

Draft guideline on the scope of restriction entry 50 of Annex XV to REACH: Polycyclic organic hydrocarbons in articles supplied to the general public

This document aims to assist producers, importers and distributors of articles, as well as Member States' competent and enforcement authorities, in understanding and complying with their obligations under the REACH Regulation. However, readers are reminded that only the Court of Justice of the European Union is entitled to interpret EU law with legally binding authority. Usage of the information remains under the sole responsibility of the user. The European Chemicals Agency does not accept any liability with regard to the use that may be made of the information contained in this document.

1. Introduction

The placing on the market for supply to the general public of articles containing polycyclic aromatic hydrocarbons (PAHs) is restricted by entry 50 of Annex XVII to REACH Regulation (EC) No 1907/2006, paragraphs 5 and 6. The restriction applies to articles placed on the market for supply to the general public, if any of the articles' rubber or plastic components that come into direct as well as prolonged contact or short-term repetitive contact with 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 8 PAHs¹ that are identified in Column 1 of the entry.

The entry includes a non-exhaustive list of types of articles falling within the scope of the restriction:

- Sport equipment such as bicycles, golf clubs, racquets,
- Household utensils, trolleys, walking frames,
- Tools for domestic use,
- Clothing, footwear, gloves and sportswear,
- Watch-straps, wrist-bands, masks, head-bands.

The restriction entry covers also toys, including activity toys, and childcare articles², in the same way but with a concentration limit of 0.5 mg/kg. The reason behind the lower concentration limit is that children may be more affected by exposure to PAHs.

The restriction does not apply to articles placed on the market for the first time before 27 December 2015.

ECHA was requested by the European Commission on 13 October 2014 to develop a practical guideline with non-exhaustive lists of articles and subtypes within and outside the scope of the restriction.

In order to prepare the guideline, ECHA launched a targeted consultation from February to April

¹ Benzo[a]pyrene (BaP) – CAS No 50-32-8, Benzo[e]pyrene (BeP) – CAS No 192-97-2, Benzo[a]anthracene (BaA) – CAS No 56-55-3, Chrysen (CHR) – CAS No 218-01-9, Benzo[b]fluoranthene (BbFA) – CAS No 205-99-2, Benzo[j]fluoranthene (BjFA) – CAS No 205-82-3, Benzo[k]fluoranthene (BkFA) – CAS No 207-08-9 and Dibenzo[a,h]anthracene (DBA[hA]) – CAS No 53-70-3
[See ECHA's Q&As 669, 670 and 671]

² See ECHA's Q&As No 982 and No 983 (see: [Q&As - ECHA](#)) for more information about the meaning of toys and childcare articles in the context of Annex XVII entries

2015 where stakeholders were contacted and requested to respond to a survey regarding types and sub-types of articles that may fall within the scope of the restriction. In addition, respondents were asked to provide information about the types and sub-types of articles that may not fall within the scope of the restriction, with justifications. Responses were received from several stakeholders.³

This guideline is based on information collected through the above survey, the Annex XV restriction report submitted by Germany to the Commission in 2010⁴, and a previous consultation on PAHs organised by the European Commission. It does not provide exhaustive lists of all the potential articles that could be in the scope of the restriction but rather gives indicative lists of concrete examples that have been identified during the interaction with different stakeholders.⁵

The target audience of this guideline is producers, importers and distributors of these types of articles as well as national enforcement authorities of EU Member States. The purpose is to ensure a common understanding of the scope and effective implementation of the restriction.

2. Scope

Descriptions of the main elements of the restriction are provided below.

2.1. Placed on the market for supply to the general public

In a note to CARACAL, the Commission presented its interpretation of the phrase "placed on the market for supply to the general public". The interpretation of this phrase was needed in order to determine whether the restriction in entry 50(5) covers tiles/mats used in public playgrounds and synthetic turf used on artificial sports fields. Nevertheless, the interpretation would also apply to other articles in the public domain.

According to the Commission, entry 50(5) of Annex XVII REACH that reads "*Articles shall not be placed on the market for supply to the general public, if any . . .*" should be interpreted in such a way that tiles/mats used in public playgrounds are supplied to the general public when they are put at the disposal of the general public. The same applies to synthetic turf used on artificial sports fields when they are put at the disposal of the general public, notwithstanding the type of ownership (public or private) or the specific type of transaction by which the objects were put at the disposal of the general public.

