TOXIC THREADS

Toxic Threads: The Big Fashion Stitch-Up

How big brands are making consumers unwitting accomplices in the toxic water cycle

GREENPEACE

Contents

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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 North and Global South

Throughout this report we refer to the terms "Global North" and "Global South" to describe two distinct groups of countries. 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*

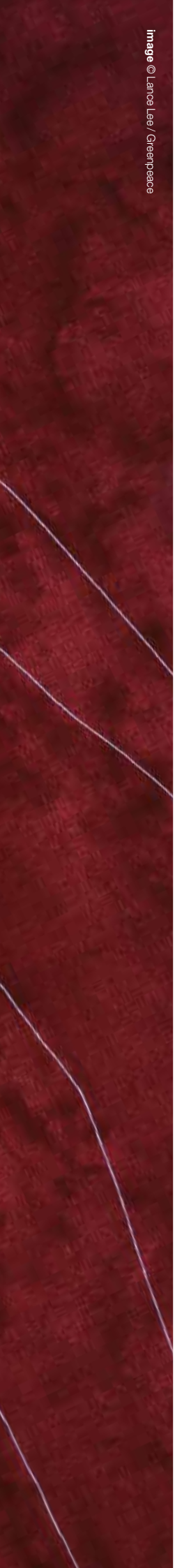


image © Lance Lee / Greenpeace

Executive Summary

Greenpeace International has commissioned a new investigation that delves even further into the hazardous chemicals used in the production of high street fashion. Spurred on by the success of Greenpeace's Detox Campaign, which exposed the links between textile manufacturing facilities using toxic chemicals and water pollution, the investigation was expanded to include 20 global fashion brands including Armani, Levi's and Zara, as well as more hazardous chemicals[1].

A total of 141 items of clothing were purchased in April 2012 in 29 countries and regions worldwide from authorised retailers. These were manufactured in at least 18 different countries, mainly in the Global South, according to the garments' labels. However, the place of manufacture was not identified for 25, which is symptomatic of an industry that is not as transparent about its manufacturing practices as it should be. The garments, designed for men, women, and children, included jeans, trousers, t-shirts, dresses, and underwear, and were made from both artificial and natural fibres; 31 of the samples bore a plastisol print, and for these items it was this part of the fabric that was tested for phthalates and nonylphenol ethoxylates (NPEs).

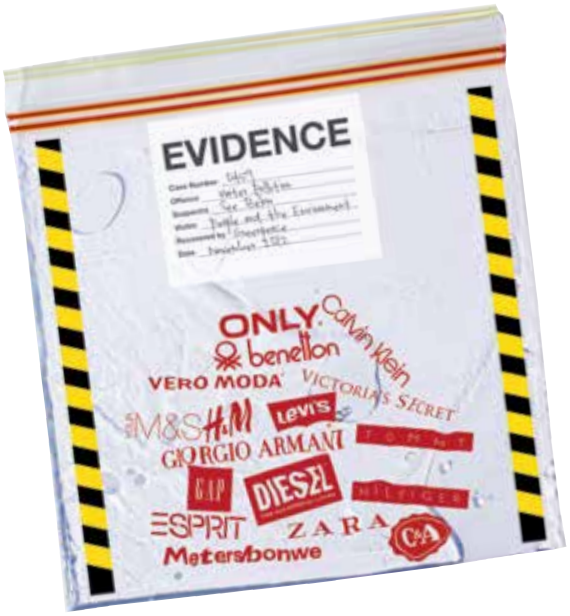
The chemicals found included high levels of toxic phthalates[2] in four of the garments, and cancer-causing amines from the use of certain azo dyes[3] in two garments. NPEs were found in 89 garments (just under two thirds of those tested), showing little difference from the results of the previous investigation into the presence of these substances in sports clothing that was conducted in 2011.[4] In addition, the presence of many other different types of potentially hazardous industrial chemicals was discovered across a number of the products tested. **As inherently hazardous substances, any use of NPEs, phthalates, or azo dyes that can release cancer-causing amines, is unacceptable.**[5]

