Apple Regulated Substances Specification

069-0135-N

Revision	ECO #	Approver	Date	Revision Description
N	63623060	JB	March 14, 2025	See Section 11 for full revision history.

1. Scope

It's Apple's mission to make sure that anyone who assembles, uses, or recycles an Apple product can do so safely. We have led the industry in removing many harmful substances from our product designs, and we go to great lengths to make sure that our products stay safe. We are constantly designing our products to be better for the environment, and for people.

This Regulated Substances Specification describes Apple's global requirements and restrictions on the use of certain chemical substances or materials in a) Apple products, accessories, and packaging (Section 3) b) ingredient formulations such as adhesives and inks that are applied, cured, or compounded into Apple products, accessories, and packaging (Section 4), and c) manufacturing processes (Section 5). Restrictions are derived from international laws or directives, regulatory agencies, eco-label requirements, environmental standards, and Apple policies. Apple's restrictions may go beyond regulatory requirements in order to protect human health and the environment.

This specification is not an exhaustive list of all chemicals of concern. Apple suppliers should take action to understand the human health and environmental impacts of all chemicals used in the manufacturing process and present in parts and materials supplied to Apple. Suppliers should take action to reduce or eliminate the use of chemicals of concern listed in this specification as a first step, as well as comply with all applicable regulations. Suppliers must demonstrate compliance with this specification and provide required documentation (including required test data, Full Material Disclosure [FMD], and disclosure of reportable substances). Suppliers must notify Apple of any changes in formulation of materials or parts.

We hold our suppliers accountable by conducting factory audits and testing materials and components at certified laboratories for substances of high concern. Apple may verify supplier data and compliance to this specification utilizing our in-house laboratory or external third-party certified laboratories.

Effective Date: This specification takes effect on August 1, 2025. Prior to this date, revision M of the Regulated Substances Specification is in effect.

Questions: Questions regarding the Apple Regulated Substances Specification should be directed to Apple at environment@apple.com.

2. Definitions

Alloy: A metallic material, homogeneous on a macroscopic scale, consisting of two or more elements so combined that they cannot be readily separated by mechanical means.

Apple policy: Apple restrictions that go beyond regulatory requirements, based on best industry practices or toxicological properties.

Benzophenones (BPs): Chemicals derived from the chemical structure of benzophenone or $(C_6H_5)_2CO$. Benzophenones may be substituted with other chemical groups and are used as photoinitiators in ultraviolet (UV)-curing applications such as inks and coatings.

Benzotriazoles (BZTs): Chemicals derived from the chemical structure of benzotriazole or $C_6H_5N_3$ (CAS No. 95-14-7). BZTs may be substituted with other chemical groups and are used as photoinitiators in ultraviolet (UV)-curing applications such as inks and coatings.

Brominated or chlorinated flame retardant: Brominated or chlorinated organic substance that has an inhibitory effect on the ignition of combustible organic materials.

Chemical Abstracts Service (CAS): Registry numbers that identify unique substances.

Chemical Safety Disclosure (CSD): Initiative that requires suppliers to provide information on the chemicals used in Apple manufacturing processes, to report practices in place to ensure compliance with occupational health and safety regulations and Apple requirements, and to support initiatives to advance the adoption of safer, environmentally preferable alternatives. See section 12 for details.

Cleaner: Chemicals and chemical mixtures used to remove contaminants, unwanted materials, and/or manufacturing processing residues from a) individual parts, subcomponents, assemblies, process substrates and/or final assembled products, and/or b) manufacturing equipment to manufacture individual components or final product. Cleaner categories in scope include but are not limited to: cleaners removing adhesives, inks, solder, and flux residuals, cleaners removing lubricants and greases, coating and paint strippers, cleaners for contaminated surfaces with debris, dirt and strain, and wiping. Out of scope categories include cleaners used in non-manufacturing processes (e.g. laboratory, housekeeping, and maintenance unrelated to manufacturing), cleaners in the pure solid state, cleaners that do not contain organic compounds, or photoresist strippers.

Coating: Product in liquid, paste, or powder form that, when applied to a substrate, forms a layer possessing protective, decorative, and/or other specific properties. Metallic plating layers are exempted from coating requirements.

Demolder: Also known as demolding solution or mold release agent. Demolders are chemicals used to prevent materials from sticking to molds during the manufacturing process. They can be applied to the surfaces of molds to ensure that the finished product can be easily removed.

E-commerce packaging: Transport packaging use to deliver products in the context of sale online or through other means of distance sales to the end user.

Elemental Chlorine Free (ECF): Process by which packaging material is produced with pulp that has been bleached using a chlorine derivative such as chlorine dioxide (ClO2) but without the use of elemental chlorine (Cl).

Endocrine-Disrupting Chemicals (EDCs): Chemicals that can interfere with the endocrine (hormone) system to cause possible adverse effects in humans and wildlife.

External materials: Materials that are accessible to a customer under reasonable or foreseeable use.

Final assembly: Manufacturing process involving assembly of a product that is then directly sold to Apple customers, retail stores, or distribution channels.

Flame retardants: Substances that are intentionally incorporated into materials to prevent or slow down the spread of fire by reducing flammability or delaying combustion.

Full Material Disclosure (FMD): Initiative that requires suppliers to provide the entire chemical composition of the parts and materials used in Apple products to ensure compliance with regulatory requirements and corporate initiatives, and to support assessment of the impact to human and environmental health. See Section 7 for details.

Hindered amine light stabilizers (HALS): A group of chemical compounds that contain a tertiary amine functional group that are used as stabilizers in plastics and polymers. Typically these compounds are derivatives of tetramethylpiperidine or TMP.

Homogeneous material: One material of uniform composition throughout, or a material consisting of a combination of materials, that cannot be disjointed, disaggregated, or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding, or abrasive processes. The definition is consistent with Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS 2). Per this document, the following examples illustrate what is and is not a homogeneous material:

- A plastic cover is a homogeneous material if it consists of one type of plastic that is not coated with other materials, or has other materials attached to it.
- A cable that consists of metal wires surrounded by nonmetallic insulation materials isn't a homogeneous material because mechanical processes could separate the different materials. In this case, restrictions apply to each of the separated materials individually.
- A semiconductor package contains many homogeneous materials that include the mold compound, die attach adhesive, die coatings, bonding wires, lead frame, and lead frame platings. Restrictions apply to each individual homogeneous material.
- Printed circuit board laminated materials consist of glass cloth, resins, and copper foil that are each a homogeneous material. Restrictions apply to each individual homogeneous material.

Incidentally present: Present as an unavoidable impurity or unintentional trace contaminant.

Ingredient formulation: Wet formulations or dry dye powder formulations that are applied, cured, or compounded into or onto Apple products, accessories, and packaging. This includes adhesives, coatings, inks, primers, and other wet formulations manufactured by the material manufacturer. This also applies to dry dye powder formulations used for creating dyes and pigments.

Intentionally added: Substance deliberately used in the formulation of a material or component, where the presence of the substance in the final product provides a specific characteristic, appearance, or quality.

Manufacturing process chemicals: Chemicals that are used to create components or materials for Apple products and the assembly of Apple products including: direct use during production or indirect use for manufacturing equipment, machines or tools during maintenance. Chemicals used in the laboratory, housekeeping, wastewater treatment plants, or other non-manufacturing processes are excluded.

Mixture: Solutions composed of two or more substances in which they do not react.

Nanomaterials: A natural, incidental, or manufactured material containing particles in an unbound state or as an aggregate or as an agglomerate; and where for 50 percent or more of the particles in the number size distribution, one or more external dimensions are in the 1 nm–100 nm size range. In addition, fullerenes, graphene flakes, and single-wall carbon nanotubes with one or more external dimensions below 1 nm should be considered as nanomaterials**.**

No intentional use: A substance must not be deliberately used in the formulation of the material. This means any residual, by-product, or contaminant does not count as an intentionally added substance. Proof of compliance for sections 4 and 5 requires either 1) the substance is not listed in "Section 3: Composition/information on ingredients" of submitted Safety Data Sheet (SDS), which meets Globally Harmonized System (GHS) cutoff value requirement or 2) chemical manufacturer provides self-declaration of no intentional use.

Non-use: Substance must not be intentionally or unintentionally present. Apple requires test reports from certified labs as proof of compliance. For all section 5 restrictions, the substance must be under the method detection level by using Apple specified analytical methods.

Packaging: Any material, item, or component used for the containment, protection, handling, delivery or presentation of products placed on the market, sold or offered for sale by Apple to other economic operators or the end user or consumer, including sales or primary, grouped or secondary, transport or tertiary, and e-commerce packaging.

Paint: Coatings containing pigments that, when applied to a substrate, form a dry film with protective, decorative, or special functions.

Per- and polyfluoroalkyl substances (PFAS): Any substance that contains at least one fully fluorinated methyl (CF3-) or methylene (-CF2-) carbon atom (without any H/Cl/Br/I attached to it). A substance that only contains the following structural elements is also excluded form the scope of the PFAS definition: CF3-X or X-CF2-X′ where X = -OR or -NRR′ and X′ = methyl (-CH3), methylene (-CH2-), an aromatic group, a carbonyl group (-C(O)-), -OR′′, -SR′, or -NR′′R′′′; and where R/R′ R′′ /R′′′ is a hydrogen (-H), methyl (-CH3), methylene (-CH2-), an aromatic group, or a carbonyl group (-C(O)-).

Personal protective equipment (PPE): Equipment for protecting manufacturing employees from exposure to hazardous materials in the workplace specific to the job function.

Photoinitiators: Chemicals that generate reactive species (free radicals, cations, anions) when exposed to a radiation (UV or visible light), initiating a chemical reaction with monomers to trigger a polymerization reaction. Photointiators are typically used in processes like UV curing for coatings, adhesives and inks.

Plasticizers: Substances that are intentionally incorporated into plastics and other resin-based materials to promote their plasticity and flexibility, and to reduce brittleness.

ppb: Parts per billion by weight of a substance; equivalent to 0.001 mg/kg or 0.0000001 percent by weight.

ppm: Parts per million by weight of a substance; equivalent to 1 mg/kg or 0.0001 percent by weight.

Primary or retail packaging: Packaging that is applied to a sales unit obtained by the final user or consumer at the point of purchase. The minimum packaging presented to the final user or customer at point of purchase. Examples include finished goods box, product wrap, and cable wrap.

Primer: Surface treatment chemical used to increase adhesion when used in conjunction with a coating or adhesive system.

Process chemical: Chemicals, used on their own or in formulations, that are not intentionally incorporated (partly or fully) into the product. Examples of a process chemical: cleaner, degreaser, demolder, lubricant, metal working fluid, heat transfer fluid, etching solution. Examples of a non-process chemicals: paint, coating, ink, adhesive, primer, resin, flux, solder paste.

Processed Chlorine Free (PCF): Process by which material is produced with pulp from recycled content that has been bleached without any type of chlorine, or that has not been bleached at all. Recycled content may have originally been bleached with chlorine or chlorine derivatives. Virgin pulp in the mix is Totally Chlorine Free.

Ortho-phthalates: Any members of the class of organic chemicals that are esters of 1,2-benzenedicarboxylic acid (phthalic acid), or as equivalent, containing two carbon chains located in the ortho position.

Secondary or grouped packaging: Packaging designed to group a certain number of sales units, whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale. The packaging of a shipment of product(s) already in primary packaging and that can be removed without affecting the product's characteristics of packaging.

Solvent: A substance, typically a liquid when at room temperature, intended to dissolve, suspend, or extract other substances without undergoing any chemical change itself. In a solution, the solvent(s) is the component typically present in the largest amount and serves as the medium in which the solute (the substance being dissolved) is dispersed or coated onto another substrate.

Tertiary or transport packaging: Packaging used to facilitate handling and transport of sales units or grouped packaging through distribution centers in order to prevent physical handling and transport damages. Transport packaging does not include road, rail, ship, and air containers. Examples include pallets, pallet wraps, and pallet strapping.

Test Report Mapping (TRM) form: The form used to map test reports to declared materials. The TRM form is created in and exported from the FMD Portal. The TRM form and mapped test reports are collected by Apple manufacturing partners to document compliance of the parts and materials used in Apple products. The information required to create a TRM form for Apple's manufacturing partners is the foundation of an FMD declaration required by Apple. These processes have been harmonized to eliminate duplicative work and align requirements across the Apple supply chain.

Textile: A flexible material made by creating an interlocking network of yarns or threads, which are produced by spinning raw fibers (from either natural or synthetic sources) into long threads.

Totally Chlorine Free (TCF): Process by which packaging material is produced with pulp from virgin content that has been bleached without any type of chlorine, or that has not been bleached at all.

UV stabilizers: Chemicals that are intentionally added to protect materials like plastics, rubbers, and textiles from the damaging effects of ultraviolet (UV) light, extending their lifespan and preventing degradation. This includes but is not limited to benzophenone (BP), benzotriazole (BZT), and hindered amine light stabilizer (HALS) based structures.

Varnish: Transparent coating material.

Wearable products: Electronics or accessories that can be comfortably worn on the body, such as Apple Watch. These products will occlude the skin.

3. Products and Packaging Requirements

Requirements in Section 3 apply to all homogeneous materials used in Apple products, accessories, and packaging.

3.1. Products and Packaging: Restrictions

Restricted substances are not allowed in homogeneous materials in Apple products, accessories, and packaging above the below thresholds. Material class-specific requirements, where applicable, are indicated under “Scope," and supersede any "All materials" general restrictions when both are indicated. Materials or applications indicated in the “Examples” column are not exhaustive.

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
Adhesive monomers Group I	See Apple Document “Restricted Monomers in Adhesives in Wearable”	No intentional use; 1000 ppm for incidentally present (A); Must pass toxicological review for approval (B)	A) Adhesives in wearable products and/or in prolonged skin contact; B) all other materials except metals, glass, and ceramics in prolonged skin contact	UV-cured adhesives	Apple policy
Adhesive monomers Group II		Must pass toxicological review for approval		UV-cured adhesives in earphones and headphones	Apple policy
Antimony; antimony compounds	1309-64-4; several	1000 ppm	All materials	Flame retardant	Apple policy
Arsenic; arsenic compounds	7440-38-2; several	No intentional use; 2 ppm for incidentally present	Wood products	Pallets	REACH 1907/2006 and amendments
		No intentional use; 50 ppm for incidentally present	All other materials except semiconductors (substrates and dopants) and metal alloys	LCD display glass, camera lens, trackpad glass, display cover glass, antifouling agent	Apple policy
		No intentional use; 1000 ppm for incidentally present	Metals	Copper alloys	
		Exempt	Semiconductor substrates and dopants	GaAs semiconductors	
Asbestos and compounds	1332-21-4 ;12001-28-4; 12001-29-5’ 12172-73-5; 77536-66-4; 77536-67-5; 77536-68-6; 132207-32-0	Non-use	All materials	Insulator, filler	REACH 1907/2006 and amendments
Azo dyes, arylamines, anilines	Appendix A	30 ppm total content	All materials	Dye or colorant for plastics, textiles	REACH 1907/2006 and amendments; Bedarfsgegenstände Verordnung GB 18401-2010, China GB 20400-2006, China
Beryllium; beryllium compounds	7440-41-7; several	No intentional use; 1000 ppm total content for incidentally present	All materials	Metals, alloys, solder, and ceramic materials in connectors, stiffeners, AC inlets, springs, EMI finger/spring, transceivers, brackets, housing, buttons, and speaker wire.	Apple policy; IEEE 1680.1-2018 criterion 4.1.4.1
		Exempt	Products shipped before September 2014		
Bisphenol A (BPA)	80-05-7	Non-use in thermal paper	Thermal paper	Thermal paper	Apple policy
		Report detectable levels of unpolymerized BPA	All materials	Adhesives, plastics, epoxy resin	California Proposition 65; Apple policy
		1000 ppm	All other materials, unless preapproved by Apple	Adhesives, plastics, epoxy resin	REACH 1907/2006 and amendments

