

**Table I: Hazardous substances in EEE – high priority**

ID	Substance name	CAS-Nr.	Hazard	Main use in EEE	Stakeholder Input		
					Specification of use: component(s) in which substance is contained	Quantity	General comments
1	Antimony trioxide	1309-64-4	Carc Cat. 3 R40	Synergist brominated flame retardants;	PCB	4-5%	Substitutes unknown
2	Antimony compounds	-	Xn; R20/22 N; R51-53	Flame retardant; melting agent in CRT glass; solder material (antimony-tin) Melting agent in CRT glass			
3	Arsenic/arsenic compounds	7440-38-2	T; R23/25 N; R50-53	III-V group semiconductor substrate (GaAs) Flame retardant	Solder Copper alloy	<0,1%	contamination
4	Beryllium metal	7440-41-7	Carc. Cat. 2; R49 T+; R26 T; R25-48/23 Xi; R36/37/38 R43	In alloys; copper-beryllium alloy; Connectors: contact springs, improves elasticity of copper alloy; Finger clips PCs: maintains electrical conductivity in metal housing; Monitors Relays: improves properties of copper contact springs Switches: high strength, high conductivity Laser printers: Rotating mirror, lightweight rigidity for precision instrumentation	Springs with electrical conductivity in switches	~2%	<b>Alternatives with copper alloys do not exist in case you need high lifecycles for safety reason</b>
5	Beryllium oxide BeO	1304-56-9	Carc. Cat. 2; R49 T+; R26 T; R25-48/23 Xi; R36/37/38	In ceramics, as cooling device; Thermally conductive electrical insulator			

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			R43				
6	Tetrabromo bisphenol A and related compounds (see Table II)	79-94-7	Dangerous to the environment N; R50/53	Flame retardant	PCB	5-12%	Substitutes unknown
7	Bisphenol A (4,4'-Isopropylidendiphenol)	80-05-7	Repr. Cat. 3; R62 Xi; R37-41 R43	Polycarbonate plastic in electronic devices, medical equipment; in PVC as hardener, catalyst, binding agents, stabiliser; epoxy resin production	Cable insulation		Substitutes unknown
8	Diethylhexylphthalate (DEHP)	117-81-7	Repr. Cat. 2; R60-61	Plasticizer in PVC cables	Cable insulation		Substitutes unknown
9	Butylbenzylphthalate (BBP)	85-68-7	Repr. Cat.2; R61 Repr. Cat.3; R62 N; R50-53	Plasticizer in PVC cables			
10	Dibutylphthalate (DBP)	84-74-2	Repr. Cat. 2; R61 Repr. Cat. 3; R62 N; R50	Plasticizer in PVC cables	Silber conductive paint for variable resisitors	~1%	Substitutes unknown
11	Diocetylphthalate (DOP)	117-84-0	Dangerous to the Environment	Plasticizer in PVC cables			
12	Dimethylformamide (DMF)	68-12-2	Repr. Cat. 2; R61 Xn; R20/21 Xi; R36	Electrolyte capacitors			
13	Formaldehyde	50-00-0	Carc. Cat. 3; R40 T; R23/24/25 C; R34 R43	Preservatives, monomer (e.g. phenol resin and melamine resin)	Insulation finish on copperwire		Substitutes unknown
14	Gallium arsenide	1303-00-0	Human	Power amplifiers, semiconductors	LED		Substitutes unknown

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			carcinogen*				
15	Hexabromocyclododecane (HBCDD) and further brominated flame retardants (see table II)	3194-55-6	not (yet) classified in the Annex I of Directive 67/548/EEC; proposal: R33, R64, N R50-53; PBT	Flame retardant			
16	Liquid crystals e.g. MBBA (4-methoxybenzylidene-4-butylaniline); 5CB (4-pentyl-4-cyanobiphenyl)			Electroactive layer in liquid crystal displays of cellular phones, notebooks, PC monitors			
17	Medium-chained chlorinated paraffins (MCCP) (Alkanes, C14-17, chloro)	85535-85-9		secondary plasticisers in PVC (cable) flame retardant plasticisers in rubbers	tulles		Substitutes unknown
18	Nickel <sup>1</sup>	7440-02-0	Carc. Cat. 3; R40 R43	Stainless steel, plating; Decorative metal finishes, barrier layers	Stainless steel, plating; decorative metal finishes on metal or plastic, galvanic or chemical barrier layers	varies	substitute unknown
19	Nonylphenol Nonylphenolpolyglycol ethers (Nonylphenoethoxylates)	25154-52-3 9016-45-9	Repr.Cat.3; R62 Repr.Cat.3; R63 Xn; R22 C; R34 N; R50-53	Surfactants, antioxidant in plastics			

<sup>1</sup> Only in those applications where nickel is likely to result in direct and prolonged skin exposure

