dimethylfumarate)

Name	Chemical symbol	CAS No.
Dimethylfumarate	C <sub>6</sub> H <sub>8</sub> O <sub>4</sub>	624-49-7

### 20) VOCs (Volatile Organic Compounds)

Name	Chemical symbol	CAS No.
Benzene	C <sub>6</sub> H <sub>6</sub>	71-43-2
Toluene	C <sub>7</sub> H <sub>8</sub>	108-88-3
Ethylbenzene	C <sub>6</sub> H <sub>5</sub> C <sub>2</sub> H <sub>5</sub>	100-41-4
m-Xylene/ p-Xylene/ o-Xylene	C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub>	108-38-3, 106-42-3, 95-47-6
Styrene	C <sub>8</sub> H <sub>8</sub>	100-42-5
Other VOC compounds	-	-

## Appendix 2 (Examples of substances and its compounds)

### 21) PFOA (Perfluoro octanoic acid)

Name	Chemical symbol	CAS No.
PENTADECAFLUOROOCANOIC ACID	$C_8HF_{15}O_2$	335-67-1
PERFLUOROOCANOIC ANHYDRIDE	$C_{16}F_{30}O_3$	33496-48-9
PERFLUOROOCANOIC ACID AMMONIUM SALT	$C_8H_4F_{15}NO_2$	3825-26-1
Perfluorooctanoic acid sodium salt	$C_8F_{15}NaO_2$	335-95-5
Potassium perfluorooctanoate	$C_8H_2F_{15}KO_2$	2395-00-8
Silver perfluorooctanoate	$C_8AgF_{15}O_2$	335-93-3
Perfluorooctanoyl fluoride	$C_8F_{16}O$	335-66-0
Methyl Perfluorooctanoate	$C_9H_3F_{15}O_2$	376-27-2
Other PFOA compounds	-	-

### 22) Poly vinyl chloride

Name	Chemical symbol	CAS No.
Poly vinyl chloride	$H(CH_2CHCl)_nH$	9002-86-2 / 93050-82-9

### 23) Brominated Chlorinated flame retardants (except PBBs, PBDEs)

Name	Chemical symbol	CAS No.
Tetrabromobisphenol A	$C_{15}H_{12}Br_4O_2$	79-94-7
Tetrabromobisphenol A dimethylether	$C_{17}H_{16}Br_4O_2$	37853-61-5
Tetrabromobisphenol A dibromopropyl ether	$C_{21}H_{20}Br_8O_2$	21850-44-2
Tetrabromobisphenol A bisallylether	$C_{21}H_{20}Br_4O_2$	25327-89-3
Tetrabromobisphenol A bis(2-hydroxyethyl ether)	$C_{19}H_{20}Br_4O_4$	4162-45-2
Tri(2, 3-dibromopropyl) phosphate	$C_9H_{15}Br_6O_4P$	126-72-7
Bis(2, 3-dibromopropyl) phosphate	$C_6H_{11}Br_4O_4P$	5412-25-9
Tetradecabromo (p-diphenoxybenzene)	$C_{18}Br_{14}O_2$	58965-66-5
Bis(2, 4, 6-tribromophenyl) carbonate	$C_{13}H_4Br_6O_3$	67990-32-3
2-Propenoic acid (pentabromophenylmethyl) ester, homopolymer	$(C_{10}H_5Br_5O_2)_n$	59447-57-3
Polystyrene, brominated	$(C_8H_5Br_3)_n$	88497-56-7
1, 2-Bis (2, 4, 6-tribromophenoxy) ethane	$C_{14}H_8Br_6O_2$	37853-59-1
Disodium tetrabromophthalate	$C_8H_2Br_4O_4 \cdot 2Na$	25357-79-3
TBBPA bis (2, 3-dibromopropyl) ether	$C_{21}H_{20}Br_8O_2$	21850-44-2
1H-Isoindole-1, 3(2H)-dione- 2,2'-(1,2-ethanediyl)bis[4,5,6,7-tetrabromo]	$C_{18}H_4Br_8N_2O_4$	32588-76-4
Hexabromocyclododecane (HBCDD)	$C_{12}H_{18}Br_6$	25637-99-4, 3194-55-6, 134237-50-6, 134237-51-7, 134237-52-8

## Appendix 2 (Examples of substances and its compounds)

### 23) Brominated Chlorinated flame retardants (except PBBs, PBDEs)

Name	Chemical symbol	CAS No.
3,4,5,6-Tetrabromo-1,2-benzenedicarboxylic mixed ester s acid, propylene with diethylene glycol and glycol	-	77098-07-8
Polymer of TBBPA, phosgene, and phenol	$(C_7H_5O_2) \cdot (C_{16}H_{10}Br_4O_3)_n \cdot (C_6H_5O)$	94334-64-2
Tris(tribromoneopentyl) phosphate	$C_{15}H_{24}Br_9O_4P$	19186-97-1
TBBPA, 2,2-bis[4-(2,3-epoxypropyloxy) dibromo Phenyl]propane polymer	$(C_{21}H_{20}Br_4O_4)_n \cdot (C_{15}H_{12}Br_4O_2)_n$	68928-70-1
Phosphoric acid, mixed 3-bromo-2,2-dimethylpropyl and 2-bromoethyl and 2-chloroethyl esters	-	125997-20-8
2,4,6-Tribromophenyl terminated carbonate oligomer	$(C_7H_2Br_3O_2) \cdot (C_{16}H_{10}Br_4O_3)_n \cdot (C_6H_2Br_3O)$	71342-77-3
Tetrabromocyclooctane	$C_8H_{12}Br_4$	31454-48-5
Brominated aliphatic Compounds	-	-
Dibromoethyl dibromo cyclohexane	$C_8H_{12}Br_4$	3322-93-8
N,N-Ethylene-bis(tetrabromophthalimide)	$C_{18}H_4Br_8N_2O_4$	32588-76-4
Brominated polystyrene	$(C_8H_5Br_3)_n$	57137-10-7
Tetrabromophthalic anhydride	$C_8Br_4O_3$	632-79-1
Ethylenebis(Tetrabromophthalimide)	$C_{18}H_4Br_8N_2O_4$	32588-76-4
Other BFRs compounds	-	-