In its note, the Commission further stated that tiles/mats that are attached to the ground or the building do not cease to be an article by mere attachment, assembly or by joining with other objects into a complex product. They could cease to be an article only if they no longer retain their shape, surface or design, or when they become waste.

2.2. Rubber and plastic components

As outlined in the Annex XV restriction report submitted by Germany to the Commission (2010), and information provided by stakeholders, PAHs in consumer products (including toys) may originate from the following sources:

³ E.g. Japan Electronics and Information Technology Industries Association (JEITA), European Tyre & Rubber Manufacturers' Association (ETRMA), Union des Industries Textiles, and European Tool Committee (CEO)

⁴ See: <http://www.reach-clp-biozid-helpdesk.de/de/REACH/Zulassung-Beschaenkung/Beschaenkung/Vorschlaege/Deutsche-Vorschlaege-zur-Beschaenkung.html>

⁵ In case an article falls under the scope of other legislation as well (e.g. toys under the Toy Safety Directive (Directive 2009/48/EC)) both legislative measures apply to this article.

- use of mineral oil- or coal-based extender/plasticiser oils in the production of rubber and plastics; oils may (unintentionally) contain different concentrations of PAHs and are added to materials to achieve the desired material properties,
- carbon black (soot), which is intentionally added to elastomers to achieve the required properties of the material (e.g. colour, flexibility, damping, solubility in the polymer matrix)

PAHs may be present in articles produced from materials containing either of these. PAHs in articles supplied to the general public may also originate from recycled rubber (e.g. recycled tyres) or plastic containing any of the above materials.

PAHs are typically found in certain elastomer/rubber materials, but potentially also in plastic materials, lacquers/varnishes, or coatings (e.g. plastic coating made of synthetic organic polymers) that may be encountered in or as part of consumer products, including toys.

The materials in articles or components of articles most likely affected by this restriction are rubber surfaces and soft or dark plastic surfaces.

The use of any of the sources indicated above in the production of the rubber or plastic components of an article can be therefore an indication of the presence of PAHs.

2.3. Direct as well as prolonged contact or short-term repetitive contact with human skin or the oral cavity

Direct contact with human skin or the oral cavity

When assessing whether articles or rubber or plastic components come into direct contact with human skin or the oral cavity, attention should be given to surfaces of the article (or parts of article) that are touched or are in touch with the skin.

It is not possible to develop an exhaustive list of all the articles that may fulfil the criterion of direct contact with human skin or the oral cavity. However, examples of articles which fall under this definition were received from the stakeholders and include masks, balloons, bracelets, handles, grips, hand tools, gloves and diving suits.

Prolonged contact with human skin or the oral cavity

There was not enough scientific evidence to enable the restriction entry to define "prolonged" contact.⁶ For the purposes of this guideline, prolonged contact is understood as an extended duration of contact, for example from carrying an article, sitting on it, leaning towards it, holding on to it, wearing it or keeping in the mouth for an extended and uninterrupted length of time.

Examples of articles that come into prolonged contact with human skin or the oral cavity include carrying handles of mobile devices, hand tools (such as the holding area of hammers or screwdrivers), masks, bracelets, gloves, diving suits, video game consoles, cases for portable and mobile units (e.g. camera, notebooks), cigarette lighters, whistles, tweezers, ear plugs or headphones, teething rings, tooth brushes and rubber lips.

⁶ According to the PAH guidance document AfPS GS 2014:01 PAK of the German quality label "Geprüfte Sicherheit" (GS; tested for safety), long-term contact would be "continuous contact for 30 seconds or longer". It should be noted that the certification under the German GS quality label is voluntary and that this definition has not been used in the preparation of this guideline and the indicative list of articles that may be within the scope of this restriction.

Short-term repetitive contact with the human skin or the oral cavity

Similarly to the criterion of prolonged contact, there was insufficient scientific evidence, in terms of relating migration of PAHs from articles to doses received after a certain period of contact with those articles, to enable the restriction entry to define "short-term repetitive contact".⁷ For the purposes of this guideline, short-term repetitive contact is understood as brief acts of contact repeated several times over a relatively short period of time.