Key findings

- **NPEs** were found in a total of 89 articles (63% of all items tested). The levels ranged from just above 1 ppm[6] up to 45,000 ppm.[7]
- All of the brands included in this study had one or more product that contained detectable levels of NPEs. They were also detected in one or more product from 13 of the 18 countries of manufacture, and also in products sold in 25 out of the 29 countries and regions of sale.
- Levels above 100 ppm were found in 20% of the samples from the current study. Higher levels of NPEs were found in a higher percentage of the samples than the previous investigation, although the results were broadly similar overall. Levels of NPEs over 1,000 ppm were recorded in 12 of the samples, compared with two in the previous investigation[8].
- Brands with clothing samples containing NPEs at the highest concentrations – above 1,000 ppm – were C&A, Mango (three samples each), Levi's (two samples), Calvin Klein (one sample), Zara (one sample), Metersbonwe (two samples), Jack & Jones (one sample), and Marks & Spencer (one sample).
- **Phthalates** were detected in all 31 of the samples of the plastisol printed fabric. Very high concentrations were found in four of the samples, at levels of up to 37.6% by weight, indicating their deliberate use as plasticisers in the plastisol print. Of these four garments, two of the products were manufactured for Tommy Hilfiger (37.6% and 20%), while the other was for Armani (23.3%). The fourth sample, containing 0.52%, was manufactured for Victoria's Secret.
- Two products manufactured for fast fashion brand Zara contained azo dyes releasing cancer-causing **amines.** While the levels found were within regulatory limits, any detection of a cancer-causing substance is unacceptable in clothing items worn by people around the world.
- A chemical screening also identified many different industrial chemicals or chemical groups, five of which are classified as "toxic" or "very toxic to aquatic life", although the concentrations were not identified for the chemicals identified using this screening test.

Table 1. The number of samples in which NPEs, phthalates and cancer-causing amines released by certain azo dyes were identified. Results are shown by product brand, with the percentage of positive results for each brand.

	No. of samples	No. tested positive NPEs	Percentage of samples tested positive per brand – NPEs	No. tested positive for phthalates, above 0.5% by weight	No. tested positive for cancer-causing amines released by certain azo dyes
GIORGIO ARMANI	9	5	56%	1	
benetton	9	3	33%		
Blažek	4	2	50%		
C&A	6	5	83%		
Calvin Klein	8	7	88%		
DIESEL	9	3	33%		
ESPRIT	9	6	67%		
GAP	9	7	78%		
H&M	6	2	33%		
JACK & JONES	5	3	60%		
Levi's	11	7	64%		
MANGO	10	6	60%		
YOUR M&S	6	4	67%		
Meters/bonwe	4	3	75%		
ONLY	4	4	100%		
TOMMY HILFIGER	9	6	67%	2	
VANCL 凡客诚品	4	4	100%		
VERO MODA	5	4	80%		
VICTORIA'S SECRET	4	2	50%	1	
ZARA	10	6	60%		2



Fast fashion

The brands in this study included some "fast fashion" brands, which respond to customer preferences by delivering new fashion trends in increasingly short cycles. This is made possible by pressuring suppliers to deliver to ever-tighter deadlines, which encourages irresponsible practices and the cutting of corners in terms of environmental and labour costs[9].

Around 80 billion garments are produced worldwide[10], the equivalent of just over 11 garments a year for every person on the planet. The increased volumes of clothing being made, sold, and thrown away magnifies the human and environmental costs of our clothes at every stage of their life cycle. Even the apparently small, quantities of a hazardous chemical such as NPEs, which are legally allowed in clothing, cumulatively amount to the widespread dispersal of damaging chemicals across the planet.

The need for leadership and transparency

As global players, fashion brands have the opportunity to work on global solutions to eliminate the use of hazardous substances throughout their product lines and to drive a change in practices throughout their supply chains. As part of this leadership, it is vital for brands to commit to Zero Discharge of hazardous chemicals by 1 January 2020. This commitment must include ambitious programmes that match the urgency of the situation, and that will lead to the swift elimination of all hazardous substances. It must also include transparent information about the chemicals that the brands are currently using and discharging as they move towards zero elimination. While these brands continue to use our public waterways like their own private sewers, threatening people's livelihoods and health, we have a right to know which chemicals they are releasing.