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
Bromine and brominated compounds	7726-95-6; several	900 ppm total content, except for specified chemicals otherwise noted in this section	All materials	Flux, solder paste, pigments	Apple policy; UL 110, criterion 9.2.3
		1500 ppm (Cl + Br) total content			
Brominated and chlorinated flame retardants	See definition	No intentional use	All materials	Plastics, electronic components	Apple policy
Cadmium; cadmium compounds	7440-43-9; several	20 ppm in the battery cell	Battery cells and packs	Nickel cadmium battery	2023/1542/EU; IEEE 1680.1-2018 criterion 4.1.2.1
		50 ppm in all other materials	All other materials	Pigment stabilizer, copper alloys	2011/65/EU; GB/T 26572; Taiwan BSMI RoHS
Chlorinated paraffins, short and medium chain (SCCP and MCCP)	Appendix B	1000 ppm total content and Cl < 900 ppm	All materials	Paint, coating, sealant, flame retardant, textiles, lubricants	REACH 1907/2006 and its amendments; EPA, SNUR 2070-AJ73, Dec. 2014; IEEE 1680; Apple policy
Chlorine; chlorinated compounds	7782-50-5; several	Must be Elemental Chlorine Free (ECF), Totally Chlorine Free (TCF), or Process Chlorine Free (PCF)	Fiber-based packaging	Fiber-based packaging	IEEE 1680.1-2018 criteria 4.1.5.1 & 4.1.5.2; UL 110, criteria 9.2.3 & 12.7.1; Apple policy
		900 ppm total content in all materials, except for specified chemicals otherwise noted in this section	All materials	Flux, solder paste, pigments	Apple policy
		1500 ppm (Cl + Br) total content in all materials			
Dechlorane Plus	13560-89-9	1 ppm	All materials	Flame retardant used in plastic	2019/1021/EU
Dimethylfumarate (DMFu)	624-49-7	0.1 ppm	All materials	Biocide, desiccant pack	2010/153/EC
Formaldehyde	50-00-0	300 ppm	All materials	Wood, adhesives, plastics, coatings	ChemVerbotsV; GB 18401-2003/2005, China; GB 20400-2006, China
Halogenated diphenyl methanes	76253-60-6; 81161-70-8; 99688-47-8	1000 ppm and Br / Cl < 900 ppm	All materials	Capacitor, transformer	REACH 1907/2006 and amendments; Apple policy
Heavy metals (Cd + Cr (VI) + Hg + Pb)	7440-43-9; 18540-29-9; 7439-97-6; 7439-92-1; several	100 ppm combined total	Packaging	Packaging materials	94/62/EC
Hexabromocyclododecane (HBCDD)	25637-99-4; 3194-55-6; 134237-50-6; 134237-51-7; 134237-52-8	Non-use or 100 ppm total if incidentally present	All materials	Flame retardant	2019/1021/EU
Hexavalent chromium (Cr (VI), Cr^{6+}); hexavalent chromium compounds	18540-29-9; several	1 ppm	All wearable products and accessories	Watch band materials including leather and textiles	REACH 1907/2006 Entry 72
		3 ppm	Leather in historical applications of use	Leather	REACH 1907/2006 Entry 47; Taiwan BSMI RoHS
		500 ppm	All other materials	Metal coating, pigment	2011/65/EU; GB/T 26572; Taiwan BSMI RoHS

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
Lead; lead compounds	7439-92-1; several	No intentional use; 40 ppm for incidentally present in the battery cell	Battery cells and packs	Zn-Mn, alkaline batteries	2023/1542/EU
		No intentional use; 50 ppm for incidentally present	Plastics, inks, surface coatings, displays (including housing, wiring, and printed circuit board)	Paints, cable jacketing and insulation	IEEE 1680.1-2018; CPSIA, 2008
		No intentional use; 1000 ppm for incidentally present	All other materials except all exemptions in 2011/65/EU and its amendments	Solder, glass, steel, copper alloys, aluminum alloys	2011/65/EU; GB/T 26572; Taiwan BSMI RoHS
Mercury; mercury compounds	7439-97-6; several	No intentional use; 5 ppm for incidentally present	Battery cells and packs	Mercury oxide, zinc-manganese, alkaline manganese batteries	2023/1542/EU
		No intentional use; 100 ppm for incidentally present	All other materials	CCFL lamps, switches, dyes	2011/65/EU; IEEE 1680-1 criterion 4.1.3.1; GB/T 26572; Taiwan BSMI RoHS
Natural rubber, latex	Latex proteins	Non-use	All wearable materials		ASTM D6499 for screening antigens. If positive, use Western Blot / SDS PAGE. for confirmation
Nickel and its compounds	7440-02-0; several	0.28 µg/cm²/week leach rate	Parts with direct and prolonged skin contact	Metal alloys with nickel, plating material, anti-corrosive alloy	REACH 1907/2006 and amendments; Entry 27 echa.europa.eu/documents/10162/3bbe9024-52a6-8e63-5581-e686331eb459
Organotin compounds	Appendix C	1000 ppm total content	All materials	Glass coatings, antifouling coatings, silicones, polyurethanes, paints, adhesives	REACH 1907/2006 and amendments; Apple policy
Ortho-phthalates	Including but not limited to Appendix E. See Definitions section.	No intentional use; 100 ppm if incidentally present	Packaging	Adhesives and coatings in packaging components	Apple policy
	Appendix E	1000 ppm total content	All other materials	Plasticizer	California Proposition 65; REACH 1907/2006 and amendments; 2011/65/EU
Perchlorates	7601-89-0 7778-74-7 7790-98-9 7791-03-9 10034-81-8	0.1 ppm total content	All materials	Lithium perchlorate coin cell batteries	CA DTSC Perchlorate Contamination Prevention Act
Poly- and perfluoroalkyl substances (PFAS)	See Apple Engineering Requirements Specification: Poly- and Perfluoroalkyl substances (PFAS) Definitions and Substance Lists, 099-39076 and Appendix D.	No intentional use; 50 ppm fluorine if incidentally present	Packaging and textile articles	Coatings and inks	See Apple Engineering Requirements Specification: PFAS Definitions and Substance Lists, 099-39076; Annex XV Restriction Report CA AB1817 CA SB343
PFBS and related substances	Appendix D	1000 ppm total content	All materials	Flame retardant additive for plastic resins	REACH 1907/2006
PFCAs (C9–C14), their salts, and related substances	Appendix D	25 ppb for the sum of C9–C14 PFCAs and their salts; 260 ppb for the sum of C9-C14 PFCA-related substances	All materials		2021/1297/EU; echa.europa.eu/documents/10162/2ec5dfdd-0e63-0b49-d756-4dc1bae7ec61

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
PFHxA, its salts, and related substances	Appendix D	25 ppb for the sum of PFHxA and its salts; 1000 ppb for the sum of PFHxA-related substances	All materials	Protective and oleophobic coatings	2024/2462/EU
PFHxS, its salts, and related substances	Appendix D	25 ppb for the sum of PFHxS and its salts; 1000 ppb for the sum of PFHxS-related substances	All materials		2019/1021/EU
PFOA, its salts, and PFOA-related compounds	Appendix D	25 ppb for sum of PFOA and its salts; 1000 ppb for the sum of PFOA-related substances	All other materials	Surfactant, impregnation agent in textiles	2023/866/EU
PFOS, its salts, and PFOS-related compounds	Appendix D	25 ppb for the sum of PFOS and its salts; 1000 ppb for the sum of PFOS-related substances	All materials	Surfactant, impregnation agent in textiles	2019/1021/EU
Phenyl, isopropylated phosphate (3:1) or PIP 3:1	68937-41-7	No intentional use	All materials	Plasticizer, flame retardant, or anti-wear additive in plastics, adhesives, lubricants	US EPA, TSCA Section 6(h)
Polybrominated biphenyls (PBBs)	59536-65-1; several	1000 ppm and Br < 900 ppm	All materials	Flame retardants	2011/65/EU; GB/T 26572; Apple policy
Polybrominated diphenyl ethers (PBDEs)	Appendix M	10 ppm individually and 500 ppm for sum of total PBDEs	All materials	Flame retardants	2011/65/EU; GB/T 26572; Apple policy
Polychlorinated biphenyl (PCB)	1336-36-3; several	Nondetect (< 0.1 ppm)	All materials	Capacitor, transformer, heat transfer fluids, lubricants	2019/1021/EU; 85/467/EEC; CRS 001/1983, Brazil
Polychlorinated naphthalenes (PCN)	Appendix N	5 ppm	All materials	Lubricant, paint, cable insulation, wood preservatives, lubricants, electroplating masking compounds, feedstock for dye production, dye carriers, capacitor fluids, flameproofing, preservatives, moistureproofing sealant, temporary binders for ceramic component manufacturing, casting material for alloys	2019/1021/EU
Polychlorinated terphenyl (PCT)	61788-33-8	5 ppm	All materials	Capacitor, transformer, heat transfer fluids, lubricants	85/467/EEC; REACH 1907/2006; Apple policy
Polycyclic aromatic hydrocarbons (PAHs)	Appendix F(i)	0.5 ppm individually and 10 ppm for sum of total PAHs	Materials in prolonged skin contact; materials in wearable products; other external materials	Carbon black, plastics, dyes, combustion by-products	2013/1272/EU; Apple policy
	Appendix F(ii)	0.5 ppm individually and 10 ppm for sum of total PAHs	Materials in prolonged skin contact		
		10 ppm individually and 50 ppm for sum of total PAHs	Materials in wearable products; Other external materials		

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
Polyvinyl chloride (PVC)	9002-86-2	No intentional use; 100 ppm Cl for incidentally present	Packaging	Packaging	Apple policy
		No intentional use; 900 ppm Cl for incidentally present	All materials	Electrical insulator, wire, tape, tubing, cable enclosure, vibration dampener, films	Apple policy
		No intentional use; 1500 ppm (Cl + Br) for incidentally present	All materials	Electrical insulator, wire, tape, tubing, cable enclosure, vibration dampener, films	Apple policy
Radioactive substances	Several	Detectable levels of ionized radiation in parts, components, materials, and products above regional background levels. Restrictions under international regulations will apply, if appropriate. Any exceedance above the background levels must be reviewed and preapproved by Apple.	All materials	Electrical sensor, phosphorescent ink	Japanese Laws for the Regulation of Nuclear Source Material, Nuclear Fuel Material, and Reactors, 1986
REACH Annex XVII	Check the ECHA website for the individual restrictions at echa.europa.eu/substances-restricted-under-reach.	Detectable levels of ionized radiation in parts, components, materials, and products above regional background levels. Restrictions under international regulations will apply, if appropriate. Any exceedance above the background levels must be reviewed and preapproved by Apple.	All materials	REACH, Annex XVII	REACH 1907/2006 and amendments
REACH Candidate List of SVHCs	Check the ECHA website for the updated list at echa.europa.eu/candidate-list-table.	1000 ppm in all materials unless allowed per Apple SVHC disclosures. Must also report to Apple all uses when > 1000 ppm in materials.	All materials	REACH, Candidate List	REACH 1907/2006 and amendments; Apple policy
Skin-sensitizing substances	See Apple Document 099-40247	Non-use	Prolonged skin contact materials in wearables and softgoods	Cases, folios, watch bands, Apple Watch, AirPods and other audio products, Apple Vision Pro	Apple policy; 099-40247
Tetrabromobisphenyl A (TBBA, TBBPA)	79-94-7	900 ppm Br	All materials	Flame retardant for electrical insulator, wire, tape, tubing, cable enclosure, vibration dampener	Apple policy
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1	1 ppm	All materials	Adhesives, plastics, polymer films	Stockholm Convention; 2019/1021/EU

3.2. Products and Packaging: Reportable Substances and Future Restrictions

Suppliers are required to report the use of all substances listed in this section, regardless of the future restriction timeline, in any homogeneous materials used in Apple products, accessories, and packaging. In some cases, reporting is required only if the substances exceed a defined permissible limit. Suppliers are required to report via FMD Portal (see section 7) and/or the Test Report Mapping (TRM) form for evaluation and approval for use prior to being shipped in Apple products. Where indicated, Apple expects future restrictions based on regulation or Apple policy. Any substance phaseout requires ensuring a replacement is not a regrettable substitution; see Section 6 for more details. Phaseout categories indicate the following:

- **Begin phaseout immediately**: provide timeline for phaseout and conduct alternatives assessment, see Section 6
- **Expect future restrictions**: proactively work to identify safer alternatives, see Section 6

Chemical or Chemical Group	Substance Identifier or CAS No.	Reporting Threshold	Scope	Examples	Phaseout Requirement	References
Per- and Polyfluoroalkyl Substances (PFAS)	See Apple Engineering Requirements Specification: Poly- and Perfluoroalkyl Substances (PFAS) Definitions and Substance Lists, 099-39076.	Any intentional use 25 ppb for nonpolymeric PFAS if incidentally present 50 ppm for polymeric PFAS if incidentally present	All materials	Lubricants, corrosion resistance coatings, top coats, water repellency coatings, plastics	Begin phaseout immediately	Apple policy; U.S. EPA TSCA Section 8(a)(7) See Apple Engineering Requirements Specification: PFAS Definitions and Substance Lists, 099-39076; Annex XV Restriction Report
1,3-Propane sultone	1120-71-4	1000 ppm	Battery materials and solutions	Battery electrolyte solutions	Begin phaseout immediately	2023/1542/EU
2,2′-(2,5-thiophenediyl)bis(5-tert-butyl-benzoxazole) (BBOT)	7128-64-5	1000 ppm	All materials	Plastics, paints, coatings, adhesives	Expect future restrictions	Apple policy
Adhesive monomers (Group I)	See Apple Document “Restricted Monomers in Adhesives in Wearables”	Detectable levels	Materials in wearables and in prolonged skin contact	Adhesives	Expect future restrictions as applicable	Apple policy
Adhesive monomers (Group II)		Detectable levels	Materials in wearables and in prolonged skin contact	Adhesives	Expect future restrictions	Apple policy
Biocides	Several echa.europa.eu/regulations/biocidal-products-regulation/understanding-bpr	Detectable levels. Treated articles must use biocides that are approved or under review.	All materials	Additive in polymers, other coated materials	Expect future restrictions	528/2021/EU
Cobalt; cobalt compounds	7440-48-4; several	1000 ppm	All materials	Moisture indicator; additive in rubber, cobalt alloys	Expect future restrictions	REACH 1907/2006 and amendments; Apple policy
Endocrine-disrupting chemicals (EDCs)	Including but not limited to substances listed in article L. 5232-5 of the French Circular Economy law: legifrance.gouv.fr/download/pdf?id=iq_iD-87wrwn8OuO06oUmmWXdZTHIv84XIt-7CAT-zY=. See “Endocrine Disrupting Chemicals” in Definitions section.	Detectable levels	All materials	Many	Begin phaseout immediately	Apple policy; French legislative No. 2020-105
	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Many	Begin phaseout immediately	Apple policy; French legislative No. 2020-105