### 24) Phthalates

Name	Chemical symbol	CAS No.
Dimethyl phthalate (DMP)	$C_{10}H_{10}O_4$	131-11-3
Diethyl phthalate (DEP)	$C_{12}H_{14}O_4$	84-66-2
Bis(2-ethyl-hexyl) phthalate (DEHP)	$C_{24}H_{38}O_4$	117-81-7
Dibutyl phthalate (DBP)	$C_{16}H_{22}O_4$	84-74-2
Benzyl butyl phthalate (BBP)	$C_{19}H_{20}O_4$	85-68-7
Diisobutyl phthalate (DIBP)	$C_{16}H_{22}O_4$	84-69-5
Di-"isononyl" phthalate (DINP)	$C_{26}H_{42}O_4$	28553-12-1, 68515-48-0
di-"isodecyl" phthalate (DIDP)	$C_{28}H_{46}O_4$	26761-40-0, 68515-49-1
di-n-octyl phthalate (DNOP)	$C_{24}H_{38}O_4$	117-84-0
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUP)	-	68515-42-4
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP)	-	71888-89-6
Other Phthalates compounds	-	-

## Appendix 2 (Examples of substances and its compounds)

### 25) Antimony compounds

Name	Chemical symbol	CAS No.
Antimony trioxide	Sb <sub>2</sub> O <sub>3</sub>	1309-64-4
Antimony pentaoxide	Sb <sub>2</sub> O <sub>5</sub>	1314-60-9

### 26) Beryllium and its compounds

Name	Chemical symbol	CAS No.
BERYLLIUM	Be	7440-41-7
BERYLLIUM CARBONATE	Be <sub>2</sub> CO <sub>3</sub> (OH) <sub>2</sub>	66104-24-3
BERYLLIUM CHLORIDE	BeCl <sub>2</sub>	7787-47-5
BERYLLIUM FLUORIDE	BeF <sub>2</sub>	7787-49-7
BERYLLIUM HYDROXIDE	BeH <sub>2</sub> O <sub>2</sub>	13327-32-7
BERYLLIUM NITRATE	Be.2HNO <sub>3</sub>	13597-99-4
BERYLLIUM PHOSPHATE	BeHO <sub>4</sub> P	13598-15-7
BERYLLIUM SULFATE	Be.H <sub>2</sub> O <sub>4</sub> S	13510-49-1
BERYLLIUM SULPHATE TETRAHYDRATE	BeH <sub>8</sub> O <sub>8</sub> S	7787-56-6
BERYLLIUM OXIDE	BeO	1304-56-9
BERYLLIUM-ALUMINUM ALLOY	-	12770-50-2
BERYLLIUM COPPER AND OTHER METAL ALLOYS CONTAINING GREATER AMOUNTS OF BERYLLIUM	-	-
Other BERYLLIUM compounds	-	-

### 27) Chlorinated flame retardants

Name	Chemical symbol	CAS No.
Tris(2-chloroethyl) phosphate(TCEP)	-	115-96-8
Tris(1,3-dichloro-2-propyl)phosphate (TDCPP)	-	13674-87-8
tris(1-chloro-2-propyl) phosphate(TCPP)	-	13674-84-5
Tetrakis(hydroxymethyl)-phosphonium chloride (THPC)	-	124-64-1
Bis(hexachlorocyclopentadieno)Cyclooctane (Dechlorane A)	-	13560-89-9
Chlorinated polymers and elastomers	-	184963-09-5/ 9002-86-2
Chlorinated paraffins	-	287-477-0/ 63449-39-8/ 85422-92-0/ 85535-84-8/ 85535-85-9
Tris(2-chloropropyl) phosphate	-	6145-73-9

### 28) BPA (bisphenol A)

Name	Chemical symbol	CAS No.
Bisphenol A	C <sub>15</sub> H <sub>16</sub> O <sub>2</sub>	80-05-7

### Appendix 3 (List of biocidal substances in products)

This is a list of biocidal materials managed by LGE, and they are usable or unusable depending on the type of use. When applying antimicrobial/disinfecting functions to products and parts, it is mandatory to confirm whether such an application has been approved by the EU or US regulatory authorities, and the functions can only be applied to the approved uses.

- How to check whether a biocide is approved by EU ECHA or US EPA
  - ① EU ECHA : <http://echa.europa.eu/web/guest/information-on-chemicals/biocidal-active-substances>
  - ② US EPA : <https://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1>
  - ③ Ministry of Environment of Korea: enactment scheduled to be in 2019
  
- List of biocidal substances to be managed(as of June 2018)



List of BPR (June.  
2018)