ELC submission to possible additional RoHS substances study, March 2008

EUROPEAN LAMP COMPANIES FEDERATION

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;	Equipment housings, mouldings, connectors and many other electrical components. Printed circuit boards (PCB). May be used as fining agent in certain special glasses, less than 1.5 %, and in glass of a variety of lamps e.g. HID, IR, PAR.		On-going EU risk assessment incomplete. To comply with obligatory fire regulations, Sb_2O_3 must be used with most types of brominated flame retardants and in PVC. There are no substitutes that are as effective. Only brominated flame retardants are suitable for some types of plastic[1]. The use of antimony trioxide as flame retardant in many electronic products is needed to meet the UL-V0 specifications. Metals and metal oxides contained in special glasses are firmly incorporated in the glass matrix and do not exhibit a toxic potential under normal conditions of use. Leaching Data partly available. For special glasses there exist no alternatives so far.

[1] Danish EPA study – see table 2.2 http://www2.mst.dk/Udgiv/publications/2007/978-87-7052-351-6/pdf/978-87-7052-352-3.pdf

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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	Halophospate fluorescent powders in certain fluorescent lamps (less than 1%); Lamp glass: Antimony for glass fining (less than 1%); Antimony in some lead free solder types.		There is no release of the substance from application. For glass see also ID1.
3	Arsenic/arsenic compounds	7440-38-2	T; R23/25 N; R50-53	III-V group semiconductor substrate (GaAs) Flame retardant	Fining of glass (less than 1% in glass).		Metals and metal oxides contained in special glasses are firmly incorporated in the glass matrix and do not exhibit a toxic potential under normal conditions of use. Leaching Data partly available. For special glasses there exist no alternatives so far.
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	No intentional use in lamps.		

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5	Beryllium oxide BeO	1304-56-9	Carc. Cat. 2; R49 T+; R26 T; R25-48/23 Xi; R36/37/38 R43	In ceramics, as cooling device; Thermally conductive electrical insulator	Substance may be present in electronic components of energy saving lamps and control gear.		BeO has the highest thermal conductivity of any electrically insulating material. Its thermal conductivity is similar to that of copper and so is used as an insulator on high power semiconductors to conduct heat away from the device. The next best material is aluminium nitride which has a thermal conductivity only one half that of BeO. BeO is expensive and so is used only if there are no alternatives. Parts containing BeO should be marked with a warning that it is present.
6	Tetrabromo bisphenol A and related compounds (see Table II)	79-94-7	Dangerous to the environment N; R50/53	Flame retardant	Flame retardant (reactive) in PCBs / plastic housings (PBT/PET) / encapsulation of electronic components. Additive FR in ABS and HIPS.		EU risk assessment carried out. Final recommendations not yet determined. Risk minimal and should be dealt with by REACH.
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	Traces are present in LED encapsulation: polymerisation not 100%. Used to make epoxy resin (PWB) but very little should be present in equipment.		EU risk assessment carried out. Recommendations should be covered by REACH since it is used in many other non electrical applications.

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8	Diethylhexylphthalate (DEHP)	117-81-7	Repr. Cat. 2; R60-61	Plasticizer in PVC cables	Can be present in cables and wiring of energy saving lamps and control gears.		These types of cables could be used in energy saving lamps and control gears for safety reasons.
9	Butylbenzylphthalate (BBP)	85-68-7	Repr. Cat.2; R61 Repr. Cat.3; R62 N; R50-53	Plasticizer in PVC cables	Can be present in cables and wiring of energy saving lamps and control gears.		These types of cables could be used in energy saving lamps and control gears for safety reasons.
10	Dibutylphthalate (DBP)	84-74-2	Repr. Cat. 2; R61 Repr. Cat. 3; R62 N; R50	Plasticizer in PVC cables	Can be present in cables and wiring of energy saving lamps and control gears.		These types of cables could be used in energy saving lamps and control gears for safety reasons.
11	Dioctylphthalate (DOP)	117-84-0	Dangerous to the Environment	Plasticizer in PVC cables	Can be present in cables and wiring of energy saving lamps and control gears.		These types of cables could be used in energy saving lamps and control gears for safety reasons.
12	Dimethylformamide (DMF)	68-12-2	Repr. Cat. 2; R61 Xn; R20/21 Xi; R36	Electrolyte capacitors	Electrolyte capacitors.		Uncommon or rare solvent for electrolytic capacitors. Most electrolytic capacitors use glycols.
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)	Used in printed circuit boards and in lamp cement (bonding glass and base).		Used to make polymers and so not present in electrical equipment. Most Formaldehye in lamp cement evaporates during the production process.
14	Gallium arsenide	1303-00-0	Human carcinogen*	Power amplifiers, semiconductors	State of the art substrate of many LED types; no alternatives available for many colours.		GaAs semiconductor uses less power, is less susceptible to heat and is much faster than silicon. GaAs is a dopant in semiconductor material; substrate in many LED applications. LED is going to be a very energy efficient light source for

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							general lighting ond other purposes. There are no alternatives to GaAs as growth substrate for high performance AlGaInP and AlGaAs LED.
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	In general flame retardants are widely used in electronic components, housing, printed circuit boards.		On-going EU risk assessment. Mainly used in fabrics so uncommon in electrical equipment so better to control risk via REACH which would include all products put on EU market. See also ID 1 on antimony trioxide.
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	Not used in lamps.		
17	Medium-chained chlorinated paraffins (MCCP) (Alkanes, C14-17, chloro)	85535-85-9		secondary plasticisers in PVC (cable) flame retardant plasticisers in rubbers	Can be present in cables and wiring of energy saving lamps and control gears.		
18	Nickel[2]	7440-02-0	Carc. Cat. 3; R40 R43	Stainless steel, plating; Decorative metal finishes, barrier layers	Widely used in lamps both for holder and current carrying parts having no direct skin contact and also for plating parts like		Nickel and nickel containing alloys are used for holder and current carrying parts to prevent inserting oxygen impurity inside lamps.