The brands' Detox statuses

Engaged Detox brands are those brands that have made a credible zero discharge commitment and are taking some steps to implement this. Implementation plans are on the right track but need to become more concrete, and more steps need to be taken faster. For example, Puma, Nike, Adidas, and Li Ning need to join H&M and C&A, and most recently Marks & Spencer, in their commitment to local online disclosure of releases of hazardous chemicals by some of their suppliers, within the next three months. All these joint roadmap brands, plus C&A, need to join H&M and Marks & Spencer by setting clearer timelines and end dates and verification procedures that will show they have "reached zero discharge" for widely used hazardous substances such as NPEs.

Detox greenwashers are those brands that have declared a Zero Discharge intention and have joined the joint roadmap activities and process, but have not made a credible individual commitment or action plan in their own right. For example, G-Star Raw, Jack Wolfskin, and Levi's. These brands need to revise their partial commitment to clearly adopt the complete paradigm shift to hazardous chemicals elimination, and develop an individual action plan to implement this Detox commitment.

Detox laggards or villains; Laggards are those brands with chemicals management policies and programmes that have yet to make a credible commitment to Zero Discharges. For example, Zara, PVH (Calvin Klein, Tommy Hilfiger), Mango, and GAP. Villains are those brands with little or no policy or programme for chemicals management, and no commitment to Zero Discharges. For example, Esprit, Metersbonwe, Victoria's Secret. These brands need to make a publicly credible Detox commitment that transforms their approach to hazardous chemicals. (See: Key steps to detox our clothes, page 40).

The role of governments

Greenpeace is calling on governments to adopt a political commitment to **"zero discharge"** of all hazardous chemicals within one generation, based on the **precautionary principle** and including a **preventative approach** by avoiding production and use and, therefore, exposure to hazardous chemicals. This approach must have at its core the **principle of substitution**, such that hazardous chemicals are progressively replaced with safer alternatives, and include **producer responsibility** in order to drive innovation and elimination of such chemicals. As a vital first step to this process, a dynamic list of hazardous chemicals should be established and include chemicals like NPEs and phthalates for priority action, and have a publicly available register of data on discharge emissions and losses of hazardous substances.

The role of "People Power"

As global citizens and consumers we can also use our influence to make this change. Together we can demand that governments and brands act NOW to detox our rivers, detox our clothing and ultimately, detox our futures. Last year, thanks to global people power, six international brands – Puma, Nike, Adidas, H&M, Li Ning, and C&A, signed up to the "Detox Challenge" and committed to work with their suppliers to cut their toxic abuse.

This is just the beginning.

A post-toxic world is not only desirable, it's possible. Together we can create it.

image © Athit Perawongmetha / Greenpeace


C&A
Levi's
DIESEL
FOR SUCCESSFUL LIVING
VICTORIA'S SECRET
H&M
ESPRIT
benetton
GIORGIO ARMANI
YOUR M&S
Metersbonwe
ONLY
TOMMY
HILFIGER
Calvin Klein
VERO MODA

image © Lance Lee / Greenpeace

TOXIC THREADS

#1

Introduction

A new investigation commissioned by Greenpeace International has found residues of a variety of hazardous chemicals in clothing made by 20 global fashion brands. The chemicals found included high levels of toxic phthalates in four of the products, and cancer-causing amines from the use of azo dyes in two products. Nonylphenol ethoxylates (NPEs) were found in 89 of the 141 garments tested, showing little difference from the results of a previous investigation into the presence of these substances in sports clothing that was conducted in 2011.[11] In addition the presence of many different types of hazardous or potentially hazardous industrial chemicals were discovered across a number of the products tested.

