PD CEN/TR 16741:2015

BSI Standards Publication

Textiles and textile products — Guidance on health and environmental issues related to chemical content of textile products intended for clothing, interior textiles and upholstery

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee TCI/80, Chemical testing of textiles.

A list of organizations represented on this committee can be obtained on request to its secretary.

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ISBN 978 0 580 85884 0

ICS 59.080.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2015.

Amendments issued since publication

Date	Text affected

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 16741

August 2015

ICS 59.080.01

English Version

Textiles and textile products - Guidance on health and environmental issues related to chemical content of textile products intended for clothing, interior textiles and upholstery

Textiles et produits textiles - Guide sur les conséquences environnementales et sur la santé liées aux substances chimiques présentes dans les produits textiles destinés à l'habillement, aux textiles d'intérieur et à l'ameublement

Textilien und textile Erzeugnisse - Anleitung für Gesundheits-und Umweltfragen in Bezug auf den Chemikaliengehalt von Textilerzeugnissen für Bekleidung, Heimtextilien und Polstermöbel

This Technical Report was approved by CEN on 14 May 2015. It has been drawn up by the Technical Committee CEN/TC 248.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. CEN/TR 16741:2015 E

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European foreword

This document (CEN/TR 16741:2015) has been prepared by Technical Committee CEN/TC 248 “Textiles and textile products”, the secretariat of which is held by BSI.

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Introduction

In 2003, the company CREM (Consultancy and Research for Environmental Management, Amsterdam, The Netherlands) started reviewing a selected number of European standards to identify relevant environmental concerns which should be addressed. Horizontal requirements were drafted during the continuing work on draft standards. These horizontal requirements comprise, among others, CMR chemicals (carcinogenic, mutagenic and toxic to reproduction), PBTs and vPvB substances (persistent, bioaccumulative and toxic and very persistent and very bioaccumulative substances) and substances identified as causing serious and irreversible effects to humans or the environment equivalent to the effects mentioned on a case-by-case basis, such as endocrine disrupters.

CEN/TC248 has decided to adopt the proposal included in the study as a technical report with general requirements for textile products with direct skin contact.

The working group extended the scope of the technical report to textile products in the proximity of the human body .

In this technical report, the wording ‘textile product’ is used, as defined in the Textile Fibre Regulation (EU) No 1007/2011. In the parts where REACH is described, the wording ‘textile article’ is used in the same meaning. Thus, in the context of this technical report ‘textile product’ and ‘textile article’ are the same.

1 Scope

This Technical Report specifies environmental and health recommendations for textile products (including accessories) with direct skin contact and in the proximity of the human body.

This Technical Report facilitates the understanding of chemicals with intended uses in the manufacturing of goods in the fields of textile products intended to clothing, interior textiles and upholstery, to comply with the European chemical regulations and recommendations in force in EU.

WARNING — This Technical Report is not intended to substitute the existing regulations. The reader is requested to check the current existing regulation.

By suggesting that the textile market follows the ethos of this Technical Report, and thereby avoiding the use of unwanted substances in the manufacture of textile products, the level of protection of human health and of environment will be increased.

The distinguishing properties of the chemicals and the processes in which they are used (intended use substances) or they occur (unintended release substances) are described in this technical report.

This Technical Report mentions, when relevant, the existing standardized test methods commonly in use, as well as, the related limit values which are generally accepted. Only the standard identification number is given in the main text and the related title is listed in Bibliography.

NOTE 1 When limit values are given, possible contamination by the external environment and inaccuracy in the measurement of very low concentration may be taken into consideration.

The listed substances of this Technical Report can be categorised in two: one related to intended use, another one related to unintended release.

NOTE 2 Inclusion in the candidate list of EU REACH Regulation (EC) n°1907/2006 has been mentioned in this Technical Report for some substances. This does not necessarily mean that a substance, for which such a note is not made, would not be included in the candidate list in the future (new substances are regularly included in the list).

NOTE 3 For filling material such as “feather & down”, refer to CEN TC 222 and, for other material used in clothing such as leather, refer to CEN TC 309, for toys, refer to CEN TC 252.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
textile clothing and accessories
clothing and accessories (such as handkerchiefs, scarves, bags, shopping bags, rucksacks, belts etc.) consisting of at least 80 % by weight of textile fibres

[SOURCE: EU fibre composition Regulation (EC) n°1007/2011]

2.2
interior textiles, textile products for interior use
textile products for interior use: textile products for interior use consisting of at least 80 % by weight of textile fibres; wall and floor coverings are excluded

[SOURCE: EU fibre composition Regulation (EC) n°1007/2011]

2.3
fibres, yarn and fabric
intended for use in textile clothing and accessories or interior textiles

Note 1 to entry: For 'textile clothing and accessories' and for 'interior textiles': down, feathers, membranes and coatings need not be taken into account in the calculation of the percentage of textile fibres.

2.4
CMR chemical
chemical (substance or substance mixtures) belonging to at least one of three different categories: Carcinogenic, Mutagenic and Reprotoxic (toxic to reproduction)

Note 1 to entry: CMR chemicals are classified according to EU Classification Labelling Packaging Regulation (EC) n°1272/2008 and are covered by the following R-phrases: R40, R45, R46 R49, R60, R61, R62, R63 and R68 (see Annex A).

2.5
PBT and vPvB substances
Persistent, Bio accumulative and Toxic substances and very Persistent and very Bio accumulative substances

Note 1 to entry: The terms of PBT and vPvB substances are defined in EU REACH Regulation (EC) n°1907/2006

2.6
Substances of Very High Concern (SVHC)
substances which should be treated with equivalent concern as CMR chemical and PBT and vPvB substances.

Note 1 to entry: These substances for which there is scientific evidence of probable serious effect to human health or the environment which give rise to an equivalent level of concern to CMR and/or PBT and/or vPvB substances.

3 General recommendations

3.1 CMR chemicals

The product should not contain or release any carcinogenic, mutagenic or reprotoxic chemicals (CMR chemicals) in amounts exceeding 0,1 % by weight of the whole product.

3.2 PBT and vPvB substances

The product should not contain any PBT and vPvB substances which meet the criteria in Annex XIII of EU REACH Regulation (EC) n°1907/2006, in amounts exceeding 0,1 % by weight of the whole product.

3.3 SVHC ("Substances of Very High Concern")

SVHC are defined in Article 57 of EU REACH Regulation (EC) n°1907/2006 and include substances which are:

— Carcinogenic, Mutagenic or toxic to Reproduction (CMR), meeting the criteria for classification in category 1 or 2 in accordance with Directive 67/548/EEC. This directive was recently replaced by the new EU Classification Labelling Packaging Regulation (EC) n°1272/2008 on classification, labelling and packaging of chemical substances and mixtures, the so-called CLP Regulation. According to the new CLP Regulation these substances shall be classified as 1a or 1b.

— Persistent, Bioaccumulative and Toxic (PBT) or very Persistent and very Bioaccumulative (vPvB) according to the criteria in Annex XIII of EU REACH Regulation (EC) n°1907/2006,

— Identified, on a case-by-case basis, from scientific evidence as causing probable serious effects to human health or the environment of an equivalent level of concern as those above (e.g. endocrine disrupters, allergenic substances and sensitizing substances)

NOTE The list of identified substances of very high concern is updated regularly. The current listing can be found at http://echa.europa.eu/candidate-list-table. The obligations relating to placing on the market articles containing SVHC

substances can be reviewed on ECHA webpages. Uses of some SVHCs in the EU require authorization. More information on this can also be found at http://echa.europa.eu/ .

4 Specific criteria for textile products

The criteria are listed in Table 1 in relation to the type of fibres and in Table 2 in relation to the type of finishing and accessories.

Table 1 — Criteria in relation to the type of fibres

	Type of fibres [a)]								
	natural fibres		**man-made fibres**						
Criteria	Animal fibres	Cellulose fibres	Polyester	Polyamide	Acetate; Triacetate	Acrylic	Viscose	Elastane	Elastodiene
Formaldehyde	X	X					X		
Azo dyes	X	X	X	X	X	X	X		
Extractable heavy metals									
Cd		X	X	X	X	X	X		
As		X							
Hg		X							
Ni		X							
Cu		X		X					
Pb			X				X		
Cr	X			X					
Co	X	X		X					
Sb			X						
Chromium (VI)	X			X					
Chlorinated Phenols									
PCP, TeCP, TriCP	X	X	X	X	X	X	X		
OPP	X	X	X	X	X	X	X		
Carcinogenic dyes	X	X	X	X	X	X	X		
Allergenic Disperse dyes			X	X	X	X			
Chlorinated benzenes and toluenes			X	X	X	X			

Organotin compounds	X	X	X	X	X	X	X	X	
Flame retardants	X	X	X	X	X	X	X		
Acrylonitrile						X			
Pesticides	X	X							
Herbicides		X							
Dimethylformamide (DMF)						X			
Dimethylfumarate (DMFu)	X	x	X	X	X	X	X		
APEO	X	X	X	X	X	X	X		
DMA						X	X	X	
PFOS[b)]	X	X	X	X	X	X	X		
PAH			X	X	X	X	X	X	X

[a)] In case of fibre blends, all criteria related to the fibre of the blends have to be considered.

[b)] only for water-, oil- and dirt- repellent finish or coated

Table 2 — Criteria in relation to the type of finishing and components used on textile products (buttons, slide fasteners, buckles, etc.)