Chemical or Chemical Group	Substance Identifier or CAS No.	Reporting Threshold	Scope	Examples	Phaseout Requirement	References
Flame retardants	Including but not limited to Appendix J. See "Flame retardants" in Definitions section.	Any intentional use	All materials	Plastics, PCBs	Expect future restrictions for select substances	Apple policy
	Tris(2-chloroethyl) phosphate (CAS No. 115-96-8);Tri(2-chloro-1-methylethyl) phosphate (CAS No. 13673-84-5); Tri[2-chloro-1-(chloromethyl)ethyl] phosphate (CAS No. 13674-87-8	1000 ppm	All materials	Plastics, PCBs	Begin phaseout immediately	Apple policy; REACH Registry of Intentions
	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Plastics, PCBs	Begin phaseout immediately	Apple policy
IEC 62474 Substances	std.iec.ch/iec62474	Various, as required by standard	All materials	Many	Expect future restrictions	Apple policy
Indium phosphide	22398-80-7	Detectable levels in electronic components	Electronic components	Electronic components	Expect future restrictions	Apple policy
Melamine	108-78-1	1000 ppm	All materials	Plastics and resins	Begin phaseout immediately	Apple policy
Nanomaterials	Several	Detectable levels	All materials	Silver nanoparticles, carbon nanotubes and graphene, nano-scale cerium dioxide, nano titanium dioxide, nano-scale iron, nanometer-sized copper particles	Expect future restrictions	France Decree No. 2012-232, Environmental Code Article L. 523-4: Annual declaration of substances in nanoparticle; 2011/696/EU
Proposition 65 list of chemicals	All chemicals listed in the following link: oehha.ca.gov/prop65/prop65_list/Newlist.html	Detectable levels	All materials	Many	Expect future restrictions	California Proposition 65
Plasticizers	Including but not limited to Appendix E. See "Plasticizers" in Definitions section.	1000 ppm	All materials	Adhesives, coatings, and plastics	Expect future restrictions for select substances	Apple policy
	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Adhesives, coatings, and plastics	Begin phaseout immediately	Apple policy
Photoinitators	Including but not limited to Appendix Q. See "Photoinitiators" in Definitions section.	1000 ppm	All materials	Adhesives, coatings, and plastics	Expect future restrictions for some	Apple policy
	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Adhesives, coatings, and plastics	Begin phaseout immediately	Apple policy
Polyvinylidene fluoride (PVDF)	24937-79-9	1000 ppm as measured by fluorine	Battery materials	Lithium ion battery cathode binders	Begin phaseout immediately	2023/1542/EU
REACH Candidate List of SVHCs	Check the ECHA website for the updated list at http://echa.europa.eu/candidate-list-table.	1000 ppm at the material level	All materials	Many	Begin phaseout immediately	REACH Candidate List of SVHCs
Bisphenol Chemicals	Appendix K	100 ppm	All materials	Adhesives, plastics, epoxy resin	Begin phaseout immediately	Apple policy

Chemical or Chemical Group	Substance Identifier or CAS No.	Reporting Threshold	Scope	Examples	Phaseout Requirement	References
Formaldehyde-releasing substances	Including but not limited to the compounds in the reference link.	Formaldehyde released from substance exceeds a concentration of 0.124 mg/m3 in the air of a test chamber used under the conditions prescribed in EN 717-1.	All materials	Many	Begin phaseout immediately	echa.europa.eu/documents/10162/13641/rest_formaldehyde_axvreport_en.pdf/
Hydrocarbyl siloxanes	Any substance with the chemical structure R3SiOR (silicone polymers excluded). Including but not limited to substances in Appendix O	1000 ppm	All materials	Residual monomers in silicone polymers, adhesives	Begin phaseout immediately	ECHA assessment of regulatory needs: 13 July 2022: https://echa.europa.eu/documents/10162/dcc550fa-00d6-fad9-42bb-df301ff2e18f
Parts/Components utilizing RoHS exemptions	ec.europa.eu/environment/waste/rohs_eee/index_en.htm	Individual substance thresholds as per the RoHS directive	All materials	Resistors, ICs, diodes, high melting temperature solder, certain metal alloys	Expect future restrictions	2011/65/EU Apple Policy
Phenyl, Isopropylated Phosphate (3:1) or PIP 3:1	68937-41-7	Any intentional use	All materials	Plasticizer, flame retardant, or anti-wear additive in plastics, adhesives, lubricants	Restricted	TSCA Section 6(h)
Skin-sensitizing substances	Including but not limited to the compounds in the reference link.	Various	All materials	Only applicable to textile, hide, and fur articles	Begin phaseout immediately	echa.europa.eu/documents/10162/82d6f20a-af6c-9a42-3cc5-77649900f348
Triphenylphosphate (TPhP)	115-86-6	1000 ppm	All materials	Plasticizer, flame retardant, or anti-wear additive in plastics, adhesives, lubricants	Begin phaseout immediately	Apple policy
Diphenyl(2,4,6-trimethylbenzoyl) phosphine oxide (TPO)	75980-60-8	1000 ppm	All materials	Adhesives, inks, coatings, solder	Begin phaseout immediately	Apple policy; EUPIA Exclusion Policy for Inks and Related Products
UV Stabilizers	Including but not limited to Appendix P. Includes all benzephenone (BP), benzotriazole (BZT), and hindered amine light stabilizer(HALS) based structures. See “UV Stabilizers” in Definitions section.	1000 ppm	All materials	Plastics, films, and dyed textiles	Expect future restrictions for select substances	Apple policy
	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Plastics, films, and dyed textiles	Begin phaseout immediately	Apple policy

4. Ingredient Formulations Requirements

The requirements in Section 4 apply to all wet formulations or dry powders (used as is or eventually mixed into formulations) applied to, cured onto, or compounded into parts in Apple products, accessories, and packaging. This includes but is not limited to adhesives, inks, coatings, primers, and other wet formulations manufactured by the material manufacturer. Restriction thresholds apply at the material manufacturer's wet formulation level or the dry dye powder formulation level. Requirements in this section also apply to dry dye powder formulations used for creating dyes and pigments as applicable when indicated in the scope.

4.1. Ingredient Formulations: Restricted Substances in Products

Restricted substances are not allowed in ingredient formulations above the below thresholds. For all wet formulations, you must also comply with 099-22549 for China VOC regulation material-specific restrictions. **The China VOC regulation limits may be more restrictive than the threshold limits below and should be followed instead where applicable**.

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold Limit	Scope	Examples	References
Benzene	71-43-2	1000 ppm	Wet formulations	Paints, coatings, inks, adhesives, and primers	Apple policy
Chlorinated organic solvents	All chlorinated organic solvents, including but not limited to Appendix G	1000 ppm total content and Cl < 900 ppm	Wet formulations	Paints, coatings, inks, adhesives, and primers	Apple policy
Methyl-phenol compounds	95-48-7 106-44-5 108-39-4 1319-77-3	10 ppm total content	Wet formulations	Adhesives, wire coating resin, coatings	Apple policy
Mineral oils	MOAH 1-7 aromatic rings	1000 ppm for C1-C7 1 ppm for C3-C7	Inks used on packaging	Inks in packaging	Apple policy; French legislative No. 2020-105
	MOSH C16-C35	1000 ppm	Inks used on packaging	Inks in packaging	
n-Hexane	110-54-3	1000 ppm	Wet formulations	Paints, coatings, inks, adhesives, and primers	Apple policy
Toluene	108-88-3	1000 ppm	Wet formulations	Paints, coatings, inks, adhesives, and primers	Apple policy
Volatile Organic Compound (VOC) Limits & Hazardous Substance Requirements	See latest revision of 099-22549 as applicable	See latest revision of 099-22549 as applicable	Wet formulations	Paints, coatings, inks, adhesives, and primers	Apple Specification: 099-22549

4.2. Ingredient Formulations: Reportable Substances and Future Restrictions

Suppliers are required to report the use of all substances listed in this section regardless of the future restriction timeline, for all ingredient formulations. Reporting thresholds apply to all wet formulations or dry dye powders (used as is or eventually mixed into formulations) applied to, cured onto, or compounded into parts in Apple products, accessories, and packaging. Suppliers are required to report via FMD or the Chemical Safety Disclosure Webform for evaluation (see Section 7). Where indicated, Apple expects future restrictions based on regulation or Apple policy. Any substance phaseout requires ensuring a replacement is not a regrettable substitution; see section 6 for more details. Phaseout categories indicate the following:

- **Begin phaseout immediately:** provide timeline for phaseout and conduct alternatives assessment, see Section 6.
- **Expect future restrictions:** proactively work to identify safer alternatives, see Section 6.

Chemical or Chemical Group	Substance Identifier or CAS No.	Reporting Threshold	Scope	Examples	Phaseout Requirement	References
Brominated organic solvents	All brominated organic solvents, including but not limited to Appendix L	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy
Ethylbenzene	100-41-4	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy
Heavy metals: all arsenic, cadmium, cobalt, copper, chromium, lead, manganese, mercury, nickel, vanadium, silver, and zinc compounds	7440-38-2; 7440-43-9; 7440-48-4; 7440-50-8; 7440-47-3; 7439-92-1; 7439-96-5; 7439-97-6; 7440-02-0; 7440-62-2; 7440-22-4; 7440-66-6; Several	Intentionally added or incidentally present > 1 ppm in the dye powder formulation	Dry dye powder formulations used for anodizing processes and other processes	Dye powder formulations	Begin phaseout immediately	Apple policy
Methanol	67-56-1	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy
N-Ethyl-2-pyrrolidone	2687-91-4	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Expect future restrictions	Apple policy
N-Methyl-2-pyrrolidone	872-50-4	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy
Solvents	ChemFORWARD: Hazard Band D, F; Greenscreen: Benchmark 1; C2CC: x-PBT, x-CMR, x/c- CMR(Cat 1), x/c-E (also x* and x*-CMR and banned); Safer Choice: Gray square	Detectable levels	All materials	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy
Volatile organic compounds (VOCs)	See latest revision of 099-22549 as applicable	See latest revision of 099-22549 as applicable	Wet formulations	Adhesives, cleaners, inks, paints, coatings, primers	Restricted	Apple Specification 099-22549
Xylene and its isomers	1330-20-7; 95-47-6; 108-38-3; 106-42-3	1000 ppm	Wet formulations	Adhesives, inks, paints, coatings, primers	Begin phaseout immediately	Apple policy

5. Manufacturing Process Requirements

Restrictions in Section 5 apply to manufacturing process chemicals used to create components or materials for Apple products and the assembly of Apple products including: direct use during production or indirect use for manufacturing equipment, machines, or tools during maintenance. Restrictions do not apply to laboratory, housekeeping, wastewater treatment plant, or other non-manufacturing processes. See Definitions (Section 2) for more clarity on in-scope manufacturing process chemicals.

5.1. Manufacturing Processes: Restrictions

Suppliers must comply with threshold limits for the chemicals listed in this section in the manufacturing process chemical formulations. Test reports are required to demonstrate compliance of non-use. "Non-use" and "no intentional use" are defined in Section 2. Per the Apple Supplier Code of Conduct, suppliers shall identify, evaluate, and manage occupational health and safety hazards through a prioritized process of hazard elimination, engineering controls, and/or administrative controls. Suppliers shall provide their employees with suitable job-related, appropriately maintained personal protective equipment and instruction on its proper use.

Chemical or Chemical Group	Substance Identifier or CAS No.	Threshold & Scope	References
Benzene	71-43-2	Non-use for cleaners and demolders; no intentional use for all other manufacturing process chemicals	Apple policy
Brominated organic solvents	All brominated organic solvents. See Appendix L for examples	Non-use for cleaners and demolders; no intentional use for all other manufacturing process chemicals	Apple policy
Chlorinated organic solvents	All chlorinated organic solvents. See Appendix G for examples	Non-use for cleaners and demolders; no intentional use for all other manufacturing process chemicals	Apple policy
Methanol	67-56-1	No intentional use for cleaners and demolders	Apple policy
n-Hexane	110-54-3	Non-use for cleaners and demolders; no intentional use for all other manufacturing process chemicals	Apple policy
N-Methylpyrrolidone (NMP)	872-50-4	Non-use for cleaners and demolders	Apple policy
Ozone-depleting chemicals (ODC)	Appendix H and Appendix I	No intentional use for all manufacturing process chemicals	Montreal Protocol 2037/2000/EC
Volatile organic compound (VOC); Limits & Hazardous Substance Requirements	See latest revision of 099-22549 as applicable	Cleaners; see latest revision of 099-22549 as applicable	See latest revision of 099-22549 as applicable
Toluene	108-88-3	Non-use for cleaners and demolders	Apple policy

5.2. Manufacturing Processes: Reportable Substances and Future Restrictions

Suppliers are required to report the use of substances listed in Section 5.2 in any manufacturing process used to create components or materials for Apple products regardless of phaseout priority. Apple is prioritizing the chemicals it intends to phase out of Apple manufacturing processes in order to work effectively with its supply chain. Suppliers are required to report use through the Chemical Safety Disclosure Webform. Apple may require disclosure of the use of manufacturing process chemicals and their chemical composition as deemed necessary.

- **Begin phaseout immediately:** provide timeline for phaseout and conduct alternatives assessment, see section 6.
- **Expect future restrictions:** proactively work to identify safer alternatives, see section 6.

Chemical or Chemical Group	Substance Identifier or CAS No.	Reporting Threshold	Scope	Phaseout Requirement	References
Ethylbenzene	100-41-4	Any intentional use	All manufacturing process chemicals	Expect future restrictions	Apple policy
Formaldehyde	50-00-0	Any intentional use	All manufacturing process chemicals	Expect future restrictions	Apple policy
Hydrogen fluoride (HF)	7664-39-3	Any intentional use	All manufacturing process chemicals	Expect future restrictions	Apple policy
Methanol	67-56-1	Any intentional use	All manufacturing process chemicals except cleaners and demolders	Expect future restrictions	Apple policy
N-Methylpyrrolidone (NMP)	872-50-4	Any intentional use	All manufacturing process chemicals except cleaners and demolders; production of lithium ion battery materials	Expect future restrictions; begin phaseout immediately for lithium ion battery material production	Apple policy
Per- and polyfluoroalkyl substances (PFAS)	See Apple Engineering Requirements Specification: Poly- and Perfluoroalkyl Substances (PFAS) Definitions and Substance Lists, 099-39076	Any intentional use	All manufacturing process chemicals	Expect future restrictions; if manufactured in the EU, begin phaseout immediately	Apple policy
Toluene	108-88-3	Any intentional use	All manufacturing process chemicals except cleaners and demolders	Expect future restrictions	Apple policy
Xylene and its isomers	1330-20-7; 95-47-6; 108-38-3; 106-42-3	Any intentional use	All manufacturing process chemicals	Expect future restrictions	Apple policy

6. Phaseout, Reformulation, and Safer Alternatives

6.1. Notifying Apple of Any Formulation Changes

Suppliers are required to communicate promptly any change in chemical manufacturing processes, manufacturing site, or any other change that will affect any attribute of the material either in its chemical composition (intentional or residual) or its lead time. For example, if for environmental or other purposes the supplier wishes to modify the goods or the processes, production lines, or site(s) used to manufacture the parts or finished goods, the supplier must provide Apple with the reason (e.g., an internal initiative to a phaseout or to reformulate any material/part due to a chemical or any other concern), by contacting the supplier's Apple Global Supply Manager(s) and the Apple Environmental Team at environment@apple.com prior to any such modification. Apple will review the submission and decide whether, or to what extent, a modification is permitted. For any such modification, the supplier must, at a minimum, provide test reports to meet the requirements of Section 9 and test reports for other substances may also be requested. Subject to the above, suppliers must agree to not modify the goods or the processes used to manufacture the goods in any way after qualification without Apple's prior written consent.

6.2 Alternatives Assessment Requirements

In line with Apple's mission to make sure that anyone who assembles, uses, or recycles an Apple product can do so safely, suppliers must ensure that when replacing chemicals of concern or restricted chemicals in this specification, they should assess and evaluate any new chemicals in the replacement materials using a comprehensive chemical hazard assessment framework. When replacing any substances listed in this specification, the material manufacturers and/or part suppliers of those materials must assess and evaluate if safer alternatives exist for the intended application. For any alternative material that is intended to replace a material containing any substances in this specification, it is recommended that the supplier do one of the following to evaluate the alternative material to ensure it is a safer alternative (see Section 6.3):

A. Supplier conducts a comparative chemical hazard assessment through a certified third party, at the supplier's expense, using a methodology such as the GreenScreen® for Safer Chemicals (greenscreenchemicals.org), the U.S. EPA Safer Choice criteria (epa.gov/saferchoice), Cradle to Cradle Certified® (c2ccertified.org), or ChemFORWARD® (chemforward.org), and specifically select materials with chemistries of low hazard toxicological properties (see Section 6.3). Supplier must provide proof of chemical hazard assessment such as a redacted report from a third-party assessor (must be pre-approved by Apple).