The clothes were sold by the leading fashion companies Benetton Group (owner of the Benetton brand), Bestseller A/S (owner of the Jack & Jones, Only and Vero Moda brands), Blažek Prague Inc (owner of the Blažek brand), Cofra Holding AG (owner of the C&A brand), Diesel SpA (owner of the Diesel brand), Esprit Holdings Ltd (owner of the Esprit brand), Gap Inc (owner of the Gap brand), Giorgio Armani SpA (owner of the Armani brand), Hennes & Mauritz AB (owner of the H&M brand), Inditex (owner of the Zara brand), Levi Strauss & Co (owner of the Levi's brand), Limited Brands (owner of the Victoria's Secret brand), Mango Group (owner of the Mango brand), Marks & Spencer Group Plc (owner of the Marks & Spencer brand), Metersbonwe Group (owner of the Metersbonwe brand), PVH Corp (owner of the Calvin Klein and Tommy Hilfiger brands), and VANCL (owner of the Vancl brand).

Unlike other recent Greenpeace investigations into chemical residues within textile products[12], which focussed on the "tip of the toxic iceberg" by only looking at NPEs in textile items, this study has looked for a number of different hazardous chemicals within a broad range of fashion clothes, as either components of materials incorporated within the product, or as residues remaining from use within manufacturing processes.

Among the chemicals for which the quantities were measured, NPEs were the most commonly detected substances, with residues identified in products across all brands and almost all countries of manufacture and countries of purchase included in the study. This shows that the use of NPEs is still widespread throughout the global textile industry, during the manufacture of products for a host of major international clothing brands.

As inherently hazardous substances, any presence of NPEs, phthalates, or azo dyes, which can release cancer-causing amines, is unacceptable.

image © Alex Stoneman / Greenpeace

image © Alex Stoneman / Greenpeace

image Scientist Kevin Brigden working at the Greenpeace Research Laboratories at Exeter University.

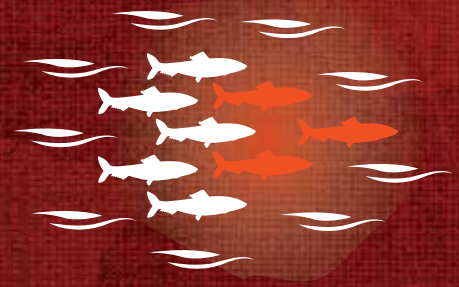
The toxic trail of clothes

1 Formulations are manufactured containing nonylphenol ethoxylates (NPEs) and are delivered to textile manufacturers to use in processing.

Some azo dyes that can later release cancer-causing amines are used in dyeing processes. Other hazardous substances are also used in various processes.

Plastisol formulations containing toxic phthalates for printing images on textiles are used in textile finishing.

2 Lax regulation and the inadequate policies by global clothing brands to eliminate the use of NPEs, phthalates, and other hazardous chemicals results in wastewater discharges containing these hazardous chemicals, or toxic chemicals that they give rise to, entering public waterways, such as rivers and lakes.