Criteria	Type of finishing or accessories											
	Prints	Leather [a)]	coated fabrics	metalic	Coated metal	galvanized ABS	painted metal	Plastic	wood	Polyurethane (foam)	rubbers	Glass
Formaldehyde	X	X	X						X	X		
Azo dyes	X	X	X							X	X	
4,4'-Diaminodiphenylmethane										X	X	
Extractable heavy metals												
Cd	X		X	X	X		X	X	X			X
As				X	X				X			X
Hg									X			
Ba												X
Se												X
Ni	X			X	X	X	X					X
Cu	X	X										
Pb	X	X										X
Cr	X	X										
Co	X											X
Sb	X		X									X
Chromium (VI)		X	X		X	X						X (glue)
Soluble mineral tanning agents Al, Cr, Ti, Zr		X										
Ni			X	X		X	X					
Ni wear				X	X		X					

Total Cd	X		X	X	X	X	X	X		X		
Lead in paint							X					
Total lead	X	X	X	X	X		X	X		X		
Phthalates	X		X									
Phthalates (Child care articles)	X		X					X				
Chlorinated Phenols:PCP, TeCP	X	X	X						X			
OPP	X	X	X									
Allergenic Disperse dyes			X									
Chlorinated benzenes and toluenes	X		X									
Organic Tin compounds	X	X	X					X		X	X	

Table 3 — Criteria in relation to the type of finishing and components used on textile products (buttons, slide fasteners, buckles, etc.)

Criteria	Type of finishing or accessories											
	Prints	**Leather** [a)]	**coated fabrics**	**metallic**	**Coated metal**	**galvanized ABS**	**painted metal**	**Plastic**	**wood**	**Polyurethane (foam)**	**rubbers**	**Glass**
Nitrosamines											X	
Chloroalcanes		X						X				
Dimethylformamide (DMF)			X									
Dimethylfumarate (DMFu)		X	X									
PAH's	X	X	X					X			X	

[a)] leather mentioned only for comparison –refer to document CEN TC309

4.1 Formaldehyde

4.1.1 General

Formaldehyde is a volatile colourless gas, that occurs naturally in small quantities in the atmosphere and in nature.

Urea (UF) and melamine formaldehyde (MF) resins are sometimes applied in the textile industry as a finishing to make clothes resistant to wrinkles and stains.

In addition, formaldehyde-based resins are used to help to bind dyes and pigments to fabrics and prevent the colours from running when clothing is washed.

Formaldehyde is also a building block chemical used in the production of other substances used to make textiles, such as 1,4-Butanediol, or BDO . BDO is an intermediate in the production of tertahydrofuran (THF) resins which are used to produce elastane fibres and similar types of sportswear materials.

For examples, common textile fabrics that may contain formaldehyde are made of Cotton, Flax, Viscose (regenerated cellulose) and other cellulosic fibres.

The emission of formaldehyde from same materials is related to:

— Easy-care treatment on cellulosic fibres;

— Flame retardant treatment on cellulosic fibres;

— Pigment printing on any kind of fibres

— Binders in coated fabrics

Occurrence:

— Dyes, pigments and printing pastes

— Epoxy and phenolic resins

— Fabrics chemically treated for dirt-repellence, durable flame retardant treatment, from fixing agents.

— Fabrics chemically treated with resins for shrinkage-resistance, wrinkle-resistance, antistatic treatment, from fixing agents.

— Preservative

4.1.2 Why is it a critical substance?

Formaldehyde is a human carcinogen that also can cause skin, nasal and eye irritation and allergy.

As an example of skin irritation, this can be a frequent problem in manufacturing, especially where jacketry is pressed on a dolly by hand.

As an example of nasal irritation, this can be, “fishy” smelling textiles, but unpleasant only, occurring in sales floor.

4.1.3 Regulation/Specific tests method

Based on several regulations (national or regional), the textile parts of the product should not contain formaldehyde which can be released in quantities higher than a limit determined between 16 to 300 ppm (in relation to the concerned country, indicative values according to EN ISO 14184-1 (free and hydrolised formaldehyde) or EN ISO 14184-2 (released formaldehyde)or technically identical test method).

The limits should be fixed at lower levels in the case of babies and infants in comparison with adults.

Sources (non-exhaustive list): legislations from Austria, Germany, South Korea, Finland, Norway, Netherlands, Japan, China / European decision: EU Commission Decision 2014/350/EC of 5 July 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products.

Test methods: EN ISO 14184-1 and EN ISO 14184-2

4.2 Chlorophenols (pentachlorophenol, isomers of tetrachlorophenol)

4.2.1 General

Pentachlorophenol (PCP) is a synthetic substance that was first produced in the 1930s. It can be found in two forms: PCP itself or as the sodium salt of PCP, which dissolves easily in water. In the past, it has been used as a herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Some applications were in agricultural seeds (for non-food uses), leather, masonry, wood, cooling tower water, rope and paper mill system.

TeCP is often used to replace the PCP.

4.2.2 Why is PCP a critical substance?

Short-term exposure to large amounts of PCP can cause harmful effects on the liver, kidneys, blood, lungs, nervous system, immune system, and gastrointestinal tract. Contact with PCP (particularly in the form of vapour) can irritate the skin, eyes, and mouth. Long-term exposure to low levels such as those that occur in the workplace can cause damage to the liver, kidneys, blood, and nervous system. Finally exposure to PCP is also associated with carcinogenic, renal, and neurological effects.

PCP is classified in the group of probable human carcinogen.

4.2.3 Regulation/Specific tests method

PCP (CAS No 87-86-5) is restricted under the EU REACH Regulation (EC) n°1907/2006, Annex XVII. PCP shall not be placed on the market, or used, as a substance or as a constituent in other substances, or mixtures, in a concentration equal to or greater than 0,1 % by weight.

PCP is regulated in Austria, Denmark, Germany, Netherlands, Norway, Poland and Switzerland and by many ecological labels in textile and leather products (not detected – 5ppm depending on countries and type of products).

TeCP is regulated only in Switzerland (not detected) but also by many ecological labels (0,05 ppm – 5 ppm).

Based on regulation or some ecological labels, the textile parts of the product should not contain chlorophenols, such as pentachlorophenol, tetrachlorophenol, which can be released in quantities higher than a limit determined between 0,05 ppm to 5 ppm (in relation to the concerned country).

Sources: regulations from European Union, European decision: European Ecolabel for textile products.

Test methods: no European standardized method available for textiles (some are national such as XP G08-015 – France, UNI 11057 — Italy), EN ISO 17070 for leather.

4.3 Orthophenylphenol (OPP)

4.3.1 General

2-Phenylphenol, or *o*-phenylphenol, is an organic compound that consists of two linked benzene rings and a phenolic hydroxyl group. It is a biocide used as a preservative.

The primary use of 2-phenylphenol is as an agricultural fungicide. It is also used for disinfection on fibres and other materials. It is used to sterilize hospital and veterinary equipment. Other uses are in rubber industry and as a laboratory reagent. It is also used in the manufacture of other fungicides, dyestuffs, resins and rubber chemicals.

The sodium salt of ortho-phenylphenol, sodium ortho-phenylphenol, is used as a preservative.

4.3.2 Why is it a critical substance?

Eye contact can cause severe irritation and burns with possible eye damage. For some individuals, 2-phenylphenol can also irritate the skin. It is one of the chemicals that the Hyperactive Children's Support Group recommends be eliminated from the diet of children.

4.3.3 Tests method

Some laboratories use the same method as for PCPs (i.e. EN ISO 17070).

The only known limits are the ones proposed by one ecological label: 50ppm for baby clothes; 100 ppm for others.

Test methods: no European standardized method available for textiles, EN ISO 17070 for leather.

4.4 Heavy metals

4.4.1 General

Toxic effects of heavy metals on human health are very well known. Once absorbed by humans, heavy metals tend to accumulate in internal organs such as the liver or kidney. The effects on health can be tremendous when high levels of accumulation are reached, damages of organs, disorders in the respiratory tract and lung diseases, dysfunction of the heart, blood and blood producing organs, skin diseases and some others. Children tend to absorb the heavy metals more than the adults, which put them to higher risk of health problem.

Metals may be introduced into textiles through dyeing and finishing processes. They are constituents of some dyes and pigments. Sometimes, natural fibres (like cotton, flax and hemp) also have traces of heavy metals, which are absorbed by the plants from the artificial fertilizers through soil.

For the metal determination, it is possible to follow two different approaches:

Due to the toxicity of some heavy metals, guidelines for tolerable amounts of these metals in textile products have been provided and are being adopted by countries and/or companies all over the world.

Heavy metals very often referred in companies' specifications and ecological labels are: Antimony (Sb), Arsenic (As), Lead (Pb), Cadmium (Cd), Mercury (Hg), Copper (Cu), Total Chromium, Chromium (Cr) VI, Cobalt (Co) and Nickel (Ni).

Despite heavy metals' toxicity is well known, only a few heavy metals are legislated on articles. Some metals are restricted under the EU REACH Regulation (EC) n°1907/2006, Annex XVII and this restriction are for textiles articles or articles that can be used as accessories in textiles articles.

Some arsenic, cadmium and chromium compounds, for example, are included in the EU REACH Regulation (EC) n°1907/2006 Candidate List of Substances of Very High Concern (SVHC). The list is regularly updated and the current list can be found at http://echa.europa.eu/candidate-list-table.

Concerning the environmental impact of the textiles it should be kept in mind that, at the end of life the textiles can contribute in a negative way to the environment, but this impact can be kept at a minimum if we restrict the added quantity.

4.4.2 Extractable heavy metals

It is the amount of metals that can be extracted from a material or a product using an extraction solution. The test method includes first an extraction of the sample and after a metal quantification. The choices of the extraction solution depend on the test goal. For examples:

— hydrochloric acid solution to simulate ingestion;

— artificial perspiration to simulate the wear;

— synthetic saliva solution to simulate the sucking.

This approach is found in the following published standards: EN 71-3; Germany: DIN 54233-2, DIN 54233-3 (will be replaced by EN 16711-2), DIN 54233-4; EN 16711-1 (under preparation); EN 16711-2 (under preparation), EN 1811, ISO 5398 (leather).

4.4.3 Total heavy metal

It is the total amount of metals contained in a material or a product. The test method includes first a total digestion of the sample and after a metal quantification.

This approach is found in the following published standards: DIN 54233-1 (Germany, will be replaced by EN 16711-1), EN 62321, EN 1122, EN 14602 (footwear) and in the following test methods: CEN/CR 13695-1 (packaging) USA: CPSC-CH-E1001-08 (Pb in children's metal products), CPSC-CH-E1002-08 (Pb in non-metal children's products), CPSC-CH-E1003-09 (Pb in paint), ASTM E1645-01.