B. Supplier provides a genuine composition FMD (i.e. full material composition information) for the new material formulation (see Section 7) that describes the alternative chemistry used and works with Apple to ensure that the new material contains chemistries with inherently low toxicological properties (i.e. "Safer alternative," see Section 6.3)

For any alternative material that replaces a material containing any of the following substance categories below, it is required that the supplier perform one of the above options to evaluate the alternative material to ensure it is a safer alternative (see Section 6.3)

Chemical or Chemical Group	Substances in Scope	RSS Section Scope	Conditions for Use	References
Per- and polyfluoroalkyl substances (PFAS)	See Apple Engineering Requirements Specification: Poly- and Perfluoroalkyl Substances (PFAS) Definitions and Substance Lists, 099-39076	All materials relevant to section 3, and section 4	Preauthorization required for use	Apple policy; U.S. EPA TSCA Section 8(a)(7); see Apple Engineering Requirements Specification: PFAS Definitions and Substance Lists, 099-39076; Annex XV Restriction Report
Flame retardants (see section 3.2)	See Definitions section	All materials relevant to section 3	Preauthorization required for use	Apple policy
Plasticizers (See section 3.2)	See Definitions section	All materials relevant to section 3	Preauthorization required for use	Apple policy
Solvents (used in wet formulations for inks coatings, adhesives, and primers)	See Definitions section	All materials relevant to section 4	Preauthorization required for use	Apple policy

Apple reserves the right to request demonstration of this requirement at any time. If no technical alternative exists or chemical hazard assessment of an alternative cannot be completed, the supplier must reach out to environment@apple.com to request pre-authorization, and must provide the following information in the case of no technical alternative:

- Name and CAS number of chemical
- Material manufacturer and grade
- Technical justification
- Roadmap and timeline for development of safer alternative

6.3 Safer Alternatives Criteria

For the following material categories and uses Apple requires suppliers to use verified safer alternatives, which must meet the acceptance criteria below. Suppliers must submit verification documentation to Apple using CSD or FMD Portal. Alternatives may not contain substances that are restricted above the allowed thresholds in this specification, nor any substances in sections 3.2, 4.2, and 5.2 that have been designated to "begin phaseout immediately."

Material Category	Scope of Use	Acceptance Criteria	Verification
Cleaners	Manufacturing processes at all final assembly sites	All substances in the formulation must meet the following criteria: • ChemFORWARD: Hazard band C or better, except for x/c-CMR(2); or • GreenScreen: BM-2 or better; however, if BM-2, then moderate hazard for Group I Human Health endpoints is only allowed if there is low confidence on data quality; or • US EPA Safer Choice: green full circle, green half circle. Additionally, the formulation may not be classified with any of the following GHS hazard classifications: • H224: Flammable Liquids, Category 1 • H314: Skin Corrosion, Category 1 • H318: Serious Eye Damage, Category 1 • H317: Skin Sensitizer, Category 1A • H334: Respiratory Sensitizer, Category 1A • H370: STOT Single Exposure, Category 1 • H372: STOT Repeated Exposure, Category 1 • H300, H310, or H330: Acute Toxicity by Oral, Dermal, or Inhalation Exposure Routes, Category 1	• Certification by either the GreenScreen Certified standard for Cleaners & Degreasers in Manufacturing (Platinum or Gold level), US EPA Safer Choice, or ToxFMD Screened Chemistry programs; or • Third-party assessor (pre-approved by Apple) chemical hazard assessment report • Full material disclosure and review by Apple
Alternatives to PFAS-Containing Materials, Alternative Materials Using Flame Retardants, Alternative Materials Using Plasticizers, Alternative Ingredient Formulations Containing Solvents (see section 6.2)	Materials used in products (section 3 related) or ingredient formulations (section 4 related)	Please follow up with Apple at environment@apple.com or consult with a third-party assessor that must be pre-approved by Apple.	• Full material disclosure and review by Apple • Third-party assessor (pre-approved by Apple) chemical hazard assessment report

7. Full Material Disclosure (FMD) & Chemical Safety Disclosure (CSD)

FMD

Apple has implemented the Full Material Disclosure (FMD) initiative that requires suppliers to provide the entire chemical composition of the parts and materials used in Apple products. Implementation of FMD requires suppliers to disclose the complete, accurate, and precise identity of the parts and materials used in Apple products. Apple's Full Material Disclosure (FMD) requirements are documented in the FMD Data Requirements for Part Suppliers (080-00316) and the FMD Data Requirements for Material Suppliers (080-01462) specifications. The use of the FMD data collected from suppliers is governed by the Apple FMD Data Use Policy (080-00967), which restricts access to and use of the FMD data submitted to Apple.

Apple will audit supplier FMD data submissions to ensure conformity with the requirements in sections 3 and 4. Apple will conduct analyses to ensure submissions accurately reflect the composition of the parts and materials provided. The analyses will include comparison of FMD data to supplier-provided test reports and may include comparison to Apple test reports. Please contact FMD_Support@apple.com for more information. As part of FMD submissions, suppliers are required to disclose the complete, accurate, and precise identity of the parts and materials used in Apple products.

CSD

Apple has implemented the Chemical Safety Disclosure (CSD) Webform in Apple SupplierCare system that requires suppliers to provide entire chemical inventory as well as other chemical usage and process information. Suppliers must submit the required information in the CSD Webform to enable Apple to evaluate conformity with the requirements in Sections 4 and 5 of this specification. Please contact CSD@group.apple.com for more information and see Section 9 for additional verification requirements.

8. Supplementary Specifications

All Apple products must comply with the restrictions listed in this Regulated Substances Specification. In cases when new restrictions are introduced over a transition period, Apple may release supplementary specifications referencing those specific restrictions. Drawings, fabrication notes, and product specifications will reference the supplementary specification as applicable. The supplementary specifications are available to qualified suppliers upon request by contacting Apple at environment@apple.com. The following supplementary specifications are considered as part of the Apple Regulated Substances specification. When a supplier agrees to comply with the RSS, they also agree to conform with the requirements in the following specifications.

8.1 Apple Environmental Quality Specification, 069-8496

The Apple Environmental Quality Specification sets forth Apple's requirements for all suppliers including but not limited to final assembly facilities, module suppliers, and component suppliers, to maintain an environmental quality control program to ensure the environmental compliance of Apple products. The environmental quality control program for supplier facilities must include a material declaration process, in-process controls, and audits of raw materials and finished goods. All final assembly and module suppliers are required to adhere to these requirements and provide information to Apple in a timely manner.

8.2 Apple Regulated Substances Specification for Prolonged Skin Contact Materials, 099-3470

The Apple Regulated Substances Specification for Prolonged Skin Contact Materials applies to materials with direct or indirect prolonged skin contact in both wearable and non-wearable products. Materials with no or incidental skin contact will not need to comply with this specification. All materials, regardless of whether they are in prolonged skin contact, must also comply with the Apple Regulated Substances Specification (069-0135).

8.3 Conflict Minerals Restrictions, 069-5202

All suppliers of materials, parts, sub-components, components, or products (Component Goods) that are to be incorporated into an Apple product and containing tantalum, tungsten, tin, gold, or cobalt must comply with the specification on Conflict Minerals Restrictions, 069-5202. Suppliers may only use tin, tantalum, tungsten, gold, or cobalt in Component Goods if the supplier demonstrates that it has exercised due diligence in the sourcing of such materials and reports to Apple on the source and chain of custody of such metals in accordance with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. This will enable a determination as to whether those metals are from the Democratic Republic of the Congo (DRC) or any adjoining country and, if so, whether those metals directly or indirectly financed or benefited armed groups that are perpetrators of serious human rights abuses in the DRC or an adjoining country. Suppliers may only source tin, tantalum, tungsten, gold, or cobalt through smelters and refiners participating in a verification of their sourcing practices by an independent third-party organization or program recognized by Apple.

Apple expects each supplier to provide complete and accurate reporting of its due diligence efforts for all tin, tantalum, tungsten, gold, or cobalt used in Apple Component Goods. Apple will audit suppliers' Conflict Minerals data submissions to ensure conformity with Apple requirements. If any supplier becomes aware that it has sourced tin, tantalum, tungsten, gold, or cobalt that is from the DRC or any adjoining country and that directly or indirectly financed or benefited armed groups, in any Component Goods incorporated into Apple products, the supplier must immediately notify Apple in writing at mineralsreporting@apple.com.

8.4 Apple Volatile Organic Compound (VOC) Specification, 099-22549

This specification sets forth Apple's requirements for compliance with all restrictions, regulations, and reporting requirements for Volatile Organic Compound (VOC)–containing materials applicable to Apple products and packaging and related manufacturing processes. Compliance is applicable to the following stakeholders: all contract manufacturing partners, suppliers, and vendors, including all component, module, or system-level assembly facilities applying VOC-containing materials. Apple expects these stakeholders to ensure that materials under the scope of this specification used by their suppliers also comply with restrictions, regulations, and reporting requirements defined in this specification.

8.5 Engineering Requirements Specification: PFAS Definitions and Substances Lists, 099-39076

This document is the material specification defining chemicals that may be considered "poly- or perfluoroalkyl substances" or "PFAS," the most comprehensive (though nonexhaustive) list of PFAS and information that helps material vendors provide information to Apple in order to satisfy Apple RSS reporting requirements for PFAS.

8.6 Non-Use Substances in Prolonged Skin Contact (PSC) Materials in Wearables and Softgoods, 099-40247

Materials in prolonged skin contact in wearables and softgoods (e.g., cases, folios) must also comply with this specification.

9. Demonstrating Compliance

In addition to requiring test reports for the substances below, Apple may request analytical test reports demonstrating compliance for any of the substances listed in this specification, at the supplier's expense. Besides the prescribed test methods below, other test methods may be acceptable by Apple if preapproved.

Apple requires test reports from certified labs as proof of compliance for the following substances in homogeneous materials (related to Sections 3a and 4a). All testing must be conducted on materials in the form present in the final Apple product, accessory, or packaging. Please note, not all testing is for restricted substances (for example, Fluorine testing is only used as an indicator for further investigations). Test reports must be submitted through Apple's Test Report Mapping process. Test methods must be conducted at method detection limits capable of addressing the restriction limits of the specified substances.

Chemical or Chemical Group	Test Results Required for:	Test Method
Arsenic (As)	Glass materials	Total acid digestion followed by ICP-MS, ICP-OES, ICP-AES
Beryllium	All metals and metal alloys; metal plating is excluded.	US EPA 3050B; US EPA 3052; ICP-AES in addition to ICP-MS; ICP-OES in addition to ICP-MS
Bis(2-ethylhexyl) phthalate (DEHP) Butyl benzyl phthalate (BBP) Cadmium (Cd) Dibutyl phthalate (DBP) Diisobutyl phthalate (DIBP) Hexavalent Chromium (Cr6+) Lead (Pb) Mercury (Hg) Polybrominated biphenyl (PBB) Polybrominated diphenyl ether (PBDE)	All materials; test reports are not required for PBB, PBDE, DEHP, BBP, DBP, and DiBP in metals, glass, or ceramic.	Methods described or referenced in the IEC 62321 series
Bromine (Br) Chlorine (Cl) Fluorine (F)	All materials except metals, ceramics, and glass	EN 14582 or US EPA SW-846 5050/9056 or ASTM D 7359-14a, DIN 53474:2017-12, or IEC62321-3-2, followed by IC testing
PFOA PFOS	Inks, coated textiles, lubricants, coatings (e.g., primers, varnishes, paints, CVDs, photoresist, solder resist; see Definitions section), fluoropolymer materials	Methods with reference to EN 17681-1:2022 and EN 17681-2:2022; an LC-MS-MS method that can achieve an MDL of 25 ppb
Mineral oils	Inks in packaging	JRC GL 2019 (JRC115694) or equivalent, analysis performed by HPLC-GC-FID. Must be tested in wet formulation state.
UV-328	Polymer-based films in displays	LCMS methods that can achieve an MDL of 5 ppm
Any other substance listed in this specification	Any material if requested by Apple	As required

Apple recommends test reports from certified labs as a means to screen for the presence of the following chemicals (related to section 4b). Test reports are collected through Apple's Chemical Safety Disclosure Webform.

Chemical or Chemical Group	Test Results Required for:	Test Method
Heavy metals: all arsenic, cadmium, cobalt, copper, chromium, lead, manganese, mercury, nickel, vanadium, silver, and zinc compounds	Dye powder formulations	ICP-QQQ-MS with AOAC 2015.01 digestion

Apple requires test reports from certified labs as proof of non-use for the following manufacturing process chemicals (related to section 5 requirements). Test reports are collected through Apple's Chemical Safety Disclosure Webform.

Chemical or Chemical Group	Test Results Required for:	Test Method
Benzene	Cleaners and demolders	Analyzed by GC-MS or HPLC-MS; 5 ppm minimum detection limit
Brominated organic solvents	Cleaners and demolders	EN 14582, US EPA SW-846 5050/9056, ASTM D 7359-14a, DIN 53474:2017-12, or IEC62321-3-2 for for total bromine; 50 ppm minimum detection limit; others preapproved by Apple
Chlorinated organic solvents	Cleaners and demolders	EN 14582, US EPA SW-846 5050/9056, ASTM D 7359-14a, DIN 53474:2017-12, or IEC62321-3-2 for for total chlorine; 50 ppm minimum detection limit; others preapproved by Apple
N-Hexane	Cleaners and demolders	Analyzed by GC-MS or HPLC-MS; 5 ppm minimum detection limit
N-Methylpyrrolidone (NMP)	Cleaners and demolders	Analyzed by GC-MS or HPLC-MS; 5 ppm minimum detection limit
Toluene	Cleaners and demolders	Analyzed by GC-MS or HPLC-MS; 5 ppm minimum detection limit

Additionally, for any Section 4 or 5 substance group where the restriction is "no intentional use," or where there is a specific threshold applicable, the supplier must provide a safety data sheet (SDS) that shows the substance is not present or under the specified threshold, or otherwise provide a declaration that the substance is not intentionally added or under the specified threshold through the Chemical Safety Disclosure Webform.

All test reports must meet the following requirements:

- Test reports must be no more than two years old from the date submitted to Apple or Apple's manufacturing partners. Material test reports are required for each use of that material in a new product design. Suppliers are obligated to maintain appropriate processes and systems to manage test reports so that the valid reports can be submitted to Apple in a timely manner. Materials tested must be homogeneous.
- Test reports that are not at a homogeneous material level are not acceptable (e.g., modules made up of several homogeneous materials tested after grinding the entire subassembly).
- Apple requires unaltered test reports of homogeneous materials from certified labs as proof of compliance for the substances listed in Section 9. Digital test reports must be in the form of original, unaltered PDF files containing text and images as provided by the certified lab(s). Scanned, photographed, modified, and/or image-only PDF files are prohibited without Apple's prior approval and will be rejected at Apple's discretion.
- All test reports must be issued by a laboratory certified by or accredited to ISO/IEC 17025 by an accreditation body that is a signatory of the ILAC Mutual Recognition Arrangement (ILAC MRA).
- The test methods used for demonstrating compliance to halogen (Br, Cl, F) and RoHS requirements must be included in the laboratory's scope of accreditation. Documentation of the laboratory's accreditation status and detailed scope, including validated and appropriate test methods, can be provided to environment@apple.com for approval.
- Test reports based on X-ray Fluorescence Spectroscopy (XRF) are not acceptable forms of compliance documentation.
- For Section 3–related requirements, testing must be conducted on the material in the form present in the final Apple product, accessory, or packaging item (i.e., "dry" or "cured"). It is very important that the supplier submit materials consistent with the final product state in order to ensure any process or unintentional contaminants are not incorporated into the product.
- When conducting test method (EN 14582) for halogens (Br, Cl, F), supplier must ensure with test laboratory that the method is validated for different halogens using certified reference materials.
- Test reports submitted to Apple must be issued in English or include English if a multilingual report.
- It is the supplier's responsibility to provide test reports at the supplier's expense.
- Redacted test reports will not be accepted by Apple. They may, however, satisfy contract manufacturer requirements. Contact the Apple Environmental Quality Team for guidance as required. Source: Current version of Apple Environmental Quality Specification (069-8496-K, Section 2.1.2: Test Report Requirement).