Examples of articles that could come into short-term repetitive contact with human skin or the oral cavity include frisbees, shuttlecocks, key caps, holding devices on domestic appliances (such as blenders or coffee machines), measuring tapes, the buttons on certain kinds of devices (such as handheld game consoles), balloons and thermos bottles.

2.4. Normal and reasonably foreseeable conditions of use

For the purposes of this guideline, interpretations of the terms are provided by the ECHA Guidance on Requirements for Substances in Articles⁸, where it is noted:

- (i) "Normal conditions of use" means the conditions associated with the main function of an article". It is explicitly not a "normal condition of use" if the user of an article uses an article in a situation or manner that the supplier of the article has clearly recommended to avoid, e.g. in the instructions or on the label of the article.
- (ii) "Reasonably foreseeable conditions of use" means conditions of use that can be anticipated as likely to occur because of the function and appearance of the article (even though they are not normal conditions of use). That would cover use by children to the extent that the use can be considered likely to occur because of the function and appearance of the article. For example, when a small child does not know the function of an article but uses it for any purpose he associates with it, such as biting or licking it.

The notion of "normal conditions of use" is largely unproblematic. Most difficulties in interpretation will involve consideration of the "reasonably foreseeable conditions of use". An assessment must be made on a case by case basis by considering the nature and function of the article.

2.5. Concentrations of PAHs in articles

The restriction entry provides concentration limits for PAHs. For articles 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, the concentration limit is 1 mg/kg (0,0001 % by weight of this component) of any of the listed PAHs. Concentrations above this limit are not allowed. For toys, including activity toys, and childcare articles the corresponding concentration limit is 0,5 mg/kg (0,00005 %).

The entry requires the Commission to review the limit values in the light of new scientific information, including migration of PAHs from the articles referred in the restriction, and

⁷ According to the PAH guidance document AfPS GS 2014:01 PAK of the German quality label "Geprüfte Sicherheit" (GS; tested for safety), short-term repetitive contact would be "repetitive contact for periods less than 30 seconds". It should be noted that the certification under the German GS quality label is voluntary and that this definition has not been used in the preparation of this guideline and the indicative list of articles that may be within the scope of this restriction.

⁸ ECHA Guidance on Requirements for Substances in Articles (2011):
http://echa.europa.eu/documents/10162/13632/articles_en.pdf

information on alternative raw materials by 27 December 2017.

3. Indicative lists of examples of articles that fall within or outside the scope of this restriction

The following figure presents a “stepwise approach” for assessing whether an article is within or outside the scope of the restriction on a case-by-case basis.