4.4.4 Antimony -Sb

4.4.4.1 General

Antimony is a chemical element in the periodic table with the symbol Sb and atomic number 51.The most important use of antimony is in chemicals used to impregnate plastics, textiles, rubber, and other materials as a flame retardant. Antimony is also used for pigments in plastics, paints, rubber, ceramics, enamels, a wide variety of alloys, electronics and for a wide variety of minor uses, including medicines, fireworks, and others. Antimony is used as catalyst in the production of polyester textile fibres.

4.4.4.2 Why is it a critical substance?

Antimony and many of its compounds are toxic. Clinically, antimony poisoning is very similar to arsenic poisoning. In small doses, antimony causes headache, dizziness, and depression. Larger doses cause violent and frequent vomiting, and will lead to death in a few days.

4.4.4.3 Regulation/Specific tests method

Table 4 summarizes the information related to regulation and test methods.

Table 4 — Regulation and Specific test methods related to Antimony

Metal	Regulation	Test method	Material	Maximum allowed
Extractable Antimony	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 560
Extractable Antimony	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	bed mattresses	0,5 mg/kg

4.4.5 Arsenic – As

4.4.5.1 General

Arsenic is a chemical element with the symbol As and the atomic number 33. This is a notoriously poisonous metalloid but it is more commonly found as arsenide and arsenate compounds.

Arsenic has had several major industrial uses as an essential component of animal feed (to promote growth), herbicides and pesticides, defoliant, lead batteries, metal alloys, semiconductors, wood preservatives, as well as glass manufacturing.

4.4.5.2 Why is it a critical substance?

Arsenic and many of its compounds are especially potent poisons. Arsenic disrupts ATP production through several mechanisms. Elemental arsenic and arsenic compounds are classified as “toxic” and “dangerous for the environment” in EU directive n°67/548/EEC.

4.4.5.3 Regulation/Specific tests method

Table 5 summarizes the information related to regulation and test methods.

Table 5 — Regulation and specific tests method related to arsenic

Metal	Regulation	Test method	Material	Maximum allowed
Extractable arsenic	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 47
Extractable arsenic	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	bed mattresses	0,5 mg/kg
Total arsenic	EU REACH Regulation (EC) n°1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Annex XVII: Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles 19. Arsenic compounds	—	preservation of wood	Not used

4.4.6 Barium – Ba

4.4.6.1 General

Barium is a chemical element with the symbol Ba, and atomic number 56. Barium is a soft silvery alkaline earth metal. The most important compounds are the peroxide (BaO2), chloride, sulfate, carbonate, nitrate, and chlorate. Lithopone, a pigment containing barium sulfate and zinc sulfide, has good covering power, and does not darken in the presence of sulfides. The sulfate, as permanent white or blanc fixe, is also used in paint, in X-ray diagnostic work, and in glassmaking. Barite is extensively used as a weighting agent in oilwell drilling fluids, and also in making rubber. The carbonate has been used as a rat poison, while the nitrate and chlorate give colours in pyrotechnic.

4.4.6.2 Why is it a critical substance?

All water or acid soluble barium compounds are extremely poisonous. At low doses, barium acts as a muscle stimulant, while higher doses affect the nervous system, causing cardiac irregularities, tremors, weakness, anxiety, dyspnea and paralysis.

4.4.6.3 Regulation/Specific tests method

Table 6 summarizes the information related to regulation and test methods.

Table 6 — Regulation and specific tests method related to barium

Metal	Regulation	Test method	Material	Maximum allowed
Extractable Barium	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 18 750

4.4.7 Cadmium – Cd

4.4.7.1 General

Cadmium is a chemical element in the periodic table with the symbol Cd and atomic number 48. A relatively rare, soft, bluish-white, transition metal, cadmium is known to cause cancer. Cadmium is used largely in batteries. Cadmium pigments is primarily used to colour plastics, but it is also used in pigments for ceramics, glass, textiles, printing, inks, rubber, lacquers, and speciality paints. Cadmium is used as a stabilizer for polyvinylchloride (PVC) plastic and other types of plastics. Cadmium, which helps stabilizing the plastic during the manufacturing process, remains in small amounts in the finished product (typically no more than 0,2 percent of a product). For the general population, the most common routes of cadmium exposure are contaminated food and cigarette smoke. Crops for human consumption, particularly grains and cereal products, including rice, potatoes, root vegetables, leafy vegetables, and tobacco, take up cadmium from the soil.

4.4.7.2 Why is it a critical substance?

Cadmium is a toxin that is harmful to human health. Once it enters the body, it tends to remain there in the long term. Low-dose exposure to elevated levels of cadmium over a long period of time has different health consequences than a single high dose exposure. Acute health effects, such as flu-like symptoms, intestinal tract ailments, and lung irritation, can be caused by intense short-term exposure.

Long-term effects of cadmium exposure can be severe and include kidney disease, weakened bones, and damage to the lungs. Cadmium is a known human carcinogen, and cadmium is recognized as a developmental toxicant and reproductive toxicant.

Cadmium is also a potential environmental hazard.

4.4.7.3 Regulation/Specific tests method

Table 7 summarizes the information related to regulation and test methods.

Table 7 — Regulation and specific tests method related to cadmium

Metal	Regulation	Test method	Material	Maximum allowed
Extractable cadmium	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 17
Total cadmium	EU REACH Regulation (EC) n°1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Point **23** of the Annex XVII:Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles	EN 1122	Plastics	0,01 %
Extractable cadmium	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	bed mattresses	0,1 mg/kg
Total cadmium	European Ecological Criteria for Footwear 2009/563/EC	EN 14602	Leather and leather base material	100 mg/kg

The ongoing European ecological footwear criteria were laid down initially by Commission Decision of 1999/179/EC and 2002/231/EC. Their related assessments and verification requirements remain applicable until 31 March 2010. The applicable period of new Decision 2009/563/EC, is valid until 30 December 2015.

4.4.8 Chromium – Cr

4.4.8.1 General

Chromium is a chemical element in the periodic table with the symbol Cr and atomic number 24. It is a steel-gray, lustrous, hard metal that takes a high polish and has a high melting point. It is also odourless, tasteless, and malleable.

Chromium compounds are used in dyes and paints, plating of metallic components and the tanning of leather.

In the past, Chromium VI was used for mordant dyeing process of textile. Both Cr III and Cr VI, as oxidation states, may occur in the textile processes.

4.4.8.2 Why is it a critical substance?

Chromium metal and trivalent chromium (Cr III) compounds are not usually considered health hazards; chromium is an essential trace mineral. However, hexavalent chromium (Cr VI) compounds can be toxic if orally ingested or inhaled. Most Cr VI compounds are irritating to eyes, skin and mucous membranes. Chronic exposure to Cr VI compounds can cause permanent eye injury, unless properly treated. Cr VI is an established human carcinogen and allergen.

4.4.8.3 Regulation/Specific tests method

Table 8 summarizes the information related to regulation and test methods.

Table 8 — Regulation and specific tests method related to chromium

Metal	Regulation	Test method	Material	Maximum allowed
Extractable chromium (total)	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	Bed matress	1,0 mg/kg
Extractable chromium (total)	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	toys	Category III (mg/kg) Cr (III) 460 Cr (VI) 0,2
Total chromium		EN ISO 5398-1 EN ISO 5398-3 EN ISO 5398-4	leather	
Cr VI	EU Regulation n°301/2014 (related to REACH restriction in Annex XVII, entry 47)	EN ISO 17075	leather	3 mg/kg

4.4.9 Cobalt – Co

4.4.9.1 General

Cobalt is a hard, lustrous, silver-grey metal, a chemical element with symbol Co. It is found in various ores, and is used in the preparation of magnetic, wear-resistant, and high-strength alloys. Its compounds are as catalysts for the petroleum and chemical industries, as drying agents in paints, de-colourizers, dyes, pigments, and oxidizers. Cobalt blue is an important part of artists' palette and is used by craft workers in porcelain, pottery, stained glass, tiles and enamel jewellery.

4.4.9.2 Why is it a critical substance?

Cobalt compounds should be handled with care due to cobalt's slight toxicity. Cobalt is known as an allergenic substance that can cause dermatitis (contact allergy).

Cobalt is beneficial for humans because it is a part of vitamin B12, which is essential for human health. Cobalt is used to treat anaemia with pregnant women, because it stimulates the production of red blood cells. The total daily intake of cobalt is variable and may be as much as 1 mg, but almost all will pass through the body unabsorbed, except that in vitamin B12. However, too high concentrations of cobalt may damage human health. When breathing too high concentrations of cobalt through air in, lung effects are experienced (such as asthma and pneumonia). This mainly occurs with people that work with cobalt.

When plants grow on contaminated soils they will accumulate very small particles of cobalt, especially in the parts of the plant we eat, such as fruits and seeds. Soils near mining and melting facilities may contain very high amounts of cobalt, so that the uptake by humans through eating plants can cause health effects.

Health effects that are a result of the uptake of high concentrations of cobalt are:

— vomiting and nausea;

— vision problems;

— heart problems;

— thyroid damage.

4.4.9.3 Regulation/Specific tests method

Table 9 summarizes the information related to regulation and test methods.

Table 9 — Regulation and specific tests method related to cobalt

Metal	Regulation	Test method	Material	Maximum allowed
Extractable cobalt	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	toys	Category III (mg/kg) 130
Extractable cobalt	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	Bed matress	0,5 mg/kg

4.4.10 Copper – Cu

4.4.10.1 General

Copper is a chemical element in the periodic table with the symbol Cu and atomic number 29. It is a ductile metal with excellent electrical conductivity, and finds extensive use as for example for artwork and jewellery around the world.

Copper compounds are used to preserve wood and as leather tanning chemicals and mordant (fixative) in textile dyeing.

Cuprous Chloride, which is insoluble in water, is used as a heat and light stabilizer for polyamide and as a catalyst for chemical synthesis.

Copper is used as a raw material for phthalocyanine blue pigments; Copper sulfate is used as a fungicide on crops, as a pesticide to kill snails and slugs, and as water treatment to kill aquatic vegetation. This chemical has serious chronic toxicity with implications for agricultural workers and the environment.

