

For LG Electronics supplier

**LG Electronics manual of the hazardous substance
management in the parts and models**

The Sixth edition

2011. 6. 1



Introduction

LG Electronics make this manual to comply with the global environmental regulations and directives effectively and secure environmentally friendly product competitiveness.

The suppliers of LG Electronics must adhere to LG Electronics' green strategy and policy based on this manual. This manual specifies LG Electronics' global product environmental requirements. The target scope includes subassemblies, parts, raw materials, batteries, packaging materials that are incorporated into LG Electronics brand products. All LG Electronics' products must meet or exceed the applicable legal requirements in each country in which these third-party products will be sold, leased, or marketed.

This manual is regularly updated to be in tune with the revision of the existed global environmental regulation / directives and/or new global environment-regulations. When this manual is updated, it would be spread out for the LG Electronics suppliers and uploaded on the LG Electronics supplier portal.

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Environmental Compliance Group
Eco strategy team
Corporate R&D

Document History

| Edition | Issued | Written by | Contents |
|-------------|-----------------------------|--|---|
| 1st Edition | 18 th Nov, 2004 | Quality Management Team, LG Electronics | The very first preparation of manual throughout the company/ Division/ Distribution to cooperating suppliers 1. Standard of environment-related substance management and operation 2. Standard of environment-related substance analysis result submission |
| 2nd Edition | 10th Mar, 2005 | Quality Management Team, LG Electronics | Outline of environment-friendly certification system (LG Green ship) added Modification in environment-related substance classification and management standard 1. Particulars of environment-friendly certification system promotion added 2. Evaluation check list for environment-friendly certification system of cooperating suppliers added 3. Environment-related substance classification redefined and management standard reorganized 4. Permitted limit of cadmium content in zinc die-cast parts and of hexavalent chromium content in chromate plate parts redefined 5. Particulars of exemption from the recently confirmed RoHS regulation reflected |
| 3rd Edition | 13 th June, 2006 | Quality/Supply Management Team, LG Electronics | Main Change 1. LG Electronics Green Program renamed 2. Maximum Allowable Concentration Value revised 3. Submitted documents and effective term added for mass production items guarantee 4. RoHS Free Mark revised 5. Organization and method for analysis updated |
| | 11 th June, 2006 | Quality/Supply Management Team, LG Electronics | 1. Exceptions of environment-related substance management standard added |

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|--------------------|----------------------------------|--|--|
| <p>4th Edition</p> | <p>May, 2007</p> | <p>Production Research Institute, LG Electronics</p> | <p>1. Main Change Chapter 2. Standard for management of hazardous substances 1) Level A-II/B substances are added and modified - Level A-II added substances: PFOS, PCP, Ugilec 121, 141, DBBT, Phthalate, PVC, BFRs 2) Related regulations, harmfulness, and Analyzing method of detailed standard for managing of environment-related substances are added 3) Analyzing authorities and approving standard for analysis report are up-dated 4) Redefinition of terminology and modification of form for operating Hazardous Substance Management System (HSMS) are reflected</p> |
| <p>5th edition</p> | <p>22nd Aug, 2008</p> | <p>Eco strategy team, LG Electronics</p> | <p>Manual name change and contents divided/deleted 1. Manual for Preparation Environmental Regulations → Guidance manual for management of hazardous substances in product 2. LG ElectronicsGP operation standard / supplier assessment checklist deleted 3. Definition of terms contents arranged - plastic, ICP, XRF, IC, UV/VIS, GS-MS 4. Analyzing Agency List and Analysis report deleted environment-related substance management standard added and changed 1. REACH 52 restriction substances and restricted conditions added 2. REACH 16 SVHC substances added 3. Norway PoHS, new RoHS regulation expected materials added 4. Level B application timeline/phased out time line management, substance added (Phthalates, antimony, beryllium etc) 5. Halogen Free Mark revised</p> |

LG Electronics Manual for hazardous substance management – 6.0 edition

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|------------------|-------------------------------|---|---|
| 5.1 edition | 11 th Nov, 2009 | Eco strategy team, LG Electronics | <p>Hazardous substances management standard changed</p> <ol style="list-style-type: none"> 1. Unit (ppm → mg/kg) 2. Analysis method by the substance 3. Added and deletion exemptions in EU RoHS 4. Lead in Battery (40 → 4 000 mg/kg) 5. Added in management for DMF 6. Level B management criteria change - Product and application time |
| Sixth Edition | 1 st June, 2011 | Eco strategy team, LG Electronics | <ol style="list-style-type: none"> 1. Definitions and Exemptions rearranged to separate groups, e.g. RoHS revised exemption, The candidate list of SVHCs in REACH. 2. Level B substances are separated into Level B-I and B-II. 3. Analysis method and criteria for several substances are added and changed. 4. The date of LG Electronics phase-out substance is breakdown according to the models. |

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1. Purpose

LG Electronics manages the substance / material information of the LG Electronics parts / products including the hazardous substance for the global environmental regulation compliance. In addition, LG Electronics try to conserve the Earth system and ultimately provide a better environment for the next generation.

- To comply with the global environmental laws and regulations, directives;
- To reduce the environmental impact upon the ecosystem; and
- To contribute to the preservation of the global environment.

This manual help the suppliers to comply with the LG Electronics standard of the substance / material information.

2. Scope

This standard is to be applied to the activities of the substance testing and analysis method, Maximum Allowable Concentration Value (MCV) and verification processes performed on all parts, raw materials, packaging materials and batteries, etc. produced and supplied by the LG Electronics suppliers.

2.1 Target

The targets shall satisfy the criteria specified in this manual. Targets are the parts, materials, and other articles that are procured by the LG Electronics, or by third parties to which the LG Electronics' outsources the design and manufacture of its Electronics products.

- 1) Semi-finished products
 - ex) Module parts, function-unit board assemblies and other assembly parts
- 2) Parts
 - ex) Electrical/ electronic parts, steel/ plastic parts, semiconductor elements, PWBs, recording media, packaging substances and packaging parts
- 3) Accessories
- 4) Subsidiary substances required in part and product composition
 - ex) Adhesives, adhesive tapes and soldering substances, etc
- 5) Product manual
- 6) Packaging material
- 7) Battery
- 8) Plastic and plastic constituting substances

2.2 This standard is applied to the following products transacted with LG Electronics

- 1) All products designed, produced, sold and supplied by LG Electronics
- 2) Products designed and produced by the suppliers, but supplied to market with the trademark of LG Electronics attached (ODM¹) part / model)
- 3) Products designed by LG Electronics, produced by the suppliers and supplied to market with the trademark of LG Electronics attached. (OEM²) part / model)

- 1) ODM : Original Design Manufacturing / Manufacturer
- 2) OEM : Original Equipment Manufacturing / Manufacturer

3. Definition of terms

3.1 Classification of Environment-related Substances

1) Level A substances (Prohibited substance)

Level A substances are harmful to human body and environment of the earth, thus are prohibited to use in products by law per each region and country. The intentional use of these substances is prohibited in all items supplied to LG Electronics. For Level A-I substance, suppliers must submit an analysis report issued by a certified organization or a composition table per each substance variety issued and confirmed by raw material supplier as required in part approval to check environment-related substances contained as impurities in parts.

- ① Level A-I : Level A-I substances are six restriction substances (Pb, Cd, Hg, Cr⁶⁺, PBDEs, PBBs) in RoHS Directives. Any use of six restriction substances must be halted immediately. If a parts include any of six restriction substances over the maximum allowable concentration value of LG Electronics, it can't be imported into LG Electronics, and be used into LG Electronics' products.
- ② Level A-II : Level A-II substances are subject to the restriction substances by international / local laws or international conventions except RoHS Directives. These substances are prohibited of use in all parts constituting products of LG Electronics.

2) Level B Substances (Voluntary phase-out substances and Monitored substances)

Level B Substances also divided into Level B-I and Level B-II.

- ① Level B-I : Level B-I substances means the voluntary phase-out substances of LG Electronics. LG Electronics have a plan to phase out several hazardous substances for contribution of the human health and conservation of the environment. Target phase-out substances of LG Electronics are shown in '4.2 Level B-I list (Voluntary phase-out substances)'.
 - ② Level B-II : Level B-II substances are subject to the monitored substances of LG Electronics. These substances refer to substances considered harmful to human being and environment that are not currently prohibited of use, but are scheduled for the information provision and/or prohibition by the law and regulation in the future.
- LG Electronics' divisions should request the test report for Level A-II and Level B-I substances in the part to indentify the inclusion of Level A-II and/or Level B-II substances in the part.
- All parts must be registered the substances / materials information of the part on HSMS

with the evidence such as MSDS, Material composition sheet, Material data sheet, Material declaration etc).

3.2 Maximum Allowable Concentration Value (MCV)

Maximum allowable concentration value means the maximum permitted level of hazardous substance in the part considering unavoidable impurities in the nature and the limitation of current manufacturing and refining techniques and measurement errors of analysis test equipments, except intentional use. It reflects the permitted limit decided by local, regional, and international environment regulations. It shall be recorded by % weight or parts per million (mg/kg).

3.3 Non-use Certification

The non-use certification is used by the supplier to verify that environment-related substances specified by LG Electronics are not contained in the part and/or product supplied with the means of submitting verification data, such as of environment-related substance test result and MSDS (material safety data sheet), to check the information of substance / material composition. If the supplier has a confidential substances in the part, the supplier registers the non-use certification report instead of the substance and/or material information on LG Electronics' hazardous substances management system.

3.4 Contained in Parts / Products

The term 'contained' refers to all cases of where the substances are contained in components and materials used in a part or product or packaging material both intentionally or unintentionally. For example, the following conditions are included.

- adding, blending, filling or adhering a substance
- use a substance in the manufacturing process and remains on or attached to the finished product or its components or materials (for example, if a product risks being contaminated by a mold, tool, or machine that directly contacts the product during the manufacturing process, contamination of such section needs to be regarded as prohibited).

3.5 Impurity

A substance contained in natural materials but which cannot be fully eliminated during the refining process, or which is generated in a reaction process but cannot be eliminated technically.

3.6 Exemptions

Exemptions refer to the cases in which use of a fixed level of environment-related substance is intentionally allowed because it is considered that alternative items are not possible with the currently available technologies, or social impact by the occurrence of an accident after alternation is expected too big.

3.7 Homogeneous materials

“Homogenous Material” means a material that cannot be mechanically disjointed into different materials. The term homogeneous is understood as “of uniform composition throughout”, e.g., individual types of plastics, ceramics, glass, metal, alloys, paper, board, resins and coatings. Paints and painted parts are not homogeneous materials and are to be considered different from each other. Therefore, concentration of environment-related substances in painted and plated layers must be analyzed by measuring the weight of these layers.

3.8 Chemical substance

In chemistry, a chemical substance is a form of matter that has constant chemical composition and characteristic properties. It can not be separated into components by physical separation methods, i.e. without breaking chemical bonds. Chemical substances are often called pure to set them apart from mixtures. A common example of a chemical substance is pure water; it has the same properties and the same ratio of hydrogen to oxygen whether it is isolated from a river or made in a laboratory. Other chemical substances commonly encountered in pure form are diamond, gold, salt (sodium chloride) and sugar (sucrose). Most chemical substances occur as mixtures with other chemical substances. For example, drinking water is a mixture of water, sodium chloride and many other chemical substances. Generally, chemical substances exist as a solid, liquid, gas, or plasma and may change between these phases of matter with changes in temperature or pressure. Chemical reactions convert one chemical substance into another.

3.9 HSMS (Hazardous Substances Management System)

As system managed hazardous substances information in products and parts, request for concerned substances information to suppliers in process of product development. Suppliers have to input for hazardous substances by homogeneous materials.