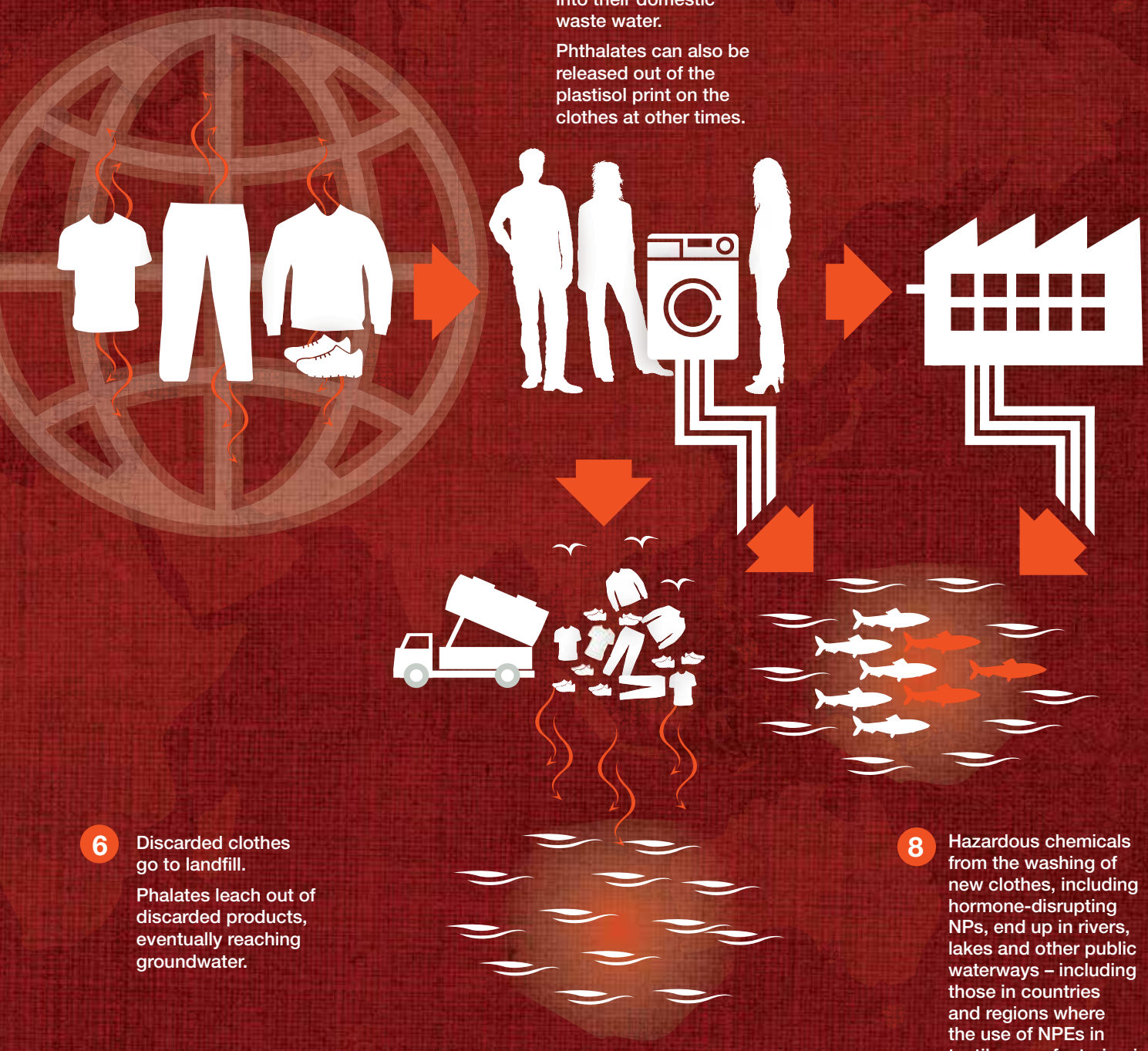
3 Following release in wastewaters, NPEs break down to form the persistent, toxic, hormone-disrupting nonylphenol (NP), which can accumulate in sediments and build up in the food chain, in fish and other wildlife. Effluents can also contain toxic phthalates, carcinogenic amines, and other hazardous substances including some that are toxic to fish.

4 The global textile industry then delivers clothes containing phthalates, residues of NPEs, and other hazardous chemicals to markets around the world (including those where NPEs are effectively banned in clothing manufacture).

5 Brands' inadequate policies then force consumers to become unwitting accomplices in the cycle of toxic water pollution when they wash their new clothes containing NPE residues, as this releases these hazardous chemicals into their domestic waste water.

Phthalates can also be released out of the plastisol print on the clothes at other times.

7 Wastewater treatment plants (in those markets that even have them) are generally ineffective in dealing with NPEs, essentially only speeding up their breakdown into toxic NPs.



6 Discarded clothes go to landfill.

Phalates leach out of discarded products, eventually reaching groundwater.

8 Hazardous chemicals from the washing of new clothes, including hormone-disrupting NPs, end up in rivers, lakes and other public waterways – including those in countries and regions where the use of NPEs in textile manufacturing is banned.

image Scientist Melissa Wang works at the Greenpeace Research Laboratories at Exeter University.