Copper is an essential trace nutrient to all high plants and animals. Just as some copper is essential for good health, too much can be harmful.

4.4.10.2 Why is it a critical substance?

A healthy human can excrete some excess copper. However, high doses, long-term exposure, and certain routes of exposure can overwhelm the biological processes that excrete excess copper from the body.

Large doses of copper-containing compounds, such as copper sulfate, are poisonous even to those with a healthy liver. However, some people are at greater risk of copper toxicity. People with certain liver diseases and those with an inherited inability to metabolize copper are particularly sensitive to copper toxicity, such as people with Menkes disease, hereditary aceruloplasminemia, and Wilson's disease.

4.4.10.3 Regulation/Specific tests method

Table 10 summarizes the information related to regulation and test methods.

Table 10 — Regulation and specific tests method related to copper

Metal	Regulation	Test method	Material	Maximum allowed
Extractable copper	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	toys	Category III (mg/kg) 7 700
Extractable copper	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	bed mattresses	2,0 mg/kg

4.4.11 Lead – Pb

4.4.11.1 General

Lead is a chemical element in the periodic table with the symbol Pb and atomic number 82.

A soft, heavy, toxic and malleable poor metal, lead is bluish white when freshly cut but tarnishes to dull gray when exposed to air. Lead can be used as a pure metal, alloyed with other metals, or as a chemical compound. The uses of lead are several for example: White lead, lead sulfate and lead chromate are used as colouring elements in paints and ceramic glazes, notably in the colours red and yellow. It is commonly used in polyvinyl chloride (PVC) plastic that covers electrical cords. It is used to form glazing bars for stained glass or other multi-lit windows. Lead sheets are used in the construction industry for weathering, roofing and cladding, to prevent water penetration. It is also used for the lining of chemical treatment baths, acid plants and storage vessels. By the virtue of its high density, lead sheet is used for sound insulation and radiation shielding. Some other applications of lead include the making of leaded bronze ornaments, toys, bullets and shot, lead weights and coffins.

4.4.11.2 Why is it a critical substance?

Lead is a potent neurotoxin which accumulates in soft tissues and bone over time.

Lead is a poisonous metal that can damage nervous connections (especially in young children) and cause blood and brain disorders. Long term exposure to lead or its salts (especially soluble salts or the strong oxidant PbO_2) can cause nephropathy. The concern about lead's role in cognitive deficits in children has brought about widespread reduction in its use (lead exposure has been linked to schizophrenia).

4.4.11.3 Regulation/Specific tests method

Table 11 summarizes the information related to regulation and test methods.

Table 11 — Regulation and specific tests method related to lead

Metal	Regulation	Test method	Material	Maximum allowed
Extractable lead	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	Bed matress	0,5 mg/kg
Extractable lead	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toy	Category III (mg/kg) 160
Total lead	Commission Decision 2009/563/EC of 28 July 2009 establishing the ecological criteria for the award of the European Ecolabel for footwear	EN 14602	footwear	100 mg/kg
Total lead	US under the Consumer Product Safety Improvement Act (CPSIA)	CPSC-CH-E1003–09 ASTM E 1645–01	Paint and similar coating material	90 mg/kg
Total lead	US under the Consumer Product Safety Improvement Act (CPSIA)	CPSC-CH-E1001–08	Children's Metal Products (Including Children's Metal Jewellery)	(300) 100 mg/kg after 08/2011
Total lead	US under the Consumer Product Safety Improvement Act (CPSIA)	CPSC-CH-E1002–08	Non-Metal Children's Products	(300) 100 mg/kg after 08/2011
Total lead	EU REACH Regulation (EC) n°1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization and		Paint	

Metal	Regulation	Test method	Material	Maximum allowed
	Restriction of Chemicals (REACH), Annex XVII:Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles (point 16)			

4.4.12 Mercury – Hg

4.4.12.1 General

Mercury is a chemical element in the periodic table with the symbol Hg and atomic number 80. A heavy, silvery transition metal, mercury is one of five elements that are liquid at or near room temperature and pressure.

Major uses of mercury include dental amalgams, tilt switches, thermometers, lamps, pigments, batteries, reagents, and barometers. In cosmetic, some skin whitening products contain the toxic chemical mercury (II) chloride as the active ingredient. The mercury-based preservative thiomersal has been added to vaccines since the 1930s to prevent their deterioration. With the exception of some flu vaccines, it is no longer used as a preservative in routinely recommended childhood vaccines in the United States; it is still in limited use as a preservative in multi-dose flu and tetanus vaccines and a few other non-childhood vaccines. Organic mercury compounds found extensive use in agriculture as plant and seed protectors and in industry as preservatives and antimicrobial agents.

4.4.12.2 Why is it a critical substance?

Mercury may cause many harmful effects on the nervous, digestive and respiratory systems, and the kidneys, and can cause an allergic skin reaction, and is a reproductive hazard.

4.4.12.3 Regulation/Tests methods

Table 12 summarizes the information related to regulation and test methods.

Table 12 — Regulation and specific tests method related to mercury

Metal	Regulation	Test method	Material	Maximum allowed
Extractable mercury	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3		0,02 mg/kg
Extractable mercury	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 94

Metal	Regulation	Test method	Material	Maximum allowed
Extractable mercury	Commission Decision 2009/563/EC of 28 July 2009 establishing the ecological criteria for the award of the European Ecolabel for footwear	//	footwear	0,02 mg/kg
	EU REACH Regulation (EC) n°1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Annex XVII:Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles 18. Mercury compounds		Shall not be used as substances and constituents of preparations intended for use: (a) to prevent the fouling by microorganisms, plants or animals of: – the hulls of boats, – cages, floats, nets and any other appliances or equipment used for fish or shellfish farming, – any totally or partly submerged appliances or equipment; (b) in the preservation of wood; (c) in the impregnation of heavy-duty industrial textiles and yarn intended for their manufacture; (d) in the treatment of industrial waters, irrespective of their use.	

4.4.13 Nickel – Ni

4.4.13.1 General

Nickel is a metallic chemical element in the periodic table with the symbol Ni and atomic number 28. Nickel is a silvery white metal that takes on a high polish. It belongs to the transition metals, and is hard and ductile.

Nickel is used in many industrial and consumer products, including stainless steel, magnets, coinage, rechargeable batteries, electric guitar strings and special alloys. It is also used for plating and as a green tint in glass. Nickel is pre-eminently an alloy metal, and its chief use is in the nickel steels and nickel cast irons, of which there are many varieties. It is also widely used in many other alloys, such as nickel brasses and bronzes, and alloys with copper, chromium, aluminium, lead, cobalt, silver, and gold.

It can be used in clothing accessories: clasps, buckles, jeans' buttons, zips, bra hooks, metallic gloves, suspenders, glasses' frame, shoe eyelets, hair pins, snap fasteners, reinforcement for safety shoes. Jewellery: needles used for ear piercing or other piercings, earrings, bracelets, watches, brooches, neck chains, necklaces, pendants…

We can also find uses in galvanization industry, in dyes, stains for paper and paint, stain and colouring agents for ceramics, ceramic and glass, colorant for oils, enamel paint: yellow (nickel phosphate), green (nickel oxide), printing and dye for certain textiles, catalyst and reactant for the plastic industry, etc…

In textile industry we can found machinery made of nickel like for example textile rotary nickel screen that can contribute to high nickel content in printed textiles.

4.4.13.2 Why is it a critical substance?

Routes of nickel intake for man and animals are inhalation, ingestion and percutaneous absorption. The pulmonary absorption of nickel compounds varies according to chemical and physical form, with insoluble compounds generally being cleared more slowly. Gastrointestinal intake of nickel by man is relatively high ranging from 300 to 500 µg daily; however, absorption is low, averaging one to 10 percent of intake.

Nickel is an important cause of contact allergy, partly due to its use in jewellery intended for pierced ears. Nickel allergies affecting pierced ears are often marked by itchy, red skin. Many earrings are now made "nickel-free" due to this problem. The amount of nickel which is allowed in products which come into contact with human skin is regulated by the European Union.

4.4.13.3 Regulation/ tests method

Table 13 summarizes the information related to regulation and test methods.

Table 13 — Regulation and specific tests method related to nickel

Metal	Regulation	Test method	Material	Maximum allowed
Extractable nickel	Council Directive 88/378/EEC of 3 May 1988 substituted by EU Toy safety directive (EC) n°48/2009 (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 930
Extractable nickel	Commission Decision 2009/598/EC of 9 July 2009 establishing the ecological criteria for the award of the European Ecolabel for bed mattresses	DIN 54233-3	bed mattresses	1,0 mg/kg
Extractable nickel	EU REACH Regulation (EC) n°1907/2006 of the European parliament and of the council of 18	EN 1811 EN 12472 + EN 1811	(a) in all post assemblies which are inserted into pierced ears and	0,5 µg/cm²/week

Metal	Regulation	Test method	Material	Maximum allowed
	December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), Annex XVII:Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles Point 27		other pierced parts of the human body unless the rate of nickel release from such post assemblies is less than 0,2 µg/cm2/week (migration limit). (b) in articles intended to come into direct and prolonged contact with the skin such as: – earrings, – necklaces, bracelets and chains, anklets, finger rings, – wrist-watch cases, watch straps and tighteners, – rivet buttons, tighteners, rivets, zippers and metal marks, when these are used in garments c) in articles such as those listed in point (b) where these have a non-nickel coating unless such coating is sufficient to ensure that the rate of nickel release from those parts of such articles coming into direct and prolonged contact with the skin will not exceed 0,5 µg/cm2/week for a period of at least two years	

4.4.14 Selenium – Se

4.4.14.1 General

Selenium is a chemical element with atomic number 34, with the chemical symbol Se. It is a non-metal, rarely occurring in its elemental state in nature.

Growth in selenium consumption was historically driven by steady development of new uses, including applications in rubber compounding, steel alloying, and selenium rectifiers. Selenium is also an essential material in the drums of laser printers and copiers. By 1970, selenium in rectifiers had largely been replaced by silicon, but its use as a photoconductor in plain-paper copiers had become its leading application. During the 1980s, the photoconductor application declined (although it was still a large end-use) as more and more copiers using organic photoconductors were produced. At the current time, the largest use of selenium worldwide is in glass manufacturing, followed by uses in chemicals and pigments. Electronics use, despite a number of continued applications, continues to decline.

In the late 1990s, the use of selenium (usually with bismuth) as an additive to plumbing brasses to meet no-lead environmental standards became important. At present, total world selenium production continues to increase modestly.

Selenium is rarely found in textile products.

4.4.14.2 Why is it a critical substance?

Trace amounts of the element are necessary for cellular function, but in large amounts Selenium salts are toxic. Selenium requirements in plants differ by species, with some plants, it seems, requiring none.

4.4.14.3 Regulation/ tests method

Table 14 summarizes the information related to regulation and test methods.

Table 14 — Regulation and specific tests method related to selenium

Metal	Regulation	Test method	Material	Maximum allowed
Extractable Selenium	Council Directive 88/378/EEC of 3 May 1988 substituted by (Part III of the Annex II)	EN 71–3	Toys	Category III (mg/kg) 460

4.5 Flame retardants

4.5.1 General

In some specific applications, textile articles need to answer standards of flammability.

Textile articles can be treated by using flame retardant auxiliaries (reactive substances) or some substances can be embedded in the fibre during the spinning process (additive substances).

4.5.2 Why is it a critical substance?

Among the substances which can be used as flame retardants, some present risks towards the human health or towards the environment.

4.5.3 Regulation/Specific test methods

4.5.3.1 Regulation

Based on the European regulation (and other national regulations) the textile articles should not contain certain flame retardant auxiliaries like: Tris (2,3 dibromopropyl) phosphate (TRIS), Tris(aziridinyl)phosphinoxide (TEPA), Polybromobiphenyls (PBB), Diphenylether, pentabromo derivative $C_{12}H_5Br_5O$ and Diphenylether, octabromo derivative $C_{12}H_2Br_8O$

4.5.3.2 Test method

At the moment, there is no standardized test method regarding the Flame Retardants testing.

Recommended method: extraction of the Flame Retardant agents with an appropriate solvent and control by chromatography.

Under preparation: EN ISO 17881-1 (brominated), EN ISO 17881-2 (phosphorus) and EN ISO 17881-3 (chlorinated paraffin).

Limit: no indication of limit

Regulatory Source:

EU REACH Regulation (EC) n°1907/2006 Annex XVII: Restriction on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles.

Entry n°4: Tris (2,3 dibromopropyl) phosphate (TRIS) CAS n°126-72-7,

Entry n°7: Tris(aziridinyl)phosphinoxide (CAS n°5455-55-1),

Entry n°8: Polybromobiphenyls (PBB) (CAS n°59536-65-1)

shall not be used in textile articles, e.g. garments, undergarments and linen, intended to come into contact with the skin.

EU Regulation n°850-2004:

Diphenylether, pentabromo derivative $C_{12}H_5Br_5O$ (CAS n°32534-81-9) and Diphenylether, octabromo derivative $C_{12}H_2Br_8O$ (CAS n°32536-52-0)

1. Shall not be placed on the market or used as a substance or as a constituent of preparations in concentrations higher than 0,1 % by mass.

2. Articles may not be placed on the market if they, or flame-retarded parts thereof, contain this substance in concentrations higher than 0,1 % by mass.

4.6 Carcinogenic dyes, suspected dyes and derived substances

4.6.1 General

Since the discovery of the first synthetic dyestuff, thousands of dyes were made and used in the textile industry worldwide.

There are many classes of dye used to colour different types of textile fibre. Some dyes have been found to cause or are suspected of causing health problems.

4.6.2 Carcinogenic amines derived from azo colorants

4.6.2.1 Why are these critical substances?

Azo colorants may release, by reductive cleavage of azo group(s), one or more aromatic amines, some of which are, or are suspected of being, carcinogenic.

Example: Red congo dyes which lead to benzidine after cleavage (see Figure 1):

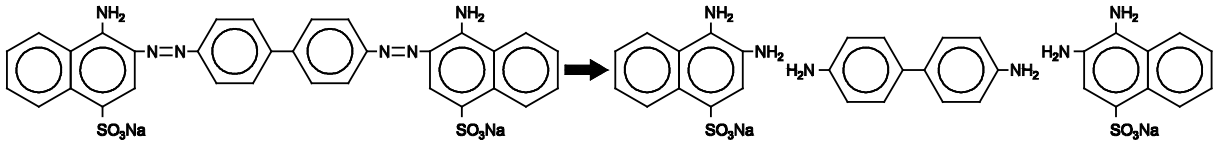

Figure 1 — Cleavage of Red Congo dyes into benzidine

4.6.2.2 Regulation/Specific test methods

EU REACH Regulation (EC) n°1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

Tests methods are EN 14362-1 and EN 14362-3.

4.6.3 Carcinogenic colorants and colorants suspected to be carcinogenic, mutagenic or toxic to reproduction

4.6.3.1 Why are these critical substances?

Some of the dyestuffs were identified as being able to present a risk for the human health: carcinogenic, mutagenic, toxic to reproduction.

4.6.3.2 Regulation/Specific test methods

Based on Ecological criteria for the European Ecolabel for textile products, the textile articles should not contain dyestuffs classified as carcinogenic, mutagenic or toxic to reproduction (see Annex A) or dyestuffs containing substances that are assigned any of the following risk phrases: R40, R45, R46, R49.

Test method: EN ISO 16373-2 and EN ISO 16373-3.

Limit:

— 50 ppm (limit inspired by one ecological label)

Source:

European decision: Commission Decision 2009/567/EC of 9 July 2009 – Ecological criteria for the European Ecolabel for textile products.

Textile parts shall not contain or release colorants which are classified to be carcinogenic or suspected and listed in Table 15.

Table 15 — Dyestuffs classified as carcinogenic, mutagenic or toxic to reproduction (Commission Decision 2009/567/EC of 9 July 2009)

C.I. Generic name	C.I. Constitution number	CAS-Nr.
C.I. Acid Red 26	C.I. 16150	3761–53–3
C.I. Basic Blue 26	C.I. 44045	2580-56-5
C.I. Basic Green 4	C.I. 42000	68513-86-0, 569-64-2, 2437-29-8, 10309-95-2
C.I. Basic Red 9	C.I. 42500	569–61–9
C.I. Basic Violet 14	C.I. 42510	632–99–5
C.I. Direct Black 38	C.I. 30235	1937–37–7
C.I. Direct Blue 3	C.I. 61505	2475-46-9
C.I. Direct Blue 6	C.I. 22610	2602–46–2
C.I. Direct Red 28	C.I. 22120	573–58–0
C.I. Disperse Blue 1	C.I. 64500	2475–45–8
C.I. Disperse Orange 11	C.I. 60700	82–28–0

NOTE C.I. means Colour Index. For further information, see the bibliography.

All dyes used should be listed and material safety data sheets for all the dyes should be provided.

4.6.4 Sensitizing colorants

4.6.4.1 Why are these critical substances?

Some of them were identified as being able to present a risk for the human health: carcinogenic, mutagenic, toxic to reproduction and potentially sensitizing dyestuffs.

4.6.4.2 Regulation/Specific test methods

Regulation:

Based on the Ecological criteria for European Ecolabel for textile products, the textile articles should not contain dyestuffs classified as potentially sensitizing dyes (see Table B).

Test method: EN ISO 16373-2

Limit:

— 50 ppm (limit inspired by one ecological label)

Source:

European Commission Decision 2009/567/EC of 9 July 2009 – Ecological criteria for the European Ecolabel for textile products.

The product shall not contain or release substances which are assigned any of the following Risk-phrases (or combinations thereof): R24, R27, R38, R42 and R43.

Textile parts should not contain or release colorants which are classified to be allergenic and listed in Table 16.

Table 16 — Dyestuffs classified as potentially sensitizing dyes (Commission Decision 2009/567/EC of 9 July 2009)

C.I. Generic name	C.I. Structure number	CAS-Nr.
C.I. Disperse Blue 3	C.I. 61505	2475–46–9
C.I. Disperse Blue 7	C.I. 62500	3179–90–6
C.I. Disperse Blue 26	C.I. 63305	3860-63-7
C.I. Disperse Blue 35	*C.I. not available*	12222–75–2
C.I. Disperse Blue 102	C.I. 111954	12222–97–8
C.I. Disperse Blue 106	C.I. 111935	12223–01–7
C.I. Disperse Blue 124	C.I. 111938	61951–51–7
C.I. Disperse Brown 1	C.I. 11152	23355–64–8
C.I. Disperse Orange 1	C.I. 11080	2581–69–3
C.I. Disperse Orange 3	C.I. 11005	730–40–5
C.I. Disperse Orange 37 C.I. Disperse Orange 59 C.I. Disperse Orange 76	C.I. 11132	13301-61-6
C.I. Disperse Red 1	C.I. 11110	2872–52–8
C.I. Disperse Red 11	C.I. 62015	2872–48–2
C.I. Disperse Red 17	C.I. 11210	3179–89–3
C.I. Disperse Yellow 1	C.I. 10345	119–15–3
C.I. Disperse Yellow 3	C.I. 11855	2832–40–8
C.I. Disperse Yellow 9	C.I. 10375	6373–73–5
C.I. Disperse Yellow 39	*C.I. not available*	12236-29-2
C.I. Disperse Yellow 49	*C.I. not available*	12236-29-2

All dyes used should be listed and material safety data sheets for all the dyes should be provided.

4.7 Sensitizing substances (others than colorants)

Textile products may contain perfumes, preservatives.

NOTE A technical report CEN/TR 15917 *Cosmetotextiles* specifies general characteristics of cosmetotextiles and describes their recommended properties.

4.8 Pesticides, herbicides and fungicides

4.8.1 General

Pesticides, herbicides and fungicides are used on wool or cotton agriculture to avoid respectively unwanted insects, plants and fungi.

The growing of conventional cotton is known to use about 25 % of the pesticides sold in the world.

4.8.2 Why is it a critical substance?

Many biocides are classified as dangerous substances for the environment and for the health of farmers.

As they are volatile components and easily soluble in water, residues of pesticides are rarely found on textiles, even on raw materials.

4.8.3 Regulation/Specific test methods

A pack of regulations concerning the marketing and the use of pesticides in general has recently been adopted by the European Commission but there is no legal requirement in textiles. Based on the European Ecolabel,

— Cotton and other natural cellulosic seed fibres shall not contain more than 0,05 ppm (sensibility of the test method permitting) of each of the following substances: aldrin, captafol, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, hexachlorocyclohexane (total isomers), 2,4,5-T, chlordimeform, chlorobenzilate, dinoseb and its salts, monocrotophos, pentachlorophenol, toxaphene, methamidophos, methylparathion, parathion, phosphamidon

Test methods: as appropriate, US EPA 8081 A (organo-chlorine pesticides, with ultrasonic or Soxhlet extraction and apolar solvents (iso-octane or hexane)), US EPA 8151 A (chlorinated herbicides, using methanol), US EPA 8141 A (organophosphorus compounds), or US EPA 8270 C (semi-volatile organic compounds).

For greasy wool and other keratin fibres (including wool from sheep, camel, alpaca, goat)

(a) The sum total content of the following substances shall not exceed 0,5 ppm: γ-hexachlorocyclohexane (lindane), α-hexachlorocyclohexane, β-hexachlorocyclohexane, δ-hexachlorocyclohexane, aldrin, dieldrin, endrin, p,p'-DDT, p,p'-DDD.

(b) The sum total content of the following substances shall not exceed 2 ppm: diazinon, propetamphos, chlorfenvinphos, dichlorfenthion, chlorpyriphos, fenchlorphos, ethion, methyl pirimiphos.

(c) The sum total content of the following substances shall not exceed 0,5 ppm: cypermethrin, deltamethrin, fenvalerate, cyhalothrin, flumethrin.

(d) The sum total content of the following substances shall not exceed 2 ppm: diflubenzuron, triflumuron, dicyclanil.

Test method: IWTO Draft Test Method 59 (International Wool Textile Organization // www.iwto.org).

Table 17 — Pesticides and their CAS number

Name	CAS Number
2,4,5-T	93–76–5
2,4-D	94–75–7
Azinophosmethyl	86–50–0
Azinophosethyl	2642–71–9
Aldrine	309–00–2
Bromophos-ethyl	4824–78–6
Captafol	2425–06–1
Carbaryl	63–25–2

Name	CAS Number
Chlordane	57–74–9
Chlordimeform	1970–95–9
Chlorfenvinphos	470–90–6
Coumaphos	56–72–4
Cyfluthrin	68359–37–5
Cyhalothrin	91465–08–6
Cypermethrin	52315–07–8
DEF	78–48–8
Deltamethrin	52918–63–5
DDD	53–19–0, 72–54–8
DDE	3424–82–6, 72–55–9
DDT	50–29–3, 789–02–6
Diazinon	333–41–5
Dichlorprop	120–36–2
Dicrotophos	141–66–2
Dieldrin	60–57–1
Dimethoate	60–51–5
Dinoseb and salts	88–85–7
Endosulfan, α-	115–29–7
Endosulfan, β-	33213–65–9
Endrine	72–20–8
Esfenvalerate	66230–04–4
Fenvalerate	51630–58–1
Heptachlor	76–44–8
Heptachloroepoxide	1024–57–3
Hexachlorobenzene	118–74–1
Hexachlorcyclohexane, α−	319–84–6
Hexachlorcyclohexane, β−	319–85–7
Hexachlorcyclohexane, δ−	319–86–8
Lindane	58–89–9
Malathion	121–75–5
MCPA	94–74–6
MCPB	94–81–5
Mecoprop	93–65–2
Metamidophos	10265–92–6
Methoxychlor	72–43–5
Mirex	2385–85–5

Name	CAS Number
Monocrotophos	6923–22–4
Parathion	56–38–2
Parathion-methyl	298–00–0
Phosdrin/Mevinphos	7786–34–7
Propethamphos	31218–83–4
Profenophos	41198–08–7
Quinalphos	13593–03–8
Toxaphene	8001–35–2
Trifluralin	1582

Test method: test should be performed with cleaned-up extracts by gas chromatography with selective detection (MSD or ECD), or LC-MS.

4.9 Chloroorganics including carriers (chlorinated benzenes, chlorinated toluenes and chlorinated naphtalenes)

4.9.1 General

Chloroorganics are solvents used in the manufacture of rubber, metal paint and fur industry, used for grease and oil, e.g. in stain removers. They are also used in cleaning agents and detergents, as well as in lubricating oils.

Chloroorganics as solvents are used:

— in dyeing of synthetic fibres (called “carriers". As carriers, chlorobenzenes and chlorotoluenes are used to allow the dyeing of polyester fibres at less than 100°C, under atmospheric conditions);

— in printing for textile and leather;

— as finishing agents (e.g. fabric softeners, moth-proofing agent in textiles, for the manufacture of silk).

4.9.2 Why is it a critical substance?

Chlorinated organic solvents may affect the nervous system and are irritating to skin and mucous membranes.

Some carriers, in particular those with chlorobenzenes and chlorotoluenes, raise problems towards the human health (they are toxic and can cause liver and kidney damage and irritate eyes and airways) or towards the environment because they are carcinogenic or suspected carcinogenic, as the hexachlorobenzene. Chloronaphthalenes are toxic and cause liver damage.

Many chlorinated organic solvents are dangerous for the environment because they are PBT (1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene).

4.9.3 Regulation/Specific tests method

Based on the European decision, especially Ecological criteria for the European Ecolabel for textile products, the textile articles should not contain halogenated carriers

Test method: no European method has been currently standardized regarding the chlorinated benzenes and toluenes testing. Germany: DIN 54232.

Limit: 1 mg/kg (limit inspired by some ecological labels)

— Chlorobenzenes

— Chlorotoluenes

Propositions: 0,1 % or 1000 mg/kg (REACH limit)

— Chloroform (CAS No 67-66-3), 1,1,2-Trichloroethane (CAS No 79-00-5), 1,1,2,2-Tetrachloroethane (CAS No 79-34-5), 1,1,1,2-Tetrachloroethane (CAS No 630-20-6), Pentachloroethane (CAS No 76-01-7) and 1,1-Dichloroethene (CAS No 75-35-4) are restricted under the EU REACH Regulation (EC) No 1907/2006, Annex XVII. These substances shall not be placed on the market, or used, as substances, or as constituents of other substances, or in mixtures, in concentrations equal to or greater than 0,1 % by weight, where the substance or mixture is intended for supply to the general public and/or is intended for diffusive applications such as in surface cleaning and cleaning of fabrics.

Sources:

— European Decision 2009/567/EC of 9 July 2009 – Ecological criteria for the European Ecolabel for textile products - Criteria 24. Halogenated carriers for polyester.

— DIN 54232

4.10 Phthalates

4.10.1 General

Phthalates are esters of phthalic acid and are mainly used as plasticisers (substances added to plastics to increase their flexibility, transparency, durability, and longevity).

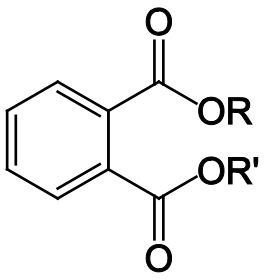

Figure 2 — General chemical description

4.10.2 Why is it critical?

Some phthalates have been found to disrupt the endocrine system. Several phthalate compounds have caused reduced sperm counts, testicular atrophy and structural abnormalities in the reproductive systems of male test animals and some studies also link some phthalates to liver cancer.

4.10.3 Regulations / Specific test method

The EU REACH Regulation (EC) n°1907/2006 Candidate List of Substances of Very High Concern (SVHC) includes phthalates, e.g. Dibutyl phthalate (DBP), Bis (2-ethylhexyl) phthalate (DEHP), Benzylbutyl phthalate (BBP), Diisobutyl phthalate (DIBP). The list of identified substances of very high concern is updated regularly. The current listing can be found at http://echa.europa.eu/candidate-list-table .

Uses of some phthalates in the EU require authorization. The list of substances subject to authorization requirement can be reviewed at http://echa.europa.eu/fi/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/authorisation-list.

Ecological labels and commercial restrictive substance lists, in addition to these four, also name Di-isononyl phthalate (DINP), Di-isodecyl phthalate (DIDP) and Di-n-octyl phthalate (DNOP). See ECHA report about DINP and DIDP in Bibliography.

Limits:

Dibutyl phthalate (DBP; CAS No 84-74-2), Bis (2-ethylhexyl) phthalate (DEHP; CAS No 117-81-7), Benzyl butyl phthalate (BBP; CAS No 85-68-7), Di-'isononyl' phthalate (DINP; CAS No 28553-12-0 and 68515-48-0), Di-'isodecyl' phthalate (DIDP; CAS No 26761-40-0 and 68515-49-1) and Di-n-octyl phthalate (DNOP; CAS No 117-84-0) are restricted under the EU REACH Regulation (EC) n°1907/2006, Annex XVII.

DBP, DEHP and BBP shall not be used as substances or in mixtures, in concentrations greater than 0,1 % by weight of the plasticised material, in toys and childcare articles. Toys and childcare articles containing these phthalates in a concentration greater than 0,1 % by weight of the plasticised material shall not be placed on the market.

DINP, DIDP and DNOP shall not be used as substances or in mixtures, in concentrations greater than 0,1 % by weight of the plasticised material, in toys and childcare articles which can be placed in the mouth by children. Such toys and childcare articles containing these phthalates in a concentration greater than 0,1 % by weight of the plasticised material shall not be placed on the market.

Test method: EN ISO 14389.

Where the phthalate content is a limited part of a component of the article, it is recommended that only this part of the article be assessed. An average result for the whole article is unacceptable.

4.11 Organotin compounds

4.11.1 General

Organotins compounds have been used in the shipping industry as protective paint coatings applied to ship's hulls. In water, trisubstituted organotin compounds decompose in a stepwise manner to less substituted compounds, down to inorganic tin. They are used in the industry in the form of chloride complexes.

In the textile industry, organotin compounds have been used for preventing the bacterial degradation of sweat and the corresponding unpleasant odour of socks, shoes and sport clothes. Can also be applied to a wide range of textile products like sanitary towels, nappies (diapers), tents, carpets and synthetic clothing (e.g. underwear, socks and sportswear).

Some organotins (mainly mono- and di-organotins) may be used in PVC as heat stabilizers for reducing the polymer degradation during high temperature processing; as catalyst in polymerization of polyurethane, polyester and silicones; as curing catalysts for urethane coatings and polyurethane foam production (the largest use of Dibutyltin); as biocide in the formulations of anti-fouling agents, fungicides, insecticides, and bactericides.

4.11.2 Why is it critical?

The use of organotin compounds in consumer articles has been found to pose a risk to human health, particularly for children. The specific published human health is the possible damage to: liver and kidney organs, disruption of biochemical process such as blood-forming mechanisms and disruption of the enzyme system.

4.11.3 Regulations / Specific test method

For the textile analysis there isn't any developed standard. A modification of the EN ISO 17353 can be used. The textile extraction could be done in an ultrasonic bath with a solution of 5 % of glacial acetic acid in ethanol and sodium diethyldithiocarbamate as a complexing agent.

When analysed by gas chromatography (GC), polar ionic organotin species need to be extracted from the sample matrices and converted into their fully alkylated and more volatile forms by derivatization, which generates sharper peaks and higher sensitivity. The analysis is made more difficult because no derivatized standards are commercially available so they have to be prepared in the laboratory.

NOTE Leather: CEN ISO/ TS 16179, Footwear - Critical substances potentially present in footwear and footwear components – Determination of organotin compounds in footwear materials.

Tri-substituted organostannic compounds such as tributyltin (TBT) compounds and triphenyltin (TPT) compounds shall not be used in articles where the concentration in the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin.

Dibutyltin (DBT) compounds shall not be used in mixtures and articles for supply to the general public where the concentration in the mixture or the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin, except for articles, by way of derogation, as fabrics coated with PVC containing DBT compounds as stabilizers when intended for outdoor applications.

Dioctyltin (DOT) compounds shall not be used in the following articles for supply to, or use by, the general public, where the concentration in the article, or part thereof, is greater than the equivalent of 0,1 % by weight of tin: — textile articles intended to come into contact with the skin, — gloves, — footwear or part of footwear intended to come into contact with the skin, — wall and floor coverings, — childcare articles, — female hygiene products, — nappies, — two-component room temperature vulcanisation moulding kits (RTV-2 moulding kits).

COMMISSION REGULATION (EU) n°276/2010 of 31 March 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) as regards Annex XVII (dichloromethane, lamp oils and grill lighter fluids and organostannic compounds).

Some organostannic compounds are included in the EU REACH Regulation (EC) n°1907/2006 Candidate List of Substances of Very High Concern (SVHC). The list is regularly updated and the current list can be found at http://echa.europa.eu/candidate-list-table.

4.12 Perfluorooctanesulfonates (PFOS) and perfluorooctanoic acid (PFOA)

4.12.1 General

PFOS (perfluorooctanesulfonates $C_8F_{17}SO_2X$; X = OH, Metal salts O-M+, halides, amides and other derivatives including polymers) are manmade perfluorinated tensides.

The major use of PFOS is in the manufacturing process to give grease, stain and water repellence properties to materials. Thus textiles for apparel and upholstery; carpets; paper and packaging; leather; adhesives; and general coatings are examples of goods that maybe treated with PFOS related compounds.

PFOA (perfluorooctanoic acid, $C_8HF_{15}O_2$) is a manmade perfluorinated surfactant. It is mainly used as a surfactant in the emulsion polymerization of fluoropolymers like for PTFE. Thus it is often found in finished textiles containing fluorinated polymers.

4.12.2 Why is it a critical substance?

PFOS are classified as very persistent, very bioaccumulative substances which are toxic to mammalian species. Therefore PFOS fulfil the criteria for being considered as persistent organic pollutants.

Perfluorooctanoic acid (PFOA) and its salts are suspected to have a similar risk profile to PFOS, and consequently the Commission shall keep under review the ongoing risk assessment activities which should be applied within the European Union. There is no European legal limit for PFOA specified yet. PFOA has been

linked to cancer and birth defects in animals and can be detected in the blood of human beings. It has also been found in the blood of marine organisms and Arctic polar bears.

4.12.3 Regulations/Test method

Based on previous EU REACH Regulation (EC) n°1907/2006 Annex XVII n°53 coated textile parts of a product should not contain perfluorooctane sulfonates (PFOS) which can be released in quantities higher than a limit of 1 µg/m^2 of the coated material. Furthermore semi-finished products or articles, or parts thereof, if the concentration of PFOS is equal to or greater than 0,1 % by weight calculated with reference to the mass of structurally or microstructurally distinct parts that contain PFOS shall not be placed on the market.

According to Directive 2006/122/EC which has been implemented in EU REACH Regulation (EC) n°1907/2006 PFOS are classified as very persistent, very bioaccumulative substances which are toxic to mammalian species. Therefore PFOS fulfil the criteria for being considered as persistent organic pollutants. According to EU REACH Regulation (EC) n°1907/2006 Annex XVII n°53 Perfluorooctanoic acid (PFOA) and its salts are suspected to have a similar risk profile to PFOS, and consequently the Commission shall keep under review the ongoing risk assessment activities which should be applied within the European Union. There is no legal limit for PFOA specified yet.

In 2011, PFOS has been removed from Annex XVII to EU POP (Persistent Organic Pollutants) Regulation (EC) n°207/2011.

PFOA - Restriction in Norway (Product regulation FOR 2004-06-01 Nr. 922, § 2-32)

Table 18 includes CAS numbers and limits.

Test method: CEN/TS 15968

Sources: EU POP (Persistent Organic Pollutants) Regulation (EC) n°207/2011 and Norway Product regulation FOR 2004-06-01.

Table 18 — PFOS, PFOA Bibliography and their CAS number

Name	CAS-No.	Limit
PFOS (Perfluorooctanesulfonic acid)	1763–23–1	- 1 µg/m^2 (coated material) - 0,1 % (semi-finished products or articles, or parts thereof)
PFOA (Perfluorooctanoic acid)	335–67–1	—-1 µg/m^2 (coated material - Norway)

4.13 Dimethylfumarate (DMFu)

4.13.1 General

The chemical dimethylfumarate (DMFu) is a biocide preventing moulds that may deteriorate textile or leather furniture or footwear during storage or transport in a humid climate. DMFu was most often contained in little pouches fixed inside the furniture or added to the footwear boxes. It thus evaporated and impregnated the product, protecting it from moulds.

4.13.2 Why is it a critical substance?

Furniture and footwear available on the market in several Member States have been identified firstly as the cause of damage to the health of consumers in France, Poland, Finland, Sweden and the UK. According to clinical tests the health damage was caused by Dimethylfumarate that affects consumers who are in contact with the products.

DMFu gets through the clothes onto consumers' skin where it causes painful skin contact dermatitis, including itching, irritation, redness, and burns; in some cases, acute respiratory troubles were reported. The dermatitis was particularly difficult to treat. The presence of DMFu is thus a serious risk.

4.13.3 Regulation/Specific test methods

Regulation:

Dimethylfumarate (DMFu) (CAS No 624-49-7) is restricted under the EU REACH Regulation (EC) n°1907/2006, Annex XVII. DMFu shall not be used in articles or any parts thereof in concentrations greater than 0,1 mg/kg. Articles or any parts thereof containing DMFu in concentrations greater than 0,1 mg/kg shall not be placed on the market.

Test method:

CEN ISO/TS 16186.

Limit:

0,1 mg/kg

Source:

European regulation 2009/251/EC: Commission Decision of 17 March 2009 requiring Member States to ensure that products containing the biocide dimethylfumarate are not placed or made available on the market.

4.14 Alkyl phenol ethoxylates (APEO)

4.14.1 General

Alkylphenolethoxylates (APEO) are non-ionic surfactants with a wide range of technical usage. In the textile and leather industry APEO are mainly used as washing active substances (detergents) as well as emulsifiers and dispersive agents for textile and leather auxiliaries.

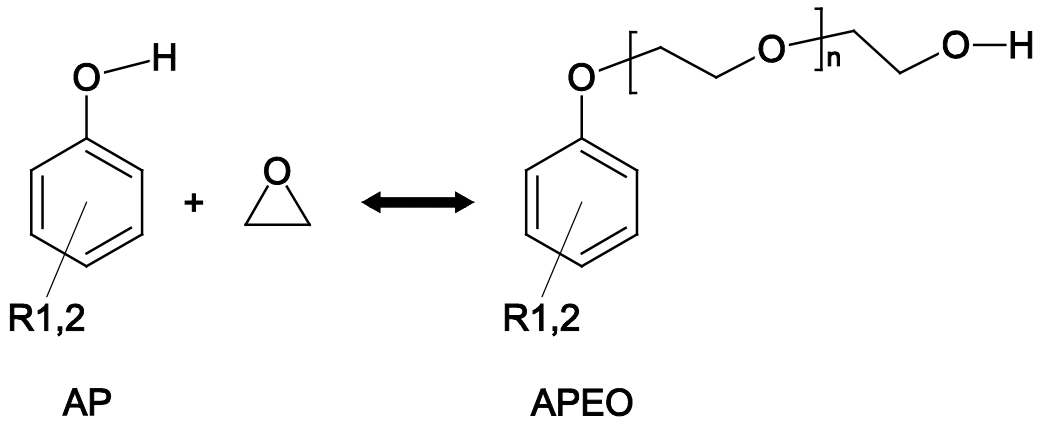

Figure 3 — APEO

APEO are produced in an ethoxylation reaction of alkylphenols (AP) and oxirane with an alkaline catalyst. APEO are always a technical mixture of substances with a varying chain length of the ethoxylate group as well different branched nonyl or octyl chains at the benzene ring.

The mean chain length of the ethoxylate group actuates the functionality of the APEO with different chain length. For instance APEO with a short ethoxylate chain length are insoluble in water, APEO with mean chain

length are fairly soluble in water and can build oil/water emulsions while APEO with a longer ethoxylate chain length have good solubility in water.

A measure for the functionality of APEO and other surfactants is the Hydrophilic Lipophilic Balance factor (HLB).

4.14.2 Why are APEO critical substances?

APEO metabolize back to Alkylphenols (AP) by degradation of the ethoxylate group. The AP are much more toxic to human beings and to aquatic animals than the APEO. The most important AP are the nonylphenols which are members of the POPs (Persistent Organic Pollutants) and are accumulated in aquatic animals like mussels and fish. Nonylphenols are suspected to cause cancer, to have hormonal effects, to cause abnormalizm and to have effect on human fertility. The daily intake of nonylphenols is approximately 7,5 µg/person and nonylphenols have been detected in human breast milk.

Significant amounts of APEO are imported into European countries on ready-made garments from countries where APEO are not restricted.

4.14.3 Regulations/Test methods

Nonylphenol (CAS No 25154-52-3) and Nonylphenol ethoxylates are restricted under the EU REACH Regulation (EC) n°1907/2006, Annex XVII.

Nonyl phenol and nonyl phenol ethoxylates are included in the Candidate list of Substances of Very High Concern (SVHC) of the REACH Regulation. The obligations relating to placing on the market articles containing SVHC substances can be reviewed on ECHA webpages.

NOTE The current entry of Annex XVII to REACH regulation on nonylphenol and its ethoxylates would be expanded to cover textile articles, or textile parts of articles, that can be washed in water.

At the moment, there is a project to standardize a method for APEO testing: prEN ISO 18254.

4.15 Residual solvents

4.15.1 General

Solvents are used in certain areas of textile processing, usually to dissolve a polymeric component. Some solvents have toxic properties and are listed in the European REACH Candidate List of Substances of Very High Concern (SVHC). The main areas of use are in wet spun fibre processing and coatings for textiles.

4.15.2 Why is it critical?

Solvents that have been listed include:

1-Methyl-2-pyrrolidone (CAS No. 872-50-4)

N,N-Dimethylacetamide (CAS No. 127-19-5)

N,N-Dimethylformamide (CAS No 68-12-2)

They are categorised as reprotoxic.

The list of identified substances of very high concern is updated regularly. The current listing can be found at http://echa.europa.eu/candidate-list-table.

4.15.3 Regulations / Specific test method

EU REACH Regulation (EC) n°1907/2006 Candidate List of Substances of Very High Concern (SVHC).

There is no standardized method of analysis for textiles but the general principle is to use thermal desorption of the solvent from the textile material or solvent extraction and subsequent analysis using GC-MS, or, in some cases, GC-MS headspace (with appropriate internal standards).

5 Others

5.1 pH

5.1.1 General

pH of textile products is the resultant of chemical treatments or finishing (including domestic washing), for which the pH solution (basic or acid) is set up in order to optimize the efficiency of the chemical reaction, and then, the solution is neutralized such as the textile products can be available for human skin contact.

If some finishing step fails, the pH neutralization cannot be reached. pH is only measurable from aqueous extraction.

5.1.2 Why is it critical?

Human skin can bear a wide range of pH from acid to basic, although a very acid pH or basic pH can, in some pH sensitive cases, lead to skin irritation.

5.1.3 Regulation/Specific tests method

Based on several regulation (national or regional), the textile parts of the product should have a pH within the range of 4,0 to 7,5 (associated to a direct contact to skin) or 4,0 to 9,0 (associated to without contact to skin). The upper limit could be extended to 10,5 if the textile semi-product will be treated by further wet process).

Sources (non exhaustive list): regulation from China (GB 18401).

Test method: ISO 3071, GB/T 7573 (China, based on ISO 3071).

5.2 Colour fastness in relation to acidic and alkaline perspiration (recommendation for screening)

The colour fastness to acidic and alkaline perspiration of textile parts should

be at least 3-4, both in terms of colour change and of staining.

Test method: EN ISO 105-E04.

5.3 Polycyclic aromatic hydrocarbons (PAH) (screening when strong odour)

5.3.1 General

PAHs (polycyclic aromatic hydrocarbons) are a group of hundreds of chemicals that can be formed during the incomplete combustion of coal, oil, petrol and other organic substances.

They may occur as impurity in leather, rubber, coated or plastic items that contain petrol and hydraulic oils.

NOTE: It is very hard to assess how common the presence of PAH are in various mineral oils and consequently in leather or rubber items.

5.3.2 Why is it critical?

For 15 PAHs, tests on animals have shown carcinogenic properties, the most toxic is Benzo[a]pyrene (BaP).

5.3.3 Regulations / Specific test method

PAHs are regulated in EU REACH Regulation (EC) n°1907/2006, Annex XVII.

Articles shall not be placed on the market for supply to the general public, if any of their rubber or plastic components that come into direct as well as prolonged or short-term repetitive contact with the human skin or the oral cavity, under normal or reasonably foreseeable conditions of use, contain more than 1 mg/kg (0,0001 % by weight of this component) of any of the listed PAHs (benzo(a)pyrene, benzo(e)pyrene, benzo(a)anthracene, chrysen, benzo(b)fluoranthene, benzo(j)fluoranthene, benzo(k)fluoranthene and dibenzo(a, h)anthracene).

Toys, including activity toys, and childcare articles, shall not be placed on the market, if any of their rubber or plastic components that come into direct as well as prolonged or short-term repetitive contact with the human skin or the oral cavity, under normal or reasonably foreseeable conditions of use, contain more than 0,5 mg/kg (0,00005 % by weight of this component) of any of the listed PAHs.

Annex A
(informative)

Risk phrases

R23 Toxic by inhalation
R24 Toxic in contact with skin
R26 Very toxic by inhalation
R27 Very toxic in contact with skin
R28 Very toxic if swallowed
R33 Danger of cumulative effects
R38 Irritating to skin
R40 Limited evidence of carcinogenic effects
R42 May cause sensitization by inhalation
R43 May cause sensitization by skin contact
R45 May cause cancer
R46 May cause heritable genetic damage
R49 May cause cancer by inhalation
R50 Very toxic to aquatic organisms
R51 Toxic to aquatic organisms
R54 Toxic to flora
R55 Toxic to fauna
R60 May impair fertility
R61 May cause harm to the unborn child
R62 Possible risk of impaired fertility
R63 Possible risk of harm to the unborn child
R68 Possible risk of irreversible effects

Annex B
(informative)

Criteria for the identification of persistent, bioaccumulative and toxic substances, and very persistent and very bioaccumulative substances

B.1 General

This annex lays down the criteria for the identification of:

i) persistent, bioaccumulative and toxic substances (PBT-substances), and

ii) very persistent and very bioaccumulative substances (vPvB-substances).

A substance is identified as a PBT substance if it fulfils the criteria in B.2.1, B.2.2 and B.2.3. A substance is identified as a vPvB substance if it fulfils the criteria in B.3.1 and B.3.2. This annex does not apply to inorganic substances, but does apply to organo-metals.

B.2 PBT substances

A substance that fulfils all three of the criteria of the sections below is a PBT substance.

B.2.1 Persistence

A substance fulfils the persistence criterion (P-) when:

— the half-life in marine water is higher than 60 days, or

— the half-life in fresh- or estuarine water is higher than 40 days, or

— the half-life in marine sediment is higher than 180 days, or

— the half-life in fresh- or estuarine water sediment is higher than 120 days, or

— the half-life in soil is higher than 120 days.

The assessment of the persistency in the environment should be based on available half-life data collected under the adequate conditions, which should be described by the registrant.

B.2.2 Bioaccumulation

A substance fulfils the bioaccumulation criterion (B-) when:

— the bioconcentration factor (BCF) is higher than 2000.

The assessment of bioaccumulation should be based on measured data on bioconcentration in aquatic species. Data from freshwater as well as marine water species can be used.

B.2.3 Toxicity

A substance fulfils the toxicity criterion (T-) when:

— the long-term no-observed effect concentration (NOEC) for marine or freshwater organisms is less than 0,01 mg/l, or

— the substance is classified as carcinogenic (category 1 or 2), mutagenic (category 1 or 2), or toxic for reproduction (category 1, 2, or 3), or

— there is other evidence of chronic toxicity, as identified by the classifications: T, R48, or Xn, R48 according to Directive 67/548/EEC.

B.3 vPvB substances

A substance that fulfils the criteria of the sections below is a vPvB substance.

B.3.1 Persistence

A substance fulfils the very persistence criterion (vP-) when:

— the half-life in marine, fresh- or estuarine water is higher than 60 days, or

— the half-life in marine, fresh- or estuarine water sediment is higher than 180 days, or

— the half-life in soil is higher than 180.

B.3.2 Bioaccumulation

A substance fulfils the very bioaccumulative criterion (vB-) when:

— the bioconcentration factor is greater than 5000.

Source: EU Regulation (EC) n°253/2011 of 15 March 2011 amending EU REACH Regulation (EC) n°1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annex XIII Text with EEA relevance.

(http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32011R0253:EN:NOT)

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[5] UNI 11057:2003, *Tessili - Prove chimiche - Determinazione del pentaclorofenolo - tetraclorofenolo e relativi sali ed esteri nei tessili*

Documents related to heavy metals

[6] EN 71-3:2013, *Safety of toys — Part 3: Migration of certain elements*

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[8] DIN 54233-2:2014, *Testing of textiles - Determination of metals - Part 2: Determination of metals extracting by hydrochloric acid*

[9] DIN 54233-3:2010, *Testing of textiles - Determination of metals - Part 3: Determination of metals extracting by acid synthetic perspiration solution*

[10] DIN 54233-4:2014, *Testing of textiles - Determination of metals - Part 4: Determination of metals extracting by synthetic salivary solution*

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[13] EN 1811:2011, *Reference test method for release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin*

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