

Hazardous substances in EEE – high priority RoHS & WEEE 最新高度關注物質

歐盟 RoHS 指令中，最新研究的目的是在鑒於 RoHS 标准第 6 条要求提供必要的支持，包括调查下述項

- 電子電器產品中其它有害物質
- 當前怎麼管理這些物質
- 其它有害物質對環境,經濟,社會帶來的持續影響，高度關注的有害物質見下屬表格：

Table I: Hazardous substances in EEE – high priority

表一:電子電器產品，高度重視的有害物質

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
1	Antimony trioxide 三氧化二銻	1309-64-4	Carc Cat. 3 R40	Synergist brominated flame retardants; 增效型溴類阻燃劑
2	Antimony compounds 銻化合物	-	Xn; R20/22 N; R51-53	Flame retardant; melting agent in CRT glass; solder material (antimony-tin) Melting agent in CRT glass 阻燃劑;顯像管玻璃裡的熔化劑;焊錫材料(銻-錫) 顯像管玻璃裡的熔化劑
3	Arsenic/arsenic compounds 砷/砷化合物	7440-38-2	T; R23/25 N; R50-53	III-V group semiconductor substrate (GaAs) Flame retardant III – V 族半導體基板阻燃劑 (GaAs)
4	Beryllium metal 金屬鈹	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

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
				rigidity for precision instrumentation 合金;銅鍍合金 接插件:彈簧觸片,提高銅合金的彈性;金手指電腦剪接,維持金屬的導電性 檢測器繼電器:改善銅接觸金屬彈片的性能 開關:高強度,高導電性能 激光打印機:旋轉鏡面,減輕精密型儀器的重量
5	Beryllium oxide BeO 氧化鈹	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 作為陶瓷材料的冷卻裝置 電子絕緣材料的熱電阻
6	Tetrabromo bisphenol A and related compounds (see Table II) 四溴雙酚 A 及其相關化合物 (見表二)	79-94-7	Dangerous to the environment N; R50/53	Flame retardant 阻燃劑
7	Bisphenol A (4,4'-Isopropylidendiphenol) 雙酚 A	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 電子設備和醫療設備裡的聚碳酸酯塑膠;PVC裡的硬化劑,催化劑,結合劑,穩定劑;環氧樹脂產品
8	Diethylhexylphthalate (DEHP) 鄰苯二甲酸二乙基己酯	117-81-7	Repr. Cat. 2; R60-61	Plasticizer in PVC cables PVC 電纜裡的增塑劑
9	Butylbenzylphthalate (BBP) 鄰苯二甲酸丁酯	85-68-7	Repr. Cat.2; R61 Repr. Cat.3; R62 N; R50-53	Plasticizer in PVC cables PVC 電纜裡的增塑劑
10	Dibutylphthalate (DBP) 鄰苯二甲酸二正丁酯	84-74-2	Repr. Cat. 2; R61 Repr. Cat. 3; R62 N; R50	Plasticizer in PVC cables PVC 電纜裡的增塑劑

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
11	Diocetylphthalate (DOP) 鄰苯二甲酸酯	117-84-0	Dangerous to the Environment	Plasticizer in PVC cables PVC 電纜裡的增塑劑
12	Dimethylformamide (DMF) 二甲基甲酰胺	68-12-2	Repr. Cat. 2; R61 Xn; R20/21 Xi; R36	Electrolyte capacitors 電解質電容器
13	Formaldehyde 甲醛	50-00-0	Carc. Cat. 3; R40 T; R23/24/25 C; R34 R43	Preservatives, monomer (e.g. phenol resin and melamine resin) 防腐劑,單體(例如酚醛樹脂和三聚氰胺樹脂)
14	Gallium arsenide 砷化鎵	1303-00-0	Human carcinogen*	Power amplifiers, semiconductors 功率放大器,半導體
15	Hexabromocyclododecane (HBCDD) and further brominated flame retardants (see table II) 六溴環十二烷及其溴類阻燃劑(見表二)	3194-55-6	not (yet) classified in the Annex I of Directive 67/548/EEC; proposal: R33, R64, N R50-53; PBT	Flame retardant 阻燃劑
16	Liquid crystals e.g. MBBA (4-methoxybenzylidene-4-butylaniline); 5CB (4-pentyl-4-cyanobiphenyl) N-(4-甲氧基亞苄基)對丁基苯胺;液晶 MBBA			Electroactive layer in liquid crystal displays of cellular phones, notebooks, PC monitors 移動電話 筆記本電腦 PC 顯示器的液晶顯示器電層
17	Medium-chained chlorinated paraffins (MCCP) (Alkanes, C14-17, chloro) C14-17 中鏈碳氯	85535-85-9		secondary plasticisers in PVC (cable) flame retardant plasticisers in rubbers PVC 電纜中塑膠類阻燃劑

