



Samsung Electronics
Standards for Control of Substances with Environmental Impacts within Products
(SEC Registration No. 0QA-2049)

(For Cooperating Suppliers)
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CS Management Center
Products Environment Technology Team

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1. Preface

In order to sell our products to the world marketplace, Samsung Electronics must guarantee and verify environmental compliance for all parts and components of finished products to prevent adverse effects on human health and the environment. The following list of substances with environmental impacts was developed based on global regulatory and customer requirements.

2. Purpose

This document is to provide information and requirements for environmental material compliance on Samsung Electronics products. The following standard specifies restrictions on substances and materials used in manufacture of Samsung Electronics products, including bans, restrictions, and reporting of certain substances as constituents of parts, components, materials and products supplied into Samsung Electronics.

3. Scope

This standard applies to all parts, components, and materials (including packaging materials), which are used to develop products to put in the market. The application scope is specified for each substance in the standard. The standard also applies to all products designed, developed and manufactured by the company regardless of region.

4. Definitions

A. Substances with Environmental Impacts

: Substances or groups of substances which are regulated and restricted for use by the company due to their adverse effects on the human body and the environment.

B. Management Classification

1) Class: Classification of the substance category by regulatory status

- **Class I :** Substances which are regulated by EU Directive RoHS (Restriction of the use of certain hazardous substances in electrical and electronic equipment, Directive 2002/95/EC). The substances include cadmium, lead, mercury, hexavalent chromium, and PBB and PBDE

- **Class II** : Substances which are designated for restricted use by regulations or other than by EU Directive RoHS
- **Class III** : Substances whose uses are monitored and reported to develop appropriate measures for future restrictions and phase-out programmes

2) **Level:** Classification of application scope and implementation date in a Class

- **Level 1** : The standard has been taken into effect on application scope specified by Level.
- **Level 2** : The standard shall be effective on regulated application at a certain time designated in Level 2
- **Exemptions:** In cases where no alternative is available and substances are used for a specific characteristic, appearance or quality, the substance can be used until appropriate measures or alternatives are developed

C. Threshold limit

: The maximum concentration level at which the presence of a substance can be tolerated in a material. This level is provided for detection sensitivity errors of instrumental measurements and trace impurities in a material. Threshold limits are criteria for fail or pass of material qualification. Only concentrations less than threshold limits will be accepted for qualified material.

D. Detailed Analysis

: Detailed analysis is a test using equipments with high precision such as ICP, IC, UV/VIS and GC/MS.

E. ICP (Inductively Coupled Plasmas) Analysis

: ICP is a method of atomic emission spectrometry for analysis of heavy metals in a given sample. When plasma energy, generated by Argon gas, is given to an analysis sample, the atoms are excited. When the excited atoms return to low energy position, emission rays (spectrum rays) are released and the emission rays that correspond to the photon wavelength are measured. The element type is determined by the position of the photon rays, and the content of each element is determined by the ray's intensity.

There can be errors in results depending on the type of acid used and the pre-treatment method. It is therefore necessary to check the recommended pre-treatment method for the substance classification of the sample.

F. IC (Ion Chromatography)

: Ion Chromatography (IC) is the separation and quantification of anions and cations using Liquid Chromatography (LC). LC is an analytical technique based on the separation of the components of a mixture in solution by selective absorption. There are basically three modes of separation: liquid/liquid, liquid/solid, and molecular size. Once the components have been separated they are measured by a conductivity detector.

G. UV/VIS spectrometry

: UV/VIS spectrometry is a tool that measures the wavelength-dependant absorption of light in the visible or ultraviolet region. It is usually applied to identify molecules and inorganic ions or complexes in solution. The UV-VIS spectra have broad bands that are of limited use for sample identification but are very useful for the quantitative measurements. Measuring the transmittance at some wavelengths, and applying the Beer-Lambert law equations, the concentration of the solvent in the solution can be determined.