3.10 Liquid Chromatography (LC)

Liquid chromatography (LC) is a separation technique in which the mobile phase is a liquid. Liquid chromatography can be carried out either in a column or a plane. Present day liquid chromatography that generally utilizes very small packing particles and a relatively high pressure is referred to as high performance liquid chromatography (HPLC).

4. Standard for management of hazardous substances

4.1 Level A list (Substances prohibited to use)

| Type | Substances | Regulation |
|---------------------------|--|---|
| Level A-I | Lead and its compounds | EU RoHS Directive EU Battery Directive EU Packaging Directive US California. Proposition 65 EU REACH Regulation |
| | Cadmium and its compounds | EU RoHS Directive EU Battery Directive EU Packaging Directive EU REACH Regulation |
| | Mercury and its compounds | EU RoHS Directive EU Battery Directive EU Packaging Directive EU REACH Regulation |
| | Hexavalent chromium and its compounds | EU RoHS Directive EU Packaging Directive EU REACH Regulation |
| | PBB (Polybrominated biphenyls) | EU RoHS Directive EU REACH Regulation |
| | PBDE (Polybrominated diphenyl ethers) | EU RoHS Directive EU REACH Regulation |
| Level A-II | Polychlorinated biphenyls (PCBs) | EU REACH Regulation OSPAR Priority Chemicals |
| | Polychlorinated naphthalenes (PCNs) | EU REACH Regulation |
| | Polychlorinated terphenyls (PCTs) | EU REACH Regulation OSPAR Priority Chemicals |
| | Pentachlorophenol (PCPs) | EU REACH Regulation |
| | chlorinated paraffin (SCCP/MCCP) (Short-chain chlorinated paraffin, C10-13/ Medium-chained chlorinated paraffin, C14-C17) | EU REACH Regulation |
| | Perfluoro compounds PFOS(Perfluoro octane sulfonate) PFOA (Perfluoro octanoic acid) | OSPAR Priority Chemicals EU REACH Regulation |
| | Nickel and its compounds | EU REACH Regulation |
| | Asbestos | EU REACH Regulation |
| | Specific 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 / global warming substances | Montreal/Kyoto Protocol EU REACH Regulation |
| | PAHs | EU REACH Regulation Germany GS mark |
| | Formaldehydes | ChemG (Germany) Formalin Act (Denmark) |
| | Dimethylfumarate (DMF) | 2009/251/EC Directive |
| | Toluene, Benzene | EU REACH Regulation |

Note.

(1) Level A substances are prohibited of intentional use in all products, parts, raw materials, subsidiary materials and packaging materials supplied from cooperating suppliers to LG Electronics.
For impurities, which cannot be completely removed due to technical problems, the maximum allowable concentration level has been suggested in “5. Detailed Standard of Environment-related Substance Management”.

- ① Level A-I : 6 substances regulated by RoHS Directive 2002/94/EC
- ② Level A-II : Substances regulated by regulations or agreements except RoHS Directive 2002/94/EC

4.2 Level B-I list (Voluntary phase-out substances)

| Type | Substances | Application | |
|-------------|---|---------------------------------|--------------------------------|
| | | Product group | Phase-out date (MM/DD/YYYY) |
| Level B-I | Poly vinyl chloride | Mobile phone | 01 / 01/ 2010 |
| | | TV, Monitor, PC | 01 / 01/ 2013 |
| | | Household appliance | 01 / 01/ 2015 |
| | Bromated Flame Retardants (Except PBB, PBDE) | Mobile phone | 01 / 01/ 2010 |
| | | TV, Monitor, PC | 01 / 01/ 2013 |
| | | Household appliance | 01 / 01/ 2015 |
| | Phthalates | Mobile phone, PC | 01 / 01/ 2011 |
| | | TV, Monitor | 01 / 01/ 2013 |
| | | Household appliance | 01 / 01/ 2015 |
| | Antimony and its compounds | Mobile phone TV, Monitor, PC | 01 / 01/ 2013 |
| | | Household appliance | 01 / 01/ 2015 |
| | Beryllium and its compounds | All products | 01 / 01/ 2013 |
| | Chlorinated flame retardants | Mobile phone | 01 / 01/ 2010 |
| Musk xylene | All products | 09/ 01/ 2014 | |

Note.

(1) LG Electronics will phase out Level B-I substances about new model of the product group after the phase-out date as mentioned in the upper table.

(2) LG Electronics provide the voluntary phase-out program and models at :

<http://www.lg.com/global/sustainability/environment/details-of-hazardous-substances.jsp>

4.3 Level B-II list (Monitored substances)

| Type | Substances |
|------------------------|---|
| Level B-II | Cobalt and its compounds, including alloy |
| | Selenium and its compounds, including alloy |
| | Bismuth and its compounds, including alloy |
| | Volatile Organic Compound- Emission |
| | Bisphenol A |
| | Triclosan |
| | Surfactant |
| | Chlorinated flame retardants |
| | Boron and its compounds |
| | Acrylamide |
| | 2-methoxyethanol |
| | 2-ethoxyethanol |
| | 2-ethoxyethyl acetate |
| | Hydrazine |
| | 1-methyl-2-pyrrolidone |
| 1,2,3-trichloropropane | |

4.4 The criteria of the verification data for the material information

The supplier shall upload the following data on HSMS at the stage / process of new product approval, 4M modification, and first article evaluation. In case of the LG Electronics request the verification data, the supplier shall submit it.

1) At the stage of new approval and 4M modification of the part.

① Test report *

- Each company and/or division of LG Electronics has the criteria of the validation period of the test report. Therefore the supplier check the criteria of the validation period of the test report.

② Non-use certification report / Warranty.

③ MSDS or Mill sheet or Material Composition sheet, Material declaration etc.

④ Samples (more than 5, raw material condition when necessary)*

* If a LG Electronics company (or division) request the test report, the supplier shall submit the test report to the department in charge of the examination for hazardous substances directly.

2) At the stage of first article evaluation

① Simplified analysis result (Desk-type XRF, Portable XRF etc) *

② Samples (more than 5, raw material condition when necessary) *

* If a LG Electronics company (or division) request the test report, the supplier shall submit the test report to the department in charge of the examination for hazardous substances directly.

3) Periodical guarantee of parts for mass production

① Test report – If the validation period of test report is expired, it would be renewed. **

② semi analysis result (XRF etc) *

③ Samples (more than 5, raw material condition when necessary)*

* If a LG Electronics company (or division) requests the test report, the supplier shall submit the test report to the department in charge of the examination for hazardous substances directly.

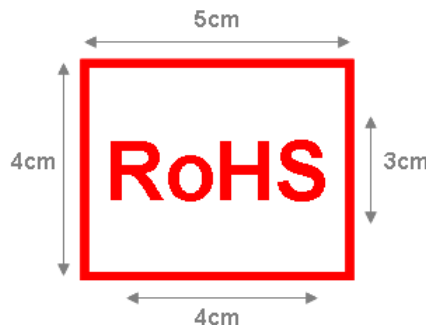
- Each company and/or division of LG Electronics has the criteria of the validation period of the test report. Therefore the supplier checks the criteria of the validation period of the test report.

4) Common mandatory data

The supplier shall register the material information of the part on HSMS, before it is supplied into LG Electronics.

4.5 Identification of RoHS free part.

If RoHS 6 restriction substances aren't included in the part, the supplier shall attach the below Red mark on the packaging box at the delivery of mass production lot and first article for mass production. However, if the LG Electronics agree the different identification mark of the supplier, the supplier can use the different mark.



① Size

- Well-recognized size (Free size)
- The upper mark is recommended for the large packaging box
- If the supplier use small packaging (ex. Reel), it is acceptable that the mark is smaller than the upper mark

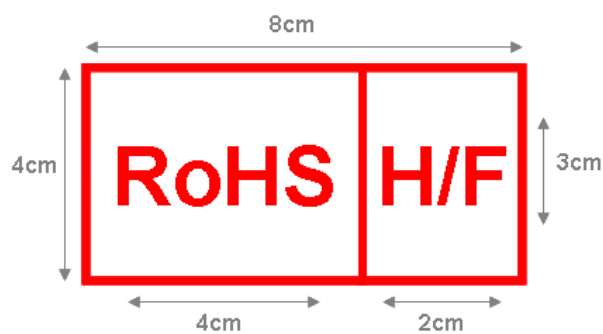
② Color

- Red color is basically recommended for letter and boundary

- Black color is allowed if the mark is printed on the label.
- ③ Position and attaching method for the mark
 - Well-recognizable shape outside packaging (Print/Stamp/Label etc.)
 - Attached the mark up to small packaging such as the reel for small circuits like IC and Chip SIZE

4.6 Identification of Halogen free part

If the RoHS 6 restriction substances and Halogen (Br, Cl) aren't included in the part, the supplier shall attach the below red mark on the packaging box(carton box, inner box, reel etc.) of the part at the delivery of mass production lot and first article for mass production.



- ① Size
 - Well-recognized size (Free size)
 - The upper mark is recommended for the large packaging box
 - If the supplier use small packaging (ex. Reel), it is acceptable that the mark is smaller than the upper mark
- ② Color
 - Red color is basically recommended for letter and boundary
 - Black color is allowed if the mark is printed on the label.
- ③ Position and attaching method for the mark
 - Well-recognizable shape outside packaging (Print/Stamp/Label etc.)
 - Attached the mark up to small packaging such as the reel for small circuits like IC and Chip SIZE

4.7 The work process that the supplier's part included the hazardous substances over the LG Electronics criteria.

- 1) If any products and parts contain the 6 restriction substances of RoHS Directives (Level A-I substances), they can't import into LG Electronics. And then LG Electronics stop to trade the supplier which imported the part including any of the 6 restriction substances of RoHS Directives. The suppliers shall prepare and submit an improvement plan for the parts concerned. In addition, the supplier improves the part not to include any RoHS restriction

substances and verifies the non use of 6 RoHS restriction substances in the part with the verification data such as the test report, XRF data etc.

- 2) Also, Level A-II must not be used in parts and products. If LG Electronics of supplier detect Level A-II substances in the parts and products, LG Electronics stop to trade the parts and products immediately.
- 3) 'No Detection' means the supplier should verify that the substances are not used in its parts/products, packaging materials and batteries (non-use certificate: Mill-sheet, MSDS, or Material declaration, Material composition sheet etc.).

4.8 Voluntary phase-out substances / Monitored substances (Level B-I, B-II)

LG Electronics have a plan to phase out several hazardous substances for contribution of the human health and conservation of the environment. When LG Electronics' divisions should request the test report to indentify the inclusion of Level B-I substances in the part, the supplier shall submit the test report to the department in charge of the hazardous substance management of the division/company.

Level B-II substances are subject to the monitored substances of LG Electronics. LG Electronics monitored Level B-II substances on HSMS. Therefore All parts must be registered the substances / materials information of the part on HSMS with the evidence such as MSDS, Material composition sheet, Material data sheet, Material declaration etc).

- For applicable products by each substance, suppliers must meet standard defined in "5. Detailed standard for environment-related substances" .

5. Detailed standard for the environment-related substances

[General notice]

- ① The test report for Level A-I substances (RoHS 6 restriction substances) must be submitted and LG Electronics checked it at the stage of part approval. The supplier shall submit the test report of Level A-II substances if a LG Electronics division and/or company can request the test report to the supplier.
- ② The evidence must be upload on HSMS by the CAS No., weight, the percentage of material and purpose of usage for detailed chemical substances used for all homogeneous materials and parts.
- ③ Fundamentally, all the part must be followed the standards as mentioned in '5. Detailed standard for the environment-related substances' 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 must follow it.