TOXIC THREADS

#2

Methodology and results

The hazardous chemicals found are either a result of their presence in manufacturing processes or, in the case of clothes with high levels of phthalates, incorporated deliberately within the plastisol print on the fabric. In both cases, emissions of these substances into water systems such as rivers, lakes and seas are likely to take place when these products are manufactured. Greenpeace's previous investigation[13] of two textile manufacturers in mainland China found NPEs and other alkylphenol ethoxylates (APEs), as well as other hazardous substances, being discharged into rivers. In addition, another Greenpeace investigation found that a high proportion of NPE residues in clothing were readily washed out under conditions simulating laundering by consumers.[14] Similarly, it was recently reported that a new UK study found that 99% of NPE residues in clothes were washed out in just two washes, and that imported clothes could be a large potential source of this toxic river pollutant in the UK.[15] It is possible that other water-soluble hazardous chemicals in clothes could be washed out in this way. There will also be ongoing losses of phthalates from the products into the surrounding environment, which would continue when clothes are discarded and sent to landfill.

These studies form a snapshot, but if they are typical for textiles, releases of this type will be distributed across the globe via a large proportion of the billions of articles of clothing sold every year, and increasing due to our ever increasing consumption of "fast fashion". This would amount to large quantities of hazardous chemicals such as NPEs being released into the aquatic environment every year.

Methodology and Results

In April 2012 national and regional Greenpeace offices purchased a total of 141 items of clothing from authorised dealers of 20 major fashion brands, in 29 different countriesand regions. A variety of garments designed for men, women, and children, were purchased including t-shirts, jeans, trousers, dresses, and underwear, as well as various other types of clothing[16]. According to their labels, products were manufactured in at least 18 different countries, however 25 garments were of unknown manufacturing origin. Knowledge of the product's country of origin is important for establishing the chain of custody of the toxic pollution.

The products were sealed immediately upon purchase in the store, or upon delivery from online stores, and shipped to the Greenpeace Research Laboratories at the University of Exeter in the UK. The clothes were then analysed for chemicals contained within them, either at the Greenpeace Research Laboratories or at independent accredited laboratories.[17]

All of the samples were tested for the concentration of NPEs. Garments that were dyed were tested for the presence of carcinogenic amines that are released from certain azo dyes used to dye fabric. The 31 garments bearing a plastisol print were also tested for phthalate esters (commonly referred to as phthalates). In addition, 63 of the products were investigated through a broader non-quantitative chemical screening to identify the presence, as far as possible, of any other hazardous chemicals present within the products.

Main results

Nonylphenol ethoxylates (NPEs) – key findings

All 141 garments were analysed for the quantity of NPEs present. For the majority (110 of 141) a section of plain fabric was tested. The remaining 31 products had a section of fabric bearing a plastisol print of an image, logo or text tested. As an inherently hazardous substance (see Box 1), all NPE use is unacceptable, as it gives rise to persistent and bioaccumulative nonylphenol. This study quantified levels of NPEs above the detection limit, which is 1 ppm.[18]