Apple or Apple's manufacturing partners may request test reports on a case-by-case basis, at the supplier's expense, if there are concerns regarding the validity of the test data or compliance of the parts.

All compliance documentation (e.g., test reports and declarations) must be retained by the supplier for a minimum of 10 years as part of the supplier's record-keeping process. Digital formats are acceptable unless otherwise noted. Suppliers are also expected to have compliance assurance processes and systems to control and maintain compliance. Refer to the Apple Environmental Quality Specification (069-8496) for additional information on supplier's internal environmental quality assurance requirements. Questions relating to test requirements may be directed to Apple Global Supply Managers (GSM), or emailed to Apple at environment@apple.com.

For substances that are restricted or regulated and have been replaced with an alternative substance, the supplier is required to ensure the alternative substance is an environmentally responsible substitution. Substitutions should be selected based on minimizing unintended consequences that might occur in phasing out a potentially hazardous substance. Suppliers shall conduct alternative assessments or obtain these assessments from their raw materials suppliers prior to making a replacement. Contact Apple at environment@apple.com for more information on conducting alternative assessments.

10. Non-Conformances and Waivers

Any instances of materials exceeding the thresholds or otherwise not meeting the requirements in this specification must immediately be reported to Apple. Suppliers that are seeking a temporary deviation to a non-conformance of a restriction (i.e. waiver) in the Apple Regulated Substances Specification must make the request to Apple in writing. Apple will review the request and provide its decision via email to the requester. Contact Apple at environment@apple.com for more information on this process.

11. Revision History

Revision	Date	Revision Description
N	March 7, 2025	Updated scope to include “Ingredient Formulations.” Updated and added definitions. Updated references. Added product restrictions for dechlorane plus, ortho-phthalates (for packaging only), PFAS for packaging and textiles, and UV-328. Modified product restrictions for PAHs, PVC, PFOS, PFOA with new limits. Added ingredient formulation restrictions for mineral oils. Added product reporting requirements and future restrictions for 1,3-propane sultone, BBOT, Flame retardants, Plasticizers, Photoinitiators, PVDF, Hydrocarbyl siloxanes, Triphenyl phosphate, and UV stabilizers. Modified product reporting requirements and future restrictions for adhesive monomers, EDCs, and lead. Added ingredient formulation reporting requirements and future restrictions for heavy metals and solvents. Added manufacturing process reporting requirements and future restrictions for PFAS. Added sections 6.2 and 6.3 on Alternatives Assessment Requirements and Safer Alternatives Criteria respectively. Made the RSS the governing safer chemistry specification for Apple. Added two additional supplementary specifications (8.5., 8.6). Increased scope of Beryllium testing to all metals and metal alloys. Added product testing requirements for mineral oils and UV-328. Added test report requirements for ingredient formulations for heavy metals. Added modified requirements for test lab accreditation and test report methods. Added Appendices O,P, and Q.
M	March 21, 2023	Section 2: Added definitions for brominated flame retardant and intentionally added. Section 3: Updated adhesive monomers Group I to include adhesives in wearable products within the scope. Updated mercury, lead, arsenic, brominated flame retardants, PVC, and beryllium to indicate “No intentional use” under the threshold limit. Removed benzenamine, N-phenyl-, reaction products with styrene and 2,4,4-trimethylpentene (BNST). Added brominated flame retardants restriction. Added PFHxA, its salts, and related substances restriction. Added phenyl, isopropylated phosphate (3:1), or PIP 3:1 restriction. Added “1000 ppm in all materials unless allowed per Apple SVHC disclosures. Must also report to Apple all use when > 1000 ppm in materials” for REACH SVHC restriction. Added toluene restriction. Section 4: Updated the threshold section of PFAS section to include 50 ppm for polymeric PFAS, 25 ppb for nonpolymeric PFAS, and a link to prepublished draft Annex XV report. Added perfluorohexanoic acid (PFHxA). Added REACH Candidate List of SVHCs. Added phenyl, isopropylated phosphate (3:1), or PIP 3:1. Removed aminoethyl ethanolamine and diphenylamines, Substituted (SDPA) (including Appendix H). Regulation references updated for POP, PFOA, and PFCAs. Section 8: Added Engineering Requirements Specification: PFAS and PFHxA Definitions and Substances (099-39076). Section 9: Added the following test methods for Beryllium “ICP-AES in addition to ICP-MS and ICP-OES in addition to ICP-MS.” Added fluorine. Added “LC-MS-MS methods that can achieve an MDL of 25 ppb” test method for PFOA and PFOS. Included language for conducting test method EN14582. Section 14: Updated POP regulation to 2019/1021/EC. Section 15: Updated substances in Appendix O and P.
L	March 15, 2021	Multiple sections: Updated section 3, section 4, and section 6 introductions to include a clarified scope. Added a larger list of brominated organic solvents that expands on “n-Propyl bromide” in section 4, section 6, and section 9. Section 2: Added definitions for alloys, Chemical Safety Disclosure (CSD), coating, mixture, no intentional use, paint, ppb, primer, process chemical, textile, varnish, and wearable products. Section 3: Added restriction for adhesive monomers Group I & II. Broadened restriction of antimony to all antimony compounds. Added restrictions for benzene, chlorinated organic solvents, and n-hexane. Updated scope and restriction thresholds for hexavalent chromium and its compounds. Updated restriction scope of lead compounds to include “No intentional use” in all other materials besides those exempted by the EU. Lowered restriction threshold for mercury and its compounds. Added natural rubber, latex restriction. Added restrictions for PFCAs (C9–C14), their salts, and related substances, and PFHxS, its salts, and related substances. Updated restriction thresholds for PFOA and updated restriction group to include “its salts, and PFOA-related compounds.” Updated restriction for PFOS to include “and its derivatives.” Updated list of restricted polybrominated diphenyl ethers (PBDEs). Updated restriction threshold for polycyclic aromatic hydrocarbons (PAHs). Section 4: Changed section 4 column “Phaseout Priority” to “Phaseout & Future Restrictions,” and clarified what is meant by “phaseout.” Changed all “Priority 1” substances to “Begin phaseout immediately. Expect future restrictions.” Changed all “Reportable” substances to “Expect future restrictions.” Added adhesive monomers Group I, per- and polyfluoroalkyl substance (PFAS), PFBS and related substances, PFHxA, its salts, and related substances, and toluene to section 4 with explicit timelines for phaseout. Expanded the list of reportable bisphenol chemicals. Added formaldehyde-releasing substances. Changed the phaseout and future restriction for parts/components utilizing RoHS exemptions from just reportable to “Begin phaseout immediately. Expect future restrictions.” Added skin-sensitizing substances. Added reference to the Apple VOC Specification for volatile organic compounds (VOCs). Added melamine and n-ethyl-2-pyrrolidone to “Expect future restrictions.” Section 6: Increased scope of benzene, brominated organic solvents, n-hexane, and chlorinated organic solvents to include “No intentional use for all other manufacturing process chemicals.” Added methanol restriction for “No intentional use for cleaning agents, degreasers, and demolder solutions.” Section 7: Added ethyl benzene, formaldehyde, hydrogen fluoride (HF), methanol, and xylene. Changed instances of “Reportable” to “Expect future restrictions.” Section 8: Added Apple Volatile Organic Compound (VOC) Specification, 099-22549, and Safeguarding Substances Specification, 080-03584. Updated text for Apple Regulated Substances Specification for Prolonged Skin Contact Materials, 099-3470, and Conflict Minerals Restrictions, 069-5202. Section 9: Updated scope of materials in “Test results required for” for beryllium and PFOS, PFOA. Added “Any other substance listed in this specification” in which test results are required for “Any material if requested by Apple.” Updated test report requirements. Other sections: Updated description of Waiver Process (section 10), Full Material Disclosure (FMD; section 11), and Chemical Safety Disclosure (CSD; section 12). Modified Appendix D. Removed SF6 from Appendix I. Created Appendices M, N, O, P, and Q.
K	March 30, 2018	Updated scope to include supplier requirements. Updated restriction on BPA. Split PFOA and PFOS into separate listings and updated PFOA restriction. Added restriction on REACH Candidate List of SVHCs, HBCDD. Moved listing for radioactive substances from reportable to restricted. Updated restrictions for cadmium, chlorine, bromine, hexavalent chromium, lead, and mercury to include “compounds.” Created separate restriction listing for heavy metals in packaging. Updated scope for restriction on PAHs to External Materials. Updated threshold for reportable listings benzene, chlorinated organic solvents, and toluene to reference wet formulation. Changed parts/components utilizing RoHS exemptions from priority phaseout 3 to 2. Added reportable listings, priority 2 phaseout listings bisphenol F/bisphenol S and VOCs. Added reportable listings for EDCs, additive phosphorous flame retardants, IEC 62474 substances, indium phosphide, PFAS, and biocides. Changed the priority phaseout for several listings to “Reportable.” Added section “Notifying Apple of Chemical Phaseout and Reformulation from Suppliers.” Added restriction on nPB in manufacturing process. Created new section “Reportable Substances and Future Restrictions in Manufacturing Processes.” Changed beryllium test results required for metals and ceramics. Added requirement for test results for DEHP, BBP, DBP, and DIBP. Added test report requirement for PFOA/PFOS for leather, textiles, and coatings. Added manufacturing chemical test report requirements for nPB. Removed test reports being valid for the life of the component. Added additional requirements for test reports. Updated Appendices D, E, F, and I with additional substances. Created Appendices K, L, and M.

J	March 21, 2016	Folded the following specifications into 069-0135-J: Apple RoHS Compliance Specification (069-1111), Apple Specification on Restriction of Beryllium (099-3471), and Apple Specification on the Restriction of Bromine and Chlorine (069-1857). Added additional asbestos compounds. Updated azo dyes, arylamines, and anilines into Appendix A. Updated formaldehyde content restrictions. Updated restrictions for lead. Additional CAS numbers added for perchlorates. Added Appendix B for chlorinated paraffins. Added Appendix C for organotin compounds, Appendix D for perfluorinated compounds, Appendix E for phthalates. Lowered the thresholds for PAHs. Lowered the threshold for PCBs. Added reporting requirements for benzene, toluene, and chlorinated solvents, Proposition 65 list, Washington State's List of Chemicals of High Concern, and substances allowed due to RoHS exemptions in section 4. Phaseout priorities added to all the items in reportable section 4. Added Manufacturing Process restrictions for NMP and toluene in section 5. Updated content restriction values for benzene, chlorinated organic solvents, n-hexane, and toluene in section 5. Updated Supplementary Specifications. Updated section 7, Demonstrating Compliance. Added testing requirements for manufacturing process chemicals. Added section 9 relating to Full Material Disclosure (FMD).
H	June 20, 2014	Updated definition of Homogeneous Material, Separated Reportable Substances into new section; updated requirements for azo dyes, beryllium, BPA, cadmium, halogenated biphenyl methanes, Lacey Act, lead, organic tin, PFOS, PFOA, phthalates, PVC, REACH SVHCs, TBBPA, benzene, n-hexane, chlorinated solvents, nPB in ODC, conflict minerals; removed halogens; addition of Softgoods Regulated Substances and Beryllium Restriction Specifications in section 6 for Supplementary Specifications; addition of alternative assessment verbiage and testing requirements for cleaning agents and degreasers in section 7 for Demonstrating Compliance.
G	April 11, 2013	Updated REACH SVHCs, arsenic, asbestos, beryllium requirements, new nickel standard. Added REACH 1907/2006 and amendments, reference to RoHS Recast (RoHS 2), CEPA substances, perchlorate, new phthalates, lead in surface coating, PFOA, BPA reporting, benzotriazole, new PAHs, Lacey Act, and EU Timber Regulation, additional ODCs, benzene and n-hexane restrictions in manufacturing. Removed polystyrene, gallium. Added reference to 069-8496 for supplier QA. Updated conflict minerals reference. Added PFOA/PFOS testing requirement for ink and paints.
F	January 6, 2010	Added restrictions on DMF, PAH, PFOS, organic tin compounds, formaldehyde in textiles, and certain phthalates. Added notification requirements and restrictions for substances regulated by REACH. Adjusted arsenic limit and added test report requirement for arsenic in glass. Added reference to Conflict Minerals Restriction specification.
E	October 9, 2007	Updated format; introduced restrictions on Br, Cl, TBBA, red phosphorus, gallium; updated limits on As, Pb, Cd, Hg, Cr(VI), asbestos, chlorinated paraffins, formaldehyde, diphenyl methanes, nickel, organic Sn, PCB, PCN, PCT, PVC, radioactive substances; added Be to watch list; limited scope restrictions on chlorinated organic solvents.
D	October 26, 2004	Updated plastics Pb limit; merged plastics and cables section; added appendix for guidance on Pb restrictions; added appendix with summary table of permissible limits.
C	August 18, 2004	Changed format, new substances added, included permissible limits.
B	February 12, 2003	Initial release
A	December 10, 2002	Initial release

12. Referenced Documents

069-5202: Conflict Minerals Restrictions, Apple Inc.

069-8496: Apple Environmental Quality Specification, Apple Inc.

080-00316: Apple FMD Data Requirements for Part Suppliers, Apple Inc.

080-00967: Apple FMD Data Use Policy, Apple Inc.

080-01462: Apple FMD Data Requirements for Material Suppliers, Apple Inc.

099-3470: Apple Regulated Substances Specification for Prolonged Skin Contact Materials

099-39076: Engineering Requirements Specification: PFAS and PFHxA Definitions and Substances

94/62/EC: Directive of the European Parliament and of the Council on Packaging and Packaging Waste, 94/62/EC, December 1994

2019/1021/EU: Regulation of the European Parliament and of the Council of 20 June 2019 (recast) amended the previous regulation (2004/850/EC)

2009/425/EC: Commission Decision of 28 May 2009 amending Council Directive 76/769/EEC as regards restrictions on the marketing and use of organostannic compounds for the purpose of adapting its Annex I to technical progress

2037/2000/EC: Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer

2010/153/EU: Prolonging the validity of Decision 2009/251/EC requiring Member States to ensure that products containing the biocide dimethyl fumarate are not placed or made available on the market

2011/65/EU: The restriction of the use of certain hazardous substances in electrical and electronic equipment ("RoHS Recast"). This directive replaces the directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

2011/696/EU: Commission recommendation of 18 October 2011 on the definition of nanomaterial

2013/56/EU: Amended 2006/66/EC Directive of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators, and repealed Directive 91/157/EEC

2013/1272/EU: Commission Regulation (EU) No 1272/2013 of 6 December 2013 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards polycyclic aromatic hydrocarbons

2023/1542/EU: Regulation (EU) 2023/1542 of the European Parliament and of the Council of 12 July 2023 concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC

2023/866/EU: Commission Delegated Regulation (EU) 2023/866 of 24 February 2023 amending Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds

2024/2462/EU: Commission Regulation (EU) 2024/2462 of 19 September 2024 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council as regards undecafluorohexanoic acid (PFHxA), its salts and PFHxA-related substances

ACGIH: American Conference of Governmental Industrial Hygienists (ACGIH), Guide to Occupational Exposure Values, 2013

AIHA TWA: The AIHA Guideline Foundation Workplace Environmental Exposure Levels® (WEELs®) provide guidance for protecting most workers from adverse health effects related to occupational chemical exposures expressed as time-weighted average (TWA)

Apple Supplier Code of Conduct and Supplier Responsibility Standards: See supplier requirements at apple.com/supplier-responsibility.