5.1 Level A-I Substances

(1) Pb, Lead and its compounds

a. Maximum Allowable Concentration Level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| ① Plastic, rubber, painting, ink, coating, adhesives, tape, label, paper | | 100 mg/kg |
| ② Solder (bar/wire/cream solder, solder ball), Pb inside of lead-wire plating of parts | | 800 mg/kg |
| ③ All parts except ① and ② | | 500 mg/kg |
| Main Containing Purpose | Rubber hardener, pigment, paint and varnish, lubricant, plastic stabilizer, battery material, free cutting brass/carbon steel, optics materials, soldering, rubber vulcanizing agent, derivative material, resin stabilizer, plating material, alloy element, resin additives | |
| Harmfulness | The central nerve damage, joint weakening, high blood pressure, brain damage, sterility and miscarriage, sperm reducing by tissue damage | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3051, EPA 3052, EPA 3050B, ASTM E350 * If waste matter is occurred by applying EPA 3052, EPA 3050B, analyze with complete disassembly and declare analyzing process | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) REACH restriction (Annex 17)

b. Exemptions

- Lead in glass of cathode ray tubes
- Lead in glass of fluorescent tubes not exceeding 0.2%
- Lead as an alloying element in steel for machining purposes and in galvanized steel containing up to 0.35% lead by weight

- Lead as an alloying element in aluminium containing up to 0.4% lead by weight
- Copper alloy containing up to 4% lead by weight
- Lead in high melting temperature type solders (i.e. lead-based alloys containing 85 % by weight or more lead)
- Lead in solders for servers, storage and storage array systems, network infrastructure equipment for switching, signalling, transmission, and network management for telecommunications
- 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
- Lead in dielectric ceramic in capacitors for a rated voltage of 125V AC or 250V DC or higher
- Lead in dielectric ceramic in capacitors for a rated voltage of less than 125V AC or 250V DC (Expires on 1 January 2013 and after that date may be used in spare parts for EEE placed on the market before 1 January 2013)
- Lead in bearing shells and bushes for refrigerant-containing compressors for heating, ventilation, air conditioning and refrigeration (HVACR) applications
- Lead used in C-press compliant pin connector systems (May be used in spare parts for EEE placed on the market before 24 September 2010)
- Lead used in other than C-press compliant pin connector systems (Expires on 1 January 2013 and after that date may be used in spare parts for EEE placed on the market before 1 January 2013)
- 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 September 2010)
- Lead in white glasses used for optical applications
- Lead in filter glasses and glasses used for reflectance standards
- 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 January 2011 and after that date may be used in spare parts for EEE placed on the market before 1 January 2011)
- Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit flip chip packages
- Lead in linear incandescent lamps with silicate coated tubes (Expires on 1 September 2013)
- Lead halide as radiant agent in high intensity discharge (HID) lamps used for professional reprography applications
- 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)₂MgSi₂O₇:Pb) (Expired on 1 January 2011)
- 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 (BaSi₂O₅:Pb)
- 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)
- 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)
- Lead in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses
- 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 September 2010)

- Lead in solders for the soldering to machined through hole discoidal and planar array ceramic multilayer capacitors
- Lead oxide in surface conduction electron emitter displays (SED) used in structural elements, notably in the seal frit and frit ring
- Lead oxide in the glass envelope of black light blue lamps (Expires on 1 June 2011)
- 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 September 2010)
- Lead bound in crystal glass as defined in Annex I (Categories 1, 2, 3 and 4) of Council Directive 69/493/EEC
- Lead in soldering materials in mercury free flat fluorescent lamps (which e.g. are used for liquid crystal displays, design or industrial lighting)
- Lead oxide in seal frit used for making window assemblies for Argon and Krypton laser tubes
- Lead in solders for the soldering of thin copper wires of 100 µm diameter and less in power transformers
- Lead in cermet-based trimmer potentiometer elements
- Lead in the plating layer of high voltage diodes on the basis of a zinc borate glass body

(2) Cd, Cadmium and its compounds

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| ① Rubber, plastic, paints, inks, and plastic surface treatment, adhesives, tape, label, paper | | 10 mg/kg |
| ② All parts except ① | | 75 mg/kg |
| Main Containing Purpose | 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 | |
| Harmfulness | Stomach cramps, the kidney damage, high blood pressure, serum ferritin reducing, the central nerve and brain damage | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3052, EPA 3050B, EN1122, ASTM E 351 * If waste matter is occurred by applying EPA 3052, EPA 3050B, analyze with complete disassembly and declare analyzing process | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) REACH restriction (Annex 17).

b. Exemptions

- Cadmium and its compounds in one shot pellet type thermal cut-offs
- Cadmium and its compounds in electrical contacts
- Cadmium in filter glasses and glasses used for reflectance standards
- Cadmium in printing inks for the application of enamels on glasses, such as borosilicate and soda lime glasses
- 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

- Cadmium and cadmium oxide in thick film pastes used on aluminum bonded beryllium oxide
- Cadmium in color converting II-VI LEDs (< 10 µg Cd per mm² of light-emitting area) for use in solid state illumination or display systems (Expires on 1 July 2014)

(3) Hg, Mercury and its compounds

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|--|---|---------------------------------------|
| Interior and exterior plastic, paint and varnish, ink, coating/soldering, wattmeter, electrical contacts (relay, switch, sensor) | | 500 mg/kg |
| Main Containing Purpose | Fluorescent material, electrical contacts material, pigment, anti-corrosion preparation, high efficiency illuminant, antibiosis treatment | |
| Harmfulness | Vomiting, wheal, eye spasm, the kidney and brain damage, visually handicap, loss of eyesight, failing of memory | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3052, ISO 3856-7, EN12497 | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) REACH restriction : any totally or partly submerged appliances or equipment, in the preservation of wood, in the impregnation of heavy-duty industrial textiles and yarn intended for their manufacture, in the treatment of industrial waters/irrespective of their use. (Annex 17)

b. Exemptions

- Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):
 - (a) For general lighting purposes < 30 W: 5 mg (Expires on 31 December 2011; 3,5 mg may be used per burner after 31 December 2011 until 31 December 2012; 2,5 mg shall be used per burner after 31 December 2012)
 - (b) For general lighting purposes ≥ 30 W and < 50 W: 5 mg (Expires on 31 December 2011; 3,5 mg may be used per burner after 31 December 2011)
 - (c) For general lighting purposes ≥50 W and < 150 W: 5 mg
 - (d) For general lighting purposes ≥ 150 W: 15 mg
 - (e) structural shape and tube diameter ≤ 17 mm For general lighting purposes with circular or square (No limitation of use until 31 December 2011; 7 mg may be used per burner after 31 December 2011)
 - (f) For special purposes: 5 mg
- Mercury in double-capped linear fluorescent lamps for general lighting purposes not exceeding (per lamp):
 - (a) Tri-band phosphor with normal lifetime and a tube diameter < 9 mm (e.g. T2): 5 mg (Expires on 31 December 2011; 4 mg may be used per lamp after 31 December 2011)
 - (b) Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≤ 17 mm (e.g. T5): 5 mg (Expires on 31 December 2011; 3 mg may be used per lamp after 31 December 2011)
 - (c) Tri-band phosphor with normal lifetime and a tube diameter > 17 mm and ≤ 28 mm (e.g. T8): 5 mg (Expires on 31 December 2011; 3,5 mg may be used per lamp after 31 December 2011)
 - (d) Tri-band phosphor with normal lifetime and a tube diameter > 28 mm (e.g. T12): 5 mg (Expires on 31

December 2012; 3,5 mg may be used per lamp after 31 December 2012)

- (e) Tri-band phosphor with long lifetime ($\geq 25\,000$ h): 8 mg (Expires on 31 December 2011; 5 mg may be used per lamp after 31 December 2011)
- Mercury in other fluorescent lamps not exceeding (per lamp):
 - (a) Linear halophosphate lamps with tube > 28 mm (e.g. T10 and T12): 10 mg (Expires on 13 April 2012)
 - (b) Non-linear halophosphate lamps (all diameters): 15 mg (Expires on 13 April 2016)
 - (c) Non-linear tri-band phosphor lamps with tube diameter > 17 mm (e.g. T9) (No limitation of use until 31 December 2011; 15 mg may be used per lamp after 31 December 2011)
 - (d) Lamps for other general lighting and special purposes (e.g. induction lamps) (No limitation of use until 31 December 2011; 15 mg may be used per lamp after 31 December 2011)
- Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for special purposes not exceeding (per lamp):
 - (a) Short length (≤ 500 mm) (No limitation of use until 31 December 2011; 3,5 mg may be used per lamp after 31 December 2011)
 - (b) Medium length (> 500 mm and $\leq 1\,500$ mm) (No limitation of use until 31 December 2011; 5 mg may be used per lamp after 31 December 2011)
 - (c) Long length ($> 1\,500$ mm) (No limitation of use until 31 December 2011; 13 mg may be used per lamp after 31 December 2011)
- Mercury in other low pressure discharge lamps (per lamp) (No limitation of use until 31 December 2011; 15 mg may be used per lamp after 31 December 2011)
- Mercury in High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner) in lamps with improved colour rendering index $R_a > 60$:
 - (a) $P \leq 155$ W
(No limitation of use until 31 December 2011; 30 mg may be used per burner after 31 December 2011)
 - (b) $155\text{ W} < P \leq 405\text{ W}$ (No limitation of use until 31 December 2011; 40 mg may be used per burner after 31 December 2011)
 - (c) $P > 405\text{ W}$
(No limitation of use until 31 December 2011; 40 mg may be used per burner after 31 December 2011)
- Mercury in other High Pressure Sodium (vapour) lamps for general lighting purposes not exceeding (per burner):
 - (a) $P \leq 155\text{ W}$
(No limitation of use until 31 December 2011; 25 mg may be used per burner after 31 December 2011)
 - (b) $155\text{ W} < P \leq 405\text{ W}$ (No limitation of use until 31 December 2011; 30 mg may be used per burner after 31 December 2011)
 - (c) $P > 405\text{ W}$
(No limitation of use until 31 December 2011; 40 mg may be used per burner after 31 December 2011)

2011)

- Mercury in High Pressure Mercury (vapour) lamps (HPMV) (Expires on 13 April 2015)
- Mercury in metal halide lamps (MH)
- Mercury in other discharge lamps for special purposes not specifically mentioned in this Annex

(4) Cr⁶⁺, Hexavalent chromium and its compounds

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| ① Plastic, rubber, painting, ink, non-plating parts as metal/plastic coating ¹⁾ | | 500 mg/kg |
| ② Hexavalent chromium surface treatment parts (Screw, Bolt, Nut, plate etc.) and electroplating ²⁾ | | Not Detected (ban to use) |
| ③ Soluble Cr6+ of the cement ^{3,4)} | | The total dry weight ≤ 2 mg/kg |
| Main Containing Purpose | Paints, pigment, ink, catalyzer, plating, corrosion protection surface treatment, dyes, pigment desiccant, surface treatment, chromate treatment, adhesion improvement for pigment | |
| Harmfulness | Sniff, sneeze, nose bleeding, tumor, convulsions, asthma, lung cancer, the kidney and liver damage, sudden death | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3060A/7196A, ISO 3613 | |
| Measurement | UV-VIS, IC | |

- 1) For ① parts like plastic and rubber, if total Cr(measured by ICP or AAS) could not be detected, that data can be the Cr6+ data.
- 2) Every surface treatment parts must not use Cr6+ intendedly, and Cr6+ should not be detected on electroplating. For close analysis for parts, standard for Not Detected (ban to use) is detection limit standard of each analyzing regulation.
- 3) Prohibit intentionally using Cr6+, and Cr3+ chromate limit value is 3mg/kg.(in close analysis by part)
- 4) Included in conditions of REACH restriction (Annex 17).

b. Exemptions

- 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

(5) PBBs (Polybrominated biphenyls)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| Plastic | | 500 mg/kg |
| Main Containing Purpose | Flame retardants | |
| Harmfulness | Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3040C etc. | |
| Measurement | GC-MS | |

1) REACH restriction (Annex 17).