H. GC/MS (Gas chromatography with Mass spectrometry)

: Gas Chromatography–Mass Spectrometry (GC-MS) is an analytical technique involving the use of both Gas Chromatography (GC) and Mass Spectrometry (MS), the former to separate a complex mixture into its components and the latter to deduce the atomic weights of those components. It is particularly useful in identifying organic compounds. (LRGC/MS : Low Resolution GC/MS, HRGC/MS : High Resolution GC/MS)

5. Management and Application Standard

A. The Standard for Substances with Environmental Impacts within Products

- 1) The company manages the substances with environmental impacts by classifying them as either Class I , II or 3 and Level 1, 2 as exemptions.
- 2) The measures and schedules for management of the substances with environmental impacts (refer to Table 1 and 2) are specified for each substance. The standard and management method will be regularly revised and further consolidated to comply with global regulatory changes, after notifying the GBMs (Global Business Management).
- 3) The company will provide a grace period for improvements until alternatives or other methods are available.
- 4) The standard provides maximum concentration levels for management of substances. Maximum concentration levels are determined after considering likely levels of impurities in materials and known error factors in the measurement instruments / methods used to assess them.
- 5) The listed substances of the standard are determined and managed at a corporate level, so GBMs must include the substances listed in the standard as a minimum requirement on the GBM's own list and rules.

B. List of Substances with Environmental Impacts for Control and Management

Table 1. Banned and restricted substances

Type	Substance/Material	Regulation
Class I ^a	Cadmium and compounds	EU RoHS Directive EU Packaging Directive EU Battery Directive OSPAR Priority Chemicals
	Lead and compounds	EU RoHS Directive California Proposition 65 EU Packaging Directive EU Battery Directive OSPAR Priority Chemicals
	Mercury and compounds	EU RoHS Directive EU Packaging Directive EU Battery Directive OSPAR Priority Chemicals
	Hexavalent chromium and compounds	EU RoHS Directive EU Packaging Directive OSPAR Priority Chemicals
	Polybrominated biphenyls (PBBs)	EU RoHS Directive OSPAR Priority Chemicals
	Polybrominated diphenylethers (PBDEs)	EU RoHS Directive OSPAR Priority Chemicals
Class II ^b	Polychlorinated biphenyls (PCBs) Polychlorinated terphenyls (PCTs) Polychlorinated naphthalenes (PCNs, with three or more chlorine substituents)	EU Directive 76/769/EEC OSPAR Priority Chemicals
	Ozone layer depleting substances (CFCs, HCFCs, Halons)	Montreal Protocol EC Regulation 2037/2000
	Asbestos	EU Directive 76/769/EEC
	Formaldehyde	German Regulations
	Short-chain chlorinated paraffins (Alkane 10 ~ 13 carbon chain)	EU Directive 76/769/EEC OSPAR Priority Chemicals
	Azo colorants	EU Directive 2002/61/EC
	Nickel and compounds	EU Directive 94/27/EC
	Organic tin compounds	EU Directive 76/769/EEC OSPAR Priority Chemicals
	Arsenic and compounds	EU Directive 76/769/EEC

* The substances listed in Table 1 are restricted for use in Samsung Electronic Co., Ltd. **These substances are prohibited for deliberate use in the production of products, parts and materials bought or manufactured by the company.** For unintentional and inevitable uses (i.e. impurities), a threshold level is provided for each substance. If the concentrations of substances are less than the appropriate threshold levels, then the item can be considered as qualified for use in production.

^a Class I 6 substances regulated by RoHS Directive 2002/95/EC. The substances are officially controlled from the implementation date and will be phased out by June 30, 2005.

^b Class II Substances other than those regulated by RoHS Directive 2002/95/EC. Most of them are hardly used but their use will be officially controlled from the implementation dates.

Table 2. Monitored and reportable substances

Type	Substance/Material	
Class III^a	Phthalates	1. For PVC, its ban of use in packaging implemented from May 14, 2004
	Polyvinyl chloride (PVC)	2. The company will monitor PVC use in products and develop phase-out plan by the end of 2005
	Beryllium and compounds	
	Other chlorinated flame retardants	
	Other brominated flame retardants (BFRs) • TBBP-A: Tetrabromobisphenol-A	1. Phase-out plan of brominated flame retardants of high concern, such as TBBP-A, will be developed after monitoring of its use 2. Phase-out plan for all other BFRs planned for end of 2005, based on available substitutes, which are both non-hazardous to health or the environment, and are technically feasible for use without unacceptable loss of product quality and performance

^a Class III Monitored and reportable substances, which are monitored and reported to reduce the use in products. The company will conduct research on development of a substitute and phase-out plan for Class III substances.