ASTM D6499: Standard Test Method for Immunological Measurement of Antigenic Protein in Hevea Natural Rubber (HNR) and Its Products

ASTM D7359-14a: Standard Test Method for Total Fluorine, Chlorine, and Sulfur in Aromatic Hydrocarbons and Their Mixtures by Oxidative Pyrohydrolytic Combustion followed by Ion Chromatography Detection (Combustion Ion Chromatography—CIC)

Bedarfsgegenstände Verordnung: German national law (consumer article regulation)

CA DTSC: California Department of Toxic Substances Control; Perchlorate Contamination Prevention Act of 2003, AB 826

Cal OSHA: California Department of Public Health, Occupational Health Branch, PELs, Title 8, section 5155/AC-1

California Prop 65: The Safe Drinking Water and Toxic Enforcement Act of 1986, California Health and Safety Code, Division 20, Chapter 6.6, sections 25249.5 through 25249.13

Canadian Environmental Protection Act, 1999 (CEPA 1999): Chemicals Management Plan, Section 71

ChemVerbotsV: Chemical Prohibition Ordinance, Germany

Children's Safe Products Act (CSPA): Washington State's Children's Safe Products Act reporting list of Chemicals of High Concern to Children (CHCC), US

China RoHS: Administrative Measures on Restricted Use of Hazardous Substances in Electrical and Electronic Products, Ministry of Industry and Information Technology of People's Republic of China, Order #32, January 21, 2016

CLP Regulation (EC) No. 1272/2008: Classification, Labeling, and Packaging complements Dangerous Substances Directive (67/548/EEC) and the Dangerous Preparations Directive (1999/45/EC) replaced by the EU Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) directive

CPSIA, 2008: Consumer Product Safety Improvement Act of 2008—Public Law 110-314; US

CRS 001/1983: Executive Directive CRS 001/1983 Regulates Procedures for the Handling, Storage, and Transport of PCB-Contaminated Equipment in Brazil

DIN 53474:2017-12: Testing of plastics, rubber, and elastomers; determination of the chlorine content

DIN CEN/TS 15968: Determination of extractable perfluorooctane sulfonates (PFOS) in coated and impregnated solid articles, liquids, and firefighting foams

DIN EN ISO 17075: Testing of leather; determination of the chromium(VI) content

ECHA/NA/15/29: SEAC (Committee for Socio Economic Analysis) concludes on Bisphenol A, DecaBDE, and PFOA restrictions and finalizes two opinions for authorization, September 2015.

EN 14372:2004: Child use and care articles. Cutlery and feeding utensils. Safety requirements and tests.

EN 1811:2023: Reference test method for release of nickel from articles intended to come into direct and prolonged contact with the skin. Replaces EN 1811:2011+A1:2015.

EN 12472:2020: Method for the simulation of accelerated wear and corrosion for the detection of nickel release from coated items

EN 14582:2016: Characterization of waste. Halogen and sulfur content. Oxygen combustion in closed systems and determination methods. British Standards Institute, 2016.

EPA SW-846 5050/9056: Bomb preparation method for solid waste; Method 9056: Determination of inorganic anions by ion chromatography. EPA,1994.

EU No. 528/2012 (BPR): Regulation of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

EU No. 528/2021/EU (BPR): Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products

EU No. 995/2010: EU Timber Regulation laying down the obligations of operators who place timber and timber products on the market

France Decree No. 2012-232, Environmental Code Article L. 523-4: Annual declaration of nanoparticles in substances

French legislative No. 2020-105: France Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy

GB 18401-2010: Chinese National General Safety Technical Code for Textile Products

GB 20400: Limit of Harmful Matters in Leather and Fur, 2006 (Chinese mandatory standard)

GB/T 26572: Chinese Standards on the Requirements of Concentration Limits for Certain Restricted Substances in Electrical and Electronic Products, 2011

GBZ 2.1-2007: Occupational exposure limits for hazardous agents in the workplace in China, 1 November 2007

IEC 62321: Determination of certain substances in electrotechnical products. IEC, 2008. Updates in 2013 and 2015.

IEC 62474: Material Declaration for Products of and for the Electrotechnical Industry

IEEE 1680.1-2018: IEEE Standard for Environmental and Social Responsibility Assessment of Computers and Displays, IEEE, 2018

ISO17075-2:2017: Chemical determination of chromium (VI) content in leather. Part 2: Chromatographic method, 2017.

Japan Chemical Substances Control Law (CSCL) and amendments, 2011

Japanese Laws: Japanese Laws for the Regulation of Nuclear Source Material, Nuclear Fuel Material, and Reactors, 1986

Lacey Act (16 U.S.C. §§ 3371–3378): Amended in the Food, Conservation, and Energy Act of 2008 (Pub. L. 110–234, H.R. 2419, 122 Stat. 923, enacted May 22, 2008), expanded its protection to a broader range of plants and plant products (Section 8204. Prevention of Illegal Logging Practices)

Montreal Protocol: Montreal Protocol on Substances that Deplete the Ozone Layer, September 1987

NIOSH: National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards, Center for Disease Control and Prevention (CDC), 2014

Norway FOR-2004-06-01-922: Regulations relating to restrictions on the use of health-hazardous chemicals and other products (Product Regulations)

REACH: Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH): Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006

REACH amendments: Annex XVII of Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006. This Annex replaces the following directives:

- **76/769/EEC** (Azocolorants, Arsenic)
- **85/467/EEC** (PCB/PCT)
- **91/659/EEC** (Asbestos)
- **94/27/EC** (Nickel)
- **2002/45/EEC** (Short-chained chlorinated paraffins)
- **2002/61/EC** (Azocolorants)
- **2003/3/EC** (Blue azocolorants)
- **2009/425/EC** (Organotin compounds)

REACH, Article 59 (10): Candidate List of Substances of Very High Concern (SVHCs) for authorization under REACH regulation

Sweden Chemical Tax (2016:1067): Tax enacted on July 1, 2017, levied on chemicals in certain electronics

SZJG 54-2017: Technical Specification for Low Volatile Organic Compound Content Paint

Taiwan BSMI RoHS: CNS 15663 is the technique standards of Taiwan BSMI RoHS.

UL Standard 110, Edition 2, UL 110 Standard for Sustainability for Mobile Phones, UL, 2017

US EPA 3050B: EPA method describing acid digestion of sediments, sludges, and soils

US EPA 3052: EPA method describing microwave-assisted acid digestion of siliceous and organically based matrices

US EPA 5021A: EPA method to determine volatile organic compounds in soils and other solid matrices using equilibrium headspace analysis

US EPA, SNUR 2070-AJ73: EPA's significant new-use rule for short-chain chlorinated paraffins, under TSCA Section 5(a)(2), December 2014

US EPA, TSCA Section 6(h): EPA TSCA's rule for Persistent, Bioaccumulative, and Toxic (PBT) compounds that restricts the manufacturing processing, and distribution of five PBTs with specification exception.

13. Appendices

Appendix A

Azo dyes, arylamines, and anilines [24 items]	CAS No.
4-Aminoazobenzene	60-09-3
o-Aminoazotoluene	97-56-3
2-Amino-4-nitrotoluene	99-55-8
o-Anisidine	90-04-0
Benzidine	92-87-5
2,2'-dichloro-4,4'-methylenedianiline (MOCA)	101-14-4
4-Biphenylamine	92-67-1
4-Chloroaniline	106-47-8
4-Chloro-2-toluidine	95-69-2
p-Cresidine	120-71-8
2,4-Diaminoanisole	615-05-4
4,4′-Diaminodiphenylmethane	101-77-9
2,4-Diaminotoluene	95-80-7
3,3′-Dichlorobenzidine	91-94-1
3,3′-Dimethoxybenzidine	119-90-4
3,3′-Dimethylbenzidine	119-93-7
3,3′-Dimethyl-4,4′-diaminodiphenylmethane	838-88-0
2-Naphthylamine	91-59-8
4,4′-Oxydianiline	101-80-4
4,4′-Thiodianiline	139-65-1
o-Toluidine	95-53-4
2,4,5-Trimethylaniline	137-17-7
2,4-Xylidine	95-68-1
2,6-Xylidine	87-62-7

Appendix B

Chlorinated paraffins (SCCP and MCCP)	CAS No.
Short-chain chlorinated paraffins (SCCPs) CxH2x+2-yCly where x=10-13 and y=1-13 [4+ items]	Examples
Alkanes, C10-13, chloro	85535-84-8
Alkanes, C10-21, chloro	84082-38-2
Alkanes, C12-13, chloro	71011-12-6
Alkanes, C12-14, chloro	85536-22-7
Medium-chain chlorinated paraffins (MCCPs) CxH2x+2-yCly, where x=14-17 and y=1-17 [1 item]	Example
Alkanes, C14-17, chloro	85535-85-9

Appendix C

Organotin compounds [9 items]	CAS No.
Dibutyltin (DBT) compounds	Multiple
Dioctyltin (DOT) compounds	Multiple
Monobutyltin (MBT) compounds	Multiple
Monooctyltin (MOT) compounds	Multiple
Tetrabutyltin (TeBT)	Multiple
Tetraoctyltin (TeOT)	Multiple
Tributyltin (TBT) compounds	Multiple
Tricyclohexyltin (TCyT) compounds	Multiple
Triphenyltin (TPhT) compounds	Multiple

Appendix D

PFAS compounds [7 items]	Chemical group definition and CAS No.[s]
PFAS compounds	See 099-39076-B: PFAS Definition and Substance Lists or the EU Annex XV Report. Any substance that contains at least one fully fluorinated methyl (CF3-) or methylene (-CF2-) carbon atom (without any H/Cl/Br/I attached to it). A substance that only contains the following structural elements is also excluded form the scope of the PFAS definition: CF3-X or X-CF2-X′ where X = -OR or -NRR′ and X′ = methyl (-CH3), methylene (-CH2-), an aromatic group, a carbonyl group (-C(O)-), -OR′′, -SR′, or -NR′′R′′′; and where R/R′ R′′ / R′′′ is a hydrogen (-H), methyl (-CH3), methylene (-CH2-), an aromatic group, or a carbonyl group (-C(O)-).
Perfluorooctanoic acid (PFOA), its salts, and PFOA-related compounds	PFOA and its salts and compounds that degrade to PFOA, including any substances (including salts and polymers) having a linear or branched perfluoroheptyl group with the moiety (C_7F_{15})C as one of the structural elements. Including but not limited to compounds on pages 79–81 in the United Nations indicative list: chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC16/POPRC16Followup/tabid/8748/Default.aspx
Perfluorooctane sulfonate (PFOS), its salts, and PFOS-related compounds	Compounds with the formula $C_8F_{17}SO_3H$, their salts, and any combinations thereof. This includes any substance having a perfluoroalkyl group (linear or branched) C8F17- directly attached to a sulfur atom. Including but not limited to compounds on pages 24–44 in the following OECD list: one.oecd.org/document/env/jm/mono(2006)15/en/pdf
Perfluorobutane sulfonate (PFBS), its salts, and related substances	Compounds with the formula $C_4F_9SO_3H$, their salts, and any combinations thereof. This includes any substance having a perfluoroalkyl group (linear or branched) C_4F_9- directly attached to a sulfur atom. Including but not limited to the list of compounds on pages 14, 15, 24, and 25 in: miljodirektoratet.no/globalassets/publikasjoner/M759/M759.pdf
Perfluorocarboxylic acids (PFCAs; C9–C14), their salts, and related substances	Compounds that are perfluoroalkyl carboxylic acids (branched and/or linear) with the formula: CF_3-(CF_2)n-, n=8-13 as a structural element, including their salts. In addition, any related substance (including its salts and polymers) with the above defined linear and/or branched perfluoroalkyl structural elements that can degrade to C9–C14 PFCA. Including but not limited to compounds listed on pages 31, 56, and 198–205 in: echa.europa.eu/documents/10162/2ec5dfdd-0e63-0b49-d756-4dc1bae7ec61
Perfluorohexanoic acid (PFHxA), its salts, and related substances	Compounds (including salts and polymers) having a linear or branched perfluoropentyl group with the formula C_5F_{11}- directly attached to another carbon atom. Including but not limited to compounds listed in: echa.europa.eu/documents/10162/7da473c1-7f27-df34-9e6a-46152ef10d4b
Perfluorohexane sulfonate (PFHxS), its salts, and related substances	Compounds with the formula $C_6F_{13}SO_3H$, their salts and any combinations thereof. This includes any substance having a perfluoroalkyl group (linear or branched) C6F13- directly attached to a sulfur atom. Including but not limited to compounds listed on pages 168–192 in: echa.europa.eu/documents/10162/a22da803-0749-81d8-bc6d-ef551fc24e19

Appendix E

Phthalates [52 items]	CAS No.
1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP)	71888-89-6
1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters; 1,2-Benzenedicar- boxylic acid, mixed decyl and hexyl and octyl diesters with ≥ 0.3% of dihexyl phthalate	68515-51-5 68648-93-1
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUP)	68515-42-4
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear (DPP)	84777-06-0
Bis-(2-methoxyethyl) phthalate (DMEP)	117-82-8
Butylbenzyl phthalate (BBP)	85-68-7
Dibutyl phthalate (DBP)	84-74-2
Diethyl phthalate (DEP)	84-66-2
Diethylhexyl phthalate (DEHP)	117-81-7
Diisobutyl phthalate (DIBP)	84-69-5
Di-isodecyl phthalate (DIDP)	26761-40-0 68515-49-1
Diisononyl phthalate (DINP)	28553-12-0 68515-48-0
Di-iso-pentyl phthalate (DIPP)	605-50-5
Dimethyl phthalate (DMP)	131-11-3
Di-n-hexyl phthalate (DnHP)	84-75-3
Di-n-Octyl phthalate (DNOP)	117-84-0
Di-n-pentyl phthalate (DnPP)	131-18-0
n-Pentyl-isopentyl phthalate (nPIPP)	776297-69-9
Diundecyl phthalate (DuDP)	3648-20-2
Dicyclohexyl phthalate (DCHP)	84-61-7
Diisohexyl phthalate (DiHP)	71850-09-4
Bis(methylcyclohexyl) phthalate (MDCHP)	27987-25-3
Diphenyl phthalate (DPhP)	84-62-8
Bis(3,3,5-trimethyl cyclohexyl) phthalate (D3MCHP)	37832-65-8
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	68515-50-4
Dibenzyl phthalate (DBzP)	523-31-9
Diisooctyl phthalate2 (DiOP)	27554-26-3

Phthalates	CAS No.
Benzyl octyl phthalate	1248-43-7
Benzyl isooctyl phthalate	27215-22-1
n-butyl octyl phthalate	84-78-6
n-pentyl benzyl phthalate	1240-18-2
2-ethylhexyl octyl phthalate	3461-26-5
iso-butyl benzyl phthalate	72170-45-7
Butyl isoamyl phthalate	144648-76-0
iso-pentyl benzyl phthalate	72170-46-8
1,2-Benzenedicarboxylic acid, 1-isononyl 2- (phenylmethyl) ester	126198-74-1
1,2-Benzenedicarboxylic acid, mixed hexyl and oleyl and stearyl diesters	84961-72-8
(+)-Mono-(1,2,2-Trimethylpropyl) phthalate	75673-16-4
1,2-Benzenedicarboxylic acid, 1-[(1R,2S,5R)-5- methyl-2-(1- methylethyl)cyclohexyl] ester	33744-74-0
Butyl hydrogen phthalate	131-70-4
(Dimethylcyclohexyl) hydrogen phthalate	1322-94-7
(2-ethylhexyl) hydrogen phthalate	4376-20-9
hexyl hydrogen phthalate	24539-57-9
1,2-Benzenedicarboxylic acid, 1-[(1S,2R,5S)-5-methyl-2-(1- methylethyl)cyclohexyl] ester	53623-42-0
1,2-Benzenedicarboxylic acid, 1-[1-(1,1-dimethylethyl)-3- methylbutyl] ester	109591-02-8
1,2-Benzenedicarboxylic acid, 1-[1-(1,1-dimethylethyl)pentyl] ester	109591-01-7
1,2-Benzenedicarboxylic acid, 1-(1-cyclohexyl-3- methylbutyl) ester	111501-63-4
1,2-Benzenedicarboxylic acid, 1-cyclohexyl ester	7517-36-4
Benzyl hydrogen phthalate	2528-16-7
1,2-Benzenedicarboxylic acid, 1-(1-phenylethyl) ester	33533-53-8
1,2-Benzenedicarboxylic acid, 1-(1-phenylethyl) ester	17470-31-4
1,2-Benzenedicarboxylic acid, 1-(1,2,2-trimethylpropyl) ester	84489-36-1