(6) PBDEs (Polybrominated diphenylethers)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| Plastic | | 500 mg/kg |
| Main Containing Purpose | Flame retardants | |
| Harmfulness | Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage | |
| Analyzing method | IEC 62321 (Ed. 1 111/116/FDIS), EN 62321:2009, EPA 3040C etc. | |
| Measurement | GC-MS | |

1) REACH restriction : Shall be prohibited in a concentration equal to or greater than 0,1 % in substances and constituents of preparations placed on the market. (Annex 17)

5.2 Level A-I Substances

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

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts ^{1), 2)} | | 50 mg/kg |
| Main Containing Purpose | - Plasticizer for insulating oil, heat medium, specific lubricant, insulating properties, and heat-resisting insulation of transformer/condenser/paper condenser - Machine oil, plasticizer, pigment, copy paper as heat medium, which need heat like 200 ~ 400 °C - Flame retardant pigment, Chlorinated Rubber pigment, vinyl pigment, polyurethane pigment, pigment (weatherproofed, polish, insulation), printing ink | |

| | |
|------------------|--|
| Harmfulness | Abnormal symptom on skin, loss of hair, weight losses, the central nerve, liver, kidney, thyroid gland, and immune system damage |
| Analyzing method | EPA 8082 etc |
| Measurement | GC/MS |

1) Polychloronaphthalence (PCN) is prohibited to use in case that the number of chlorine is more than 4

2) Included in conditions of REACH restriction (Annex 17).

(2) Pentachlorophenol (PCP)

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts ¹⁾ | | 1 000 mg/kg |
| Main Containing Purpose | Embalmmment and preservative for processed goods | |
| Harmfulness | High epispastic, Acute Oral Toxicity, dermal toxicity, cancer-causing, and more poisonous cancer-causing material is occurred by incineration | |
| Analyzing method | DIN 53313 | |
| Measurement | GC/MS | |

1) REACH restriction (Annex 17).

(3) SCCP/MCCP (Short-chain chlorinated paraffin, C10-13/ Medium-chained chlorinated paraffin, C14-C17)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts | | 1 000 mg/kg |
| Main Containing Purpose | PVC plasticizer, flame retardant | |
| Harmfulness | Cancer-causing, possible to generate dioxin by incineration | |
| Analyzing method | EPA 3540C, 3550C etc., Extraction with organic solvent etc | |
| Measurement | GC/MS | |

1) REACH Restriction : Shall not be placed on the market for use as substances or as constituents of other substances or preparations in concentrations higher than 1 %: in metalworking / for fat liquoring of leather. (Annex 17)

(4) Perfluorooctyl compounds (Perfluorooctyl sulfonate, PFOS / Perfluorooctyl acid , PFOA)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| Substance and Preparation | | 50 mg/kg |
| Article and parts | | 1 000 mg/kg |

| | | |
|----------------------------|--|---------------------|
| Textiles, coating material | | 1 µg/m ² |
| Main Containing Purpose | PFOS (carpet, textiles, cotton, leather, clothes, paper packaging, Metal plating, Fire fighting foam) PFOA (fire fighting foam, antiseptic) | |
| Harmfulness | High persistent, Bioaccumulative, toxicity for mammalia | |
| Analyzing method | Solvent Extraction | |
| Measurement | LC-MS | |

1) Exemptions for PFOS

- Photoresist or anti-reflection coating use for photolithography
- Coating for photo used for film and paper print lithography
- Mist suppressants for nondecorational chrome plating
- Aircraft hydraulic fluid

(5) Nickel and its compounds

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| Exterior plating parts contact with customer body continuously (earphone, necklace, handle, mobile phone, etc.) | | 0.5 µg -Ni/cm ² /week |
| Main Containing Purpose | Coating or alloy compounds, surface treatment(coating), bottom layer coating of parts, protecting coating, accessory coating | |
| Harmfulness | Allergy stimuli | |
| Analyzing method | EN 1811, EN 12471, EN 12472 | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) REACH restriction : banned to use on parts, materials, and surface treatment which contact with the skin directly. (Annex 17)

(6) Asbestos

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| Fire-resistant, lagging materials, heat insulator, electric insulator, filter | | Not Detected |
| Main Containing Purpose | Asbestos fibers, insulator, packing material, abrasive material, heat insulating material, fireproof material | |
| Harmfulness | Lung cancer, Asbestosis | |
| Analyzing method | NIOSH 9000, NIOSH 9002, NIOSH 7402 etc | |
| Measurement | XRD, PLM, TEM | |

1) REACH restriction (Annex 17).

(7) Azo compounds

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| Textiles and leather contact with customer body continuously (belt, leather strap, earphone, headphone, shoulder pad, etc.) | | 30 mg/kg |
| Main Containing Purpose | Paint, pigment, coloring agent for textiles and leather | |
| Harmfulness | 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 | |
| Analyzing method | Leather : CEN ISO/TS 17234, Textiles : EN 14362-1,2 | |
| Measurement | GC/MS | |

1) REACH restriction : shall not be placed on the market or used for coloring textile and leather articles as a substance or constituent of preparations in concentrations higher than 0,1 % by mass, and azodyes over 30mg/kg shall not be used in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity. (Annex 17)

2) Diaminodiphenylmethane (MDA) shall not be used in substance, part and product after Aug. 2014

(8) Ugilec 121, 141, DBBT

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts ¹⁾ | | Not Detected |
| Main Containing Purpose | Electric transformer insulating oil, plasticizer, flame retardants, excavator antifricition | |
| Harmfulness | Non resolvability, possible to generate dioxin, all most production stop since 1990's | |
| Analyzing method | EPA 3540C, Solvent Extraction | |
| Measurement | GC/MS | |

1) REACH restriction (Annex 17).

(9) Organic tin compounds

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts ¹⁾ | | 1 000 mg/kg |
| Main Containing Purpose | PVC stabilizer, antioxidant, antifungal, antipollution, Painting, ink, sterilizer, antiseptic, Antifoulant biocides | |
| Harmfulness | Wild ecosystem destruction, cancer-causing, nerve disorder materials, immune system disorder materials | |
| Analyzing method | DIN 17353, DIN 38407, KS K 0737 etc. | |
| Measurement | GC-MS | |

1) REACH restriction: paint, Shall not be placed on the market for use as substances and constituents of preparations when acting as biocides in free association paint. Shall not be any totally or partly submerged appliance or equipment and preparations intended for use in the treatment of industrial waters. (Annex 17)

(10) Arsenic and its compounds

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts ²⁾ | | 100 mg/kg |
| Main Containing Purpose | Paint, ink, sterilizer, wood preservative | |
| Harmfulness | vomiting, skin browning/blackening, red blood cell reducing, loss of appetite, enlarged spleen, dry eruption | |
| Analyzing method | EPA 3052, EPA 3050B, EN 1122 $\frac{2}{\infty}$ Microwave digestion | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) REACH restriction: Shall not be any totally or partly submerged appliances or equipment; (b) in the preservation of wood. Furthermore, wood so treated shall not be placed on the market. (Annex 17)

2) Exemption for parts of semiconductor, glass, magnetic filter, copper foil and battery

(11) Ozone layer depleting / global warming substances

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts | | Not Detected |
| Main Containing Purpose | Refrigerant, foaming agent, digestive, detergent | |
| Analyzing method | EPA 5021A, EPA 8260B, PNNL-16813 | |
| Measurement | GC-MS, GC-ECD, Headspace | |

1) REACH restriction (Annex 17).

(12) PAHs (Polycyclic aromatic hydrocarbons)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|--|--|---------------------------------------|
| Rubber, plastic, rubber foam used in parts possible contact in body, polymer | | Not Detected |
| Main Containing Purpose | Cable, Plug, Plastic shaft, Plastic package, box, Strange smell plastic, Rubber product, Rubber shaft, coating agent | |
| Harmfulness | DNA change, harmful , mutation, cancer | |
| Analyzing method | EPA 8100, EPA 3540C/8270D, ISO 187287 etc | |
| Measurement | GC-MS | |

1) REACH restriction: Shall not be used in tier (Annex 17)

(13) Formaldehydes

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum allowable concentration level |
|---|--|--|
| Wooden products like HWPW-VC / HWPW-CC / PB / MDF, (Fiberboard, plywood, speaker, shelf, etc.) / Thin MDF | | 0.05 ¹⁾ / 0.08 ²⁾ / 0.09 ³⁾ / 0.11 ⁴⁾ / 0.21 ⁵⁾ mg/kg |
| Other product and parts (adhesive, vinyl, tape etc.) | | 0.1 mg/kg or 0.15 mg/m ³ |
| Main Containing Purpose | Wooden product, adhesives, sterilizer, antiseptic, coating agent | |
| Harmfulness | Cancer-causing, promoting cancer-causing, atopic dermatitis, allergy | |
| Analyzing method | VDA275, DIN53315, ISO 16000 etc. Chamber | |
| Measurement | HPLC-UV, UV-VIS | |

- 1) In case of HWPW-VC, apply to 0.05 mg/kg from 1. Jan. 2010
- 2) In case of HWPW-CC, apply to 0.05 mg/kg from 1. July. 2012
- 3) In case of PB, apply to 0.09 mg/kg from 1. Jan. 2011
- 4) In case of MDF, apply to 0.11 mg/kg from 1. Jan. 2011
- 5) In case of Thin MDF, apply to 0.13 mg/kg from 1. Jan. 2012.

(14) Dimethylfumarate (DMF)

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum allowable concentration level |
|-------------------------------|---|---------------------------------------|
| All parts | | Not Detected |
| Main Containing Purpose | Leather, insecticide treatment in wrapped fiber product or must protection agent | |
| Harmfulness | Easily passing skin due to strong fat-solubility, strong stimulus into eyes, eczema | |
| Analyzing method | EPA 3540C, Solvent Extraction | |
| Measurement | GC-MS | |

(15) Toluene, Benzene

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---------------------------------------|
| Adhesive, paint | | 1 000 mg/kg |
| Main Containing Purpose | Solvent (toluene, benzene) | |
| Harmfulness | Atopic dermatitis, allergy, head ache, lethargic | |
| Analyzing method | EPA 5012 A | |

| | |
|-------------|-----------------|
| Measurement | Headspace-GC-MS |
|-------------|-----------------|

1) REACH restriction: Shall not be used in Adhesive, spray paint (Annex 17)

5.3 Level B-I Substances

(1) PVC, Poly vinyl chloride

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts | | Not Detected |
| Main Containing Purpose | Insulation, poly vinyl electric wire, tube, power supply code | |
| Harmfulness | 1. 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 2. Lots of hydrogen chloride could be occurred by pyrolyzing PVC 3. Experiments on animals discover that long-term exposure causes damage on sperm and testicles | |
| Analyzing method | KS 0210 etc | |
| Measurement | Beilstein-Test or FT-IR | |

(2) Bromated Flame Retardants (Except PBBs, PBDEs)

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|--|
| All parts contain plastic including flame retardant | | HBCDD 1 000 mg/kg Others : 900 mg/kg (Total Br) |
| Main Containing Purpose | Plastic as PCB | |
| Harmfulness | EU regulated as potential hazardous substance, Possible to be decomposed into Endocrine disruptor | |
| Analyzing method | EPA 3540C, EPA 3550B etc Total Br : EN 50267-2-2, ASTM D 7359, KS M 0180:2009, EN 14582 etc | |
| Measurement | GC-MS, AQF-IC, Oxygen Bomb-IC | |