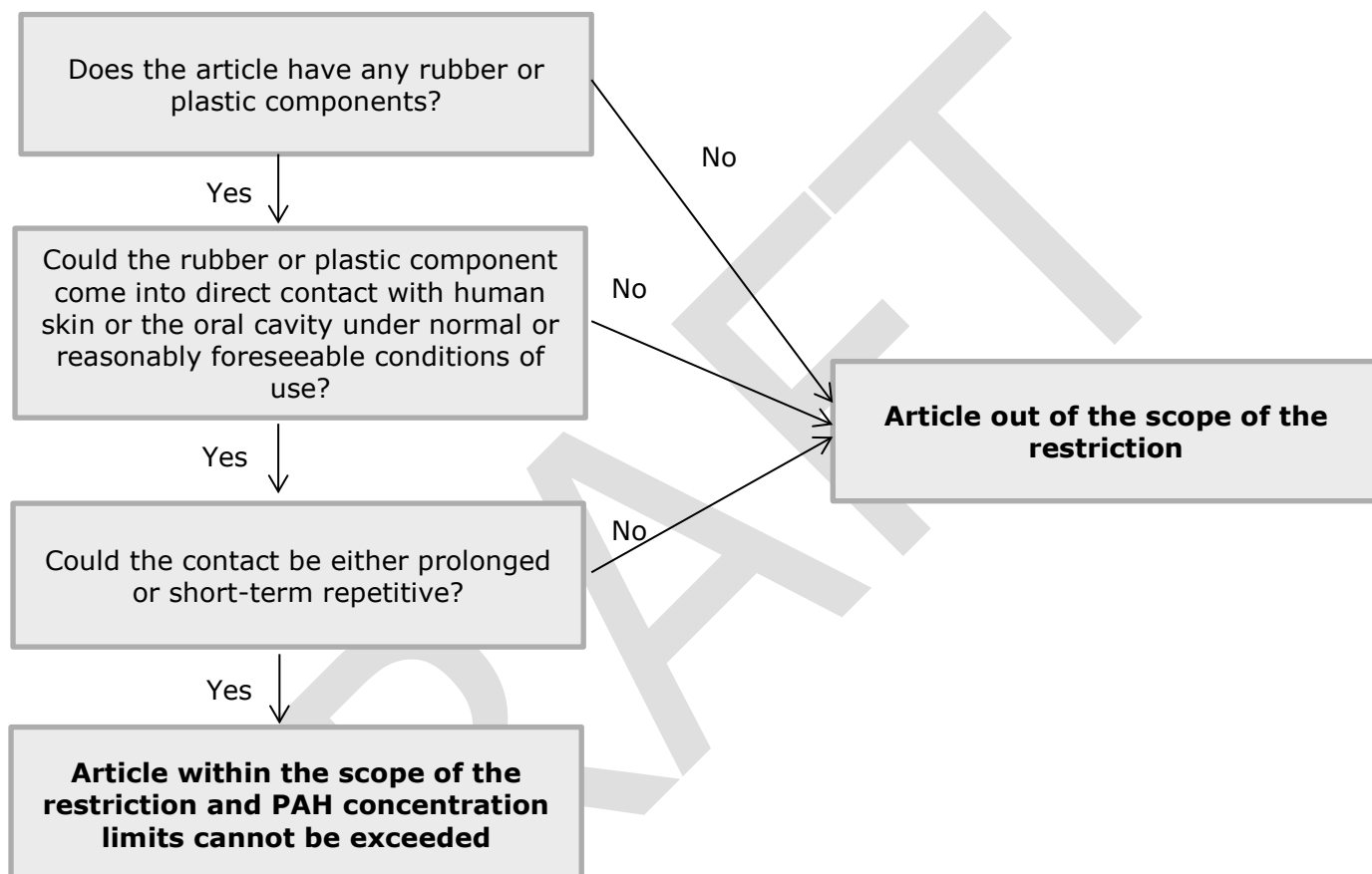


Figure 1. Steps to assess whether articles are within the scope of the restriction

3.1. Examples of articles within the scope of the restriction (Annex 1)

The restriction entry includes a non-exhaustive list of types of articles falling within its scope:

- Sport equipment such as bicycles, golf clubs, racquets,
- Household utensils, trolleys, walking frames,
- Tools for domestic use,
- Clothing, footwear, gloves and sportswear,
- Watch-straps, wrist-bands, masks, head-bands.

The restriction entry covers also toys, including activity toys, and childcare articles, with a lower concentration limit than for the above mentioned articles (see Table 1G for examples of toys and childcare articles).

Based on the non-exhaustive list in the entry, Annex I covers also subtypes and similar types of articles and explains which components may come into direct and prolonged or short-term repetitive contact with the human skin or oral cavity.

3.2. Examples of articles excluded from the scope (Annex 2)

There are a few groups of articles that can be considered to be excluded from the scope since no contact with the skin in the terms of the entry is foreseen.

Inaccessible or internal components

Inaccessible or internal components, which cannot be accessed during normal use or which only become accessible as a result of dismantling or destruction, can be considered not to come into direct and prolonged or short-term repetitive contact with the human skin or oral cavity. In relation to toys, including activity toys, and childcare articles, accessibility can be assessed following the definition and method laid down in the European Standard on the safety of toys, EN 71-1⁹.

Examples of these include electronic components, cables and other internal parts of household appliances, tools, toys, childcare articles (e.g. exposure to internal cables due to destruction of toy is excluded from the scope) and of IT devices.

Components that are only accessed during simple maintenance or upgrading work

Components that are rarely and only briefly accessed during simple maintenance or upgrading work by the user can be considered not to come into direct and prolonged or short-term repetitive contact with the human skin or oral cavity. This also applies to components that can no longer be touched by the consumer after installation.

Examples include printer cartridges, batteries and battery compartments, parts of lamps that are only touched when bulbs have to be exchanged, the undersides, rear sides, seals and feet of household appliances.

Articles or components in short and infrequent contact with the skin or oral cavity

Articles or components which are only in short and infrequent contact with the skin or oral cavity can be considered excluded from the scope of the restriction.

Examples include plugs, cable sheathings, bicycle tyres, lamp and power switches that are only expected to be in short and infrequent contact with the skin. However, note that buttons that are expected to be in short and repetitive contact with the skin (such as the buttons of video game consoles) are within the scope of this restriction.

⁹ EN 71-1: European standards within the field of safety of toys on mechanical and physical properties (http://standards.cen.eu/dyn/www/?p=204:110:0:::FSP_PROJECT:41917&cs=105249A5D7F7CDB15454E2D00F0786F71)

ANNEX 1 Indicative list of examples of articles within the scope of this restriction¹⁰

It should be noted that some of the listed examples could be mentioned in several product groups but for clarity have only been mentioned in one of the tables below. Also note that this is not an exhaustive list but rather an indication of possible examples.

Table 1A – Sport equipment	
Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Bicycles, kick scooters for sports	Horn, grips and seat
Golf clubs	Handle
Racquets	Handle
Training equipment, such as steppers, training bicycles and rowing machines	Handles and seat
Gymnastics bands	Handles
Helmets, knee and elbow protectors, and protectors for the mouth used by boxers and in other contact sports	Whole articles
Dumb-bell sets	Handle
Frisbees	Whole articles
Boxing gloves	Whole articles
Shuttlecocks	Whole articles
Golf bags	Whole articles
Yoga / stretching mats	Whole article
Gym / stretching balls	Whole article
Surf boards	Handle and the laying area
Swimming aids	Whole articles
Billiard, pool and snooker accessories	Cue grips
Sports balls (balls intended for children are listed)	Whole article

¹⁰ *Some of the products listed this Annex may contain inaccessible or internal components which do not come into contact with the skin or oral cavity as described in section 3.2*

in Table 1G)	
Kayaks, canoes and similar light boats	Inside parts, e.g. spray skirt, cockpit lining, hip and knee bracers, sitting area
Stand up paddling boards	Standing and sitting area
Paddles	Handle
Swimming belts, shoes and gloves	Whole articles
Snorkelling equipment, goggles and diving glasses (for children, see Table 1G)	Whole articles
Fishing and shooting equipment	Handle and grip area
Ski goggles	Whole article
Hand-operated air pumps, e.g. for bike or swimming aids	Handle and grip area
Carpet pile used in synthetic turf used on artificial sports fields (for artificial grass used for other purposes, please see Table 1F) ¹¹	Whole article

¹¹ The synthetic turf carpet comprises: carpet pile (part of the synthetic turf carpet), primary and secondary backings (the base of the synthetic turf carpet). In addition, a synthetic turf sport surface contains performance infill, stabilising infill and shockpad (optional) beneath the synthetic turf carpet. (See picture (r) in Annex 3).

Table 1B – Household utensils, trolleys, walking frames

Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Cookware and cooking utensils, such as turners, ladles, whisks, cutlery, sauce pans, frying pans, trays	Handle and holding area
Domestic appliances, such as blenders, water boilers, citrus presses, coffee machines	Handle and holding area
Trolleys and trolley bags	Handles
Hand and shoulder bags	Whole articles
Walking frames (for children, see Table 1G)	Handles
Cleaning tools (such as window wipers, vacuum cleaners, cleaning brushes)	Handle / holding area
Handheld game consoles	Holding area and buttons
PC keyboards	Whole articles (external parts)
PC mice	Whole articles (external parts)
Mouse pads	Whole articles
Desk pads	Whole articles
TV/audio-visual remote controls	Buttons and outer case
Mobile and portable devices, such as notebook- and tablet computers, mobile phones, smartphones, cameras, e-readers, dictation machines or pocket calculators	Buttons and outer case
Cases of mobile and portable devices, such as notebook and tablet computers, smartphones or cameras	Whole articles
Torches, flashlights	Handle / holding area
Furniture, such as chairs, or tables (not book shelves)	Seats, handles, back rest, table top
Thermos bottles	Holding and drinking area
Plastic mugs	Holding and drinking area
Plastic utensils	Whole articles

Walking sticks and crutches	Handle
Shower handles	Grip
Table cloths and mats	Whole articles
Plastic drinking bottles	Whole articles

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Table 1C – Tools for domestic use	
Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Tools, such as hammers, screwdrivers, knives, pliers, spanners	Handle / grip area
Gardening tools and equipment, such as shovels, spades, hoses, watering cans, wheelbarrows, lawnmowers and grass-cutters	Handle / grip area
Handheld electrical tools, such as power drills	Handle / grip area
Measuring tapes	Whole articles
Scissors	Handles
Thimbles	Whole article

Table 1D – Clothing, footwear, gloves and sportswear

Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Sandals	Whole articles, apart from underside
Flip-flops	Whole articles, apart from underside
Shoes	Whole articles, apart from underside
Rubber boots	Whole articles, apart from underside
Clogs	Whole articles, apart from underside
Gloves (including protective gloves)	Whole articles
Underwear	Whole articles
All types of corsetry articles	Whole articles
Prints of T-Shirts and other clothing	Whole articles
Weather protection garments, such as jackets, pants and hats	Whole articles
Fishing pants	Whole articles
Wet suits	Whole articles
Flippers / fins	Area in contact with the skin
Hats	Whole articles
Rucksacks	Handles and belts, as well as area in contact with back and shoulders
Protection clothing, such as knee or elbow covers, hearing protections	Whole articles
Socks	Whole article

Table 1E – Watch-straps, wrist-bands, masks, head-bands (including similar type of articles)	
Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Watch-straps	Whole articles
Wrist-bands	Whole articles
Activity trackers	Whole articles
Bracelets	Whole articles
Masks, rubber lips and other masquerade items with close skin contact (apart from masquerade items intended for children, as these are listed in Table 1G)	Whole articles
Headbands	Whole articles
Mobile audio devices, such as headphones	Whole articles
Earplugs	Whole articles
Sunglasses	Whole articles
Hair slides, hairgrips, hair clasps	Whole articles
Head torches	Whole articles
Pulse monitors	Whole articles
Eye cups	Whole articles
Sex articles	Whole articles
Whistles	Whole articles
Musical instruments	Handles, plastics cases, mouthpieces, buttons, guitar cords, keys
Tooth brushes	Whole articles
Fever thermometers	Outer parts
Domestic blood-pressure meters	Strap, cuff and bulb
Combs, brushes	Whole articles
Stress balls	Whole articles

Table 1F – Miscellaneous articles similar to the categories described in the restriction entry and thus covered by the entry	
Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Writing instruments (colouring and painting articles for children are listed in Table 1G)	Holding area
Colouring and painting articles for artistic use (colouring and painting articles for children are listed in Table 1G)	Holding area
Manicure/pedicure tools, such as nail files	Whole articles
Tweezers	Whole articles
Eyelash curlers	Whole articles
Shavers	Grip
Vehicles (e.g. car, boat or scooter)	Grips, upholstery of seats, seat belt, gear stick and steering wheel
Needles, including knitting needles	Whole articles
Hair dryers, straighteners and curlers	Handle / holding area
Cigarette lighters	Outer case
Erasers (erasers intended for children are listed in Table 1G)	Whole article
Pocket articles, such as cosmetics or powder boxes (pocket articles intended for children are listed in Table 1G)	Outer case
Hearing aids	Outside area
Rubber bands	Whole article
Textiles (e.g. polyesters, polyamides or other synthetic organic polymers) and fibers (e.g. thread and yarn), such as making clothing, table cloths or other items in this Annex	Whole article
Carpet pile used in artificial grass used e.g. by the pool	Whole article
Tiles/mats used in playgrounds (including public playgrounds), sport fields and other public areas	Whole articles

Furniture in public areas (e.g. hospitals, public transport, playgrounds)	Seats, handles, back rest, table top
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Table 1G – Toys and childcare articles*Note the lower concentration limit for this category*

Articles	Articles/components of articles which may be in direct as well as prolonged or short-term repetitive contact with the skin/oral cavity
Balls intended for children (sports balls are listed in Table 1A)	Whole article
Plastic or rubber figurines	Whole articles
Loom bands and charms	Whole articles
Toy cars and trains	Outside and accessible inside
Run bikes and toy scooters	Whole articles
Colouring and painting articles for children	Whole articles
Erasers intended for children	Whole articles
Pocket articles intended for children, such as toy cosmetics	Whole articles
Toy guns	Whole articles
Rubber balloons	Whole articles
Dolls (apart from dolls for collectors bearing the requisite marking)	Whole articles
Baby walkers / walking frames (for adults, see Table 1B)	Whole articles
Stationary walkers	Whole articles
Paddling pools for play	Whole articles apart from underside
Bath toys	Whole articles
Buggies, prams, baby carriages, pushchairs and strollers	Whole articles, apart from wheels, tyres and underside
Teething rings	Whole articles
Changing pads	Whole articles
Cots, cribs, pillows and mattresses	Whole articles
Carrying slings	Whole articles

Breast-feeding pillows	Whole articles
Trampolines	Whole articles
Swings	Whole articles
Slides and climbing frames	Whole articles
Non-aquatic inflatable toys	Whole articles
Toy musical instruments, such as trumpets, blows, shakes, maracas, guitars, flutes and tambourines	Whole articles
Slinky	Whole articles
Snorkelling equipment, goggles and diving glasses for children (for adults, see Table 1A)	Whole articles

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ANNEX 2 Indicative list of examples of articles outside the scope of this restriction

It should be noted that plastic and rubber articles not placed on the market for the general public (i.e. placed on the market exclusively for industry, as well as exclusively for professional use), are out of the scope of this restriction.

Table 2A – Inaccessible or internal components

Electronic components, internal cables and other internal articles of household appliances, tools, IT devices and consumables supplied to the general public
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Table 2B – Components that are only accessed during simple maintenance or upgrading work

Printer cartridges
Batteries and battery compartments
Parts of lamps that are only touched when bulbs have to be exchanged
The undersides, rear sides, seals and feet of household devices

Table 2C – Articles or components in short and infrequent contact with the skin or oral cavity

Light switches
Power switches of different devices (e.g. coffee machine, radio, TV)
Plugs
Cable sheathings
Bicycle tyres

ANNEX 3 Pictures¹² of certain articles that are within the scope of the restriction

- (a) Picture of bicycle (horn, grips and seat)



- (b) Picture of training bicycles (handles and seat)



- (c) Picture of fishing equipment (handle / grip area)



¹² Images were provided by the following source: by Fotolia (2015) except picture (r) by European Synthetic Turf Association

(d) Picture of walking frame (handles)



(e) Picture of TV/audio-visual remote control (buttons and outer case)



(f) Picture of tool (handle / grip area)



- (g) Picture of flippers/fins (area in contact with the skin)



- (h) Picture of watch (watch-strap, side of the sphere in contact with the skin and wheel button)



- (i) Picture of mask (whole article)



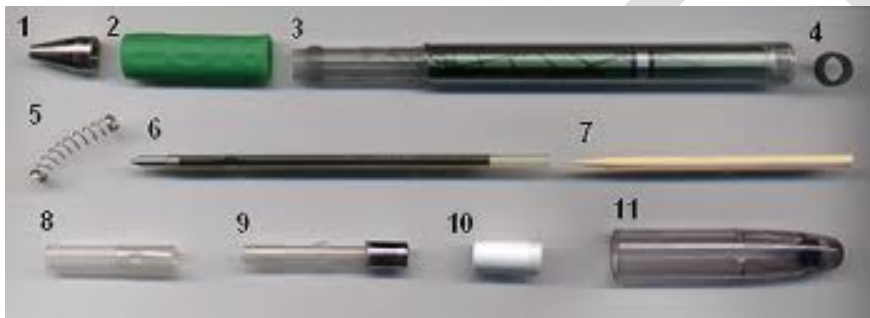
- (j) Picture of whistle (whole article)



- (k) Picture of musical instrument (whole article)



- (l) Picture of writing instruments (holding area: 2, 3 and 11)



- (m) Picture of gear stick (whole articles)



(n) Picture of powder box (puter case)



(o) Picture of run bike (whole articles)



(p) Picture of baby walker / walking frame (whole article)



(q) Picture of colouring and painting articles for children (whole article)



(r) Picture of synthetic turf (carpet pile, note that infill material is a mixture)