C. Application of Standards for Substances with Environmental Impacts within Products

C.1. Cadmium and compounds (Cd)

Example use: Pigment, anti-corrosion surface treatment, electric and electronic materials, optical material, stabilizer, stabilizer for PVC, plating, electrode, etc.

Type	Level 1		Level 2
Threshold Limit (mg/kg = ppm)	5 ppm	80 ppm	80 ppm
Application	Internal / external plastics, rubber, stabilisers, colouring agents, dyes / pigments, paints or surface coating / plated plastic, packaging / batteries	Plated metal	All applications except for level 1
Implementation date	May 14, 2004		January 1, 2005
Exemption	<ul style="list-style-type: none"> - The Cadmium plating of electric / electronic contacts which requires a high safety and reliability standard for which no alternative materials exist. - Cadmium in optical and filter glass 		

C.2. Lead and compounds (Pb)

Example use: Rubber hardener, pigment, paint, lubricant, plastic stabilizer, battery material, free-machining alloy, free-cutting steels, optical materials, X-ray shielding in CRT glass, electrical solder materials, mechanical solder, curing agent, vulcanizing agent, resin stabilizer, plating, metal alloy, resin additives

Type	Level 1		Level 2
Threshold Limit (mg/kg = ppm)	100 ppm	800 ppm	800 ppm
Application	Internal / external plastics, rubber, stabilizers, colouring agents, dyes / pigments, paints, coating	PWB board surface, surface coating / plating (external electrodes, lead wires, etc), alloy, solder paste and other assembly materials, which are not specified in Exemption	All applications except for level 1
Implementation date	May 14, 2004		January 1, 2005
Exemption	<ul style="list-style-type: none"> - Lead in glass of cathode ray tubes, electronic components and fluorescent tubes - Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminium containing up to 0.4 % lead by weight and as a 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 as well as network management for telecommunications, - Lead in electronic ceramic parts (e.g. piezoelectronic devices) - Lead used in compliant pin connector systems. - Lead as a coating material for the thermal conduction module c-ring. - Lead in optical and filter glass. - 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. - Lead in solders to complete a viable electrical connection between semiconductor die and carrier within integrated circuit Flip Chip packages. 		

C.3. Mercury and compounds (Hg)

Example use: fluorescent bulb, contact point material, pigment, anti-corrosion, high-efficiency phosphor, antibacterial treatment		
Type	Level 1	Level 2
Threshold Limit (mg/kg = ppm)	800 ppm	800 ppm
Application	Internal / external plastics, rubber, colouring agents, pigments / dyes, paints, inks, packaging / batteries	All applications except for level 1
Implementation date	May 14, 2004	January 1, 2005
Exemption	<ul style="list-style-type: none"> - Mercury in compact fluorescent lamps not exceeding 5 mg per lamp - Mercury in straight fluorescent lamps for general purposes not exceeding <ul style="list-style-type: none"> • halophosphate 10 mg • triphosphate with normal lifetime 5 mg • triphosphate with long lifetime 8 mg - Mercury in straight fluorescent lamps for special purpose 	

C.4. Hexavalent chromium and compounds (Cr⁺⁶)

Example use: Pigment, paint, ink, catalyst, plating, anti-corrosion surface treatment, dye, paint dryer, surface treatment, chromate treatment, paints adhesion enhancement, anti-corrosion		
Type	Level 1	Level 2
Threshold Limit (mg/kg = ppm)	800 ppm	800 ppm
Application	Internal / external plastics, rubber, coloring agents, pigments / dyes, paints, inks, packages / batteries	All applications except for level 1
Implementation date	May 14, 2004	January 1, 2005
Exemption	<ul style="list-style-type: none"> - Hexavalent chromium as an anti-corrosion of the carbon steel cooling system in absorption refrigerators 	

* **Qualification method** : Spot-test (Prohibit Cr+6 Passivation Coating)