Appendix F(i)

Polycyclic aromatic hydrocarbons (PAHs)	CAS No.
Benzo(a)anthracene	56-55-3; 1718-53-2
Benzo(a)phenanthrene (chrysene)	218-01-9
Benzo(a)pyrene	50-32-8
Benzo(b)fluoranthene	205-99-2
Benzo(e)pyrene	192-97-2
Benzo(g,h,i)perylene	191-24-2
Benzo(j)fluoranthene	205-82-3
Benzo(k)fluoranthene	207-08-9
Dibenzo(a,h)anthracene	53-70-3

Appendix F(ii)

Polycyclic aromatic hydrocarbons (PAHs)	CAS No.
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo(j,k)fluorene (fluoranthene)	206-44-0; 93951-69-0
Benzo(r,s,t)pentaphene	189-55-9
Dibenz(a,j)acridine	224-42-0
Dibenzo(a,e)fluoranthene	5385-75-1
Dibenzo(a,e)pyrene	192-65-4
Dibenzo(a,h)pyrene	189-64-0
Dibenzo(a,l)pyrene	191-30-0
7H-Dibenzo(c,g)carbazole	194-59-2
Dibenz(a,h)acridine	226-36-8
Fluorene	86-73-7
Indeno(1,2,3-cd)pyrene	193-39-5
5-Methylchrysene	3697-24-3
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0; 1718-52-1

Appendix G

Chlorinated organic solvents	CAS No.
Chlorinated methanes [6 items]	
Bromodichloromethane	75-27-4
Carbon tetrachloride	56-23-5
Chloroform	67-66-3
Dibromochloromethane	124-48-1
Methylene chloride	75-09-2
Methyl chloride	74-87-3
Chlorinated ethanes [9 items]	
Chloroethane	75-00-3
1,1-Dichloroethane	75-34-3
1,2-Dichloroethane	107-06-2
Hexachloroethane	67-72-1
Pentachloroethane	76-01-7
1,1,1,2-Tetrachloroethane	630-20-6
1,1,2,2-Tetrachloroethane	79-34-5
1,1,1-Trichloroethane	71-55-6
1,1,2-Trichloroethane	79-00-5
Chlorinated ethylenes [5 items]	
1,1-Dichloroethylene	75-35-4
cis-1,2-Dichloroethylene	156-59-2
trans-1,2-Dichloroethylene	156-60-5
Tetrachloroethylene	127-18-4
Trichloroethylene	79-01-6

Appendix H

Ozone-depleting chemicals	CAS No.
1,1,1-Trichloroethane (methyl chloroform) and its isomers except 1,1,2-trichloroethane	71-55-6
1,1,2-Trichloro-1,2,2 trifluoroethane (CFC-113) 1,1,1-Trichloro-2,2,2 trifluoroethane (CFC-113a)	76-13-1 354-58-5
1,1,2,2-Tetrachloro-1,2-difluoroethane (CFC-112) 1,1,1,2-Tetrachloro-2,2-difluoroethane (CFC-112a)	76-12-0 76-11-9
1,2,2-Trichloropentafluoropropane (CFC-215aa) 1,2,3-Trichloropentafluoropropane (CFC-215ba) 1,1,2-Trichloropentafluoropropane (CFC-215bb) 1,1,3-Trichloropentafluoropropane (CFC-215ca) 1,1,1-Trichloropentafluoropropane (CFC-215cb)	1599-41-3 76-17-5 – – 4259-43-2
Bromochlorodifluoromethane (Halon 1211)	353-59-3
Bromochloromethane	74-97-5
Bromodifluoroethane	420-47-3, 357188-74-0
Bromodifluoromethane	1511-62-2
Bromodifluoropropane	–
Bromoethane (ethyl bromide)	74-96-4
Bromofluoroethane	762-49-2
Bromofluoromethane	373-52-4
Bromofluoropropane	1871-72-3
Bromohexafluoropropane	2252-78-0
Bromomethane (methyl bromide)	74-83-9
Bromopentafluoropropane	460-88-8
Bromotetrafluoroethane	124-72-1
Bromotetrafluoropropane	679-84-5
Bromotrifluoroethane	421-06-7
Bromotrifluoromethane (Halon 1301)	75-63-8
Bromotrifluoropropane	421-46-5
Chloromethane (methyl chloride)	74-87-3
Chlorotrifluoromethane (CFC-13)	75-72-9
Dibromodifluoroethane	75-82-1
Dibromodifluoromethane (Halon 1202)	75-61-6
Dibromodifluoropropane	460-25-3
Dibromofluoroethane	358-97-4
Dibromofluoromethane	1868-53-7
Dibromofluoropropane	51584-26-0
Dibromopentafluoropropane	431-78-7
Dibromotetrafluoroethane (Halon 2402)	124-73-2
Dibromotetrafluoropropane	–
Dibromotrifluoroethane	354-04-1
Dibromotrifluoropropane	431-21-0
Dichlorodifluoromethane (CFC-12)	75-71-8
Dichlorohexafluoropropane (CFC-216)	661-97-2
Dichlorotetrafluoroethane (CFC-114)	76-14-2
Heptachlorofluoropropane (CFC-211) 1,1,1,2,2,3,3-Heptachloro-3-fluoropropane (CFC-211aa) 1,1,1,2,3,3,3-Heptachloro-2-fluoropropane (CFC-211ba)	135401-87-5 422-78-6 422-81-1
Hexabromofluoropropane	–
Hexachlorodifluoropropane (CFC-212)	3182-26-1
Monochloroheptafluoropropane (CFC-217)	422-86-6, 76-18-6
Monochloropentafluoroethane (CFC-115)	76-15-3
Pentabromodifluoropropane	–
Pentabromofluoropropane	–
Pentachlorofluoroethane (CFC-111)	354-56-3
Pentachlorotrifluoropropane (CFC-213)	2354-06-5; 134237-31-3
Tetrabromodifluoropropane	–
Tetrabromofluoroethane	306-80-9
Tetrabromofluoropropane	–
Tetrabromotrifluoropropane	–
Tetrachloromethane (carbon tetrachloride)	56-23-5

Appendix H (Continued)

Ozone-depleting chemicals	CAS No.
Tetrachlorotetrafluoropropane (CFC-214) 1,2,2,3-Tetrachloro-1,1,3,3-tetrafluoropropane (CFC-214aa) 1,1,1,3-Tetrachloro-2,2,3,3-tetrafluoropropane (CFC-214cb)	29255-31-0 2268-46-4 –
Tribromodifluoroethane	–
Tribromodifluoropropane	70192-80-2
Tribromofluoroethane	–
Tribromofluoropropane	75372-14-4
Tribromotetrafluoropropane	–
Tribromotrifluoropropane	–
Trichlorofluoromethane (CFC-11)	75-69-4
Trifluoroiodomethane (trifluoromethyl iodide)	2314-97-8

Appendix I

Hydrochlorofluorocarbons	CAS No.
1,1,2,2-Tetrachloro-1-fluoroethane (HCFC-121) 1,1,1,2-Tetrachloro-2-fluoroethane (HCFC-121a)	354-11-0 354-14-3
Chlorodifluoroethane (HCFC-142) 2-Chloro-1,1-difluoroethane (HCFC-142) 1-Chloro-1,1-difluoroethane (HCFC-142b) 1-Chloro-1,2-difluoroethane (HCFC-142a)	25497-29-4 338-65-8 75-68-3 338-64-7
Chlorodifluoromethane (HCFC-22)	75-45-6
Chlorofluoromethane (HCFC-31)	593-70-4
Chlorotetrafluoroethane (HCFC-124) 2-chloro-1,1,1,2-tetrafluoroethane 1-chloro-1,1,2,2-tetrafluoroethane (HCFC-124a)	63938-10-3 2837-89-0 354-25-6
Chlorotrifluoroethane (HCFC-133) 1-Chloro-1,2,2-trifluoroethane (HCFC-133) 2-Chloro-1,1,1-trifluoroethane (HCFC-133a) 1-Chloro-1,1,2-trifluoroethane (HCFC-133b)	431-07-2 1330-45-6 75-88-7 421-04-5
Dichlorodifluoroethane (HCFC-132) 1,2-Dichloro-1,2-difluoroethane (HCFC-132) 1,1-Dichloro-2,2-difluoroethane (HCFC-132a) 1,2-Dichloro-1,1-difluoroethane (HCFC-132b) 1,1-Dichloro-1,2-difluoroethane (HCFC-132c)	25915-78-0 431-06-1 471-43-2 1649-08-7 1842-05-3
Dichlorofluoroethane (HCFC-141) 1,2-Dichloro-1-fluoroethane (HCFC-141) 1,1-Dichloro-2-fluoroethane (HCFC-141a) 1,1-Dichloro-1-fluoroethane (HCFC-141b)	25167-88-8 430-57-9 430-53-5 1717-00-6
Dichlorofluoromethane (HCFC-21)	75-43-4
Dichlorotrifluoroethane (HCFC-123) Dichloro-1,1,2-trifluoroethane 2,2-dichloro-1,1,1-trifluroethane 1,2-dichloro-1,1,2-trifluroethane (HCFC-123a) 1,1-dichloro-1,2,2-trifluroethane (HCFC-123b)	34077-87-7 90454-18-5 306-83-2 354-23-4 812-04-4
Trichlorodifluoroethane (HCFC-122) 1,2,2-Trichloro-1,1-difluoroethane (HCFC-122) 1,1,2-Trichloro-1,2-difluoroethane (HCFC-122a) 1,1,1-Trichloro-2,2-difluoroethane (HCFC-122b)	41834-16-6 354-21-2 354-15-4 354-12-1
Trichlorofluoroethane (HCFC-131) 1-Fluoro-1,2,2-trichloroethan 1,1,2-Trichloro-1-fluoroethane (HCFC-131a) 1,1,1-trichloro-2-fluoroethane (HCFC-131b)	27154-33-2 359-28-4 811-95-0 2366-36-1
Chlorofluoroethane (HCFC-151) 1-Chloro-2-fluoroethane (HCFC-151) 1-Chloro-1-fluoroethane (HCFC-151a)	110587-14-9 762-50-5 1615-75-4

Appendix I (Continued)

Hydrochlorofluorocarbons	CAS No.
Chlorohexafluoropropane (HCFC-226) 2-Chloro-1,1,1,3,3,3-hexafluoro-propane (HCFC-226da)	134308-72-8 431-87-8
Chloropentafluoropropane (HCFC-235) 1-Chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa)	134237-41-5 460-92-4
Dichloropentafluoropropane (HCFC-225) 2,2-Dichloro-1,1,1,3,3-pentafluoropropane (HCFC-225aa) 2,3-Dichloro-1,1,1,2,3-pentafluoropropane (HCFC-225ba) 1,2-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225bb) 3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca) 1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb) 1,1-Dichloro-1,2,2,3,3-pentafluoropropane (HCFC-225cc) 1,2-Dichloro-1,1,3,3,3-pentafluoropropane (HCFC-225da) 1,3-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC-225ea) 1,1-Dichloro-1,2,3,3,3-pentafluoropropane (HCFC-225eb)	127564-92-5 128903-21-9 422-48-0 422-44-6 422-56-0 507-55-1 13474-88-9 431-86-7 136013-79-1 111512-56-2
Dichlorotetrafluoropropane (HCFC-234) 1,2-Dichloro-1,2,3,3-tetrafluoropropane (HCFC-234db)	127564-83-4 425-94-5
Hexachlorofluoropropane (HCFC-221) 1,1,1,2,2,3-Hexachloro-3-fluoropropane (HCFC-221ab)	134237-35-7, 29470-94-8 422-26-4
Pentachlorodifluoropropane (HCFC-222) 1,1,1,3,3-pentachloro-2,2-difluoropropane (HCFC-222ca) 1,2,2,3,3-pentachloro-1,1-difluoropropane (HCFC-222aa)	134237-36-8 422-49-1 422-30-0
Pentachlorofluoropropane (HCFC-231) 1,1,1,2,3-pentachloro-2-fluoro-propane (HCFC-231bb)	134190-48-0 421-94-3
Tetrachlorodifluoropropane (HCFC-232) 1,1,1,3-Tetrachloro-3,3-difluoropropane (HCFC-232fc)	134237-39-1 460-89-9
Tetrachlorofluoropropane (HCFC-241) 1,1,2,3-Tetrachloro-1-fluoropropane (HCFC-241db)	134190-49-1 666-27-3
Tetrachlorotrifluoropropane (HCFC-223) 1,1,3,3-Tetrachloro-1,2,2-trifluoropropane (HCFC-223ca) 1,1,1,3-Tetrachloro-2,2,3-trifluoropropane (HCFC-223cb)	134237-37-9 422-52-6 422-50-4
Trichlorotetrafluoropropane (HCFC-224) 1,3,3-Trichloro-1,1,2,2-tetrafluoropropane (HCFC-224ca) 1,1,3-Trichloro-1,2,2,3-tetrafluoropropane (HCFC-224cb) 1,1,1-Trichloro-2,2,3,3-tetrafluoropropane (HCFC-224cc)	134237-38-0 422-54-8 422-53-7 422-51-5
Trichlorotrifluoropropane (HCFC-233) 1,1,1-Trichloro-3,3,3-trifluoropropane (HCFC-233fb)	134237-40-4 7125-84-0 7125-83-9
Chlorodifluoropropane (HCFC-262) 1-Chloro-2,2-difluoropropane (HCFC-262ca) 2-Chloro-1,3-difluoropropane (HCFC-262da) 1-Chloro-1,1-difluoropropane (HCFC-262fc)	134190-53-7 420-99-5 102738-79-4 421-02-3

Hydrochlorofluorocarbons	CAS No.
Chlorofluoropropane (HCFC-271) 2-Chloro-2-fluoropropane (HCFC-271ba) 1-Chloro-1-fluoropropane (HCFC-271fb)	134190-54-8 420-44-0 430-55-7
Chlorotetrafluoropropane (HCFC-244) 3-Chloro-1,1,2,2-tetrafluoropropane (HCFC-244ca) 1-Chloro-1,1,2,2-tetrafluoropropane (HCFC-244cc)	134190-50-4 679-85-6 421-75-0
Chlorotrifluoropropane (HCFC-253) 3-chloro-1,1,1-trifluoropropane (HCFC-253fb)	134237-44-8 460-35-5
Dichlorodifluoropropane (HCFC-252) 1,3-Dicloro-1,1-difluoropropane (HCFC-252fb)	134190-52-6 819-00-1
Dichlorofluoropropane (HCFC-261) 1,1-Dichloro-1-fluoropropane (HCFC-261fc) 1,2-Dichloro-2-fluoro-propane (HCFC-261ba)	134237-45-9 7799-56-6 420-97-3
Dichlorotrifluoropropane (HCFC-243) 1,1-dichloro-1,2,2-trifluoropropane 2,3-dichloro-1,1,1-trifluoropropane 3,3-dichloro-1,1,1-trifluoropropane	134237-43-7 7125-99-7 338-75-0 460-69-5
Trichlorodifluoropropane (HCFC-242) 1,3,3,Trichloro-1,1-difluoropropane (HCFC-242fa)	134237-42-6 460-63-9
Trichlorofluoropropane (HCFC-251) 1,1,3-Trichloro-1-fluoropropane (HCFC-251fb) 1,1,2-Trichloro-1-fluoropropane (HCFC-251dc)	134190-51-5 818-99-5 421-41-0