1) REACH restriction : Tris(2,3 dibromopropyl) phosphate Shall not be used in textile articles, such as garments, undergarments and linen, intended to come into contact with the skin. (Annex 17)

(3) Phthalates and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts | | 1 000 mg/kg |
| Main Containing Purpose | Plasticizer to be soften plastic | |
| Harmfulness | Lung, kidney, heart, blood harmful, deformed birth, genital generation repression | |
| Analyzing method | KS M 1991, ASTM D 3421 | |
| Measurement | GC-MS | |

1) REACH restriction : Shall not be used as substances or as constituents of preparations, at concentrations higher than 0,1 % by mass of the plasticized material, in toys and childcare articles1. (Annex 17)

(4) Antimony and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts contain plastic including flame retardant ¹⁾ | | 1000 mg/kg |
| Main Containing Purpose | Pigment, dye, catalyzer, flame retardant, stabilization, optical lens, solder, ink | |
| Harmfulness | Pneumoconiosis, physiology problem, premature birth, abortion | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

1) Exemption for antimony used except of flammability purpose.
(Example) antimony used for shape capability of varistor's ceramic body, polymerization catalyzer of PET

(5) Beryllium and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---|
| All parts | | BeO : Not detected others : 1000 mg/kg |
| Main Containing Purpose | Ceramic materials, alloy, catalyzer, electrodes, molds, electrical contacts, spring materials, connectors | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

(6) Musk fragrance substances (musk xylene)

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---------------------------------------|
| All parts | | Not detected |
| Main Containing Purpose | Perfume, detergent, fabric conditioner, air cleaner, home washing, scentless product | |
| Harmfulness | Endocrine disruptors | |
| Analyzing method | EPA 3540C etc. Solvent Extraction | |
| Measurement | GC-MS | |

1) Musk xylene should not be used in substance, part and product after Aug. 2014

(7) Chlorinated flame retardants

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---|
| All parts contain plastic | | TCEP : 1 000 mg/kg others : 900 mg/kg (Total Cl) |
| Main Containing Purpose | Plastic as PCB | |
| Harmfulness | EU regulated as potential hazardous substance, Possible to be decomposed into Endocrine disruptor | |
| Analyzing method | TCEP : KS M 1991, Solvent Extraction etc Total Cl : EN 50267-2-2, ASTM D 7359, KS M 0180:2009, EN 14582 etc | |
| Measurement | GC-MS, AQF-IC, Oxygen Bomb-IC | |

1) In the MC department, Chlorinated flame retardants shall not be used in substance, part and product after Jan. 2010

5.4 Level B-II Substances

(1) Cobalt and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | alloy, magnetic material, binder, glass/ceramics blue pigment | |
| Harmfulness | carcinogenity, skin stimulation, aquatic ecosystem disturbance | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

(2) Selenium and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | Semiconductor materials, photosensitive materials, pigment, paint, photo-receiving device | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

(3) Bismuth and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | Lead free solder, semiconductor terminal plating, electrodes, lead alloys | |
| Harmfulness | Endocrine disruptors | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

(4) Volatile Organic Compound (about Emission in products)

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---|
| Built-in household products | | TVOC 5 mg/m ³ Formaldehyde 0.05 mg/m ³ |
| Main Containing Purpose | - | |
| Harmfulness | Atopic dermatitis, allergy, head ache, lethargic | |
| Analyzing method | KS X ISO/IEC 28360 | |
| Measurement | VOC Chamber/ ATD-GC-MS | |

- 1) The guidance of the Clean Healthy House in Korea
(The Korean law of The Ministry of Land, Transport and Maritime affairs)
: Should not be used in Built-in household products on 1 Dec. 2010.

(5) Bisphenol A

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | PC raw material, Epoxy Resin raw material | |
| Harmfulness | Endocrine disruptors, sperm decapacitation, feminization, nerve developmental disability | |
| Analyzing method | EPA 3540C etc. Solvent Extraction | |
| Measurement | HPLC/UV, GC-/MS | |

(6) Triclosan

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|---|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | Anti-microbial agent, insecticide agent, anti-bacteria agent in plastic | |
| Harmfulness | Skin stimulation, immunity capability weakening, carcinogenic, procreation damage in dioxin substance | |
| Analyzing method | EPA 3540C etc. Solvent Extraction | |
| Measurement | GC-MS | |

(7) Surfactant

a. Maximum allowable concentration level

| Regulated parts and materials | | Maximum Allowable Concentration Level |
|-------------------------------|--|---------------------------------------|
| cleaner | | - |
| Main Containing Purpose | Purpose of cleaner, sweeping, treatment | |
| Harmfulness | Human, aquatic ecosystem toxic, non bio degradable | |
| Analyzing method | Solvent Extraction | |
| Measurement | LC-MS | |

1) Shall not be used over 0.1w/w% in industrial clean, leather treatment

(8) Boron and its compounds, including alloy

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | Soldering, flame retardants, preservatives, pesticides | |
| Harmfulness | Stimulating gastrointestinal tract, lack of appetite, vomit, sickness | |
| Analyzing method | EPA 3052, EPA 3050B etc | |
| Measurement | ICP-AES/OES, AAS, ICP-MS | |

(9) Acrylamide

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | Synthesis of plastics, coagulant, adhesive | |
| Harmfulness | Disease of central nervous, mutagenic, lack of nervous system and liver | |
| Analyzing method | EPA 3540C, Solvent Extraction | |
| Measurement | GC-MS | |

(10) 2-methoxyethanol

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | Paints, Inks, Solvents for adhesive | |
| Harmfulness | Disease of central nervous, mutagenic, lack of nervous system and liver | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

(11) 2-ethoxyethanol

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|---|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | Paint, Ink, Solvent for adhesive | |
| Harmfulness | Disease of central nervous, mutagenic, lack of nervous system and liver | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

(12) 2-ethoxyethyl acetate

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | Solvent, paint, polish, adhesive | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

(13) Hydrazine

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | Paint, ink, azo-dye, polyurethane coating agent, fule cell, corrosion inhibitor (Ni, Cr, Sn plating) | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

(14) 1-methyl-2-pyrrolidone

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts | | - |
| Main Containing Purpose | LCD TFT cleaner, coating agent, silicone oil, battery, wafer | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

(15) 1,2,3-trichloropropane

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---------------------------------------|
| All parts contain plastic | | - |
| Main Containing Purpose | Chemical Intermediates, cross-linking agent, paint, polish remover | |
| Harmfulness | Carcinogenity, mutagenicity, toxicity for reproduction | |
| Analyzing method | EPA 3550C, ultrasonic extraction | |
| Measurement | GC-MS | |

5.5 Standard for management of hazardous substances for Packaging Materials

a. Maximum allowable concentration level

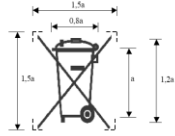
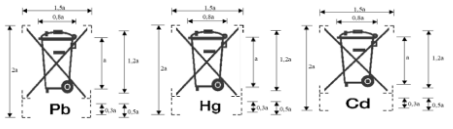
| Regulated parts and materials | Maximum Allowable Concentration Level |
|--|---|
| Packaging materials for all products on market | Pb, Cd, Hg, Cr+6 total 100 mg/kg (Cd under 50mg/kg managed separately) Br 900 mg/kg, Cl 900 mg/kg |

b. Exemptions

- ① packaging materials made from Lead crystal glass

5.6 Standard for management of hazardous substances for Battery and Battery Pack

a. Maximum allowable concentration level

| Regulated parts and materials ¹⁾ | | Maximum Allowable Concentration Level |
|---|--|---|
| ① Pb and its compounds | Carbon zinc, Alkaline battery | 2000 mg/kg |
| | The other all battery | 4000 mg/kg |
| ② Cd and its compounds | | 20 mg/kg |
| ③ Hg and its compounds | Carbon zinc, Alkaline battery | 1 mg/kg |
| | The other all battery | 5 mg/kg exemption) button cell 2% |
| Marking | Not including hazardous substances |  |
| | Including hazardous substances ²⁾ |  |

1) Above the spec. is regulation for Battery Cell, and instrument/circuit parts used in Battery Pack have to be followed standard stated in 5.1)~2) items.

2) Above the spec. is based on the weight of battery Cell, and the name of substance have to marked on in case of that is above Pb 40, Cd 20, Hg 5mg/kg.

Appendix 1. Chemical substances list

(1) Pb, Lead and its compounds

| Name | Chemical symbol | CAS No. |
|--------------------------------------|---|------------|
| Lead | Pb | 7439-92-1 |
| Lead(II) carbonate | PbCO ₃ | 598-63-0 |
| Lead(IV) oxide | PbO ₂ | 1309-60-0 |
| Lead(II,IV) oxide | Pb ₃ O ₄ | 1314-41-6 |
| Lead(II) sulfide | PbS | 1314-87-0 |
| Lead azide | Pb(N ₃) ₂ | 13424-46-9 |
| Lead(II) oxide | PbO | 1317-36-8 |
| Lead(II) fluoride | PbF ₂ | 7783-46-2 |
| Lead(II) chloride | PbCl ₂ | 7758-95-4 |
| Lead(IV) chloride | PbCl ₄ | 13463-30-4 |
| Lead(II) carbonate basic | Pb ₃ (CO ₃) ₂ (OH) ₂ | 1319-46-6 |
| Lead(II) iodide | PbI ₂ | 10101-63-0 |
| Lead hydroxycarbonate | (PbCO ₃) ₂ Pb(OH) ₂ | 1344-36-1 |
| Lead(II) cyanide | Pb(CN) ₂ | 592-05-2 |
| Lead(II) fluoroborate | Pb(BF ₄) ₂ | 13814-96-5 |
| Lead(II) fluosilicate | PbSiF ₆ | 25808-74-6 |
| Lead(II) sulfate | PbSO ₄ | 7446-14-2 |
| Lead(II) phosphate | Pb ₃ (PO ₄) ₂ | 7446-27-7 |
| Lead thiocyanate | Pb(SCN) ₂ | 592-87-0 |
| Lead(II) chromate | PbCrO ₄ | 7758-97-6 |
| Lead(II) titanate | PbTiO ₃ | 12060-00-3 |
| Lead(II) acetate, trihydrate | Pb(CH ₃ COO) ₂ 3H ₂ O | 6080-56-4 |
| Lead(II) acetate | Pb(CH ₃ COO) ₂ | 301-04-2 |
| Lead(II) metaborate | Pb(BO ₂) ₂ H ₂ O | 10214-39-8 |
| Lead metasilicate | PbSiO ₃ | 11120-22-2 |
| Lead silicate | H ₂ O ₃ Si.xPb | 22569-74-0 |
| Lead antimonite | Pb(SbO ₄) ₃ | 13510-89-9 |
| Lead hydrogen arsenate | PbHAsO ₄ | 7784-40-9 |
| Lead(II) arsenite | Pb(AsO ₂) ₂ | 10031-13-7 |
| Lead(IV) acetate / Lead tetraacetate | Pb(C ₂ H ₃ O ₂) ₄ / C ₈ H ₁₂ O ₈ Pb | 546-67-8 |
| Sulphuric acid, lead salt | PbSO ₄ | 15739-80-7 |
| Lead sulfate, tribasic | Pb ₄ SO ₇ / PbSO ₄ (PbO) ₃ | 12202-17-4 |

| | | |
|---|---|------------|
| Lead nitrate | Pb(NO ₃) ₂ | 10099-74-8 |
| Lead sulfochromate yellow | - | 1344-37-2 |
| Lead oxide sulfate | Pb ₂ O(SO ₄) | 12036-76-9 |
| Lead molybdate | PbMoO ₄ | 10190-55-3 |
| Tetramethyl lead | Pb(CH ₃) ₄ | 75-74-1 |
| Tetraethyl lead | Pb(C ₂ H ₅) ₄ | 78-00-2 |
| Lead selenide | PbSe | 12069-00-0 |
| Lead perchlorate ClHO4.1/2Pb | Pb(ClHO ₄) ₂ | 13637-76-8 |
| Lead distearate | C ₃₆ H ₇₀ O ₄ Pb | 1072-35-1 |
| Lead stearate (stearic acid, lead salt) | C ₃₆ H ₇₀ O ₄ Pb | 7428-48-0 |
| Lead stearate, dibasic | 2PbO / Pb(C ₁₇ H ₃₅ COO) ₂ | 56189-09-4 |
| Other lead compounds | - | - |