[2] Only in those applications where nickel is likely to result in direct and prolonged skin exposure

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					Edison bases or LED lead frames.		Nickel plating is used to make parts corrosion resistant at elevated temperature.
19	Nonylphenol Nonylphenolpolyglycolethers (Nonylphenolethoxylates)	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	Could be a trace in polycarbonates (not in case of 100% polymerisation).		Not used in electrical equipment as already restricted in EU by 76/769/EEC (item 46 of Annex XVII of REACH).
20	Perfluorooctane sulfonates[3]	1763-23-1	-		Not used in lamps.		Will be banned by 76/769/EEC.
21	PVC	9002-86-2	Dependent on the additives (stabilizers and plasticizer) used; Dioxin formation during incineration; Source of organic bound clorine	Sleeve material (of capacitors), cables, tubing films labels and gaskets, insulator, chemical resistance, transparency, sheath material	Present in cables and wiring of energy saving lamps and control gears.		PVC itself is not hazardous.
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	Not used in lamps.		Already restricted by 76/769/EEC.

[3] Restriction 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 non-decorative hard chromium (VI) plating; 4) wetting agents for use in controlled electroplating systems

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23	PCT Polychlorinated Terphenyls	61788-33-8 and various others		Electrical insulation medium, Plasticizers, fire retardants, coatings for electrical wire and cable, dielectric sealants	Not used in lamps.		Already restricted by 76/769/EEC and will also be restricted by REACH (item 1 of Annex XVII).
24	Polychlorinated Naphthalenes	70776-03-3		lubricant, paint, stabilizer (electric characteristic, flame-resistant, water-resistant) insulator, flame retardant	Not used in lamps.		
25	Selenium	7782-49-2	T; R23/25 R33 R53 Toxic/ Danger of cumulative effects / Environment**	Rectifiers and detector instruments, photoreceptor, semiconductor material, light receiving element, photocell	Use in light detection semiconductors, photo sensors (lighting controls). Is used as colouring agent in certain special glasses, less than 1%.		Substitute for Cadmium; no alternative available. Metals and metal oxides contained in special glasses are firmly incorporated in the glass matrix and do not exhibit a toxic potential under normal conditions of use. No less dangerous alternative available.
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	Used in production process, not present in final product.		
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	Not used in lamps.		
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	Not used in lamps.		Already restricted by 76/769/EC and REACH (item 20 of Annex XVII).

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29	Tributyl Tin Oxide (TBTO)	56-35-9	No classification according to 67/548	antiseptic, antifungal agent, paint, pigment, antistaining, refrigerant, foaming agent, extinguishant,	Not used in lamps.		Already restricted by 76/769/EC and REACH (item 20 of Annex XVII).
30	dinickel trioxide	1314-06-3	Carc. Cat. 1; R49 R43 R53	May be used as an electrolyte	May be used as colouring agent in certain special glasses, less than 1%.		Metals and metal oxides contained in special glasses are firmly incorporated in the glass matrix and do not exhibit a toxic potential under normal conditions of use. For colouring applications no alternative available.
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	See ID 3.		This substance is considered as an arsenic compound.
32	4,4'-methylenedi-o-toluidine	838-88-0	Carc. Cat. 2; R45 Xn; R22 R43 N; R50-53	Potential use as a dye	Not used in lamps.		
33	Petrolatum; Petrolatum	8009-03-8	Carc. Cat. 2; R45	Used in solder fluxes/pastes	Not used in lamps.		
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	Not used in lamps.		
35	tributyl phosphate	126-73-8	Carc.Cat.3; R40 Xn; R22 Xi; R38	May be present in certain plastics, metallic- or ceramic materials	Could be a trace on nickel plated lamp bases.		
36	divanadium pentaoxide; vanadium pentoxide	1314-62-1	Muta. Cat. 3; R68 Repr. Cat. 3; R63 T; R48/23 Xn; R20/22 Xi; R37	May be present in certain plastics, metallic- or ceramic materials	Used in special fluorescent lamps with “external ignition strip”.		

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			N; R51-53				
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	Could be a trace on nickel plated lamp bases.		
38	cobalt oxide	1307-96-6	Xn; R22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials	Used as colouring agent in certain special glasses, less than 5% e.g. in glass for special lamps (black light blue lamps).		Inherent in the glass not released. No alternative available.
39	cobalt	7440-48-4	R42/43 R53	May be present in certain plastics, metallic- or ceramic materials	Unknown for lamps.		
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 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.	Not used in lamps.		
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	Not used in lamps.		

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42	phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide	162881-26-7	R43 R53	May be present in certain plastics, metallic- or ceramic materials	Not used in lamps.		
43	thallium	7440-28-0	T+; R26/28 R33 R53	May be present in certain plastics, metallic- or ceramic materials	Thallium compounds are used in HID lamps.		No alternative available.
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	Not used in lamps.		
45	2,2'-(ethylenedioxy)diethyl diacrylate; triethylene glycol diacrylate	1680-21-3	Xi; R36/38 R43	May be used in carton materials	Not used in lamps.		
46	Rosin; colophony [1]	8050-09-7 [1] 8052-10-6 [2] 73138-82-6 [3]	R43	Used in solder fluxes/pastes	Used in lamp cement (bonding glass and base) and solder material		

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

Brominated Flame Retardants (other than PBBs or PBBEs)	CAS Numbers
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