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20	Perfluorooctane sulfonates <sup>2</sup>	1763-23-1	-				
21	PVC	9002-86-2	Dependent on the additives (stabilizers and plasticizer) used;  Dioxin formation during incineration;  Source of organic bound chlorine	Sleeve material (of capacitors), cables, tubing films labels and gaskets, insulator, chemical resistance, transparency, sheath material	Cables insulation shrink sleeves, dust protection caps	varies	Substitutes in some application unknown
22	PCBs Polychlorinated Biphenyls	1336-36-3 and various others	R33 N; R50-53  Dioxin/furan formation during incineration	Flame retardant in PVC plastic cable; capacitors			
23	PCT Polychlorinated Terphenyls	61788-33-8 and various others		Electrical insulation medium, Plasticizers, fire retardants, coatings for electrical wire and cable, dielectric sealants			
24	Polychlorinated Naphthalenes	70776-03-3		lubricant, paint, stabilizer (electric characteristic, flame-resistant, water-resistant) insulator, flame retardant			
25	Selenium	7782-49-2	T; R23/25 R33	Rectifiers and detector instruments, photoreceptor,	Copper		contamination

<sup>2</sup> iRestriction does not apply to the following applications or processes: 1) photoresists or antireflective coatings for photolithography processes; 2) photographic coatings applied to films, papers, or printing plates; 3) mist suppressants for nondecorative hard chromium (VI) plating; 4) wetting agents for use in controlled electroplating systems

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					Specification of use: component(s) in which substance is contained	Quantity	General comments
			R53 Toxic/ Danger of cumulative effects / Environment**	semiconductor material, light receiving element, photocell			
26	Short-chained chlorinated paraffins (SCCP) (Alkanes, C10-13, chloro)	85535-84-8	Carc. Cat. 3; R40 N; R50-53	plasticisers in PVC (cable) flame retardant plasticisers			
27	Synthetic vitreous fibres -glass fibres - mineral wool - refractory ceramic fibre (RCFs)	142844-00-6	RCF: Carc. Cat. 2;	Thermal insulation materials in domestic electrical appliances			
28	Tributyl Tin (TBT) compounds  Triphenyl Tin (TPT) compounds	various	T; R25-48/23/25 Xn; R21 Xi; R36/38 N; R50-53;  T; R23/24/25 N; R50-53	Stabilizer, antioxidant, antibacterial and antifungal agents, antifoulant, antiseptic, anti-fungal agent, paint, pigment, antistaining			
29	Tributyl Tin Oxide (TBTO)	56-35-9	No classification according to 67/548	antiseptic, antifungal agent, paint, pigment, antistaining, refrigerant, foaming agent, extinguishant,			
30	dinickel trioxide	1314-06-3	Carc. Cat. 1; R49 R43 R53	May be used as an electrolyte			
31	diarsenic trioxide; arsenic trioxide	1327-53-3	Carc. Cat. 1; R45 T+; R28 C; 34 N; R50-53	May be used in certain glass-materials, less than 5000ppm			
32	4,4'-methylenedi-o-	838-88-0	Carc. Cat. 2; R45	Potential use as a dye			

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					Specification of use: component(s) in which substance is contained	Quantity	General comments
	toluidine		Xn; R22 R43 N; R50-53				
33	Petrolatum; Petrolatum	8009-03-8	Carc. Cat. 2; R45	Used in solder fluxes/pastes	Gaskets of EPDM		Substitutes unknown
34	nickel dihydroxide	12054-48-7	Carc. Cat. 3; R40 Xn; R20/22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials			
35	tributyl phosphate	126-73-8	Carc.Cat.3; R40 Xn; R22 Xi; R38	May be present in certain plastics, metallic- or ceramic materials			
36	divanadium pentaoxide; vanadium pentoxide	1314-62-1	Muta. Cat. 3; R68 Repr. Cat. 3; R63 T; R48/23 Xn; R20/22 Xi; R37 N; R51-53	May be present in certain plastics, metallic- or ceramic materials	Battery cathode		Substitutes unknown
37	nickel sulphate	7786-81-4	Carc. Cat. 3; R40 Xn; R22 R42/43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials	Galvanic nickel bath		Substitutes unknown
38	cobalt oxide	1307-96-6	Xn; R22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials			
39	cobalt	7440-48-4	R42/43 R53	May be present in certain plastics, metallic- or ceramic materials	Part of alloys hard-gold, copper alloys, Cr III finishes on Zn layers		Substitutes unknown
40	2-ethylhexyl acrylate	103-11-7	Xi; R37/38 R43	2-Ethylhexyl acrylate is used as a monomer in the chemical industry for the production of polymers and copolymers, which are mainly processed further to	Adhesive on labels		Substitutes unknown