(2) Cd, 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 ₃ | 513-78-0 |
| Cadmium chloride | CdCl ₂ | 10108-64-2 |
| Cadmium sulfate | CdSO ₄ | 10124-36-4 |
| Cadmium nitrate | Cd(NO ₃) ₂ | 10325-94-7 |
| Cadmium nitrate tetrahydrate | Cd(NO ₃) ₂ 4H ₂ O | 10022-68-1 |
| Cadmium stearate | Cd(C ₁₈ H ₃₅ O ₂) ₂ | 2223-93-0 |
| Other cadmium compounds | - | - |

(3) Hg, Mercury and its compounds

| Name | Chemical symbol | CAS No. |
|-----------------------|---|------------|
| Mercury | Hg | 7439-97-6 |
| Mercury(I) chloride | Hg ₂ Cl ₂ | 10112-91-1 |
| Mercury(II) chloride | HgCl ₂ | 7487-94-7 |
| Mercury(I) oxide | Hg ₂ O | 15829-53-5 |
| Mercury(II) oxide | HgO | 21908-53-2 |
| Mercury(II) nitrate | Hg(NO ₃) ₂ | 10045-94-0 |
| Mercury(I) sulfate | Hg ₂ (SO ₄) ₄ | 7783-35-9 |
| Mercury(II) fulminate | Hg(CNO) ₂ | 628-86-4 |

| | | |
|----------------------------|--|-----------|
| Mercury(II) acetate | Hg(CH ₃ COO) ₂ | 1600-27-7 |
| Methylmercury salts | CH ₃ HgX (X: halogen) | - |
| Ethylmercury salts | C ₂ H ₅ HgX | - |
| Propylmercury salts | C ₃ H ₇ HgX | - |
| Methoxyethyl-mercury salts | CH ₃ OC ₂ H ₄ HgX | - |
| Diphenylmercury | (C ₆ H ₅) ₂ Hg | 587-85-9 |
| Dialkylmercury | R ₂ Hg(R: alkyl group) | - |
| Phenylmercury nitrate | C ₆ H ₅ HgNO ₃ | 55-68-5 |
| Other mercury compounds | - | - |

(4) Cr⁶⁺, Hexavalent chromium and its compounds

| Name | Chemical symbol | CAS No. |
|--|--|------------|
| Sodium dichromate | Na ₂ Cr ₂ O ₇ | 10588-01-9 |
| Sodium dichromate, dihydrate | Na ₂ Cr ₂ H ₂ O ₇ | 7789-12-0 |
| Chromium(VI) oxide / Chromium trioxide | CrO ₃ | 1333-82-0 |
| Calcium chromate | CaCrO ₄ | 13765-19-0 |
| Lead(II) chromate | PbCrO ₄ | 7758-97-6 |
| Potassium dichromate | K ₂ Cr ₂ O ₇ | 7778-50-9 |
| Potassium chromate | K ₂ CrO ₇ | 7789-00-6 |
| Lithium chromate | Li ₂ CrO ₄ | 14307-35-8 |
| Sodium chromate | Na ₂ CrO ₄ | 7775-11-03 |
| Potassium chlorochromate | K[CrO ₃ Cl] | 16037-50-6 |
| Ammonium chromate | (NH ₄) ₂ CrO ₄ | 7788-98-9 |
| Copper chromate | CuCrO ₄ | 13548-42-0 |
| Magnesium chromate | MgCrO ₄ | 13423-61-5 |
| Strontium chromate | SrCrO ₄ | 7789-06-02 |
| Barium chromate | BaCrO ₄ | 10294-40-3 |
| Lead chromate (orange color) | PbCrO ₄ | 1344-38-3 |
| Lead chromate (yellow color) | PbCrO ₄ +PbSO ₄ | 1344-37-2 |
| Dichromium zinc tetraoxide | Cr ₂ O ₄ Zn | 12018-19-8 |
| Zinc chromate | ZnCrO ₄ | 13530-65-9 |
| Zinc dichromate | ZnCr ₂ H ₂ O ₇ | 14018-95-2 |
| Ammonium dichromate | (NH ₄) ₂ Cr ₂ O ₇ | 7789-09-05 |
| Calcium dichromate | CaCr ₂ O ₇ | 14307-33-6 |
| Dichromic acid | H ₂ Cr ₂ O ₇ | 13530-68-2 |
| Copper chromite | CuCrO ₃ | 12053-18-8 |
| Other hexavalent chromium compounds | - | - |

(5) Polybrominated biphenyls (PBBs)

| Name | Chemical symbol | CAS No. |
|--|-----------------------|-------------|
| Polybrominated biphenyl (PBB) | $C_{12}HXBr_{(10-X)}$ | 67774-32-7 |
| 2-bromodiphenyl | $C_{12}H_9Br$ | 2502-07-5 |
| 3-bromodiphenyl | $C_{12}H_9Br$ | 2113-57-7 |
| 4-bromodiphenyl | $C_{12}H_9Br$ | 92-66-0 |
| 4,4'-Dibromodiphenyl | $C_{12}H_8Br_2$ | 92-86-4 |
| 3,4,5-Tribromodiphenyl | $C_{12}H_7Br_3$ | 115245-08-4 |
| 2,4,6-Tribromodiphenyl | $C_{12}H_7Br_3$ | 59080-33-0 |
| 3,3',4,4',-tetrabromobiphenyl | $C_{12}H_6Br_4$ | 77102-82-0 |
| 2,2',4,5',-tetrabromobiphenyl | $C_{12}H_6Br_4$ | 60044-24-8 |
| 2,2',4,5',6-pentabromobiphenyl | $C_{12}H_5Br_5$ | 59080-39-6 |
| 3,3',4,4',5,5'-Hexabromodiphenyl | $C_{12}H_4Br_6$ | 60044-26-0 |
| 2,2',4,4',5,5'-Hexabromodiphenyl | $C_{12}H_4Br_6$ | 59080-40-9 |
| 2,2',3,3',4,5',6,6'-Octabromodiphenyl | $C_{12}H_2Br_8$ | 119264-60-7 |
| 2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl | $C_{12}Br_{10}$ | 13654-09-6 |
| Other PBBs compounds | - | - |

(6) Polybrominated diphenylethers (PBDEs)

| Name | Chemical symbol | CAS No. |
|--------------------------------------|-------------------------|------------|
| Polybrominated diphenyl ether(PBDE) | | |
| Polybrominated diphenyl oxide(PBDO) | $C_{12}H_{(10-X)}Br_XO$ | - |
| Polybrominated byphenyl ethers(PBBE) | | |
| 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) Pentachlorophenol (PCP)

| Name | Chemical symbol | CAS No. |
|-------------------|-----------------|---------|
| Pentachlorophenol | C_6HCl_5O | 87-86-5 |

(9) SCCP/MCCP

| Name | Chemical symbol | CAS No. |
|---|-----------------|------------|
| Short-chain chlorinated paraffine (C10~13) | - | 85535-84-8 |
| Medium-chained chlorinated paraffins, (C14-C17) | - | 85535-85-9 |

(10) Perfluorooctyl sulfonate, PFOS / Perfluorooctyl acid , PFOA

| Name | Chemical symbol | CAS No. |
|---|---------------------------|------------|
| AMMONIUM HEPTADEC AFLUORO OCTANESULPHONATE | $C_8H_4F_{17}NO_3S$ | 29081-56-9 |
| HEPTADEC AFLUORO-1-OCTANESULFONIC ACID, COMPD. WITH DIETHANOLAMINE | $C_{12}H_{12}F_{17}NO_5S$ | 70225-14-8 |
| LITHIUM PERFLUORO OCTANE SULFONATE | $C_8F_{17}LiO_3S$ | 29457-72-5 |
| HEPTADEC AFLUORO OCTANESULFONIC ACID | $C_8HF_{17}O_3S$ | 1763-23-1 |
| POTASSIUM PERFLUORO OCTANESULFONATE | $C_8F_{17}KO_3S$ | 2795-39-3 |
| PENTADEC AFLUORO OCTANOIC ACID | $C_8HF_{15}O_2$ | 335-67-1 |
| PERFLUORO OCTANOIC ANHYDRIDE | $C_{16}F_{30}O_3$ | 33496-48-9 |
| PERFLUORO OCTANOIC ACID AMMONIUM SALT | $C_8H_4F_{15}NO_2$ | 3825-26-1 |
| Other PFOS, PFOA compounds | - | - |

(11) 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 ₂ O ₃ | 1314-06-3 |
| Nickel dihydroxide | NiH ₂ O ₂ | 12054-48-7 |
| Nickel acetate | NiC ₄ H ₆ O ₄ | 373-02-4 |
| Nickel carbonyl | Ni(CO) ₄ | 13463-39-3 |
| Other nickel compounds | - | - |

(12) Asbestos

| Name | Chemical symbol | CAS No. |
|---------------|--|------------|
| Actinolite | Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂ | 77536-66-4 |
| Amosite | (Mg,Fe) ₇ Si ₈ O ₂₂ (OH) ₂ | 12172-73-5 |
| Anthophyllite | (Mg,Fe) ₇ Si ₈ O ₂₂ (OH) ₂ | 77536-67-5 |
| Chrysotile | Mg ₃ Si ₂ O ₅ (OH) ₄ | 12001-29-5 |
| Crocidolite | Na ₂ F ₅ Si ₈ O ₂₂ (OH) ₂ | 12001-28-4 |
| Tremolite | Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂ | 77536-68-6 |

(13) Azo compounds

| Name | Chemical symbol | CAS No. |
|---|--|----------|
| 2,4,5-Trimethylaniline | C ₉ H ₁₃ N | 137-17-7 |
| 2,4-Diaminoanisole | C ₇ H ₁₀ N ₂ O | 615-05-4 |
| 2,4-Toluediamine | C ₇ H ₁₀ N ₂ | 95-80-7 |
| 2-Amino-4-nitrotoluene | C ₇ H ₈ N ₂ O ₂ | 99-55-8 |
| 2-Naphthylamine | C ₁₀ H ₉ N | 91-59-8 |
| 3,3'-Dichlorobenzidine | C ₁₂ H ₁₀ Cl ₂ N ₂ | 91-94-1 |
| 3,3'-Dimethoxybenzidine | C ₁₄ H ₁₆ N ₂ O 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 ₂ N ₂ | 101-14-4 |
| 4,4'-Oxydianiline | C ₁₂ H ₁₂ N ₂ O | 101-80-4 |

| | | |
|----------------------|--|----------|
| 4,4'-Thiodianiline | C ₁₂ H ₁₂ N ₂ S | 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 ₇ H ₈ ClN | 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 ₇ H ₉ NO | 90-04-0 |
| o-Toluidine | C ₇ H ₉ N | 95-53-4 |
| p-Chloroaniline | C ₆ H ₆ ClN | 106-47-8 |
| p-Cresidine | C ₈ H ₁₁ NO | 120-71-8 |