C.5. Polybrominated biphenyls (PBBs)

Example use: flame retardant	
Type	Level 2
Threshold Limit (mg/kg = ppm)	800 ppm
Application	All applications (e.g. flame retardants)
Implementation date	February 1, 2005

C.6. Polybrominated diphenylethers (PBDEs)

Example use: flame retardant	
Type	Level 2
Threshold Limit (mg/kg = ppm)	800 ppm
Application	All applications (e.g. flame retardants)
Implementation date	February 1, 2005

C.7. Polychlorinated biphenyls (PCBs) / polychlorinated terphenyls (PCTs) / polychlorinated naphthalenes (PCNs, with three or more chlorine substituents)

Example use: insulation oil, lubricant oil, electrical insulation medium, solvent, electrolytic solution, stabilizer, electricity, flame retardant, water-resistant, insulator	
Type	Level 1
Threshold Limit (mg/kg = ppm)	50 ppm
Application	All applications
Implementation date	May 14, 2004

C.8. Ozone layer depleting substances (CFCs, HCFCs, Halons)

Example use: refrigerant, foaming agent, extinguishant, solvent cleaner	
Type	Level 1
Threshold Limit	Non-use
Application	All applications
Implementation date	May 14, 2004

C.9. Asbestos and its compounds

Example use: Brake lining pad, insulator, filler, abrasive, pigment, paint, talc, adiabatic material	
Type	Level 1
Threshold Limit	Non-use
Application	All applications (e.g. filler, insulating material)
Implementation date	May 14, 2004

C.10. Formaldehydes

Example use: antiseptic solution, preservative		
Type	Level 1	Level 2
Threshold Limit (mg/kg = ppm)	0.1ppm in a test chamber.	0.1ppm in a test chamber.
Application	Exporting wooden products into EU member states	phenolic resin
Implementation date	May 14, 2004	

C.11. Short-chain chlorinated paraffins, alkane 10 ~ 13 carbon chain

Example use: plasticizer for PVC, flame retardant	
Type	Level 1
Threshold Limit (mg/kg = ppm)	1000 ppm
Application	Plastic softener or plasticizer, PWBs
Implementation date	May 14, 2004

C.12. Azo colorants

Example use: pigment, dyes, colorants	
Type	Level 1
Threshold Limit (mg/kg = ppm)	30 ppm
Application	Textile and leather article in prolonged contact with the skin (e.g. belt, straps, grip, etc.)
Implementation date	May 14, 2004

C.13. Nickel and compounds

Example use: pigment, paint, optical thin film, reflection coating, battery materials, conductive materials, semiconductors, surface treatment, magnetic thin film, nickel plating, electrode, catalyst, alloy	
Type	Level 1
Threshold Limit	0.5 ug-Ni/cm ² /week
Application	Applications (alloys) for the components contacting human skins : External chassis/ case parts
Implementation date	May 14, 2004

C.14. Organic tin compounds

Example use: antiseptic, anti-oxidizer, antibacterial and antifungal agents, antifoulant, paint, pigment, antistaining	
Type	Level 1
Threshold Limit	Non-use
Application	Paints, inks, preservatives, and fungicides
Implementation date	May 14, 2004

C.15. Arsenic compounds

Example use: pigment, paint, dye, anti-foamer for glass, GaAs semiconductor	
Type	Level 1
Threshold Limit	Non-use
Application	Paints, inks, preservatives, and fungicides
Implementation date	May 14, 2004

D. Application of Standards for Packaging Materials

D.1. Cadmium, lead, mercury, hexavalent chromium

Type	Level 1
Threshold limit (mg/kg = ppm)	80 ppm (Sum of Cd, Pb, Hg, and Cr ⁺⁶ concentrations)
Application	All packaging material
Implementation date	May 14, 2004
Exemptions	- Packaging entirely made of lead crystal glass - Incidental presence of regulated heavy metals by using recycled material

D.2. Ozone layer depleting substances (CFCs, HCFCs, Halons)

Example use: blowing agents	
Type	Level 1
Threshold limit	Non-use
Application	All packaging materials
Implementation Date	May 14, 2004

D.3. PVC (Polyvinyl chloride)

Example use: packaging material	
Type	Level 1
Threshold limit	Non-use
Application	All packaging materials
Implementation Date	May 14, 2004

D.4. BFR (Brominated Flame Retardant)

Example use: packaging material	
Type	Level 1
Threshold limit	Non-use
Application	All packaging materials
Implementation Date	February 1, 2005

E. Application of Standards for Battery and Accumulators

E.1. Cadmium and compounds

Type	Level 1
Threshold limit (mg/kg = ppm)	250 ppm
Application	All application in battery and accumulators
Implementation Date	May 14, 2004

※ Cadmium-contained battery exceeding the threshold limit will be accepted only if adequately marked or labeled according to applicable regulations.

E.2. Lead and compounds

Type	Level 1
Threshold limit (mg/kg = ppm)	4000 ppm
Application	All applications in battery and accumulators
Implementation Date	May 14, 2004

※ Lead-contained battery exceeding the threshold limit will be accepted only if adequately marked or labeled according to applicable regulations.

E.3. Mercury and compounds

Type	Level 1
Threshold limit (mg/kg = ppm)	5 ppm
Application	All applications in battery and accumulators
Implementation Date	May 14, 2004
Exemptions	< 2% by wt. for button cell batteries

*** Cadmium or Lead-contained battery exceeding the threshold limit will be accepted only if adequately marked or labeled according to applicable regulations**



labeling

Appendix. Detailed chemical list with CAS-No.

Appendix 1. Cadmium and compounds

Substance	CAS Number
Cadmium	7440-43-9
Cadmium alloys	-
Cadmium oxide	1306-19-0
Cadmium sulfide	1306-23-6, 8048-07-5
Cadmium carbonate	513-78-0
Cadmium chloride	10108-64-2
Cadmium nitrate	10325-94-7
Cadmium nitrate tetrahydrate	10022-68-1
Cadmium sulfate	10124-36-4
Cadmium stearate	2223-93-0
Other cadmium compounds and alloys	

Appendix 2. Lead and compounds

Substance	CAS Number
Lead; metal	7439-92-1
Lead/Tin alloy	-
Lead(II)oxide	1317-36-8
Lead(IV)oxide	1309-60-0
Dilead trioxide	-
Lead(II , IV)oxide	1314-41-6
Lead azide	13424-46-9
Lead(II)fluoride	7783-46-2
Lead(II)chloride	7758-95-4
Lead(IV)chloride	13463-30-4
Lead(II)iodide	10101-63-0
Lead(II)sulfide	1314-87-0
Lead(II)cyanide	592-05-2
Lead fluoroborate	13814-96-5
Lead fluosilicate	25808-74-6
Lead nitrate	10099-74-8
Lead carbonate	598-63-0
Lead hydroxycarbonate	1344-36-1
Lead perchlorate	13637-76-8
Lead(II) sulfate	7446-14-2, 15739-80-7
Lead oxide sulfate	12202-17-4
Lead(II) phosphate	7446-27-7
Lead thiocyanate	592-87-0
Lead(II)acetate, trihydrate	6080-56-4
Lead(II)acetate	301-04-2
Lead(IV)acetate	546-67-8
Lead oleate	1120-46-3

Lead stearate	7428-48-0
Lead(II)metaborate	10214-39-8

Appendix 2. Lead and compounds (cont'd)

Substance	CAS Number
Lead metasilicate	11120-22-2, 22569-74-0
Lead antimonite	13510-89-9
Lead arsenate(1:1)	7784-40-9
Lead(II)arsenite	10031-13-7
Lead chromate; chrome yellow	1344-37-2
Lead molybdate	10190-55-3
Calcium plumbate	12013-69-3
Tetramethyl lead	75-74-1
Tetraethyl lead	78-00-2
Lead hydrocarbonate	1319-46-6
Lead selenide	12069-00-0
Other lead compounds and alloys	

Appendix 3. Mercury and compounds

Substance	CAS Number
Mercury	7439-97-6
Mercury alloys;amalgam	-
Mercury(I)oxide	15829-53-5
Mercury(II)oxide	21908-53-2
Mercury(I)chloride	10112-91-1
Mercury(II)chloride	7487-94-7
Mercury(II)nitrate	10045-94-0
Mercury(I)sulfate	7783-35-9
Mercury(II)fulminate	628-86-4
Mercury(II)acetate	1600-27-7
Methylmercury salts	e.g. 22967-92-6
Ethylmercury salts	-
Propylmercury salts	-
Phenylmercury salts	-
Methoxyethyl-mercury salts	-
Dialkylmercury	-
Diphenylmercury	587-85-9
Other mercury compounds and alloys	

Appendix 4. Hexavalent chromium and compounds

Substance	CAS Number
Chromium trioxide	1333-82-0
Lithium chromate	14307-35-8
Sodium chromate	7775-11-3
Potassium chromate	7789-00-6
Potassium chlorochromate	16037-50-6
Ammonium chromate	7788-98-9
Copper chromate	13548-42-0
Magnesium chromate	13423-61-5
Calcium chromate	13765-19-0
Strontium chromate	7789-06-02
Barium Chromate	10294-40-3
Lead chromate (orange)	1344-38-3
Lead chromate (yellow)	1344-37-2
Zinc chromate	12018-19-8;13530-65-9; 14018-95-2
Sodium dichromate	10588-01-9
Potassium dichromate	7788-50-9
Ammonium dichromate	7789-09-05
Calcium dichromate	14307-33-6
Dichromic acid	13530-68-2
Copper chromite	12053-18-8
Strontium chromate	7789-06-02
Zinc dichromate	-
other chromium compound	-

Appendix 5. PBB (polybrominated biphenyls)

Substance	CAS Number
Polybrominated biphenyls (PBBs)	67774-32-7

Appendix 6. PBDE (polybrominated diphenylethers)

Substance	CAS Number
Polybromodiphenyl ether (PBDE) Polybromodiphenyloxide (PBDO) Polybrominated biphenyl ethers (PBBE)	-
Decabromodiphenyl ether (DBDPE) Decabromodiphenyloxide (DBDPO)	1163-19-5
Octabromodiphenyl ether Octabromodiphenyloxide	32536-52-0
Hexabromodiphenyl ether Hexabromodiphenyloxide	36483-60-0

Pentabromodiphenyl ether Pentabromodiphenyloxid	32534-81-9
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Appendix 7. PCB (polychlorinated biphenyls); PCT (polychlorinated terphenyls);

PCN (polychlorinated naphthalenes)

Substance	CAS Number
Polychlorinated bipheyls (PCB)	1336-36-3
Polychlorinated terpheyls (PCT)	61788-33-8
Polychlorinated naphtalenes (PCN)	-
Trichloronaphthalenes	1321-65-9
Tetrachloronaphthalenes	1335-88-2
Pentachloronaphthalenes	1321-64-8
Octachloronaphthalenes	2234-13-1

Appendix 8. Ozone layer depleting substances

Group	Substance	CAS Number
A- I Refrigerant Detergent	CFCl ₃ (CFC-11)	75-69-4
	CF ₂ Cl ₂ (CFC-12)	75-71-8
	C ₂ F ₃ Cl ₃ (CFC-113)	76-13-1
	C ₂ F ₄ Cl ₂ (CFC-114)	1320-37-2
	C ₂ F ₅ Cl (CFC-115)	76-15-3
B- I	CF ₃ Cl (CFC-13)	75-72-9
	C ₂ FCl ₅ (CFC-111)	354-56-3
	C ₂ F ₂ Cl ₄ (CFC-112)	28605-74-5
	C ₃ FCl ₇ (CFC-211)	135401-87-5
	C ₃ F ₂ Cl ₆ (CFC-212)	3182-26-1
	C ₃ F ₃ Cl ₅ (CFC-213)	2354-06-05
	C ₃ F ₄ Cl ₄ (CFC-214)	2268-46-4
	C ₃ F ₅ Cl ₃ (CFC-215)	1652-81-9
	C ₃ F ₆ Cl ₂ (CFC-216)	662-97-2
C ₃ F ₇ Cl (CFC-217)	422-86-6	
A- II fire extinguisher	CF ₂ BrCl (halon-1211)	353-59-3
	CF ₃ Br (halon-1301)	75-63-8
	C ₂ F ₄ Br ₂ (halon-2402)	124-73-2
B- II CFC raw material	CCl ₄ (carbon tetrachloride)	56-23-5
B- III Solvent	C ₂ H ₃ Cl ₃ (2)	71-55-6
E- I Disinfectant	CH ₃ Br (methyl bromide)	
C- II Halon alternatives	CHFBr ₂	1868-53-7
	CHF ₂ Br	1511-62-2
	CH ₂ FBr	373-52-4
	C ₂ HFBr ₄	306-80-9
	C ₂ HF ₂ Br ₃	-
	C ₂ HF ₃ Br ₂	354-04-1
	C ₂ HF ₄ Br	124-72-1
	C ₂ H ₂ FBr ₃	-
	C ₂ H ₂ F ₂ Br ₂	75-82-1
	C ₂ H ₂ F ₃ Br	421-06-7
	C ₂ H ₃ FBr ₂	358-97-4
	C ₂ H ₃ F ₂ Br	-
	C ₂ H ₄ FBr	762-49-2
	C ₃ HFBr ₆	-
	C ₃ HF ₂ Br ₅	-
	C ₃ HF ₃ Br ₄	-
	C ₃ HF ₄ Br ₃	-
	C ₃ HF ₅ Br ₂	431-78-7
	C ₃ HF ₆ Br	-
	C ₃ H ₂ FBr ₅	-
C ₃ H ₂ F ₂ Br ₄	-	
C ₃ H ₂ F ₃ Br ₃	-	
C ₃ H ₂ F ₄ Br ₂	-	
C ₃ H ₂ F ₅ Br	460-88-8	
C ₃ H ₃ FBr ₄	-	

	C3 H3 F2 Br3	70192-80-2
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Appendix 8. Ozone layer depleting substances (cont'd)

Group	Substance	CAS Number
C- II Halon alternatives	C3 H3 F3 Br2	70192-83-5
	C3 H3 F4 Br	679-84-5
	C3 H4 FBr3	75372-14-4
	C3 H4 F2 Br2	460-25-3
	C3 H4 F3 Br	421-46-5
	C3 H5 FBr2	51584-26-0
	C3 H5 F2 Br	-
	C3 H6 FBr 0,7	352-91-0
C- I CFC alternatives	CHFCI2 (HCFC-21)	75-43-4
	CHF2 CI (HCFC-22)	75-45-6
	CH2 FCI (HCFC-31)	593-70-4
	C2 HFCl4 (HCFC-121)	354-14-3
	C2 HF2 Cl3 (HCFC-122)	354-21-2
	C2 HF3 Cl2 (HCFC-123)	306-83-2
	C2 HF4 Cl (HCFC-124)	2837-89-0
	C2 H2 FCl3 (HCFC-131)	134237-34-6
	C2 H2 F2 Cl2 (HCFC-132)	25915-78-0
	C2 H2 F3 Cl (HCFC-133)	75-88-7
	C2 H3 FCl2 (HCFC-141)	25167-88-8
	CH3 CFCI2 (HCFC-141b)	1717-00-6
	C2 H3 F2 Cl (HCFC-142)	25497-29-4
	CH3 CF2 Cl (HCFC-142b)	75-68-3
	C2 H4 FCl (HCFC-151)	1615-75-4
	C3 HFCl6 (HCFC-221)	134237-35-7
	C3 HF2 Cl5 (HCFC-222)	134237-36-8
	C3 HF3 Cl4 (HCFC-223)	134237-37-9
	C3 HF4 Cl3 (HCFC-224)	134237-38-0
	C3 HF5 Cl2 (HCFC-225)	128903-21-9
	CF3 CF2 CHCl2 (HCFC-225ca)	422-56-0
	CF2 ClCF2 CHClF (HCFC-225cb)	507-55-1
	C3 HF6 Cl (HCFC-226)	134308-72-8
	C3 H2 FCl5 (HCFC-231)	134190-48-0
	C3 H2 F2 Cl4 (HCFC-232)	134237-39-1
	C3 H2 F3 Cl3 (HCFC-233)	134237-40-4
	C3 H2 F4 Cl2 (HCFC-234)	127564-83-4
	C3 H2 F5 Cl (HCFC-235)	134237-41-5
	C3 H3 FCl4 (HCFC-241)	134190-49-1
	C3 H3 F2 Cl3 (HCFC-242)	134237-42-6
	C3 H3 F3 Cl2 (HCFC-243)	134237-43-7
	C3 H3 F4 Cl (HCFC-244)	134190-50-4
	C3 H4 FCl3 (HCFC-251)	134190-51-5
C3 H4 F2 Cl2 (HCFC-252)	134190-52-6	
C3 H4 F3 Cl (HCFC-253)	134237-44-8	
C3 H5 FCl2 (HCFC-261)	134237-45-9	
C3 H5 F2 Cl (HCFC-262)	134190-53-7	
C3 H6 FCl (HCFC-271)	134190-54-8	

Appendix 9. Asbestos and compounds

Substance	CAS Number
actinolite	77536-66-4
amosite	12172-73-5
anthrophyllite	77536-67-5
chrysotile	12001-29-5
crocidolite	12001-28-4
tremolite	77536-68-6

Appendix 10. Formaldehyde and compounds

Substance	CAS Number
Formaldehyde; formalin; formic aldehyde; formol	50-00-0

Appendix 11. Short-chain chlorinated paraffins (Alkane10~13 carbon chain)

Substance	CAS Number
Short-chain Chlorinated paraffins C10-13 Cl≥50wt %	85535-84-8

Appendix 12. Azo colorants

Substance	CAS Number
4-aminoazobenzene	60-09-3
o-anisidine	90-04-0
2-naphthylamine	91-59-8
3,3-dichlorobenzidine	91-94-1
4-aminodiphenyl	92-67-1
Benzidine	92-87-5
ortho-toluidine	95-53-4
4-chloro-o-toluidine	95-69-2
2,4-toluediamine	95-80-7
ortho-Aminoazotoluene	97-56-3
5-nitro-o-toluidine	99-55-8
4,4-methylene-bis-(2-chloroaniline)	101-14-4
4,4-diaminodiphenylmethane	101-77-9
4,4-oxydianiline	101-80-4
p-chloroaniline	106-47-8
3,3-dimethoxybenzidine	119-90-4
3,3-dimethylbenzidine	119-93-7
p-cresidine	120-71-8
2,4,5-trimethylaniline	137-17-7
4,4-thiodianiline	139-65-1
2,4-diaminoanisole	615-05-4
3,3-dimethyl-4,4-diaminodiphenylmethane	838-88-0

Appendix 13. Nickel and compounds

Substance	CAS Number
Nickel	7440-02-0
Nickel(II)oxide	1313-99-1
Nickel Sulfate	7786-81-4
Nickel chloride	7718-54-9
Other nickel compounds	-

Appendix 14. Organic tin compounds

Substance	CAS Number
Tributyl tin (TBT)	56573-85-4
Triphenyl tin (TPT)	668-34-8
Tributyl tin oxide (TBTO)	56-35-9
Tributyl tin bromide	1461-23-0
Triphenyl tin bromide	56-35-9
Triphenyl tin chloride	639-58-7
Triphenyl tin hydroxide	76-87-9
Triphenyl tin N, N' -dimethyldithiocarbamate	1803-12-9
Triphenyl tin fluoride(fentin fluoride)	379-52-2
Triphenyl tin acetate(fentin acetate)	900-95-8
Tributyl tin methacrylate	18380-71-7
Tributyl tin fumarate	6454-35-9
Tributyl tin fluoride	1983-10-4
Tributyl 2,3-dibromosuccinate	31732-71-5
Tributyl tin acetate	56-36-0
Tributyl tin laurate	3090-36-6
Tributyl tin phthalate	4782-29-0
Tributyl tin sulfamate	6517-25-5
Trivutyl tin maleate	14275-57-1
Tributyl tin chloride	1461-22-9
Tributyl tin naphthenate	85409-17-2
Tributyl tin rosin salts	26239-64-5
Methyl Methacrylate and tributyl tin methacrylate	-