ID	Substance name 物質名稱	CAS-Nr.	Hazard	Main use in EEE 電子產品中主要用途
	化石蠟			
18	Nickel ¹ 鎳	7440-02-0	Carc. Cat. 3; R40 R43	Stainless steel, plating; Decorative metal finishes, barrier layers 不銹鋼,鍍層,金屬裝飾品,阻隔層
19	Nonylphenol Nonylphenolpolyglycolethers (Nonylphenoethoxylates) 壬基酚	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 塑膠中的表面活性劑,抗氧化劑
20	Perfluorooctane sulfonates ² 氟辛烷	1763-23-1	-	
21	PVC 聚氯乙烯	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 套環材料(電容),電纜,管道薄膜標籤和墊圈,絕緣材料,化學阻抗劑,轉換劑
22	PCBs Polychlorinated Biphenyls 多氯聯苯	1336-36-3 and various others	R33 N; R50-53 Dioxin/furan formation during incineration	Flame retardant in PVC plastic cable; capacitors PVC 塑膠電纜中的阻燃劑;電容
23	PCT Polychlorinated Terphenyls 聚氯三聯苯	61788-33-8 and various others		Electrical insulation medium, Plasticizers, fire retardants, coatings for electrical wire and cable, dielectric sealants 電器絕緣介質,增塑劑,阻燃劑,電線電纜的塗層,絕緣密封膠

¹ Only in those applications where nickel is likely to result in direct and prolonged skin exposure
只有在這些應用才有可能導致於鎳直接和長期的皮膚接觸

² 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

上述限值不適用於下列設施:1) 光致抗蝕劑或增塗料的光刻工藝 2) 薄膜,紙張,印刷品的鍍層 3) 非裝飾性六價鉻電鍍抑制性水霧 4) 電鍍行業中液態試劑

ID	Substance name 物質名稱	CAS-Nr.	Hazard	Main use in EEE 電子產品中主要用途
24	Polychlorinated Naphthalenes 多萘	70776-03-3		lubricant, paint, stabilizer (electric characteristic, flame-resistant, water-resistant) insulator, flame retardant
25	Selenium 硒	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 潤滑劑,油漆,穩定性(電性,阻燃,防水)絕緣器,阻燃劑 整流器和檢測器,半導體材料,光接收材料,光電池
26	Short-chained chlorinated paraffins (SCCP) (Alkanes, C10-13, chloro) 短鏈碳氯化石蠟	85535-84-8	Carc. Cat. 3; R40 N; R50-53	plasticisers in PVC (cable) flame retardant plasticisers PVC 塑膠電纜中阻燃劑
27	Synthetic vitreous fibres -glass fibres - mineral wool - refractory ceramic fibre (RCFs) 合成玻璃纖維 -玻璃纖維 -礦棉 -耐火陶瓷纖維	142844-00-6	RCF: Carc. Cat. 2;	Thermal insulation materials in domestic electrical appliances 家用電器設備中的熱絕緣材料
28	Tributyl Tin (TBT) compounds 三丁基錫 Triphenyl Tin (TPT) compounds 三苯基錫	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 穩定劑,抗氧化劑,抗菌抗真菌劑,阻垢劑,防腐劑,油漆,顏料,防銹劑
29	Tributyl Tin Oxide (TBTO) 三丁基錫氧化物	56-35-9	No classification according to 67/548	antiseptic, antifungal agent, paint, pigment, antistaining, refrigerant, foaming agent, extinguishant, 抗菌抗真菌劑,油漆,顏料,防銹劑,制冷劑,發泡劑,滅火劑

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
30	dinickel trioxide 三氧化二砷	1314-06-3	Carc. Cat. 1; R49 R43 R53	May be used as an electrolyte 可能用做電解質
31	Diarsenic trioxide; arsenic trioxide 五氧化二砷	1327-53-3	Carc. Cat. 1; R45 T+; R28 C; 34 N; R50-53	May be used in certain glass-materials, less than 5000ppm 可能用於特定玻璃材料,含量不少於 5000ppm
32	4,4'-methylenedi-o-toluidine 4,4' - 二甲基乙烯-鄰甲苯胺	838-88-0	Carc. Cat. 2; R45 Xn; R22 R43 N; R50-53	Potential use as a dye 潛在用途染料
33	Petrolatum; 凡士林	8009-03-8	Carc. Cat. 2; R45	Used in solder fluxes/pastes 用於焊接溶劑/熔膏
34	nickel dihydroxide 氫氧化鎳	12054-48-7	Carc. Cat. 3; R40 Xn; R20/22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
35	tributyl phosphate 磷酸三丁酯	126-73-8	Carc.Cat.3; R40 Xn; R22 Xi; R38	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
36	divanadium pentaoxide; vanadium pentoxide 五氧化二釩	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 可能存在於特定塑膠,金屬或者陶瓷材料中
37	nickel sulphate 硫酸鎳	7786-81-4	Carc. Cat. 3; R40 Xn; R22 R42/43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials 可存在於特定塑膠,金屬或者陶瓷材料中
38	cobalt oxide 氧化鈷	1307-96-6	Xn; R22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials 可存在於特定塑膠,金屬或者陶瓷材料中
39	Cobalt 鈷	7440-48-4	R42/43 R53	May be present in certain plastics, metallic- or ceramic materials 可存在於特定塑膠,金屬或者陶瓷材料中
40	2-ethylhexyl	103-11-	Xi; R37/38	2-Ethylhexyl acrylate is used as a

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
	acrylate 2-乙基丙烯酸酯	7	R43	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. 2-乙基丙烯酸酯作為一種用於生產化學聚合物的單體,主要用於水性聚合物進一步分散處理.聚合物和聚合物分散體用於塗料粘合劑.其它用途包括塗料原材料以及塑膠和紡織工業.
41	Naphthenic acids, copper salts; copper naphthenate 環烷酸·銅鹽類;環烷酸銅	1338-02-9	R10 Xn; R22 N; R50-53	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
42	phenyl bis(2,4,6-trimethylbenzoyl)-phosphine oxide 苯基二氧化磷	162881-26-7	R43 R53	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
43	Thallium 鉈	7440-28-0	T+; R26/28 R33 R53	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
44	bromobenzylbromotoluene, mixture of isomers 溴苄 溴甲苯異構體化合物	99688-47-8	Xn; R48/22 R43 N; R50-53	May be present in certain plastics, metallic- or ceramic materials 可能存在於特定塑膠,金屬或者陶瓷材料中
45	2,2'-(ethylenedioxy)diethyl diacrylate; triethylene glycol diacrylate 2,2'-(亞乙二氧基)二乙基二丙烯酸酯;三甘醇二丙烯酸酯	1680-21-3	Xi; R36/38 R43	May be used in carton materials 可用作紙箱材料

ID	Substance name 物質名稱	CAS- Nr.	Hazard	Main use in EEE 電子產品中主要用途
	酸酯			
46	Rosin; colophony [1] 松香	8050- 09-7 [1] 8052- 10-6 [2] 73138- 82-6 [3]	R43	Used in solder fluxes/pastes 用於焊錫材料

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

表二: 溴系阻燃劑(除 PBBs PBDEs 外)(2007 年一月)

Brominated Flame Retardants (other than PBBs or PBDEs) 溴類阻燃劑(除PBBs PBDEs外)	CAS Numbers
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(14) [Aliphatic/alicyclic brominated compounds] 屬於法国 (14) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(15) [Aliphatic/alicyclic brominated compounds in combination with antimony compounds] 屬於法国 (15) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(16) [Aromatic brominated compounds excluding brominated diphenyl ether and biphenyls] 屬於法国 (16) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
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 屬於法国 (17) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(22) [Aliphatic/alicyclic chlorinated and brominated compounds] 屬於法国 (22) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
Brominated flame retardant which comes under notation of ISO 1043-4 code number FR(42) [Brominated organic phosphorus compounds] 屬於法国 (42) ISO 1043-4 , [脂肪族/脂环溴化合物] 编号的溴類阻燃劑	-
Poly(2,6-dibromo-phenylene oxide) 聚(2,6-二溴醚)	69882-11-7
Tetra-decabromo-diphenoxy-benzene	58965-66-5
1,2-Bis(2,4,6-tribromo-phenoxy) ethane 1,2-雙(2,4,6-三溴苯氧基)乙烷	37853-59-1
3,5,3',5'-Tetrabromo-bisphenol A (TBBA) 3,5,3',5'-四溴雙酚A	79-94-7
TBBA, unspecified 普通TBBA,	30496-13-0
TBBA-epichlorhydrin oligomer TBBA-低聚物	40039-93-8
TBBA-TBBA-diglycidyl-ether oligomer TBBA-TBBA-雙氧醚低聚物	70682-74-5
TBBA carbonate oligomer TBBA碳酸低聚物	28906-13-0
TBBA carbonate oligomer, phenoxy end capped 苯氧劑除阻力TBBA碳酸低聚物	94334-64-2
TBBA carbonate oligomer, 2,4,6-tribromo-phenol terminated 2,4,6-三溴苯酚終止 TBBA碳酸低聚物	71342-77-3
TBBA-bisphenol A-phosgene polymer TBBA-雙酚A-光聚合物	32844-27-2
Brominated epoxy resin end-capped with tribromophenol 用於溴類環氧樹脂的三溴苯酚	139638-58-7
Brominated epoxy resin end-capped with tribromophenol 用於溴類環氧樹脂的三溴苯酚	135229-48-0
TBBA-(2,3-dibromo-propyl-ether) TBBA-(2,3-二溴丙醚)	21850-44-2
TBBA bis-(2-hydroxy-ethyl-ether) TBBA雙(2-羥基乙基甲醚)	4162-45-2
TBBA-bis-(allyl-ether) TBBA-雙(烯丙基醚)	25327-89-3
TBBA-dimethyl-ether TBBA-二甲基乙醚	37853-61-5
Tetrabromo-bisphenol S 四溴雙酚S	39635-79-5
TBBS-bis-(2,3-dibromo-propyl-ether) TBBS-雙(2,3-二溴丙醚)	42757-55-1
2,4-Dibromo-phenol 2,4-二溴苯酚	615-58-7
2,4,6-tribromo-phenol 2,4,6-三溴苯酚	118-79-6
Pentabromo-phenol 五溴苯酚	608-71-9
2,4,6-Tribromo-phenyl-allyl-ether 2,4,6-三溴-苯基烯丙基醚	3278-89-5
Tribromo-phenyl-allyl-ether, unspecified 三溴-苯基烯丙基醚	26762-91-4
Bis(methyl)tetrabromo-phthalate 雙(甲基)四溴phthalate	55481-60-2
Bis(2-ethylhexyl)tetrabromo-phthalate 雙(2-乙基己基)四溴phthalate	26040-51-7
2-Hydroxy-propyl-2-(2-hydroxy-ethoxy)-ethyl-TBP 2-羥基-丙基-2-(2-羥基乙氧基)-乙基磷酸三丁酯	20566-35-2
TBPA, glycol-and propylene-oxide esters TBPA , 乙二醇和丙稀氧化酯	75790-69-1
N,N'-Ethylene-bis-(tetrabromo-phthalimide) N,N'-亞乙基-雙(四溴邻苯二甲酰亞胺)	32588-76-4
Ethylene-bis(5,6-dibromo-norbornane-2,3-dicarboximide)	52907-07-0

2,3-Dibromo-2-butene-1,4-diol 2,3 -二溴- 2 -丁烯- 1 ,4 -二醇	3234-02-4
Dibromo-neopentyl-glycol 二溴辛戊乙二醇	3296-90-0
Dibromo-propanol 二溴丙醇	96-13-9
Tribromo-neopentyl-alcohol 三溴辛戊醇	36483-57-5
Poly tribromo-styrene 聚三溴苯乙烯	57137-10-7
Tribromo-styrene 三溴苯乙烯	61368-34-1

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

表三:在現有法規裡已經限制使用於電子電器產品中的有害物質

Substance name 物質名稱	CAS-Nr.	Main use in EEE 電子電器產品中主要用途	Hazard	Key Legal and Regulatory Information 主要法規信息
Asbestos 石棉	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, pigment, paint, talc, adiabatic material 制動性襯墊,絕緣材料,填料,顏料,滑石粉	Carc. Cat. 1; R45 T; R48/23	76/769/EEC, Marketing and Use of Dangerous Substances and amendment: (83/478/EEC; 85/610/EEC; 87/217/EEC; 91/659/EEC; 99/77/EEC) 76/769/EEC 有害物質的銷售和使用以及(83/478/EEC; 85/610/EEC; 87/217/EEC; 91/659/EEC; 99/77/EEC)修正版
Specific Azocolourants and azodyes (which form certain aromatic amines) 偶氮化合物(用於特定芳香胺)	Various	Pigment, dyes, colorants 顏料,染料,著色劑		76/769/EEC, Marketing and Use of Dangerous Substances and amendments: (2002/61/EC; 2003/03/EEC). 76/769/EEC 有害物質的銷售和使用以及(2002/61/EC; 2003/03/EEC)的修正版.
Ozone Depleting Substances and Hydrochlorofluorocarbons 含氫氯氟碳化合物	Various	Refrigerant, foaming agent, insulation extinguishant 制冷劑,發泡劑,絕緣滅火器		Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer (EC) No. 2037/2000 消耗臭氧層物質的限制要求