Appendix J

Flame retardants	CAS No.
Melamine cyanurate	37640-57-6
Tricresyl phosphate	1330-78-5
Aluminum hypophosphite	7784-22-7
2-Ethylhexyl diphenyl phosphate	1241-94-7
Dicyandiamide	461-58-5
Triisobutyl phosphate	126-71-6
o-Cresyl phosphate	78-30-8
Dipentaerythritol	126-58-9
Calcium hypophosphite	7789-79-9
Dimethyl propylphosphonate	18755-43-6
Melamine phosphate	41583-09-9
Tributyl phosphate	126-73-8
Tris(2-ethylhexyl) phosphite	301-13-3
Phosphoric acid, mixed esters with [1,1′-biphenyl]-4,4′-diol and phenol	1003300-73-9
Diethyl ethylphosphonate	78-38-6
Phosphoric acid, triethyl ester, polymer with oxirane and phosphorus oxide	184538-58-7
Ammonium pentaborate tetrahydrate	12046-04-7
Butanedioic acid, 2-[(6-oxido-6H-dibenz[c,e][1,2]oxaphosphorin-6-yl)methyl]-, 1,4-bis(2-hydroxyethyl) ester	63562-34-5
4-Piperidinol, 2,2,6,6-tetramethyl-1-(undecyloxy)-, 4,4′-carbonate	705257-84-7
1,3,2-Dioxaphosphorinane, 2,2′-oxybis[5,5-dimethyl-, 2,2′-disulfide	4090-51-1
2,4,8,10-Tetraoxa-3,9-diphosphaspiro[5.5]undecane, 3,9-dimethyl-, 3,9-dioxide	3001-98-7
Alcohols, C9-11-iso-, C10-rich, ethoxylated	78330-20-8
Ethylenediamine, phosphate	14852-17-6
Diphosphoric acid, zinc salt, compd. with 1,3,5-triazine-2,4,6-triamine (1:1:2)	1271172-98-5
Phosphonic acid, P-methyl-, compd. with N-(aminoiminomethyl)urea (1:1)	84402-58-4
Dimethyl P-[3-[(hydroxymethyl)amino]-3-oxopropyl]phosphonate	20120-33-6
Phosphonium, tetrakis(hydroxymethyl)-, chloride (1:1), polymer with urea	27104-30-9
Guanidine, phosphate (1:1)	5423-22-3

Appendix K

Bisphenol chemicals	CAS No.
2,2-bis(2-hydroxy-5-biphenylyl)propane [BPBP]	24038-68-4
4,4'-(1- methylpropylidene)bisphenol [BPB]	77-40-7
4,4'-(1-Phenylethylidene)bisphenol [BPAP]	1571-75-1
4,4'-(1,3-phenylene-bis(1-methylethylidene))bisphenol [BPM]	13595-25-0
4,4'-(1,4-Phenylenediisopropylidene)bisphenol [BPP]	2167-51-3
4,4'-(dichlorovinylidene)diphenol [BPC12]	14868-03-2
4,4'-[2,2,2-trifluoro-1-(trifluoromethyl)ethylidene]diphenol [BPAF]	1478-61-1
4,4'-cyclohexylidenebisphenol [BPZ]	843-55-0
4,4'-ihydroxytetraphenylmethane [BPPH]	1844-01-5
4,4'-isopropylidenedi-o-cresol [BPC]	79-97-0
4,4'-isopropylidenediphenol [BPA]	80-05-7
4,4'-methylenediphenol [BPF]	620-92-8
4,4'-sulphonyldiphenol [BPS]	80-09-1
4,4′-Ethylidenebisphenol [BPE]	2081-08-5
9,9-Bis(4-hydroxyphenyl)fluorene [BPFL]	3236-71-3
Biphenyl-4,4'-diol [BP4,4′]	92-88-6
Bis(2-hydroxyphenyl)methane [BIS2]	2467-02-9
p,p′-oxybisphenol [DHDPE]	1965-09-9

Appendix L

Brominated organic solvents	CAS No.
1-Bromobutane	109-65-9
1-Bromopropane	106-94-5
2-Bromopropane	75-26-3
Bromodichloromethane	75-27-4
Bromoethane	74-96-4
Bromomethane	74-83-9
Dibromochloromethane	124-48-1

Appendix M

Polybrominated diphenyl ethers (PBDEs)	CAS No.
2,2',3,4,4'-Pentabromodiphenyl ether	3846-71-7
2,2',3,4,4',5'-Hexabromodiphenyl ether	182677-30-1
2,3',4,4'-Tetrabromodiphenyl ether	189084-61-5
2,3',4,4',6-Pentabromodiphenyl ether	189084-66-0
2,4,4',6-Tetrabromodiphenyl ether	189084-63-7
Bis(pentabromophenyl) ether	1163-19-5
Diphenyl ether, heptabromo derivative	68928-80-3
Diphenyl ether, hexabromo derivative	36483-60-0
Diphenyl ether, pentabromo derivative	32534-81-9
Diphenyl ether, tetrabromo derivative	40088-47-9

Appendix N

Polychlorinated naphthalenes	CAS No.
Naphthalene, chloro derivatives	70776-03-3
1-Chloronaphthalene	90-13-1
2-Chloronaphthalene	91-58-7
1,5-Dichloronaphthalene	1825-30-5
1,4-Dichloronaphthalene	1825-31-6
1,2-Dichloronaphthalene	2050-69-3
1,6-Dichloronaphthalene	2050-72-8
1,7-Dichloronaphthalene	2050-73-9
1,8-Dichloronaphthalene	2050-74-0
2,3-Dichloronaphthalene	2050-75-1
2,6-Dichloronaphthalene	2065-70-5
1,3-Dichloronaphthalene	2198-75-6
2,7-Dichloronaphthalene	2198-77-8
Chloronaphthalene	25586-43-0
Dichloronaphthalene	28699-88-9
Pentachloronaphthalene	1321-64-8
Trichloronaphthalene	1321-65-9
Hexachloronaphthalene	1335-87-1
Tetrachloronaphthalene	1335-88-2
Perchloronaphthalene	2234-13-1
1,4,6-Trichloronaphthalene	2437-54-9
1,4,5-Trichloronaphthalene	2437-55-0
1,4,5,8-Tetrachloronaphthalene	3432-57-3
1,2,4,8-Tetrachloronaphthalene	6529-87-9
1,2,4,5-Tetrachloronaphthalene	6733-54-6
1,2,3,6,7,8-Hexachloronaphthalene	17062-87-2
1,2,3,4-Tetrachloronaphthalene	20020-02-4
1,3,5,8-Tetrachloronaphthalene	31604-28-1

Appendix N (Continued)

Polychlorinated naphthalenes	CAS No.
Heptachloronaphthalene	32241-08-0
2,3,6,7-Tetrachloronaphthalene	34588-40-4
1,2,4-Trichloronaphthalene	50402-51-2
1,2,3-Trichloronaphthalene	50402-52-3
1,3,5-Trichloronaphthalene	51570-43-5
1,2,6-Trichloronaphthalene	51570-44-6
1,2,4,6-Tetrachloronaphthalene	51570-45-7
1,2,3,5-Tetrachloronaphthalene	53555-63-8
1,3,5,7-Tetrachloronaphthalene	53555-64-9
1,2,3,5,7-Pentachloronaphthalene	53555-65-0
1,2,5-Trichloronaphthalene	55720-33-7
1,2,7-Trichloronaphthalene	55720-34-8
1,2,8-Trichloronaphthalene	55720-35-9
1,3,6-Trichloronaphthalene	55720-36-0
1,3,7-Trichloronaphthalene	55720-37-1
1,3,8-Trichloronaphthalene	55720-38-2
1,6,7-Trichloronaphthalene	55720-39-3
2,3,6-Trichloronaphthalene	55720-40-6
1,2,3,7-Tetrachloronaphthalene	55720-41-7
1,3,6,7-Tetrachloronaphthalene	55720-42-8
1,4,6,7-Tetrachloronaphthalene	55720-43-9
1,2,3,4,5,6,7-Heptachloronaphthalene	58863-14-2
1,2,3,4,5,6,8-Heptachloronaphthalene	58863-15-3
1,2,3,4,5,6-Hexachloronaphthalene	58877-88-6
1,2,4,7-Tetrachloronaphthalene	67922-21-8
1,2,5,6-Tetrachloronaphthalene	67922-22-9
1,2,5,7-Tetrachloronaphthalene	67922-23-0
1,2,6,8-Tetrachloronaphthalene	67922-24-1
1,2,3,4,5-Pentachloronaphthalene	67922-25-2
1,2,3,4,6-Pentachloronaphthalene	67922-26-3
1,2,3,4,5,7-Hexachloronaphthalene	67922-27-4
1,2,4,5,6,8-Hexachloronaphthalene	90948-28-0
1,2,4,5,7,8-Hexachloronaphthalene	103426-92-2
1,2,3,4,5,8-Hexachloronaphthalene	103426-93-3
1,2,3,5,7,8-Hexachloronaphthalene	103426-94-4
1,2,3,5,6,8-Hexachloronaphthalene	103426-95-5
1,2,3,4,6,7-Hexachloronaphthalene	103426-96-6
1,2,3,5,6,7-Hexachloronaphthalene	103426-97-7
1,2,3,6-Tetrachloronaphthalene	149864-78-8
1,2,6,7-Tetrachloronaphthalene	149864-79-9
1,2,5,8-Tetrachloronaphthalene	149864-80-2
1,2,3,8-Tetrachloronaphthalene	149864-81-3
1,2,7,8-Tetrachloronaphthalene	149864-82-4
1,2,3,7,8-Pentachloronaphthalene	150205-21-3
1,3,6,8-Tetrachloronaphthalene	150224-15-0
1,2,3,6,7-Pentachloronaphthalene	150224-16-1
1,2,4,6,7-Pentachloronaphthalene	150224-17-2
1,2,3,5,6-Pentachloronaphthalene	150224-18-3
1,2,4,5,7-Pentachloronaphthalene	150224-19-4
1,2,4,5,6-Pentachloronaphthalene	150224-20-7
1,2,4,7,8-Pentachloronaphthalene	150224-21-8
1,2,4,6,8-Pentachloronaphthalene	150224-22-9
1,2,3,6,8-Pentachloronaphthalene	150224-23-0
1,2,3,5,8-Pentachloronaphthalene	150224-24-1
1,2,4,5,8-Pentachloronaphthalene	150224-25-2

Appendix O

Hydrocarbyl siloxanes	CAS No.
Hexamethyldisiloxane (L2)	107-46-0
Tetradecamethyl cycloheptasiloxane	107-50-6
Octamethyltrisiloxane (L3)	107-51-7
Tetradecamethylhexasiloxane (L6)	107-52-8
Decamethyltetrasiloxane (L4)	141-62-8
Dodecamethylpentasiloxane (L5)	141-63-9
Dodecamethylcyclohexasiloxane (D6)	540-97-6
Decamethylcyclopentasiloxane (D5)	541-02-6
Hexamethylcyclotrisiloxane (D3)	541-05-9
Octaphenylcyclotetrasiloxane	546-56-5
Octamethylcyclotetrasiloxane (D4)	556-67-2
1,1,1,3,5,5,5-heptamethyltrisiloxane (H-L3)	1873-88-7
1,1,5,5,5-hexamethyl-3-phenyl-3-[(trimethylsilyl)oxy]trisiloxane (PhM3T)	2116-84-9
2,4,6,8-tetramethylcyclotetrasiloxane (H4-D4)	2370-88-9
2,4,6,8- tetramethyl-2,4,6,8-tetravinylcyclotetrasiloxane (Vi4-D4)	2554-06-5
1,1,3,3-tetramethyl-1,3-divinyldisiloxane (Vi2-L2 (dvTMDS))	2627-95-4
1,1,3,3-tetramethyldisiloxane (H2-L2)	3277-26-7
1,3,5-trimethyl-1,1,3,5,5-pentaphenyltrisiloxane	3390-61-2
1,1,5,5,5-hexamethyl-3,3-bis[(trimethylsil yl)oxy]trisiloxa ne (M4Q)	3555-47-3
1,3,3,5-tetramethyl- 1,1,5,5-tetraphenyltrisil oxane	3982-82-9
1,1,1,5,5,5-hexamethyl-3-[(trimethylsilyl)oxy)-3-vinyltrisiloxane	5356-84-3
2,4,6,8,10-pentamethylcyc lopentasiloxane (H5-D5)	6166-86-5
1,1,1,3,5,5,5-heptamethyl-3- [(trimethylsilyl) oxy]trisiloxane (M3T)	17928-28-8
1,1,1,3,5,5,5-heptamethyl-3- octyltrisiloxane	17955-88-3
3-[(dimethylsilyl) oxy]-1,1,5,5-tetramethyl-3- phenyltrisiloxan e	18027-45-7
Tetramethyltetr avinylcyclotetra siloxane	27342-69-4
3-[(dimethylvinyl silyl)oxy]- 1,1,5,5-tetramethyl-3-phenyl-1,5-divinyltrisiloxane	60111-47-9
3,3-bis[(dimethylvi nylsilyl)oxy]-1,1,5,5-tetramethyl-1,5-divinyltrisiloxan e (ViM4Q)	60111-54-8
1,1,3,3-tetramethyl-1,3-dioctadecyldisiloxane	34214-91-0
3-hexylheptamethyltrisiloxane	1873-90-1
KF-56A	352230-22-9
3-Ethylheptamethyltrisiloxane	17861-60-8
1-butyl- 1,1,3,3,5,5,7,7,9,9-decamethylpentasiloxane	121263-53-4
Octamethyltrisiloxane	107-51-7
1,1,3,3,5,5,7,7,9,9-decamethylpen tasiloxane	995-83-5

Appendix P

UV stabilizers	CAS No.
UV-P; (2-2H-benzotriazol-2-yl-p-cresol)	2240-22-4
UV-234; (2-(2H-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol)	70321-86-7
UV-326; (2-tert-butyl-6-(5-chloro-2H-benzotriazol-2-yl)-4-methylphenol)	3896-11-5
UV-329; (2-(2H-benzotriazol-2-yl)-4-(1,1,3,3-tetramethylbutyl)phenol)	3147-75-9
UV-928; (2-(2H-benzotriazol-2-yl)-6-(1-methyl-1-phenylethyl)-4-1,1,3,3-tetramethylbutyl)phenol)	73936-91-1
UV-320	3846-71-7
UV-327	3864-99-1
UV-350	36437-37-3
Chimassorb 944	70624-18-9
Tinuvin 770	52829-07-9
Benzephenone-3 (BP-3)	131-57-7
Bisoctrizole	103597-45-1
UV-3638	18600-59-4

Appendix Q

Photoinitiators	CAS No.
1-Hydroxycyclohexyl phenyl ketone	947-19-3
Benzoin methyl ether	3524-62-7
Ethyl (2,4,6-trimethylbenzoyl)phenylphosphinate (TPO-L)	84434-11-7
2-Benzyl-2-(dimethylamino)-4′-morpholinobutyrophenone	119313-12-1
2-Hydroxy-2-methylpropiophenone (HMPP)	7473-98-5
2-Hydroxy-4′-(2-hydroxyethoxy)-2-methylpropiophenone	106797-53-9
2-Methyl-1-[4-(methylthio)phenyl]-2-morpholinopropan-1-one	71868-10-5
2,4,6-Trimethylbenzophenone	954-16-5
4-Methylbenzophenone	134-84-9
Diethylthioxanthone	82799-44-8
2-Hydroxy-1,2-diphenylethanone	119-53-9
Ethyl 4-(dimethylamino)benzoate	10287-53-3
Isopropylthioxanthone	5495-84-1
Ethyl 2,4,6-trimethylbenzoylphenylphosphinate	84434-11-7
Ethylhexyl-4-dimethylaminobenzoate	21245-02-3
Diphenyl(2,4,6-trimethylbenzoyl)phosphine oxide (TPO)	75980-60-8
Bis(acyl)phosphine oxide (BAPO)	162881-26-7
(2,4,6-trimethyl benzoyl)bis(p-tolyl)phosphine oxide (TMO)	270586-78-2
2-(2H-Benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol	70321-86-7