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				aqueous polymer dispersions. The polymers and polymer dispersions are used in adhesives and as binders for paints. Other applications include coatings raw materials and uses in the plastics and textiles industries.			
41	Naphthenic acids, copper salts; copper naphthenate	1338-02-9	R10 Xn; R22 N; R50-53	May be present in certain plastics, metallic- or ceramic materials			
42	phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide	162881-26-7	R43 R53	May be present in certain plastics, metallic- or ceramic materials			
43	thallium	7440-28-0	T+; R26/28 R33 R53	May be present in certain plastics, metallic- or ceramic materials			
44	bromobenzylbromotoluene , mixture of isomers	99688-47-8	Xn; R48/22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials			
45	2,2'-(ethylenedioxy)diethyl diacrylate; triethylene glycol diacrylate	1680-21-3	Xi; R36/38 R43	May be used in carton materials			
46	Rosin; colophony [1]	8050-09-7 [1] 8052-10-6 [2] 73138-82-6 [3]	R43	Used in solder fluxes/pastes	Solder fluxes		Substitutes unknown

**Table II: Brominated flame retardants (other than PBBs or PBDEs) (JIG, 2007)**

<b>Brominated Flame Retardants (other than PBBs or PBDEs)</b>	<b>CAS Numbers</b>
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(14) [Aliphatic/alicyclic brominated compounds]	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(15) [Aliphatic/alicyclic brominated compounds in combination with antimony compounds]	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(16) [Aromatic brominated compounds excluding brominated diphenyl ether and biphenyls]	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(17) [Aromatic brominated compounds excluding brominated diphenyl ether and biphenyls] in combination with antimony compounds]	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(22) [Aliphatic/alicyclic chlorinated and brominated compounds]	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(42) [Brominated organic phosphorus compounds]	-
Poly(2,6-dibromo-phenylene oxide)	69882-11-7
Tetra-decabromo-diphenoxy-benzene	58965-66-5
1,2-Bis(2,4,6-tribromo-phenoxy) ethane	37853-59-1
3,5,3',5'-Tetrabromo-bisphenol A (TBBA)	79-94-7
TBBA, unspecified	30496-13-0
TBBA-epichlorhydrin oligomer	40039-93-8
TBBA-TBBA-diglycidyl-ether oligomer	70682-74-5
TBBA carbonate oligomer	28906-13-0
TBBA carbonate oligomer, phenoxy end capped	94334-64-2
TBBA carbonate oligomer, 2,4,6-tribromo-phenol terminated	71342-77-3
TBBA-bisphenol A-phosgene polymer	32844-27-2
Brominated epoxy resin end-capped with tribromophenol	139638-58-7
Brominated epoxy resin end-capped with tribromophenol	135229-48-0
TBBA-(2,3-dibromo-propyl-ether)	21850-44-2
TBBA bis-(2-hydroxy-ethyl-ether)	4162-45-2
TBBA-bis-(allyl-ether)	25327-89-3
TBBA-dimethyl-ether	37853-61-5
Tetrabromo-bisphenol S	39635-79-5
TBBS-bis-(2,3-dibromo-propyl-ether)	42757-55-1
2,4-Dibromo-phenol	615-58-7
2,4,6-tribromo-phenol	118-79-6
Pentabromo-phenol	608-71-9
2,4,6-Tribromo-phenyl-allyl-ether	3278-89-5
Tribromo-phenyl-allyl-ether, unspecified	26762-91-4
Bis(methyl)tetrabromo-phtalate	55481-60-2
Bis(2-ethylhexyl)tetrabromo-phtalate	26040-51-7
2-Hydroxy-propyl-2-(2-hydroxy-ethoxy)-ethyl-TBP	20566-35-2
TBPA, glycol-and propylene-oxide esters	75790-69-1
N,N'-Ethylene -bis-(tetrabromo-phthalimide)	32588-76-4
Ethylene-bis(5,6-dibromo-norbornane-2,3-dicarboximide)	52907-07-0
2,3-Dibromo-2-butene-1,4-diol	3234-02-4
Dibromo-neopentyl-glycol	3296-90-0
Dibromo-propanol	96-13-9
Tribromo-neopentyl-alcohol	36483-57-5
Poly tribromo-styrene	57137-10-7
Tribromo-styrene	61368-34-1



**Table III: Hazardous substances in EEE already regulated by existing legislation**

Substance name	CAS-Nr.	Main use in EEE	Hazard	Key Legal and Regulatory Information
Asbestos	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5	Brake lining pad, insulator, filler, abrasive, insulator, filler, pigment, paint, talc, adiabatic material	Carc. Cat. 1; R45 T; R48/23	76/769/EEC, Marketing and Use of Dangerous Substances and amendments: (83/478/EEC; 85/610/EEC; 87/217/EEC; 91/659/EEC; 99/77/EEC)
Specific Azocolourants and azodyes (which form certain aromatic amines)	Various	Pigment, dyes, colorants		76/769/EEC, Marketing and Use of Dangerous Substances and amendments: (2002/61/EC; 2003/03/EEC).
Ozone Depleting Substances and Hydrochlorofluorocarbons	Various	Refrigerant, foaming agent, insulation extinguishant		Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer