A Little Story about a Fashionable Lie

Hazardous chemicals in luxury branded clothing for children

GREENPEACE

Contents

Acknowledgements:
We would like to thank the following people who contributed to the creation of this report. If we have forgotten anyone, they know that our gratitude is also extended to them.

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Terminology used in this report

Bioaccumulation: The mechanism by which chemicals accumulate in living organisms and get passed along the food chain.

Hormone disruptors: Chemicals known to interfere with hormone systems of organisms. For nonylphenol, the most widely recognised hazard is the ability to mimic natural oestrogen hormones. This can lead to altered sexual development in some organisms, most notably the feminisation of fish*.

Persistence: The property of a chemical whereby it does not degrade in the environment, or degrades very slowly.

Plastisol: A suspension of plastic particles, commonly PVC or EVA, in a plasticiser. Used as ink for screen-printing images and logos onto textiles.

Surfactants: Chemicals used to lower the surface tension of liquids. They include wetting agents, detergents, emulsifiers, foaming agents and dispersants used in a variety of industrial and consumer applications including textile manufacture.

**Jobling S, Reynolds T, White R, Parker MG & Sumpter JP (1995). A variety of environmentally persistent chemicals, including some phthalate plasticisers, are weakly estrogenic. Environmental Health Perspectives 103(6): 582-587; Jobling S, Sheahan D, Osborne JA, Matthiessen P & Sumpter JP (1996). Inhibition of testicular growth in rainbow trout (Oncorhynchus mykiss) exposed to estrogenic alkylphenolic chemicals. Environmental Toxicology and Chemistry 15(2): 194-202*

Note to the reader

Global South and Global North

The term "Global South" is used to describe developing and emerging countries, including those facing the challenges of often-rapid industrial development or industrial restructuring, such as Russia. Most of the Global South is located in South and Central America, Asia and Africa. The term "Global North" is used for developed countries, predominantly located in North America and Europe, with high human development, according to the UN Human Development Index.* Most, but not all, of these countries are located in the northern hemisphere.

** United Nations Development Programme (UNDP). (2005). Human Development Report 2005. International cooperation at a crossroads. Aid, trade and security in an unequal world. Available at: http://hdr.undp.org/en/media/HDR05_complete.pdf*

Executive Summary

A new investigation by Greenpeace International has found a broad range of hazardous chemicals in children's clothing and footwear produced by eight luxury fashion brands.

The study follows on from several previous investigations published by Greenpeace as part of its Detox campaign, which identified that hazardous chemicals are present in textile and leather products as a result of their use during manufacture.[1] It confirms that the use of hazardous chemicals is still widespread – even during the manufacture of the most expensive luxury textile articles for children.

This is the first study done by Greenpeace where the products were all manufactured by major luxury brands. The eight fashion brands represented are: **Dior, Dolce & Gabbana, Giorgio Armani, Hermès, Louis Vuitton, Marc Jacobs, Trussardi** and **Versace**.

The 27 products were predominantly clothing articles, including one swimwear article, as well as four items of footwear. They were purchased between May and June 2013 from the flagship stores of the clothing brands investigated, or from other stores authorised to sell the branded products. The majority were bought in Italy (11 products) and France (four), followed by China (three), Hong Kong, Russia and Switzerland (two from each) and Denmark, Taiwan and the UK (one from each).

The products were also predominantly made in Italy (10 products), followed by China (four), Morocco (three), Turkey (two) and Hungary, India and Thailand (one in each). For five products – two by Dior, two by Trussardi and one by Hermès – the country of manufacture was not stated on the labelling, showing a lack of transparency on the part of the brands concerned. Also notable is the number of products manufactured in Europe, compared to previous studies where China and other developing countries have predominated, though this pattern may not be representative of luxury textile products in general.

The products were sent to the Greenpeace Research Laboratories at the University of Exeter in the UK, from where they were dispatched to independent accredited laboratories.[2] All products were investigated for the presence of nonylphenol ethoxylates (NPEs); certain products were also analysed for phthalates, per/poly-fluorinated chemicals (PFCs), or antimony, where the analysis was relevant for the type of product.[3] The analysis for antimony was carried out at the Greenpeace Research Laboratories.

Sixteen of the 27 products (59%) tested positive for one or more of these hazardous chemicals; these were nonylphenol ethoxylates (NPEs), phthalates, per- or polyfluorinated chemicals, and antimony. Examples of these residues were found in products from **all of the brands** represented in the study apart from **Trussardi**,[4] although it is not possible to draw any conclusions about Trussardi's use of hazardous chemicals on the basis of such a small sample.

In addition, seven out of the 12 products contaminated with NPE were labelled "**Made in Italy**", with four of these articles (TX13039, TX13078, TX13076, TX13078) containing higher concentrations. The presence of NPEs in the finished articles indicates that NPEs were used during their manufacture. The use of formulations containing more than 0.1% NPEs by industry has been restricted in the EU since 2005.[5] The fact that NPEs were detected at the levels found could mean that the formulations used during manufacturing contained NPEs at levels higher than 0.1%, especially for those articles with the higher concentrations of NPEs. It is possible that the "made in" Europe label does not refer to all parts of the manufacturing process, such as wet processing; this shows that buying products labelled as "made in" Europe does not necessarily guarantee the total manufacture of a product within Europe, under more stringent regulations.

Key findings

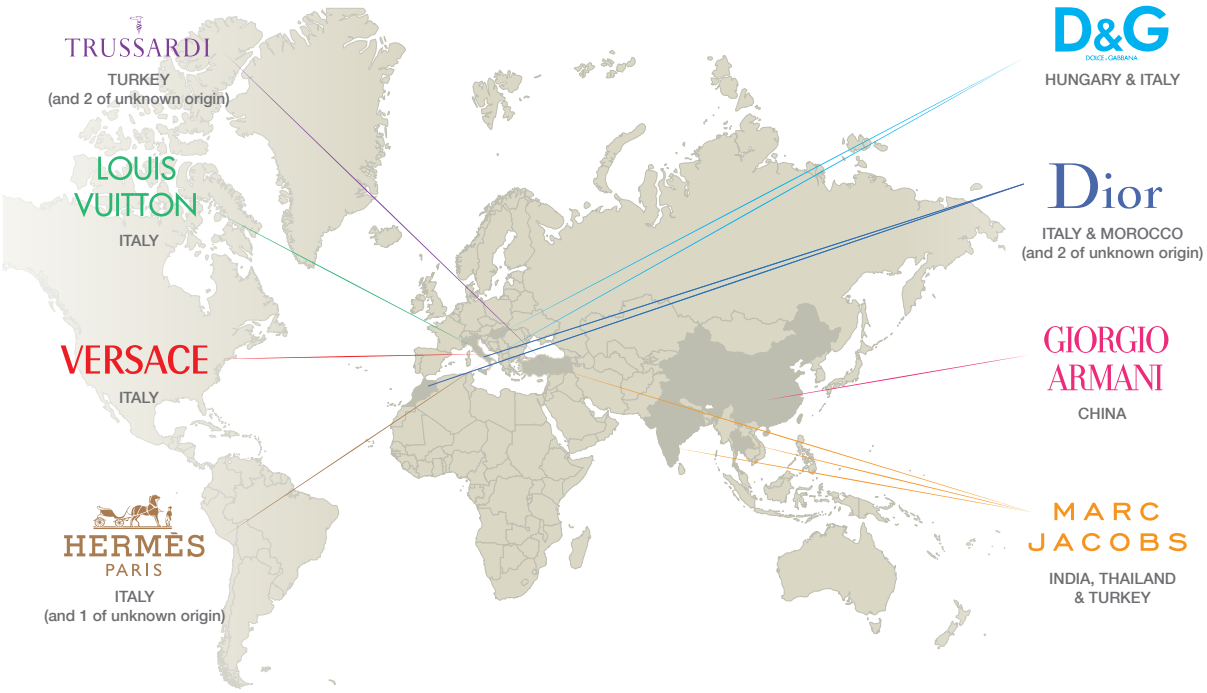
- The highest concentration of NPEs (760 mg/kg) was detected in a **Louis Vuitton** branded ballerina shoe manufactured in Italy and sold in Switzerland.
- Three of the **Dior** products – a t-shirt, a polo shirt, and a knitted top – contained concentrations of 560, 460 and 400 mg/kg NPE respectively.
- Similar concentrations of NPEs were found in baby booties by **Hermès** (380 mg/kg) and suede trainers by **Louis Vuitton** (100 mg/kg).
- Volatile PFCs were found in two of five articles tested for PFCs, with the highest total concentration found in a **Versace** waterproof jacket (374 μg/kg).
- Ionic PFCs were detected in all 5 articles tested for PFCs, two of which were by **Louis Vuitton**, with one product each by **Dior**, **Giorgio Armani** and **Versace**.
- The highest concentration of ionic PFCs was found in the **Louis Vuitton** ballerina shoes (16.9 μg/kg total ionic PFCs, 31 μg/kg total volatile PFCs). The shoes were also one of the two products found to contain volatile PFCs.
- Among the ionic PFCs, PFOA – which will be restricted in textiles in Norway by June 2014 – was also found in the **Versace** waterproof jacket and **Louis Vuitton** ballerina shoes, although in both cases at concentrations below the Norwegian limit. The predominant volatile PFC found in the Versace jacket also gives rise to additional PFOA.
- Phthalates were found in plastisol printed fabric for all of the articles tested, which were two products by **Dior**, one by **Dolce & Gabbana**, and two by **Marc Jacobs**.
- Antimony was also detected in all three of the articles analysed that contained polyester, from **Dolce & Gabbana**, **Giorgio Armani** and **Versace**.

Table 1: Concentrations of NPEs, phthalates, ionic PFCs, volatile PFCs and antimony in all articles tested[6]

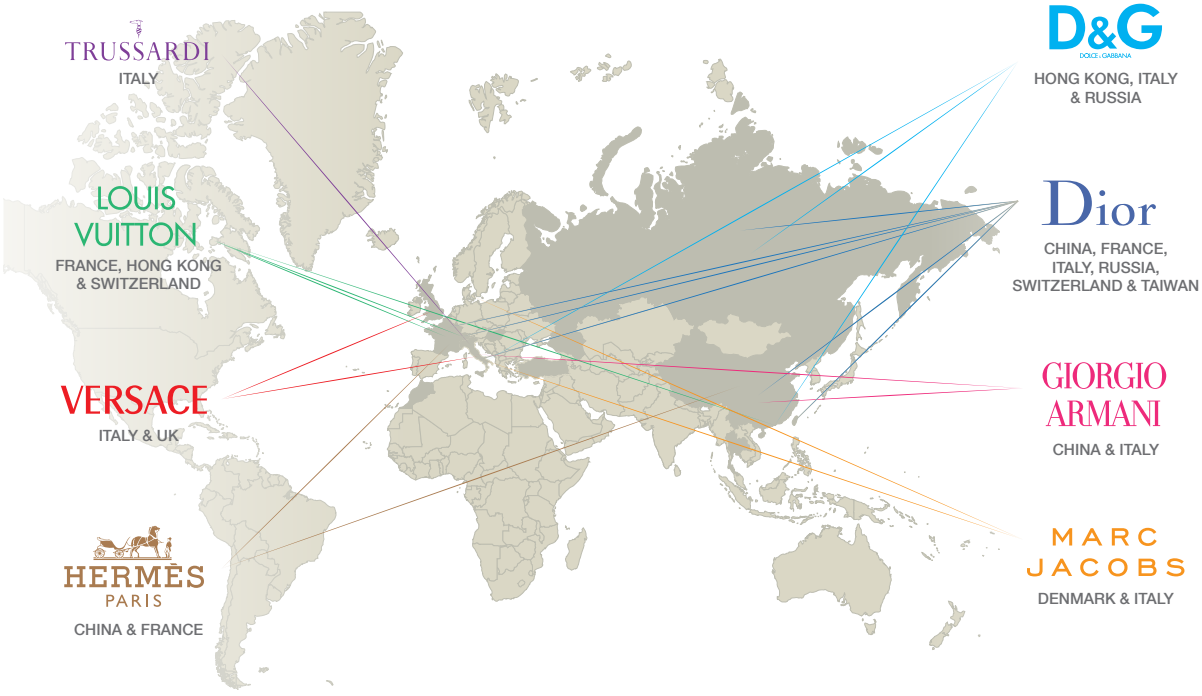
Brand	Type of product	NPEs (mg/kg)	phthalate total (mg/kg)	Ionic PFCs (ug/kg)	volatile PFCs (ug/kg)	Antimony in fabric (mg/kg)	Antimony in polyester* (mg/kg)
Dior	t-shirt	**560**	**13**	-	-	-	-
	polo shirt	**460**	-	-	-	-	-
	t-shirt	<1.0	-	-	-	-	-
	trainers	**75**	-	**6.88**	ND	-	-
	t-shirt	<1.0	-	-	-	-	-
	t-shirt	**4.0**	**48**	-	-	-	-
	knitted top	**400**	-	-	-	-	-
D&G	t-shirt	**6.1**	**4.1**	-	-	-	-
	t-shirt	**2.1**	-	-	-	**117**	**234**
	skirt	<1.0	-	-	-	-	-
GIORGIO ARMANI	swimsuit	<1.0	-	**4.50**	ND	-	-
	t-shirt	<1.0	-	-	-	-	-
	shorts	<1.0	-	-	-	**54**	**120**
	t-shirt	<1.0	-	-	-	-	-
HERMÈS PARIS	baby shawl	<1.0	-	-	-	-	-
	baby booties	**380**	-	-	-	-	-
LOUIS VUITTON	shoes	**370**	-	-	-	-	-
	trainers	**100**	-	**2.52**	ND	-	-
	ballerina shoes	**760**	-	**16.9**	**31**	-	-
MARC JACOBS	body suit	**1.7**	**40**	-	-	-	-
	t-shirt	<1.0	**46**	-	-	-	-
	t-shirt	<1.0	-	-	-	-	-
TRUSSARDI	t-shirt	<1.0	-	-	-	-	-
	t-shirt	<1.0	-	-	-	-	-
	t-shirt	<1.0	-	-	-	-	-
VERSACE	jacket	<1.0	-	**8.41**	**374**	**110**	**110**
	t-shirt	<1.0	-	-	-	-	-

For phthalates and PFCs, the concentrations of the individual compounds detected in each group are given.
ND – not detected; '-' indicates not tested.
* Where fabric was composed of mixed fibres, the concentration of antimony in the polyester fraction was calculated from fabric composition information, on the basis that all antimony arose from the polyester fibre within the fabric blend.

All branded products analysed for this report.



Countries of manufacture



Places of purchase

The cumulative effect of over 50 years of hazardous chemicals use in the textile sector - producing many billions of products each year - has resulted in a major global environmental crisis. The distribution of hazardous chemicals from the textile sector is occurring in both the local production and customer communities around the world.

Major textile companies with a global reach have the potential to implement solutions towards the elimination of hazardous substances in the industry as a whole. Luxury brands, with their reputation for paying more attention to detail and quality, are particularly well-placed to act as leaders by committing to zero discharge of hazardous chemicals by January 1, 2020, thus becoming a positive influence to drive change not only across their supply chains, but also for the sector as a whole, and make real progress towards a toxic-free future for our children.

Greenpeace challenged 15 luxury brands to clean up fashion by addressing deforestation and the toxic pollution of water resources with its launch of the Fashion Duel in February 2013.[7] Since then, only one of these brands – **Valentino** – has shown leadership in the sector by committing to zero discharges of hazardous chemicals from its textile production, making it the only brand in the fashion duel to be rated as "Good". Valentino is also identified as a "Leader" in Greenpeace's Detox Catwalk for following through on its promises with credible actions.[8] Most recently, **Burberry** has also made a commitment to Detox[9]. Apart from these two, no other luxury brand has committed to Detox, despite several Greenpeace reports which show that hazardous chemicals residues in products or supply chain effluents are found throughout the textile supply chain. Even evidence of hazardous chemicals in **Giorgio Armani** products in one of these studies[10] – has so far failed to convince it to make a credible commitment to Detox.

The evidence that all but one of the luxury brands in this report were found to be selling children's products that contain hazardous chemicals must be a strong incentive to act. All clothes should be free from hazardous chemicals, which should not be used and released during manufacturing or be present in the final product. The customers who pay a premium for these prestigious products would be right to expect the luxury brands – as fashion leaders – to be Detox trendsetters by ensuring that their products are free from hazardous chemicals and that waterways are not polluted during their production. This is especially true when children – their most vulnerable customers – may be more sensitive to the effects of some hazardous chemicals compared to adults.

Greenpeace is calling on the companies identified in this report to recognise the urgency of the situation and become **Detox Leaders**, committing to zero discharge of hazardous chemicals by January 1, 2020. Their commitment must be ambitious and achievable via the setting of rapid timelines that will lead to the swift elimination of hazardous chemicals through credible actions.

Government

Greenpeace is calling on governments to adopt a political commitment to zero discharges of all hazardous chemicals within one generation. This needs to be based on the precautionary principle, and include a preventative approach that avoids the production, use and release of hazardous chemicals. This commitment must be implemented through comprehensive policies and regulations that establish short-term targets to ban the production and use of priority hazardous chemicals, a dynamic list of hazardous chemicals requiring immediate action based on the substitution principle, and a publicly available register of data on discharges, emissions and losses of hazardous substances such as a Pollutant Release and Transfer Register (PRTR).

The role of People Power

Our children deserve to live in a world free of hazardous chemicals, and adults around the world have the power to make this a reality. As parents, global citizens and consumers, by acting together now we can challenge major brands and governments to bring about the urgent change the world needs. United calls for toxic-free fashion have already led to landmark Detox commitments from 19 major clothing companies and one supplier, including well-known brands such as H&M, Zara, Valentino, and Burberry.

It doesn't stop here.

Acting together we can build the toxic-free future our children deserve.

#1

Introduction

Following a similar investigation recently published by Greenpeace East Asia[11], this study tested **children's clothing and footwear produced by eight luxury fashion brands** for the presence of a broad range of hazardous chemicals: nonylphenol ethoxylates (NPEs), certain types of amines, phthalates, organotins, per- and polyfluorinated chemicals (PFCs), and antimony. Most of these hazardous chemicals were found, except for organotins and carcinogenic amines released by certain azo dyes which had been found in previous studies.[12]

Sixteen of the 27 products (59%) tested positive for one or more hazardous chemicals. Of all 27 products tested, 44% were found to be contaminated with NPEs, a somewhat lower percentage compared to previous investigations (between 61% to 67% of articles tested), although the smaller number of samples in the current study might contribute to this difference. All products that were analysed for phthalates, PFCs and antimony tested positive.

In general, these latest findings are in line with what has been established by earlier investigations. Greenpeace has previously identified the presence of a range of hazardous chemicals in textile and leather products and concluded that this was as a result of their use during manufacture, either within the processes used in textile factories or due to their presence in materials that are used to make the products.[13]

It is obvious that, despite the documented hazards associated with them, hazardous chemicals continue to be used for a variety of purposes in the textiles process or in the product itself: NPEs are widely used as surfactants and detergents in textiles processing; phthalates have various uses, including as additives in plastisol prints on clothing; clothes are treated with per- and polyfluorinated chemicals to impart waterproofing or oil proofing properties, while a compound of antimony (antimony trioxide) is used as a catalyst in the manufacture of polyester.

Even though in many instances more environmentally responsible alternatives are available for these chemicals, they continue to be used.

Tested positive for NPEs

TX13076 - LOUIS VUITTON

TX13033 - DIOR

TX13038 - DIOR

TX13045 - DOLCE & GABBANA

TX13079 - MARC JACOBS

TX13034 - DIOR

TX13071 - HERMÈS

TX13039 - DIOR

TX13036 - DIOR

TX13077 - LOUIS VUITTON

TX13078 - LOUIS VUITTON

Tested positive for volatile PFCs

TX13061 - GIORGIO ARMANI

Tested positive for antimony

TX13080 - MARC JACOBS

Tested positive for phthalates

Branded products analysed for this report that tested positive for hazardous chemicals.

TX13046 - DOLCE & GABBANA

TX13109 - VERSACE

TX13059 - GIORGIO ARMANI

Tested positive for ionic PFCs

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#2

Results

Nonylphenol ethoxylates (NPEs)

Twelve out of the 27 articles tested (44%) contained residues of nonylphenol ethoxylates; detectable residues of NPEs indicate that they were used during the manufacturing process. Where NPEs are used in manufacturing, the levels that remain in the final product can be influenced by the processes used, including the number of times the article was rinsed, which releases the NPEs into wastewater wherever the product was manufactured. Residues of NPEs in the final product are also released when the items are washed by consumers.

- NPE residues were present in products from five out of the eight brands; **Dior** (TX13033, TX13034, TX13036, TX13038 and TX13039), **Dolce & Gabbana** (TX13045 and TX13046), **Hermès** (TX13071), **Louis Vuitton** (TX13076, TX13077 and TX13078) and **Marc Jacobs** (TX13079).
- The highest concentration of 760 mg/kg was detected in a **Louis Vuitton** branded ballerina shoe (TX13078) manufactured in Italy and sold in Switzerland.
- Three of the **Dior** products – a t-shirt (TX13033), a polo shirt (TX13034), and a knitted top (TX13039) – contained NPE concentrations of 560, 460 and 400 mg/kg respectively.
- Similar concentrations of NPEs were found in baby booties by **Hermès** (TX13071, 380 mg/kg) and suede trainers by **Louis Vuitton** (TX13077, 100 mg/kg).

Box 1: Nonylphenol ethoxylates/ nonylphenols (NPEs/NPs)[14]

Nonylphenol ethoxylates (NPEs) are man-made chemicals that are widely used as surfactants by textiles manufacturers. Once released to the environment, NPEs degrade to nonylphenols (NP), which are known to be toxic, act as hormone disrupters, and are persistent and bioaccumulative. NP is known to accumulate in many living organisms. The presence of NPEs in finished products shows that they have been used during their manufacture, which is likely to result in the release of NPEs and NP in wastewater from manufacturing facilities. In addition, NPE residues in these products will be washed out during laundering and released into the public wastewater systems of the countries where the products are sold.

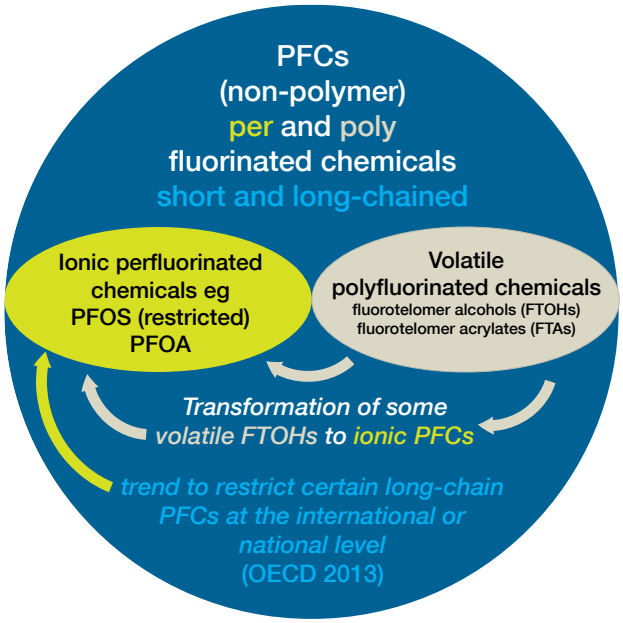
There have been restrictions on certain uses of NPEs by industry since 2005 in the EU[15], with similar restrictions in place in the US and Canada[16]. Although there are currently no EU regulations that restrict the sale of textile products containing NPE residues, measures are currently under development within the EU, proposed by the Swedish Chemicals Agency.[17] Elsewhere, NP and NPEs are included on the list of toxic chemicals severely restricted for import and export in China, which means that their import or export across China's borders now requires prior permission, though their manufacture, use and release are not currently regulated in China.[18] NP/NPEs are also included in China's dangerous chemicals list and in the 12th 5-year plan for Prevention and Control of Environmental Risk of Chemicals.

Per- and polyfluorinated chemicals (PFCs)

A total of five articles were analysed for the presence of per- and polyfluorinated chemicals (PFCs), consisting of one waterproof jacket, three items of footwear and one swimsuit. Textiles can be treated with PFCs for their water and oil repellent properties. Two different types of PFCs were analysed – ionic PFCs (for example, PFOS and PFOA) and volatile PFCs, which are used as precursors or generated during manufacturing processes, such as fluorotelomer alcohols (FTOHs) and fluorotelomer acrylates (FTAs), which can break down into ionic PFCs.

- One or more PFCs were detected in all five articles tested.
- Volatile PFCs were found in two of the five articles tested, with the highest concentrations in a **Versace** waterproof jacket (TX13109, 374 µg/kg total volatile PFCs).
- Ionic PFCs were more commonly detected, with examples being found in all articles, two of which were by **Louis Vuitton** (TX13077 and TX13078), with one product each by **Dior** (TX13036), **Giorgio Armani** (TX13059) and **Versace** (TX13109).
- When detected, volatile PFCs were found in higher concentrations than ionic PFCs.
- The highest concentration of ionic PFCs was found in the **Louis Vuitton** ballerina shoes (TX13078, 16.9 µg/kg total ionic PFCs, 31 µg/kg total volatile PFCs). The shoes were also one of the two products found to contain volatile PFCs.
- Among the ionic PFCs, PFOA – which will be restricted in textiles Norway by June 2014 – was also found in the **Versace** waterproof jacket and **Louis Vuitton** ballerina shoes, though in both cases at a concentration below the Norwegian limit. The predominant volatile PFC found in the **Versace** jacket also gives rise to additional PFOA.
- Differences in the types of volatile PFCs found in the **Louis Vuitton** ballerina shoes, compared to findings for footwear from previous studies suggest that an alternative manufacturing method may have been used for the shoes compared to the footwear previously studied.[19]

It should be noted that in Greenpeace East Asia's recent study[20], investigations have shown that concentrations of ionic PFCs can vary widely not only between products but within different parts of the same product. These variations are likely to be a characteristic of textile products treated with PFCs in general, and not only the specific products tested.[21]



Box 2: Per- and polyfluorinated chemicals (PFCs)

Per- and polyfluorinated chemicals (PFCs) are used in many industrial processes and consumer products, including textile and leather products, due to their chemical properties such as their ability to repel both water and oil. A well-known example is the polymer PTFE, marketed as Teflon and widely used for "non-stick" cookware, but not for textiles.

Many PFCs, especially **ionic PFCs** such as PFOS and PFOA, are highly persistent and do not readily break down once released to the environment, which has led to their presence throughout the environment, even in remote regions. Ionic PFCs have been reported in a wide range of both aquatic and terrestrial biota, due to their ability to bioaccumulate, as well as in human blood and milk in the general population in many countries around the world. Studies show that PFCs such as PFOS and PFOA can cause adverse impacts both during development and during adulthood, in part due to their hormone disrupting properties, with impacts on the reproductive system and the immune system, as well as being potentially carcinogenic in animal tests.

Volatile PFCs such as FTOHs are generally used as precursors during manufacturing processes. However, FTOHs can be transformed into ionic PFCs (such as PFOA) in the body or in the atmosphere. The process of transformation can also form intermediate products in the body that may be more harmful than the end product. Studies indicate that some FTOHs show endocrine disrupting activity themselves, including disturbing fish reproduction, though far less information exists compared to the compounds that FTOHs can give rise to (eg PFOA). In addition to these direct hazards from FTOH, the potential for FTOHs to transform into other ionic PFCs, poses an additional hazard. Precursor PFCs, such as FTOHs, are volatile and have frequently been detected in air samples, even in remote areas. Recent Greenpeace tests have found evaporation of volatile PFCs from outdoor clothes.[22]

The ionic PFC, PFOS, has been classified as a persistent organic pollutant (POP) under the Stockholm Convention, a global treaty that requires contracting parties to take measures to restrict the production and use of PFOS.[23] The marketing and use of PFOS within the EU has been prohibited for certain uses since 2008, with a maximum limit of 1 $\mu g/m^2$ set for PFOS in textiles.[24] However, there are currently no limits set for any other PFCs, despite concerns about their hazardous nature and the fact that they can commonly be found at far higher concentrations in textiles.

Norway is the first country where the sale of textiles containing PFOA above 1 $\mu g/m^2$ will be prohibited from June 2014; certain PFCs have also recently been added to a list of priority chemicals, meaning that releases to the environment must be eliminated or substantially reduced by 2020.[25] Norway, and all other countries, should enforce the elimination of PFOA (and the PFC chemical group as a whole) at much lower levels, using the best current testing technology. In addition, PFOA and four other long chain PFCAs are also classified as substances of very high concern (SVHCs) within the EU under the REACH regulations (ECHA 2013).[26]

Box 3: Phthalates

Phthalates are mainly used as plasticisers (or softeners) in plastics, especially PVC. Because phthalates are not chemically bound to the plastics, they are released into the indoor and outdoor environment during the lifetime of the products and again following disposal. Phthalates are found widely in the indoor environment, including in air and in dust. They are commonly found in human tissues, with reports of significantly higher levels of intake in children. There are substantial concerns about the toxicity of phthalates to wildlife and humans and in particular their hormone-disrupting effects. For example, DEHP – one of the most widely used to date – is known to be toxic to reproductive development in mammals, capable of interfering with development of reproductive organs in males[27] and affecting reproductive success in females[28].

Legislation does not currently exist in any of the countries where the 27 tested articles were sold that prohibits the sale of clothing containing phthalates.[29] However, probably the best known legislation on phthalates is the EU-wide ban on the use of six phthalates in children's toys and childcare articles, first agreed as an emergency measure in 1999 and finally made permanent in 2005. The use of certain phthalates, including DEHP, is prohibited in all toys or childcare articles put on the market within the EU (with a limit of 0.1% by weight, equivalent to 1,000 mg/kg), and the use of others, including DINP, is prohibited in such articles if they can be placed in the mouth by children (EU 2005).

Such regulations have been replicated in other countries such as the US[30], and most recently in China, where a new standard on toy safety prohibiting the use of six phthalates in children's toys was notified to the World Trade Organisation (WTO) in July 2013 and will come into force in June 2014.[31]

The definition of "childcare articles" does not include items of clothing in these regulations[32]. However, draft legislation has been proposed in China that would prohibit the presence of six phthalates, including DEHP and DINP, at concentrations above 0.1% by weight (1,000 mg/kg), in clothes sold for babies and young children (under 36 months old)[33]. Another exception is South Korea, where the restriction on six phthalates in toys and childcare articles also applies to clothing for infants under 24 months[34].

Within the European Union, certain phthalates, including DEHP, DBP, DiBP and BBP, have been listed as Substances of Very High Concern (SVHC) under the EU REACH[35].

Phthalates

A section of plastisol printed fabric from five articles was analysed for phthalates, which were found in all five items tested, with total concentrations in the range 4.1 to 48 mg/kg.

- Phthalates were found in two products by **Dior** (TX13033 and TX13038), one product by **Dolce & Gabbana** (TX13045), and two products by **Marc Jacobs** (TX13079 and TX13080).

This illustrates that the distribution of these chemicals as ingredients and/or contaminants in industrial processes is widespread. Previous studies similarly detected phthalates in all, or almost all, such samples, though these previous studies found some examples with considerably higher levels amongst the larger number of articles that they investigated.

Antimony

Polyester fibres are known to contain residues of antimony trioxide where it was used as a catalyst during their manufacture.[36, 37] Factories that manufacture polyester fabrics or use polyester fibres can also discharge antimony in their wastewater, as found by a recent Greenpeace investigation into a textiles facility that processes polyester in Indonesia.[38]

- Antimony was detected in all three of the articles made with polyester that were analysed, with concentrations within the polyester fraction of each fabric in the range 110-234 mg antimony/kg polyester. The products were by **Dolce & Gabbana** (TX13046), **Giorgio Armani** (TX13061) and **Versace** (13109).

Box 4: Antimony

Antimony shows many similarities in its chemistry and toxicity to arsenic.[39] Trivalent antimony, such as is present in antimony trioxide, is a more toxic form of antimony compound, with effects including dermatitis, irritation of the respiratory tract, and interference with the immune system. In addition, antimony trioxide is listed as "possibly carcinogenic to humans" principally due to inhalation of dusts and vapours.[40] Inhalation exposure to antimony is more common in occupational settings, whereas the general population is exposed to antimony mainly through ingestion of food and water.

No regulations currently exist which prohibit the use of antimony in textile manufacture worldwide, despite the availability of alternative catalysts for polyester manufacture. Recently, Greenpeace found antimony being discharged from manufacturing facility processing polyester in Indonesia.[41] Within the EU, the Ecolabel Regulation[42] requires that the antimony content in polyester fibres does not exceed 260 mg/kg for articles bearing the Ecolabel.[43]

The "made in" question

A significant number of products in this study were labelled "**Made in Italy**", in contrast to previous studies where the majority of clothes were made in China or other Asian countries in the Global South. This is not unexpected, as most of the brands in this study are based in Europe, specifically Italy and France, which are seen as the home of luxury fashion and a by-word for quality. However, the predominance for the labelling to report manufacture in Europe may not be representative of luxury testile products in general.

The study finds that there is a similar pattern of hazardous chemical residues in these luxury products labelled as made in Europe, compared to products made in Global South countries in this and previous studies. In fact, eight of the 10 products made in Italy were found to contain one or more hazardous chemicals in this study: from the Italian brands **Dolce & Gabbana** and **Versace**, and the French brands **Dior** and **Louis Vuitton**.

NPEs were found in seven of these products. This is a cause for concern, as the use of formulations containing more than 0.1% NPEs by industry has been restricted in the EU since 2005[44], with similar restrictions in force in North America[45]. The fact that NPEs were detected at the levels found could mean that the formulations used during manufacturing contained NPEs at levels higher than 0.1%, especially for those articles (TX13039, TX13078, TX13076, TX13078) with the higher concentrations of NPES.

If this is the case, there are two possible explanations for these findings. The first is that NPEs have been used during the manufacture of these products at supply chain facilities in the EU and that they have therefore been released from manufacturing facilities in the EU, suggesting that formulations containing more than 0.1% may have been used in the manufacturing process for some of these articles, in breach of EU regulations.[46] The second is that parts of the wet processing of textiles for these articles, possibly including dyeing, did not take place in Italy but elsewhere, most likely in the Global South where equivalent regulations do not exist for NPEs, with the final part or parts of the fabrication actually taking place in Europe.

There are currently no restrictions on the import of textile products containing NPEs into the EU[47], which means that these brands could have imported contaminated textiles made in the Global South. Buying a product "made in" Europe does not therefore guarantee the total manufacture of a product within Europe, under more stringent regulations. Furthermore, the more stringent European regulations on NPEs also do not guarantee that production and products will be entirely free from hazardous NPEs.

This situation exposes the clear need for these brands to be more transparent about the use of hazardous chemicals in the manufacturing of their textile products, wherever it takes place. Brands need to ensure the reporting of chemical-by-chemical discharges from individual supply chain facilities, on a global online platform, in line with the public "Right to Know".

Consumers who buy luxury products, and particularly those with a "made in" Europe label, will be looking for quality, based on the reputation of European made fashion items. There will be an expectation that clothes produced by luxury brands, and children's clothes in particular, should be ahead of the trend in many ways – including care for the environment and for preventing the presence of hazardous chemicals in their clothes. People in countries such as China, India, Brazil or Mexico[48] may look for European-made fashion when buying products for their children because of this expectation, avoiding products "Made in China" due to various scandals in the past around consumer products. Interestingly, NPEs were not detected in any of the four products labelled "Made in China" in this study, above the detection limits, a finding that is not typical for products made in China across all the studies.[49]

LOUIS VUITTON

Garment	Sold in	Hazardous chemical found
Shoes	Hong Kong	NPEs
Trainers	France	NPEs, PFCs
Ballet shoes	Switzerland	NPEs, PFCs

D&G DOLCE & GABBANA

Garment	Sold in	Hazardous chemical found
T-shirt	Hong Kong	NPEs, pthalates
T-shirt	Italy	NPEs, antimony

VERSACE

Garment	Sold in	Hazardous chemical found
Jacket	Italy	PFCs, antimony

Dior

Garment	Sold in	Hazardous chemical found
Trainers	France	NPEs, PFCs
Knitted top	Switzerland	NPEs

The effects on children

Finding residues of hazardous chemicals in clothing is a cause for concern – especially if the clothing is made for children: infants and children may be more sensitive to the effects of some hazardous chemicals compared to adults.[50]

This is already reflected in some voluntary standards,[51] as well as in the restrictions that some textiles companies set for themselves, with more protective limits for concentrations of certain chemicals in clothing items for children, compared to adult clothing.[52] It is also recognised in the restrictions on the presence of certain phthalates in toys and articles for children under three in the EU and other countries,[53] which do not apply to clothing.

Hazardous chemicals and adverse health effects

Many hazardous chemicals, including some of those identified in this report, are known to accumulate in our bodies following exposure to them. The use of hazardous chemicals in children's clothing leads to the release of such chemicals into the environment, either during manufacturing or from the products directly during their use and disposal. In some instances, there may also be the potential risk of direct exposure to these hazardous chemicals.

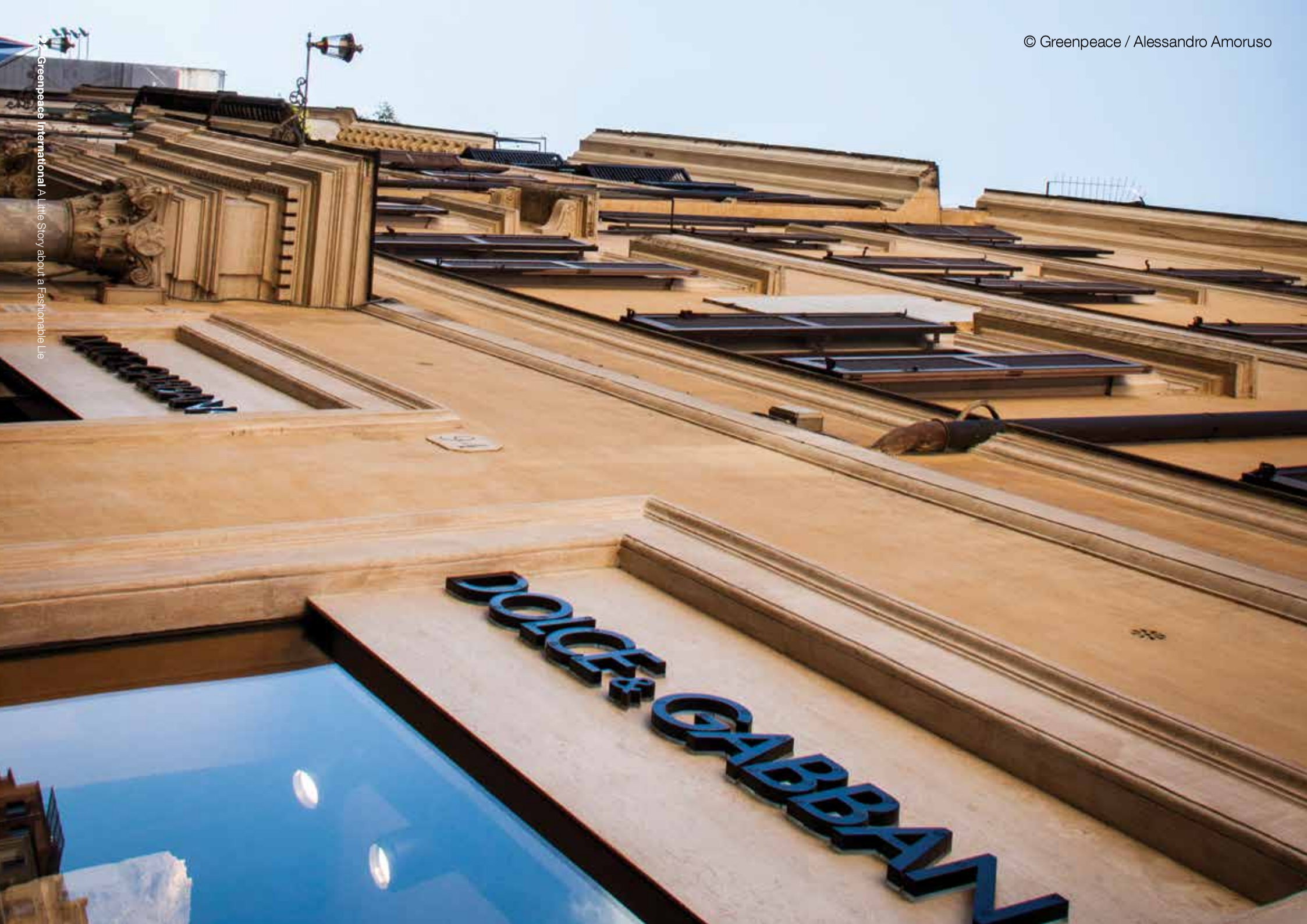
Some of the chemicals found in this report – such as PFCs and phthalates - are known endocrine disruptors, or (in the case of NPEs) able to give rise to chemicals which are endocrine disruptors – which can interfere with hormone systems in animals and humans. A recent UNEP & WHO report[54] on endocrine disruptors concluded that some can act at very low doses and that the timing of some impacts on hormone systems can be critical. Many endocrine-related diseases and disorders are on the rise (though in many cases the extent to which exposure to endocrine disruptors are contributing is still unclear).[55]

In particular, the report highlights that:

> *"Effects shown in wildlife or experimental animals may also occur in humans if they are exposed to EDCs at a vulnerable time and at concentrations leading to alterations of endocrine regulation. Of special concern are effects on early development of both humans and wildlife, as these effects are often irreversible and may not become evident until later in life."*

The special vulnerability of children to certain chemicals has led regulators to enforce relatively more restrictive – but still insufficient – regulations on a small number of hazardous chemicals in certain products (such as phthalates in toys). Although necessary to protect children from direct exposure to hazardous chemicals in such cases, this approach is nowhere near enough; limits are set at a level that's determined as "acceptable", not at the lowest level that is technically possible.

The focus of some regulations on children under three also excludes older children and other vulnerable people, in particular the unborn baby – via its parents and, in particular, the mother. Most importantly, such an approach ignores the often much greater indirect exposure to hazardous industrial chemicals from the environment and in particular through diet. Pollution from the textile industry is contributing to this problem daily, with the greatest releases of hazardous chemicals into the environment taking place at manufacturing facilities. Allowing the presence of these chemicals in our clothes perpetuates their use during manufacturing. Only eliminating the use of hazardous chemicals across the whole textiles supply chain will address the problem.



#3

Detox: High fashion = high expectations

There is no "safe" level for hazardous chemicals – that is why the target of zero use is the only credible basis for taking effective action to eliminate these harmful substances. Companies and governments both need to clearly commit to this aim.

So-called "acceptable" levels of hazardous chemicals are not acceptable

Greenpeace's previous investigations into textiles found that, in spite of decades of regulation and corporate responsibility programmes, hazardous chemicals – including the 11 priority groups identified for the textile sector by Greenpeace[56] – continue to be used by supply chain manufacturers of clothes for many well-known brands. This new study finds that luxury brand products are no different, despite the price tag, with residues of hazardous chemicals present in a wide range of luxury children's clothing.

So-called "acceptable" limits of these chemicals, set by regulations, have allowed releases from a multitude of sources, from the manufacturing processes through to the final products. For some of these chemicals this has resulted in their build-up in the environment, and in some cases their accumulation in animals and humans, over the years.

The findings of this study show that both companies and governments need thorough and comprehensive plans to achieve the elimination of hazardous chemicals, including those used in textiles manufacturing, and therefore prevent residues of these chemicals from contaminating consumer products, as well their release from manufacturing facilities.

Detox is not a luxury

Beyond the luxury sector, some companies have taken on the challenge to be **Detox Leaders** and have begun the process of eliminating the use of hazardous chemicals. **Burberry** has recently joined the fourteen companies that have made a commitment to Detox and have been identified as Detox Leaders by Greenpeace,[57] as a result of the actions they have undertaken to address the problem of hazardous chemicals used in their supply chains.

Surprisingly, only two of these brands – **Valentino** and **Burberry** – are luxury brands. Both are ahead of the trend in the luxury sector with their comprehensive commitment to zero discharges of hazardous chemicals. Valentino is ahead of schedule on its agreement to rid its supply chain of all PFCs and has ensured publication of discharge data from its supply chain. Burberry (like Mango and Uniqlo) is also committed to applying the best available screening methodology (Clean Production Action's GreenScreen[58]) to identify which chemicals are hazardous and to achieve the lowest possible detection limits for monitoring hazardous chemicals to ensure zero discharges across its supply chain.

Other luxury brands have yet to make a commitment to Detox, but they need to do so urgently.

Box 5: The Fashion Duel

In November 2012 Greenpeace issued a challenge to 15 high fashion brands by sending them a kit with a link to an online survey on three sections of the brands' global supply chain: leather, pulp and paper, and toxic water pollution.[59] Greenpeace threw down a "green gauntlet", challenging the following brands to a "fashion duel"; **Armani**, **Louis Vuitton**, **Dior**, **Salvatore Ferragamo**, **Roberto Cavalli**, **Alberta Ferretti**, **Chanel**, **Dolce & Gabbana**, **Hermès**, **Prada**, **Trussardi**, **Gucci**, **Versace**, **Ermenegildo Zegna** and **Valentino**. Brands were asked to answer 25 questions about their production processes and policies and were evaluated on whether they had replied in a transparent manner and had formally committed to implementing zero deforestation and zero discharge purchasing and production policies.[60] The results of this survey were published with the launch of the fashion duel in February 2013.

While five of the brands have commitments and programmes in place for zero deforestation, only one – **Valentino** – has made a commitment to zero discharges of hazardous chemicals. As a result, Valentino is the only brand that achieves a "good" ranking on the fashion duel website. All but one of the brands represented by products in this study (**Marc Jacobs**[61]) have already been challenged to act by the "Fashion Duel".

Giorgio Armani, **Dior**, **Louis Vuitton** and **Versace** have not given a specific response on the questions about toxic water pollution in the survey, and are currently ranked as "unsatisfactory" on the textiles category. **Dolce & Gabbana**, **Hermès** and **Trussardi** are ranked as having "failed", as they have not replied to numerous requests from Greenpeace, refusing to share what is going on behind closed doors with regards to leather and pulp and paper purchasing and toxic discharges from textile production.

All of these brands now need to commit to take individual responsibility for the use of hazardous chemicals in their supply chain and commit to Detox urgently to help support a toxic-free fashion industry.

Box 6: The growth of luxury brands

In the luxury market the usual rules of supply and demand can be reversed, with the desire for these products sometimes increasing with their price. Luxury goods represent premium quality, craftsmanship, recognisability, exclusivity and reputation; the price, uniqueness, availability and brand of the products all determine their desirability.[62]

Recent market research shows that the luxury goods market – with clothing forming a major part of it – continues to grow. In 2013 sales will exceed $318 bn US dollars worldwide, an increase of 3% from 2012. Over the next five years spending is projected to increase by more than 35%.[63] Italian brands are reported to have the largest share of the personal luxury goods market (which includes jewellery, beauty, accessories as well as clothing[64]), followed by French and US brands.[65]

The consumption of luxury goods in Asia is set to over-take consumption in Western Europe by 2018 to become the biggest region in the world for luxury goods, according to recent reports. China predominates, with India being a major contributor. Emerging markets such as Malaysia and Indonesia are also important. Mexico is also becoming an important growth market for luxury goods[66] contributing to the growing importance of the Americas.[67] Currently, Europe continues to be the largest market for personal luxury, followed by the Americas, Asia Pacific and Japan.[68]

Wherever they buy, over half of these luxury goods consumers are of Chinese, Japanese or other Asian nationality.[69] Despite a slow-down in the Chinese domestic market, Chinese consumers worldwide are the top and fastest growing luxury goods consumers.[70]

The Detox commitment – to eliminate the use of all hazardous chemicals by no later than January 1, 2020 – is necessarily ambitious, to match the urgency of the problem (see Box 7). It is also achievable, so long as companies make the necessary investments based on credible commitments and do not then compromise on their implementation.

As a result of actions taken by some of the companies that have committed to Detox, significant changes have taken place. For example, the public's "Right to Know" about the chemical-by-chemical discharge from an individual supply chain facility used by a brand is becoming a reality. This has been continually rejected by parts of the textile industry and considered almost impossible before the Detox campaign began. Today, several companies – including Mango, Fast Retailing (Uniqlo), Inditex, H&M, Benetton, Valentino, G-Star, M&S, Limited Brands, C&A, Puma, Coop, Canepa[71] and Esprit – have ensured the publication of data from some of their suppliers about discharges of hazardous chemicals, on the global online platform IPE.[72]

Communities local to textiles manufacturers and the wider public have now begun to gain their "Right to Know" about pollution from textile facilities. This, combined with information about current levels of hazardous chemicals in certain products, such as the findings presented in this report, is the starting point for the progressive reduction and elimination of hazardous chemicals pollutants into local waterways and in consumer products.

The path to zero discharges requires every company to invest sufficient resources with urgency and there is no excuse to delay taking the first step. The luxury brands investigated in this report need to act immediately to address the inadequacies in their policy and practice, to join the Detox revolution.

Box 7: Elements of an effective Detox plan

An effective, credible Detox commitment and action plan – aiming at zero discharges of hazardous chemicals by 2020 – consists of commitments and actions under three headings:

- Core principles.
- Transparency.
- Elimination.

An adequate approach needs to be hazard-based, comprehensive and have credible definitions for the **precautionary principle**[73], zero discharge of hazardous chemicals, individual corporate accountability[74], and the public's "**Right to Know**"[75] about the use and discharge of hazardous chemicals from a company's supply chain facilities, and their presence in the final product. Together, a commitment to these principles frames the practices that are necessary to progress towards zero hazardous chemical use.

To effectively eliminate the use of hazardous chemicals in the textile industry and resolve the problem of pollution of our waters with hazardous chemicals, companies should:

- Adopt a credible commitment to phase out the use, from their global supply chain and all products, of all hazardous chemicals by January 1, 2020.
- Start disclosing – in the months following a commitment and at regular (at least annually) and relevant intervals afterwards – information on the releases of hazardous chemicals that are still used at their suppliers' facilities to the public, especially to local/national inhabitants (e.g. using credible public information platforms[76]).
- Commit to the elimination of the 11 priority chemical groups within a reasonable timeline, and set clear and credible intermediate progress targets for the elimination of other hazardous chemicals beyond these groups. Introduce non-hazardous chemistry by the earliest specific date possible: responsible companies will act now and not wait until December 31, 2019 to eliminate their hazardous chemical use.

Governments: a political commitment to zero discharge is vital

Credible actions taken by companies need to be matched with credible regulatory action from governments, to level the playing field and to send a strong message to the textile industry, as well as other sectors, that the use and release of hazardous chemicals is not acceptable. Although many of the Detox principles (see Box 7) are accepted by governmental bodies, this is not yet reflected by the thorough implementation of bans and restrictions on hazardous chemicals that will lead to their elimination by no later than January 1, 2020. Specific regulation needs to be targeted at each of the hazardous chemicals found in the children's clothing in this report, to address the particular problems posed by each chemical group.

Detox Leaders have taken up the challenge, but the current nature of the textiles industry, where brands outsource much of their production, means that the continued use of hazardous chemicals by companies that ignore the need to Detox can undermine these efforts. Therefore, regulation to implement this change across the whole sector is vital. To be effective, this needs to be defined to the strictest testing standards possible, so that the truth of where and how hazardous chemicals are turning up in our clothing and in the effluent of manufacturers is fully revealed.

Many of the chemicals within the 11 priority groups of hazardous chemicals identified are already regulated in some places, in one form or another, including certain APEs (alkylphenol ethoxylates, which include NPEs), PFCs and phthalates.[77] However, the fact that these hazardous chemicals appear to be so widely present in clothing products, as well as found in examples of effluent from the manufacturing supply chain, means that there can be only one conclusion: existing regulations are failing to protect human health and the environment.

Some shortcomings in the current regulatory approach are:

- The use of NPEs/NPs in textile manufacturing within Europe has been effectively banned for many years, in order to protect surface waters, yet there are no restrictions on clothes sold in the EU containing these chemicals, imported and otherwise, which are released into public wastewater systems on a wide scale as a result of laundering.[78, 79]
- Regulations are not consistent across different product groups. For example, the EU has restriction on phthalates in children's toys, but not children's clothes.
- In general, the permitted levels of hazardous chemicals for use in manufacturing and in the finished product, set both by regulators and by voluntary industry labels, are far too high, and allow their continued use in manufacturing albeit at reduced amounts. Therefore these "permitted" chemical residues in clothing products, distributed across the globe via the numerous products that are traded, add up to significant quantities of hazardous and persistent chemicals in textile products overall, which can lead to their ongoing release and continued build-up in the environment.
- Restrictions on the use of hazardous chemicals in manufacturing, such as for NPEs/NPs in Europe (above), are not yet in place in the countries where the majority of manufacturing takes place, such as China, Bangladesh, Indonesia, Thailand, Turkey and Mexico.

Governments need to reinforce efforts by companies to Detox – by adopting a political commitment to **zero discharge** of all hazardous chemicals within one generation, incorporating the **precautionary principle** and including a **preventative approach** by avoiding the production and use, and therefore, releases of hazardous chemicals. Within this context, action is needed to tackle the hazardous chemicals that have been found in children's clothing in this report, to ensure the progressive elimination of their use, leading to zero discharges into waterways and adequate protection for consumers.

Some specific steps include:

- Regulation that will lead to the elimination of APEs (which includes NPEs) needs to implement a restriction that does not allow any use, including within textiles production. There should also be an enforcement of no-allowable-residues in clothing articles, imported or otherwise. In order to offer adequate protection, both of these measures would need to set any limit for NPEs in products as low as possible, to the strictest possible testing limits, and cover as wide a range of NPEs as possible.
- The immediate extension of regulations that restrict phthalates in toys to include all articles for children, in particular clothing that bears plastisol prints. Ultimately, this needs to be extended to all products, including all textiles.
- The restriction on PFOS needs to be implemented globally (with exemptions minimised) and expanded to all PFCs, both ionic and volatile, to recognise the intrinsic hazard posed by this group of chemicals and prevent the current trend of substituting regulated PFCs with other PFCs.
- Regulations also need to restrict the use of antimony in polyester manufacture to encourage the use and development of alternative catalysts in polyester production.

For all measures, limits should be set at the lowest technical detection limit with the potential for this to be reduced further in the future, as technology improves.

These measures need to be part of a comprehensive implementation plan containing intermediate short term targets, a dynamic list of priority hazardous substances requiring immediate action based on the **substitution principle**, and a publicly available register of data on discharge emissions and losses of hazardous substances, such as a Pollutant Release and Transfer Register (PRTR).

Such a plan would prevent ongoing releases into the environment with the potential for impacts on the environment and on people's health and livelihoods, especially in the Global South. It would avoid the huge costs associated with hazardous chemical pollution and its clean-up, although in most cases full clean-up is not possible.[80] It would set a clear direction for the textiles industry by showing that hazardous chemicals have no place in a sustainable society, which will in turn drive innovation towards safer alternatives. Finally, it would level the playing field and make the actions of leading companies a reality throughout the entire sector and beyond, as many of the hazardous chemicals used in textiles are also in use in other sectors.

In the context of the global textiles industry, the greatest quantities of hazardous chemical emissions take place where clothes are manufactured by the suppliers of major clothing companies, which mostly take place in the Global South. Inevitably, clothing products that contain hazardous chemicals (because they were manufactured using hazardous chemicals) will release these substances after they are bought by consumers, particularly when washed, wherever they are in the world.

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The role of "People Power"

People will naturally be concerned about their own exposure to hazardous chemicals in clothes, particularly when these clothes are for infants and young children. After using second-hand clothes wherever possible, the best option currently available when buying new clothes for children is to look for clothes from brands that have committed to Detox and that have been certified with eco-oriented labels, although labels will allow the presence of some hazardous chemicals within certain limits, to a varying degree.[81]

As global citizens we can also collectively:

- Choose to buy fewer new clothing products, and instead buy second-hand clothes where possible. This can also involve re-purposing and re-using older items to create "new" pieces for our wardrobes, or taking part in clothes swaps with friends.
- Influence brands to act responsibly on behalf of the planet and its people. The need for companies to make the right choices and protect future generations has never been greater than it is today, and brands need to be challenged on whether they have set a date for the elimination of the use of hazardous chemicals in their supply chains.

- Demand that governments act to restrict the sales and import of products containing hazardous chemicals.

Our children deserve to live in a world free of hazardous chemicals. Luxury brands need to match their trendsetting reputation by showing leadership in the sector and committing to Detox our clothes and our future once and for all.

By using our collective power, as adults, parents and global citizens, we can ensure that companies and governments bring about the transformational change the textile industry desperately needs, by taking real steps to Detox our clothes, Detox our water and Detox our future.

Creating a toxic-free future for our children is not only necessary, it is possible.

To find out how you can make your voice heard visit: www.greenpeace.org/detox

Endnotes

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2 For full details of the samples, the methodology and results, see Greenpeace International (2014). See Technical Note 01-2014 at:|http://www.greenpeace.org/international/a-fashionable-lie

3 Some were also tested for organotins and for carcinogenic amines released under reducing conditions, neither of which were detected in this study.

4 Three t-shirts by Trussardi were tested for nonylphenol ethoxylates and two of these for amines, which were not found above the detection limits.

5 REACH Regulation EC 1907/2006, Annex XVII (Restriction Annex), Entry No. 46a & 46b. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006R1907:20110505:en:PDF

6 For full details of all articles, including the concentrations of NPEs, phthalates, PFCs and antimony, see the Technical Report (Greenpeace International 2014, op cit).

7 The Fashion Duel, Greenpeace website. http://en.thefashionduel.com/ranking/

8 http://www.greenpeace.org/international/en/campaigns/toxics/water/detox/Detox-Catwalk/

9 Burberry 2014 http://www.burberryplc.com/corporate_responsibility/burberry-commitment-on-chemical-management-in-manufacturing

10 Greenpeace International (2012b), op cit. Five out of nine Giorgio Armani products contained nonylphenol ethoxylates, and an Armani t-shirt was also found to contain high levels of phthalates (20% DEHP, 2.3% BBP).

11 Greenpeace East Asia (2014), op.cit.

12 Carcinogenic amines were not released under the test conditions at levels above the method detection limit (<5 mg/kg) in any of the 11 articles tested. Organotins were not detected above the method detection limit (0.1 mg/kg) in any of the 7 articles tested

13 See footnote 1.

14 For references, see Technical Report (Greenpeace International 2014, op cit).

15 NP and NPEs were included on the first list of chemicals for priority action towards achieving the OSPAR Convention target of ending discharges, emissions and losses of all hazardous substances to the marine environment of the northeast Atlantic by 2020. NP has also been included as a "priority hazardous substance" under the EU Water Framework Directive. Furthermore, within the EU, since January 2005 products (formulations used by industry) containing greater than 0.1% of NP or NPEs may no longer be placed on the market, with some minor exceptions principally for closed loop industrial systems. See: Brigden K, Hetherington S, Wang M, Santillo D & Johnston P (2013). Hazardous chemicals in branded textile products on sale in 25 countries/regions during 2013. Greenpeace Research Laboratories Technical Report 06-2013, December 2013. http://www.greenpeace.to/greenpeace/wp-content/uploads/2014/01/A-Little-Story-About-the-Monsters-In-Your-Closet-Technical-Report.pdf

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18 MEP (2011). List of Toxic Chemicals Severely Restricted for Import and Export in China Ministry of Environmental Protection (MEP), The People's Republic of China, 2011. http://www.crc-mep.org.cn/news/NEWS_DP.aspx?TitID=267&T0=10000&LanguageType=CH&Sub=125

19 For sample TX13078, the only volatile compound was 8:2 FTA (31 μg/kg). The related ionic C8 compound, PFOA (1.19 μg/kg) was also detected in this compound. The reasons for the presence of 8:2 FTA and PFOA in this article, despite FTOHs not being detected, are not clear, but may indicate alternative manufacturing processes.

20 See Technical Report (Greenpeace International 2014, op cit). For five articles (three waterproof clothing articles, one footwear article and one swimwear article), two different portions from each article were analysed separately for ionic PFCs to determine variation in concentrations in different parts of the article.

21 Quality control checks confirm that differences in PFC levels measured for different parts of individual clothing articles reflect real variations in concentrations within the clothing, and do not result from the testing method. Though the within-article variations were determined using products manufactured by certain brands, the reported variations are likely not only to be a reflection on the products sold by those brands alone, but rather a characteristic of textile products treated with PFCs in general. The full extent of such variations, and the underlying causes, deserves further investigation.

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35 Regulation (ECHA 2013). See Technical Report (Greenpeace International 2014, op cit).

36 Duh (2002), Lacasse & Baumann (2004). See Technical Report (Greenpeace International 2014, op cit.)

37 Jaffe & East (2007), Thiele (2004). See Technical Report (Greenpeace International 2014, op cit)

38 Greenpeace (2013a). Toxic Threads: Polluting Paradise. A story of big brands and water pollution in Indonesia, pp 44; including the accompanying Technical report, pp30. http://www.greenpeace.org/international/en/publications/Campaign-reports/Toxics-reports/Polluting-Paradise/

39 Arsenic and many of its compounds are especially potent poisons. Acute arsenic poisoning is associated initially with nausea, vomiting, abdominal pain, and severe diarrhoea. Chronic arsenic toxicity results in multisystem disease. Arsenic is a well documented human carcinogen affecting numerous organs. Ratnaike RN (2003), Acute and chronic arsenic toxicity. Postgrad Med J. 2003 Jul;79(933):391-6. http://www.ncbi.nlm.nih.gov/pubmed/12897217

40 Listed by the International Agency for Research on Cancer (IARC) as "possibly carcinogenic to humans" (group 2B), principally due to inhalation of dusts and vapours. IARC (1989). International Agency for Research on Cancer (IARC) Monographs programme on the evaluation of carcinogenic risks to humans: Some Organic Solvents, Resin Monomers and Related Compounds, Pigments and Occupational Exposures in Paint Manufacture and Painting vol. 47, pp. 291–306

41 Greenpeace (2013a), op cit.

42 Which aims to promote products with a reduced environmental impact compared with other products in the same product group.

43 EC (2009) op cit.

44 REACH Regulation EC 1907/2006, op cit.

45 CEPA (2004). Notice requiring the preparation and implementation of pollution prevention plans in respect of effluents from textile mills that use wet processing (TMEs) and nonylphenol (NP) and its ethoxylates (NPEs), under the Canadian Environmental Protection Act (CEPA), 1999. Canada Gazette Part I, Vol. 138, No. 49, 4 December 2004. http://www.ec.gc.ca/planp2-p2plan/B2D19B6D-325F-458A-88E1-F69291E58DE3/g1-13849.pdf

USPEA (2010) Nonylphenol (NP) and Nonylphenol Ethoxylates (NPEs) Action Plan. Unites States Environmental Protection Agency (USEPA), August 18, 2010. http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/np-npe.html

46 REACH Regulation EC 1907/2006, op cit.

47 KEMI (2012), op cit.

48 Lisa Wang (2013). The Business of Fashion. http://www.businessoffashion.com/2013/10/euromonitor-coach-michael-kors-louis-vuitton-versace-fflur-roberts.html

49 See footnote 1

50 Dorey CN (2003). Chemical Legacy: Contamination of the Child, Greenpeace UK, October 2003, ISBN 1-903907-06-3 http://www.greenpeace.org/international/Global/international/planet-2/report/2003/10/chemical-legacy-contaminatio.pdf

51 For example: Oeko-tex, which has separate product categories for infants and children as well as for products that have "direct skin contact" which provide specific guarantees to the consumer.

52 For example, M&S does not permit any biocidal finish on its childrenswear products but for all products only triclosan is not permitted. M&S Restricted Substances List May 2013, p. 4: http://corporate.marksandspencer.com/documents/how_we_do_business/restrictedsubstancelist_may_2013.pdf

53 American Apparel and Footwear Association (2013), op cit, lists countries which restrict phthalates in toys and childcare articles are listed as the EU, the US, South Korea, Denmark, Egypt and Turkey .

Similar restrictions are proposed in China:
SAC (2013). Toys safety, Part 1: Basic Code, GB 6675.1—201. SAC (Standardization Administration of the People's Republic of China
http://www.sac.gov.cn/zwgk/wtotb/tbttb/201307/t20130702_138723.htm (Chinese)

54 WHO (2013). State of the science of endocrine disrupting chemicals - 2012. An assessment of the state of the science of endocrine disruptors prepared by a group of experts for the United Nations Environment Programme (UNEP) and WHO, 2013, http://www.who.int/ceh/publications/endocrine/en/index.html

55 Ibid.

56 The 11 priority hazardous chemical groups are : 1. Alkylphenols and their ethoxylates (APEOs & APs) 2. Phthalates 3.Brominated and chlorinated flame retardants (BFRs, CFRs) 4. Azo dyes that can release carcinogenic amines 5. Organotin compounds 6. Per- and poly-fluorinated chemicals (PFCs) 7. Chlorobenzenes 8. Chlorinated solvents 9. Chlorophenols 10. Short chain chlorinated paraffins 11. Heavy metals such as cadmium, lead, mercury and chromium (VI).

57 Since the Burberry commitment was announced, the fast fashion brand Primark has also made a Detox commitment. http://www.greenpeace.org/detoxcatwalk

58 http://www.cleanproduction.org/Greenscreen.php

59 http://en.thefashionduel.com/azioni/15-kit-per-15-fashion-top-brand/

60 http://en.thefashionduel.com/ranking/

61 Part of the Louis Vuitton Moët Hennesey (LVMH) group - as are Louis Vuitton and Dior.

62 PRWeb (2014); Global Luxury Goods Market Report 2013 Edition - Latest Industry Analysis, Size, Shares, Growth and Trends Research Report.
http://www.prweb.com/releases/2014/01/prweb11482961.htm

63 The Business of Fashion (2013), op cit.

64 Apparel makes up 25% of this market, Bain & Co , slide 23
http://www.slideshare.net/ukaszSzymula/2013-luxury-goods-worldwide-market

Referring to Luxury Goods Worldwide Market Study Fall 2013, October 28, 2013 Bain study.
http://www.bain.com/publications/articles/luxury-goods-worldwide-market-study-fall-2013.aspx

65 Bain & Co (2013), slide 30, op.cit.

66 The Business of Fashion (2013), op.cit.

67 Bain & Co (2013), op cit. slide 14

68 Bain & Co (2013), op cit. slide 14. Europe 34%, Americas 32%, Asia Pacific 21% and Japan 8%

69 Bain & Co (2013), op cit. slide 28. Chinese nationals make up 29% of luxury goods consumers worldwide.

70 Bain & Co (2013), op cit. slide 33

71 Canepa is a textiles manufacturer and a supplier to many luxury brands, its Detox commitment proves that the luxury sector can eliminate hazardous chemicals. See: http://www.canepa.it/wp-content/uploads/Canepa-Detox-Solution-Commitment.pdf via their public website:
http://www.canepa.it/canepa-spa-becomes-the-first-textile-company-in-the-world-to-sign-the-detox-solution-commitment-following-the-greenpeace-challenge?lang=en

72 IPE – Chinese Institute for Environmental Affairs, which is a credible global chemical discharge disclosure platform.

73 This means taking preventive action where there are legitimate reasons for concern regarding the intrinsic hazards of a chemical, even if information is insufficient to verify those hazards. It is based, in part, on the premise that some hazardous substances cannot be rendered harmless by the receiving environment (i.e. there are no "environmentally acceptable/safe" use or discharge levels) and that prevention of potential damage is required. The process of applying the Precautionary Principle must involve an examination of the full range of alternatives, including, where necessary, substitution through the development of sustainable alternatives where they do not already exist.

74 All brands need to take corporate responsibility for a clear Individual Action Plan that identifies the steps it will take to follow through on its Detox commitment and continuously review and update these steps.

75 "Right to Know" is defined as practices that allow members of the public access to environmental information – in this case specifically about the uses and discharges of chemicals based on reported quantities of releases of hazardous chemicals to the environment, chemical-by-chemical, facility-by-facility, at least year-by-year.

76 http://www.ipe.org.cn/En/

77 Examples of regulated chemicals are: APEs – certain NPEs, NPs, OPEs and OPs; PFCs – PFOS; phthalates; DEHP, DBP, BBP.

78 Such a regulation has been proposed within the EU, by the Swedish Chemical Inspectorate, KEMI, see: KEMI (2012) Proposals for new restrictions under REACH. Swedish Chemicals Agency (KEMI). http://www.kemi.se/en/Content/Rules-and-regulations/Reach/Begransningsregler-bilaga-XVII/Proposals-for-new-restrictions/

79 Greenpeace International (2012a). op.cit. (footnote 1)

80 Greenpeace 2011, Hidden Consequences, The costs of industrial water pollution on people, planet and profit
http://www.greenpeace.org/international/en/campaigns/toxics/water/Hidden-Consequences/

81 A selective list of some of the most comprehensive and stringent ecolabels currently available is provided in a recent report by Women in Europe for a Common Future. Some labels also cover the use of organic cotton. See WECF (2013), Textiles : Stop the chemical overdose! Towards more coherent and transparent rules for textiles in EU and beyond for better protection of workers, consumers and the environment, Madeleine Cobbing, Elisabeth Ruffinengo, October 31, 2013, See Figure 1, page 7.
http://www.wecf.eu/english/articles/2013/10/textiles-chemicals.php

Appendix 1:

Concentration of NPEs, carcinogenic amines, phthalates, organotins, ionic PFCs,volatile PFCs and antimony in all articles tested

Sample code	Brand	Place of sale	Place of manufacture	Type of product	Fabric
TX13033	Dior	China	Morocco	t-shirt	100% cotton
TX13034	Dior	Taiwan	Morocco	polo shirt	100% cotton
TX13035	Dior	France	unknown	t-shirt	92% cotton, 8% elastane
TX13036	Dior	France	Italy	trainers	not specified
TX13037	Dior	Italy	unknown	t-shirt	main 100% cotton; ribbing 97% cotton, 3% elastane
TX13038	Dior	Russia	Morocco	t-shirt	100% cotton
TX13039	Dior	Switzerland	Italy	knitted top	70% cashmere, 30% silk
TX13045	Dolce & Gabbana	Hong Kong	Italy	t-shirt	100% cotton
TX13046	Dolce & Gabbana	Italy	Italy	t-shirt	50% cotton, 50% polyester
TX13047	Dolce & Gabbana	Russia	Hungary	skirt	100% cotton
TX13059	Giorgio Armani	China	China	swimsuit	outshell-1 80% polyamide, 20% elastane; outshell-2 100% polyester; lining 92% polyamid, 8% elastane
TX13060	Giorgio Armani	Italy	China	t-shirt	100% cotton
TX13061	Giorgio Armani	Italy	China	shorts	fabric 1 100% cotton; fabric 2 55% cotton, 45% polyester
TX13062	Giorgio Armani	Italy	China	t-shirt	100% cotton
TX13070	Hermès	China	Italy	baby shawl	100% cotton
TX13071	Hermès	France	unknown	baby booties	dipped lambskin
TX13076	Louis Vuitton	Hong Kong	Italy	shoes	upper calf leather; sole rubber
TX13077	Louis Vuitton	France	Italy	trainers	suede
TX13078	Louis Vuitton	Switzerland	Italy	ballerina shoes	suede
TX13079	Marc Jacobs	Italy	Thailand	body suit	93% cotton 7% elastane
TX13080	Marc Jacobs	Italy	Turkey	t-shirt	100% cotton
TX13081	Marc Jacobs	Denmark	India	t-shirt	100% cotton
TX13103	Trussardi	Italy	unknown	t-shirt	96% cotton, 4% elastane
TX13104	Trussardi	Italy	Turkey	t-shirt	95% cotton, 5% elastane
TX13105	Trussardi	Italy	unknown	t-shirt	96% cotton, 4% elastane
TX13109	Versace	Italy	Italy	jacket	fabric 1 100% polyester; facric 2 100% cotton; lining component 96% cotton, 4% elasthan
TX13110	Versace	UK	Italy	t-shirt	96% cotton, 4% elasthan

Table A1. Details of all articles, including the concentrations of NPEs, carcinogenic amines, phthalates, organotins, PFCs and antimony.
For carcinogenic amines "<5 mg/kg" indicates that all quantified amines were below the detection limit (<5 mg/kg).
For phthalates, organotins and PFCs, the total concentration of the quantified individual compounds in each group is given, with data for individual phthalates, organotins and PFCs provided in Appendices 2, 3 and 4 respectively.
ND = not detected.
"-" indicates not tested.

* Where fabric was composed of mixed fibres, the concentration of antimony in the polyester portion was calculated from fabric composition information, on the basis that all antimony arose from the polyester fibre within the fabric blend.

NPEs (mg/kg)	Amines (mg/kg)	Phthalate total (mg/kg)	Organotin total (mg/kg)	Ionic PFCs (µg/kg)	Volatile PFCs (µg/kg)	Antimony in fabric (mg/kg)	Antimony polyester (mg/kg)*
560	-	13	-	-	-	-	-
460	-	-	-	-	-	-	-
<1.0	-	-	-	-	-	-	-
75	-	-	-	6.88	ND	-	-
<1.0	-	-	-	-	-	-	-
4.0	-	48	-	-	-	-	-
400	<5	-	-	-	-	-	-
6.1	-	4.1	<0.1	-	-	-	-
2.1	-	-	-	-	-	117	234
<1.0	<5	-	-	-	-	-	-
<1.0	-	-	-	4.50	ND	-	-
<1.0	<5	-	-	-	-	-	-
<1.0	<5	-	-	-	-	54	120
<1.0	<5	-	-	-	-	-	-
<1.0	-	-	-	-	-	-	-
380	<5	-	<0.1	-	-	-	-
370	-	-	<0.1	-	-	-	-
100	-	-	<0.1	2.52	ND	-	-
760	<5	-	<0.1	16.9	31	-	-
1.7	-	40	-	-	-	-	-
<1.0	-	46	<0.1	-	-	-	-
<1.0	<5	-	<0.1	-	-	-	-
<1.0	<5	-	-	-	-	-	-
<1.0	<5	-	-	-	-	-	-
<1.0	-	-	-	-	-	-	-
<1.0	-	-	-	8.41	374	110	110
<1.0	<5	-	-	-	-	-	-

Appendix 2:

Concentration of individual phthalates in the five articles tested

Sample code	Brand	Type of product	DiBP (mg/kg)	DMP (mg/kg)	DEP (mg/kg)	DnBP (mg/kg)	BBP (mg/kg)	DEHP (mg/kg)	DnOP (mg/kg)	DiNP (mg/kg)	DiDP (mg/kg)	Total* (mg/kg)
TX13033	Dior	t-shirt	<3.0	<3.0	<3.0	<3.0	<3.0	**4.4**	<3.0	**8.1**	<3.0	**13**
TX13038	Dior	t-shirt	**8.9**	<3.0	**19**	**4.3**	<3.0	**16**	<3.0	<10	<10	48
TX13045	Dolce & Gabbana	t-shirt	<3.0	<3.0	<3.0	<3.0	<3.0	**4.1**	<3.0	<3.0	<3.0	4.1
TX13080	Marc Jacobs	t-shirt	**12**	<3.0	<3.0	**3.4**	<3.0	**25**	<3.0	<3.0	<3.0	40
TX13081	Marc Jacobs	t-shirt	**8.0**	**26**	<3.0	**6.4**	<3.0	**6.0**	<3.0	<3.0	<3.0	46

Table A2. Concentrations (mg/kg), in plastisol printed fabric, of the following phthalates; di-iso-butyl phthalate (DiBP), dimethyl phthalate (DMP), diethyl phthalate (DEP), di-n-butyl phthalate (DnBP), butylbenzyl phthalate (BBP), di-(2-ethylhexyl) phthalate (DEHP), di-n-octyl phthalate (DnOP), di-iso-nonyl phthalate (DiNP) and di-iso-decyl phthalate (DiDP).

* Total concentration to 2 significant figures

Appendix 3:

Concentrations of individual organotins in the seven articles tested

Sample code	Brand	Type of product	Material analysed	MBT (mg/kg)	DBT (mg/kg)	DOT (mg/kg)	TBT (mg/kg)	TPhT (mg/kg)	MOT (mg/kg)	TTBT (mg/kg)	TCHT (mg/kg)	Total (mg/kg)
	Plastisol print											
TX13045a	Dolce &	t-shirt	print black & grey	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13045b	Gabbana		print blue, red, blue, light blue	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13080a	Marc Jacobs	t-shirt	fabric/print plastic white	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13080b			print plastic dark blue	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13081	Marc Jacobs	t-shirt	fabric/print plastic white & black	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Footwear											
TX13071	Hermès	baby booties	leather orange & white (side wall)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13076a	Louis Vuitton	shoes	leather white & grey	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13076b			plastic white & foam grey	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13077	Louis Vuitton	sneakers	leather brown & white	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TX13078	Louis Vuitton	ballerina shoes	leather black	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table A3. Concentrations (mg/kg) of the following organotins; monobutyltin (MBT), dibutyltin (DBT), dioctyltin (DOT),tributyltin (TBT), triphenyltin (TPhT), monooctyltin (MOT), tetrabutyltin (TTBT), tricyclohexyltin (TCHT).
Data for two individual subsamples is given for some articles where more than one type of fabric was analysed.

Appendix 4:

Concentrations of individual PFCs in the five articles tested

Sample code	Brand	Type of product		PFBS (ng/kg)	PFHxS (ng/kg)	PFHpS (ng/kg)	PFOS (ng/kg)	PFDS (ng/kg)	PFBA (ng/kg)	PFPA (ng/kg)	PFHxA (ng/kg)	PFHpA (ng/kg)
TX13036	Dior	trainers	(footwear)	< 1750	< 1750	< 1750	< 1160	< 1750	**6880**	< 1160	< 1160	< 1160
TX13077	Louis Vuitton	trainers	(footwear)	< 846	< 846	< 846	< 564	< 846	**1650**	< 564	< 564	< 564
TX13078	Louis Vuitton	ballerina shoes	(footwear)	< 966	< 966	< 966	< 644	< 966	**15700**	< 644	< 644	< 644
TX13059	Giorgio Armani	swimwear	(swimwear)	< 758	< 758	< 758	< 505	< 758	**3180**	< 505	< 505	< 505
TX13109	Versace	jacket	(waterproof)	< 1970	< 1970	< 1970	< 1320	< 1970	< 1320	< 1320	< 1320	< 1320

Table A4a. Concentrations of ionic PFCs* by mass (ng/kg; 1000 ng/kg = 1 μg/kg) in waterproof clothing, footwear or swimwear, with total concentration for 21 compounds (μg/kg)

Sample code	Brand	Type of product		PFBS (μg/m²)	PFHxS (μg/m²)	PFHpS (μg/m²)	PFOS (μg/m²)	PFDS (μg/m²)	PFBA (μg/m²)	PFPA (μg/m²)	PFHxA (μg/m²)	PFHpA (μg/m²)
TX13036	Dior	trainers	(footwear)	<0.972	<0.972	<0.972	<0.644	<0.972	**3.82**	<0.644	<0.644	<0.644
TX13077	Louis Vuitton	trainers	(footwear)	<0.823	<0.823	<0.823	<0.548	<0.823	**1.61**	<0.548	<0.548	<0.548
TX13078	Louis Vuitton	ballerina shoes	(footwear)	<0.433	<0.433	<0.433	<0.288	<0.433	**7.04**	<0.288	<0.288	<0.288
TX13059	Giorgio Armani	swimwear	(swimwear)	<0.151	<0.151	<0.151	<0.101	<0.151	**0.636**	<0.101	<0.101	<0.101
TX13109	Versace	jacket	(waterproof)	<0.137	<0.137	<0.137	<0.092	<0.137	<0.092	<0.092	<0.092	<0.092

Table A4b. Concentrations of ionic PFCs* by area (μg/m²) in waterproof clothing, footwear or swimwear, with total concentration for 21 compounds (μg/m²)

Sample code	Brand	Type of product		6:2 FTA (μg/kg)	8:2 FTA (μg/kg)	10:2 FTA (μg/kg)	4:2 FTOH (μg/kg)	6:2 FTOH (μg/kg)	8:2 FTOH (μg/kg)	10:2 FTOH (μg/kg)	MeFOSE (μg/kg)	EtFOSE (μg/kg)
TX13036	Dior	trainers	(footwear)	< 14	< 14	< 14	< 47	< 160	< 120	< 56	< 9	< 9
TX13077	Louis Vuitton	trainers	(footwear)	< 12	< 12	< 12	< 38	< 130	< 100	< 46	< 8	< 8
TX13078	Louis Vuitton	ballerina shoes	(footwear)	< 14	**31**	< 14	< 45	< 150	< 120	< 54	< 9	< 9
TX13059	Giorgio Armani	swimwear	(swimwear)	< 14	< 14	< 14	< 46	< 160	< 120	< 55	< 9	< 9
TX13109	Versace	jacket	(waterproof)	< 15	**34**	< 17	< 51	< 170	**210**	**130**	< 10	< 10

Table A4c. Concentrations of volatile PFCs* by mass (μg/kg) in waterproof clothing, footwear or swimwear, with total concentration for 11 compounds (μg/kg)

Sample code	Brand	Type of product		6:2 FTA (μg/m²)	8:2 FTA (μg/m²)	10:2 FTA (μg/m²)	4:2 FTOH (μg/m²)	6:2 FTOH (μg/m²)	8:2 FTOH (μg/m²)	10:2 FTOH (μg/m²)	MeFOSE (μg/m²)	EtFOSE (μg/m²)
TX13036	Dior	trainers	(footwear)	<7.20	<7.20	<7.20	<24.1	<82.3	<61.7	<28.8	<4.63	<4.63
TX13077	Louis Vuitton	trainers	(footwear)	<12.5	<12.5	<12.5	<39.8	<136.	<104.	<48.2	<8.38	<8.38
TX13078	Louis Vuitton	ballerina shoes	(footwear)	<6.27	**13.9**	<6.27	<20.1	<67.2	<53.7	<24.2	<4.03	<4.03
TX13059	Giorgio Armani	swimwear	(swimwear)	<2.94	<2.94	<2.94	<9.66	<33.6	<25.2	<11.5	<1.89	<1.89
TX13109	Versace	jacket	(waterproof)	<1.05	**2.38**	<1.19	<3.57	<11.9	**14.7**	**9.10**	<0.70	<0.70

Table A4d. Concentrations of volatile PFCs* by area (μg/m²) in waterproof clothing, footwear or swimwear, with total concentration for 11 compounds (μg/m²)

PFOA (ng/kg)	PFNA (ng/kg)	PFDA (ng/kg)	PFUnA (ng/kg)	PFDoA (ng/kg)	PFTrA (ng/kg)	PFTeA (ng/kg)	PFOSA (ng/kg)	PF-3,7-DMOA (ng/kg)	HPFHpA (ng/kg)	H2PFDA (ng/kg)	H4PFOS; 6:2 FTS (ng/kg)	Total (µg/kg)
< 1210	< 1160	< 1160	< 1160	< 1160	< 1160	< 1160	< 1160	< 2330	< 2330	< 2330	< 1750	**6.88**
< 564	< 564	**868**	< 564	< 564	< 564	< 564	< 564	< 1130	< 1130	< 1130	< 846	**2.52**
1190	< 644	< 644	< 644	< 644	< 644	< 644	< 644	< 1290	< 1290	< 1290	< 966	**16.9**
< 505	< 505	< 505	< 505	< 505	< 505	< 505	< 505	< 1010	**1320**	< 1010	< 758	**4.5**
4750	< 1320	**3660**	< 1320	< 1320	< 1320	< 1320	< 1320	< 2630	< 2630	< 2630	< 1970	**8.41**

PFOA (µg/m²)	PFNA (µg/m²)	PFDA (µg/m²)	PFUnA (µg/m²)	PFDoA (µg/m²)	PFTrA (µg/m²)	PFTeA (µg/m²)	PFOSA (µg/m²)	PF-3,7-DMOA (µg/m²)	HPFHpA (µg/m²)	H2PFDA (µg/m²)	H4PFOS; 6:2 FTS (µg/m²)	Total (µg/m²)
<0.672	<0.644	<0.644	<0.644	<0.644	<0.644	<0.644	<0.644	<1,294	<1,294	<1,294	<0.972	**3.82**
<0.548	<0.548	**0.845**	<0.548	<0.548	<0.548	<0.548	<0.548	<1,099	<1,099	<1,099	<0.823	**2.45**
0.533	<0.288	<0.288	<0.288	<0.288	<0.288	<0.288	<0.288	<0,578	<0,578	<0,578	<0.433	**7.58**
<0.101	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101	<0.101	<0,202	**0.264**	<0,202	<0.151	**0.900**
0.333	<0.092	**0.256**	<0.092	<0.092	<0.092	<0.092	<0.092	<0,184	<0,184	<0,184	<0.137	**0.589**

MeFOSA (µg/kg)	EtFOSA (µg/kg)	Total (µg/kg)
< 9	< 9	ND
< 8	< 8	ND
< 9	< 9	**31**
< 9	< 9	ND
< 10	< 10	**374**

MeFOSA (µg/m²)	EtFOSA (µg/m²)	Total (µg/m²)
<4.63	<4.63	ND
<8.38	<8.38	ND
<4.03	<4.03	**13.9**
<1.89	<1.89	ND
<0.70	<0.70	**26.2**

* Individual PFCs included the following;

Ionic PFCs:
Perfluorobutane sulfonate (PFBS), perfluorohexane sulfonate (PFHxS), perfluoroheptane sulfonate (PFHpS), perfluorooctane sulfonate (PFOS),
perfluorodecane sulfonate (PFDS), perfluorobutanoate (PFBA), perfluoropentanoate (PFPA), perfluorohexanoate (PFHxA), perfluoroheptanoate (PFHpA), perfluorooctanoate (PFOA), perfluorononanoate (PFNA), perfluorodecanoate (PFDA), perfluoroundecanoate (PFUnA), perfluorododecanoate (PFDoA), perfluorotridecanoate (PFTrA), perfluorotetradecanoate (PFTeA), perfluorooctane sulfonamide (PFOSA), perfluoro-3,7-dimethyloctanoate (PF-3,7-DMOA), 7H-dodecafluoroheptanoate (HPFHpA), 2H,2H-perfluorodecanoate (H2PFDA), 2H,2H,3H,3H-perfluoroundecanoate (H4PFUnA)

Volatile PFCs:
1H,1H,2H,2H-perfluorooctylacrylate (6:2 FTA), 1H,1H,2H,2H-perfluorodecylacrylate (8:2 FTA), 1H,1H,2H,2H-perfluorododecylacrylate (10:2 FTA), 1H,1H,2H,2H-perfluoro-1-hexanol (4:2 FTOH), 1H,1H,2H,2H-perfluoro-1-oktanol (6:2 FTOH), 1H,1H,2H,2H-perfluoro-1-decanol (8:2 FTOH), 1H,1H,2H,2H-perfluoro-1-dodecanol (10:2 FTOH), 2-(N-methylperfluoro-1-octanesulfonamido)-ethanol (MeFOSE), 2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol (EtFOSE), N-methylperfluoro-1-octansulfonamide (MeFOSA), N-ethylperfluoro-1-octanesulfonamide (EtFOSA)

GREENPEACE

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

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