(14) 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 |

(15) Organic tin compounds

| Name | Chemical symbol | CAS No. |
|---|--|------------------------|
| Bis(tri-n-butyltin) oxide | O(Sn(C ₄ H ₉) ₃) ₂ | 56-35-9 |
| Tributyltin(TBT) | (C ₄ H ₉) ₃ Sn | 56573-85-4 |
| Triphenyltin (TPT) | (C ₆ H ₅) ₃ Sn | 668-34-8 |
| Tributyltin bromide | (C ₄ H ₉) ₃ SnBr | 1461-23-0 |
| Triphenyltin N,N'-dimethyldithiocarbamate | (C ₆ H ₅) ₃ Sn(CH ₃) ₂ NCS ₂ | 1803-12-9 |
| Triphenyltin fluoride | (C ₆ H ₅) ₃ SnF | 379-52-2 |
| Triphenyltin acetate | (C ₆ H ₅) ₃ SnOCOCH ₃ | 900-95-8 |
| Triphenyltin chloride | (C ₆ H ₅) ₃ SnCl | 639-58-7 |
| Triphenyltin hydroxide | (C ₆ H ₅) ₃ SnOH | 76-87-9 |
| Triphenyltin fatty acid salts (C=9~11) | - | 47672-31-1 |
| Triphenyltin chloroacetate | (C ₆ H ₅) ₃ SnOCOCH ₃ Cl | 7094-94-2 |
| Tributyltin methacrylate | (C ₄ H ₉) ₃ SnC ₄ H ₅ O ₂ | 2155-70-6 / 18380-71-7 |
| Bis(tributyltin) fumarate | C ₂ H ₂ (COO) ₂ ((C ₄ H ₉) ₃ Sn) ₂ | 6454-35-9 |
| Tributyltin fluoride | (C ₄ H ₉) ₃ SnF | 1983-10-4 |
| Bis(tributyltin) 2,3-dibromosuccinate | ((C ₄ H ₉) ₃ Sn) ₂ C ₂ H 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 |
| Diocyltin | $C_{16}H_{36}Sn$ | 15231-44-4 |
| Dibutyltin X | $C_8H_{20}SnX$ | - |
| Diocyltin X | $C_{16}H_{36}SnX$ | - |
| Other organotin compounds | - | - |

(16) Arsenic and its compounds

| Name | Chemical symbol | CAS No. |
|--|----------------------|------------|
| ARSENIC | As | 7440-38-2 |
| TRIETHYL ARSENATE | $C_6H_{15}AsO_4$ | 15606-95-8 |
| ARSENIC ACID DISODIUM SALT, HEPTAHYDRATE | $AsH_{15}Na_2O_{11}$ | 10048-95-0 |
| ARSENIC ACID, CALCIUM SALT | $As_2Ca_3O_8$ | 7778-44-1 |
| ARSENIC ACID, COPPER SALT | $As_2Cu_3O_8$ | 10103-61-4 |
| ARSENIC ACID, DIAMMONIUM SALT | $AsH_9N_2O_4$ | 7784-44-3 |
| ARSENIC ACID, LEAD SALT | $AsHO_4Pb$ | 7784-40-9 |
| ARSENIC ACID, MAGNESIUM SALT | $As_2Mg_3O_8$ | 10103-50-1 |
| ARSENIC PENTOXIDE | As_2O_5 | 1303-28-2 |
| ARSENIC TRICHLORIDE | $AsCl_3$ | 7784-34-1 |
| ARSENIC TRIHYDRIDE | AsH_3 | 7784-42-1 |
| ARSENIC TRIOXIDE | As_2O_3 | 1327-53-3 |
| ARSENIOUS ACID, COPPER (II) SALT | $AsCuHO_3$ | 10290-12-7 |
| GALLIUM ARSENIDE | $AsGa$ | 1303-00-0 |
| ARSENIOUS ACID, POTASSIUM SALT | $AsKO_2$ | 10124-50-2 |

(17) Ozone layer depleting / global warming substances

| Name | Chemical symbol | CAS No. |
|---------------------------|--|------------------------|
| Chloroform | CHCl ₃ | 67-66-3 |
| 1,1,2 Trichloroethane | C ₂ H ₃ Cl ₃ | 79-00-5 |
| 1,1,2,2 Tetrachloroethane | C ₂ H ₂ Cl ₄ | 79-34-5 |
| 1,1,1,2 Tetrachloroethane | C ₂ H ₂ Cl ₄ | 630-20-6 |
| Pentachloroethane | C ₂ HCl ₅ | 76-01-7 |
| 1,1 Dichloroethylene | C ₂ H ₂ Cl ₂ | 75-35-4 |
| CFC 11 | CCl ₃ F | 75-69-4 |
| CFC 111 | C ₂ Cl ₅ F | 354-56-3 |
| CFC 112 | C ₂ Cl ₄ F ₂ | 76-12-0 / 28605-74-5 |
| CFC 113 | C ₂ Cl ₃ F ₃ | 76-13-1 |
| CFC 114 | C ₂ Cl ₂ F ₄ | 76-14-2 / 1320-37-2 |
| CFC 115 | C ₂ ClF ₅ | 76-15-3 |
| CFC 12 | CCl ₂ F ₂ | 75-71-8 |
| CFC 13 | CClF ₃ | 75-72-9 |
| CFC 211 | C ₃ Cl ₇ F | 422-78-6 / 135401-87-5 |
| CFC 212 | C ₃ Cl ₆ F ₂ | 3182-26-1 |
| CFC 213 | C ₃ Cl ₅ F ₃ | 2354-06-5 |
| CFC 214 | C ₃ Cl ₄ F ₄ | 2268-46-4 |
| CFC 215 | C ₃ Cl ₃ F ₅ | 1652-81-9 |
| CFC 216 | C ₃ Cl ₂ F ₆ | 661-97-2 |
| CFC 217 | C ₃ ClF ₇ | 422-86-6 |
| Halon 1211 | CBrClF ₂ | 353-59-3 |
| Halon 1301 | CBrF ₃ | 75-63-8 |
| Halon 2402 | C ₂ Br ₂ F ₄ | 124-73-2 |
| bromochloromethane | CH ₂ BrCl | 74-97-5 |
| HBFC-121B4 | C ₂ HFBBr ₄ | 306-80-9 |
| HBFC-122B3 | C ₂ HF ₂ Br ₃ | - |
| HBFC-123B2 | C ₂ HF ₃ Br ₂ | 354-04-1 |
| HBFC-124B1 | C ₂ HF ₄ Br | - |
| HBFC-131B3 | C ₂ H ₂ FBr ₃ | - |
| HBFC-132B2 | C ₂ H ₂ F ₂ Br ₂ | 75-82-1 |
| HBFC-141B2 | C ₂ H ₃ FBr ₂ | 358-97-4 |
| HBFC-133B1 | C ₂ H ₂ F ₃ Br | - |
| HBFC-142B1 | C ₂ H ₃ F ₂ Br | - |
| HBFC-151B1 | C ₂ H ₄ FBr | 762-49-2 |
| HBFC-21B2 | CHFBr ₂ | - |

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|------------|--|-------------|
| HBFC-221B6 | C ₃ HFB ₆ | - |
| HBFC-222B5 | C ₃ HF ₂ Br ₅ | - |
| HBFC-223B4 | C ₃ HF ₃ Br ₄ | - |
| HBFC-224B3 | C ₃ HF ₄ Br ₃ | - |
| HBFC-226B1 | C ₃ HF ₆ Br | - |
| HBFC-225B2 | C ₃ HF ₅ Br ₂ | 431-78-7 |
| HBFC-22B1 | CHF ₂ Br | - |
| HBFC-231B5 | C ₃ H ₂ FBr ₅ | - |
| HBFC-232B4 | C ₃ H ₂ F ₂ Br ₄ | - |
| HBFC-233B3 | C ₃ H ₂ F ₃ Br ₃ | |
| HBFC-234B2 | C ₃ H ₂ F ₄ Br ₂ | - |
| HBFC-235B1 | C ₃ H ₂ F ₅ Br | 460-88-8 |
| HBFC-242B3 | C ₃ H ₃ F ₂ Br ₃ | 70192-80-2 |
| HBFC-241B4 | C ₃ H ₃ FBr ₄ | - |
| HBFC-243B2 | C ₃ H ₃ F ₃ Br ₂ | 70192-83-5 |
| HBFC-244B1 | C ₃ H ₃ F ₄ Br | 679-84-5 |
| HBFC-251B3 | C ₃ H ₄ FBr ₃ | 75372-14-1 |
| HBFC-253B1 | C ₃ H ₄ F ₃ Br | 421-46-5 |
| HBFC-252B2 | C ₃ H ₄ F ₂ Br ₂ | 460-25-3 |
| HBFC-261B2 | C ₃ H ₅ FBr ₂ | 51584-26-0 |
| HBFC-262B1 | C ₃ H ₅ F ₂ Br | - |
| HBFC-31B1 | CH ₂ FBr | - |
| HBFC-271B1 | C ₃ H ₆ FBr | 352-91-0 |
| HCFC-31 | CH ₂ FCl | 373-52-4 |
| HCFC-121 | C ₂ HFCl ₄ | 354-14-3 |
| HCFC-122 | C ₂ HF ₂ Cl ₃ | 354-21-2 |
| HCFC-123 | C ₂ HF ₃ Cl ₂ | 306-83-2 |
| HCFC-124 | C ₂ HF ₄ Cl | 2837-89-0 |
| HCFC-131 | C ₂ H ₂ FCl ₃ | 134237-34-6 |
| HCFC-132 | C ₂ H ₂ F ₂ Cl ₂ | 25915-78-0 |
| HCFC-133 | C ₂ H ₂ F ₃ Cl | 75-88-7 |
| HCFC-141 | C ₂ H ₃ FCl ₂ | 25167-88-8 |
| HCFC-141b | C ₂ H ₃ FCl ₂ | 1717-00-6 |
| HCFC-142 | C ₂ H ₃ F ₂ Cl | 25497-29-4 |
| HCFC-142b | CH ₃ CF ₂ Cl | 75-68-3 |
| HCFC-151 | C ₂ H ₄ FCl | 1615-75-4 |
| HCFC-21 | CHFC ₂ | 75-43-4 |

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| HCFC-22 | CHF ₂ Cl | 75-45-6 |
| HCFC-221 | C ₃ HFC ₆ | 134237-35-7 |
| HCFC-222 | C ₃ HF ₂ Cl ₅ | 134237-36-8 |
| HCFC-223 | C ₃ HF ₃ Cl ₄ | 34237-37-9 |
| HCFC-224 | C ₃ HF ₄ Cl ₃ | 134237-38-0 |
| HCFC-225 | C ₃ HF ₅ Cl ₂ | 128903-21-9 |
| HCFC-225ca | CF ₃ CF ₂ CHCl ₂ | 422-56-0 |
| HCFC-225cb | CF ₂ CICF ₂ CHClF | 507-55-1 |
| HCFC-226 | C ₃ HF ₆ Cl | 134308-72-8 |
| HCFC-231 | C ₃ H ₂ FC ₅ | 134190-48-0 |
| HCFC-232 | C ₃ H ₂ F ₂ Cl ₄ | 134237-39-1 |
| HCFC-233 | C ₃ H ₂ F ₃ Cl ₃ | 134237-40-4 |
| HCFC-234 | C ₃ H ₂ F ₄ Cl ₂ | 127564-83-4 |
| HCFC-235 | C ₃ H ₂ F ₅ Cl | 134237-41-5 |
| HCFC-241 | C ₃ H ₃ FC ₄ | 134190-49-1 |
| HCFC-242 | C ₃ H ₃ F ₂ Cl ₃ | 134237-42-6 |
| HCFC-243 | C ₃ H ₃ F ₃ Cl ₂ | 134237-43-7 |
| HCFC-244 | C ₃ H ₃ F ₄ Cl | 134190-50-4 |
| HCFC-251 | C ₃ H ₄ FC ₃ | 134190-51-5 |
| HCFC-252 | C ₃ H ₄ F ₂ Cl ₂ | 134190-52-6 |
| HCFC-253 | C ₃ H ₄ F ₃ Cl | 134237-44-8 |
| HCFC-261 | C ₃ H ₅ FC ₂ | 134237-45-9 |
| HCFC-262 | C ₃ H ₅ F ₂ Cl | 134190-53-7 |
| HCFC-271 | C ₃ H ₆ FC ₁ | 134190-54-8 |
| methyl bromide | CH ₃ Br | 74-83-9 |
| 1,1,1-trichloroethane | C ₂ H ₃ Cl ₃ | 71-55-6 |
| Carbon tetrachloride | CCl ₄ | 56-23-5 |
| Trichloroethylene | C ₂ HCl ₃ | 79-01-06 |
| sulfur hexafluoride | F ₆ S | 2551-62-4 |
| HFCs | - | - |
| PFCs | - | - |

(18) PAHs

| Name | Chemical symbol | CAS No. |
|----------------|--------------------------------|----------|
| NAPHTHALENE | C ₁₀ H ₈ | 91-20-3 |
| ACENAPHTHYLENE | C ₁₂ H ₈ | 208-96-8 |
| ACENAPHTHENE | C ₁₂ H ₈ | 83-32-9 |

| | | |
|----------------------------|---------------------------------|----------|
| FLUORENE | C ₁₃ H ₁₀ | 86-73-7 |
| PHENANTHRENE | C ₁₄ H ₁₀ | 85-01-8 |
| ANTHRACENE | C ₁₄ H ₁₀ | 120-12-7 |
| FLUORANTHENE | C ₁₆ H ₁₀ | 206-44-0 |
| INDENO[c,d]PYRENE | C ₂₂ H ₁₂ | 193-39-5 |
| PYRENE | C ₁₆ H ₁₀ | 129-00-0 |
| BENZO[g,h,i]PERYLENE | C ₂₂ H ₁₂ | 129-24-2 |
| Benzo(a)pyrene(BaP) | C ₂₀ H ₁₂ | 50-32-8 |
| Benzo(e)pyrene(BeP) | C ₂₀ H ₁₂ | 192-97-2 |
| Benzoanthracenepyrene(BaA) | C ₁₈ H ₁₂ | 56-55-3 |
| Chrysen | C ₁₈ H ₁₂ | 218-01-9 |
| Benzofluoranthene(BbFA) | C ₂₀ H ₁₂ | 205-99-2 |
| Benzofluoranthene(BjFA) | C ₂₀ H ₁₂ | 205-82-3 |
| Benzofluoranthene(BkFA) | C ₂₀ H ₁₂ | 207-08-9 |
| Dibenzoanthracene(DBAhA) | C ₂₂ H ₁₄ | 53-70-3 |

(19) Formaldehydes

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

(20) Dimethylfumarate (DMF)

| Name | Chemical symbol | CAS No. |
|------------------|--|----------|
| Dimethylfumarate | C ₆ H ₈ O ₄ | 624-49-7 |

(21) Poly vinyl chloride

| Name | Chemical symbol | CAS No. |
|---------------------|--|------------------------|
| Poly vinyl chloride | H(CH ₂ CHCl) _n H | 9002-86-2 / 93050-82-9 |

(22) Bromated Flame Retardants (Except PBB, PBDE)

| Name | Chemical symbol | CAS No. |
|---|--|------------|
| Tetrabromobisphenol A | C ₁₅ H ₁₂ Br ₄ O ₂ | 79-94-7 |
| Tetrabromobisphenol A dimethylether | C ₁₇ H ₁₆ Br ₄ O ₂ | 37853-61-5 |
| Tetrabromobisphenol A bis(dibromopropyl ether) | C ₂₁ H ₂₀ Br ₈ O ₂ | 21850-44-2 |
| Tetrabromobisphenol A bisallylether | C ₂₁ H ₂₀ Br ₄ O ₂ | 25327-89-3 |
| Tetrabromobisphenol A bis(2-hydroxyethyl ether) | C ₁₉ H ₂₀ Br ₄ O ₄ | 4162-45-2 |

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|---|---|-------------|
| 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-ethanediy)bis[4,5,6,7-tetrabromo] | $C_{18}H_4Br_8N_2O_4$ | 32588-76-4 |
| Hexabromocyclododecane | $C_{12}H_{18}Br_6$ | 25637-99-4 |
| 3,4,5,6-Tetrabromo-1,2-benzenedicarboxylic mixed esters 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 | - | - |

(23) 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 |
| 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 | | 68515-42-4 |
| 1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP) | | 71888-89-6 |
| Other Phthalates compounds | - | - |

(24) Antimony and its compounds

| Name | Chemical symbol | CAS No. |
|--------------------|--------------------------------|-----------|
| Antimony trioxide | Sb ₂ O ₃ | 1309-64-4 |
| Antimony pentoxide | Sb ₂ O ₅ | 1314-60-9 |

(25) Beryllium and its compounds

| Name | Chemical symbol | CAS No. |
|--|---|------------|
| BERYLLIUM | Be | 7440-41-7 |
| BERYLLIUM CARBONATE | Be ₂ CO ₃ (OH) ₂ | 66104-24-3 |
| BERYLLIUM CHLORIDE | BeCl ₂ | 7787-47-5 |
| BERYLLIUM FLUORIDE | BeF ₂ | 7787-49-7 |
| BERYLLIUM HYDROXIDE | BeH ₂ O ₂ | 13327-32-7 |
| BERYLLIUM NITRATE | Be.2HNO ₃ | 13597-99-4 |
| BERYLLIUM PHOSPHATE | BeHO ₄ P | 13598-15-7 |
| BERYLLIUM SULFATE | Be.H ₂ O ₄ S | 13510-49-1 |
| BERYLLIUM SULPHATE TETRAHYDRATE | BeH ₈ O ₈ 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 | - | - |
|---------------------------|---|---|

(26) Cobalt and its compounds

| Name | Chemical symbol | CAS No. |
|------------------------|-------------------|-----------|
| Cobalt | Co | 7440-48-4 |
| Cobalt Oxide | CoO | 1307-96-6 |
| Cobalt dichloride | CoCl ₂ | 7646-79-9 |
| Other cobalt compounds | - | - |

(27) Musk fragrance substances

| Name | Chemical symbol | CAS No. |
|---|---|---------|
| 5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene) | C ₁₂ H ₁₅ N ₃ O ₆ | 81-15-2 |
| 4'-tert-butyl-2',6'-dimethyl-3',5'-dinitroacetophenone (musk ketone) | C ₁₄ H ₁₈ N ₂ O ₅ | 81-14-1 |

(28) Selenium and its compounds

| Name | Chemical symbol | CAS No. |
|---|----------------------------------|------------|
| Selenium | Se | 7782-49-2 |
| Hydrogen selenide | SeH ₂ | 7783-07-5 |
| Sodium selenide | SeNa ₂ | 1313-85-5 |
| Selenium dioxide | SeO ₂ | 7446-08-4 |
| Sodium selenate (Selenic acid, monosodium salt) | - | 10112-94-4 |
| Dimethyl selenide | C ₂ H ₆ Se | 593-79-3 |
| Selenium oxide | SeO | 12640-89-0 |
| Other Selenium compounds | - | - |

(29) Bismuth and its compounds

| Name | Chemical symbol | CAS No. |
|-------------------------|------------------------------------|------------|
| Bismuth | Bi | 7440-69-9 |
| Bismuth nitrate | Bi(HNO ₃) ₃ | 10361-44-1 |
| Bismuth trioxide | Bi ₂ O ₃ | 1304-76-3 |
| Other bismuth compounds | - | - |

(30) Halogen compounds

| Name | Chemical symbol | CAS No. |
|-------------------|-----------------|---------|
| Bromine compound | - | - |
| Chlorine compound | - | - |

(31) Volatile Organic Compound

| Name | Chemical symbol | CAS No. |
|------------------------------|---|------------------------------------|
| Toluene | C ₇ H ₈ | 108-88-3 |
| Benzene | C ₆ H ₆ | 71-43-2 |
| Trichlorobenzene | C ₆ H ₃ Cl ₃ | 120-82-1 |
| 1,2,3-trichloropropane | CH ₂ ClCHClCH ₂ Cl | <u>96-18-4</u> |
| 1,2-dichloropropane | CH ₃ CHClCH ₂ Cl | <u>78-87-5</u> |
| Ethylbenzene | C ₆ H ₅ C ₂ H ₅ | <u>100-41-4</u> |
| m-Xylene/ p-Xylene/ o-Xylene | C ₆ H ₄ (CH ₃) ₂ | <u>108-38-3/ 106-42-3/ 95-47-6</u> |
| 1,2,4- Trimethylbenzene | C ₆ H ₃ (CH ₃) ₃ | <u>95-63-6</u> |
| 1,4-dichlorobenzene | C ₆ H ₄ Cl ₂ | <u>106-46-7</u> |

(32) Bisphenol A

| Name | Chemical symbol | CAS No. |
|--|--|---------|
| Bisphenol A (4,4'-Isopropylidendiphenol) | C ₁₅ H ₁₆ O ₂ | 80-05-7 |

(33) Triclosan

| Name | Chemical symbol | CAS No. |
|--|---|-----------|
| 5-chloro-2-(2,4-dichlorophenoxy)phenol | C ₁₂ H ₇ Cl ₃ O ₂ | 3380-34-5 |

(34) Surfactant

| Name | Chemical symbol | CAS No. |
|------------------------|--|------------|
| DTDMAC | - | - |
| DODMAC/DSDMAC | - | - |
| HTDMAC | - | - |
| Nonylphenol | C ₆ H ₄ (OH)C ₉ H ₁₉ | 25154-52-3 |
| Nonylphenol ethoxylate | (C ₂ H ₄ O) _n C ₁₅ H ₂₄ O | 9016-45-9 |

(35) Chlorinated flame retardants

| Name | Chemical symbol | CAS No. |
|------------------------------|---|-----------------|
| Tris(2-chloroethyl)phosphate | C ₆ H ₁₂ Cl ₃ O ₄ P | <u>115-96-8</u> |
| Other CFRs compounds | - | - |

(36) Boron and its compounds, including alloy

| Name | Chemical symbol | CAS No. |
|---|--|-------------------------------------|
| Boric acid | H ₃ BO ₃ | 10043-35-3, 11113-50-1 |
| Disodium tetraborate, anhydrous | Na ₂ B ₄ O ₇ , Na ₂ [B ₄ O ₅ (OH) ₄] | 1303-96-4, 1330-43-4, 12179-04-3 |
| Tetraboron disodium heptaoxide, hydrate | Na ₂ B ₄ O ₇ •xH ₂ O | 12267-73-1 |

(37) Others ¹⁾

| Name | Chemical symbol | CAS No. |
|-----------------------|---|-----------------|
| Acrylamide | CH ₂ =CHCONH ₂ | 79-06-1 |
| 2-Methoxyethanol | CH ₃ OCH ₂ CH ₂ OH | 109-86-4 |
| 2-Ethoxyethanol | C ₂ H ₅ OCH ₂ CH ₂ OH | 110-80-5 |
| 2-ethoxyethyl acetate | CH ₃ COOCH ₂ CH ₂ OC ₂ H ₅ | 111-15-9 |
| Hydrazine | NH ₂ NH ₂ | <u>302-01-2</u> |

1) Others are the substances of the candidate list of SVHCs in REACH regulation and/or the expected restriction substances in the future law and regulation.