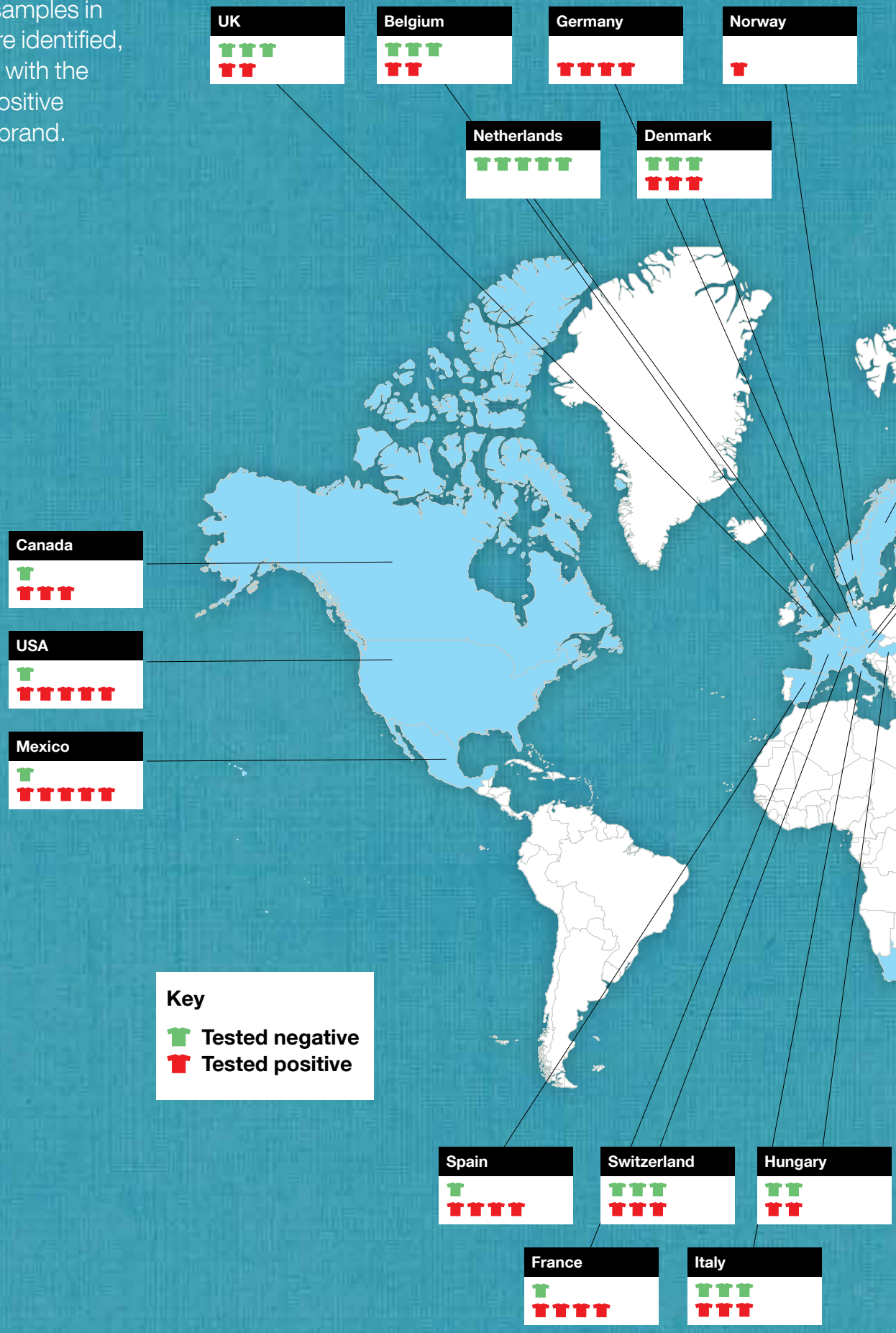
- **NPEs** were found in a total of 89 articles (63% of all the items tested). The levels ranged from just above 1 ppm up to 45,000 pm.[19]
- All of the brands included in this study produced one or more garments that contained detectable levels of NPEs. NPEs were found in one or more garments from 13 out of the 18 countries of manufacture[20], and in garments sold in 25 out of 29 countries and regions.
- The highest concentration (45,000 mg/kg) was detected in a sample of fabric bearing a plastisol print from a C&A-branded t-shirt manufactured and sold in Mexico.[21] This was significantly higher than the levels found in any of the other samples, with the next highest concentration of 9,800 mg/kg recorded in a plain fabric Mango t-shirt, manufactured in Turkey and sold in Spain.[22]
- Brands with clothing samples containing NPEs at the highest concentrations – above 1,000 ppm – were C&A (one sample), Mango (three samples), Levi's (two samples), Calvin Klein (one sample), Zara (one sample), Metersbonwe (two samples), Jack & Jones (one sample) and Marks & Spencer (one sample).
- Higher levels of NPEs were found in a greater proportion of the samples than in the previous investigation, although the results overall were broadly similar. Levels of NPEs over 1,000 ppm were recorded in 12 of the samples, compared with two of the former samples. Levels above 100 ppm were found in 20% of the samples from the current study.
- It is important to note that the lower levels of NPEs in other items do not necessarily indicate that similarly lower amounts of NPEs were used during their manufacture.

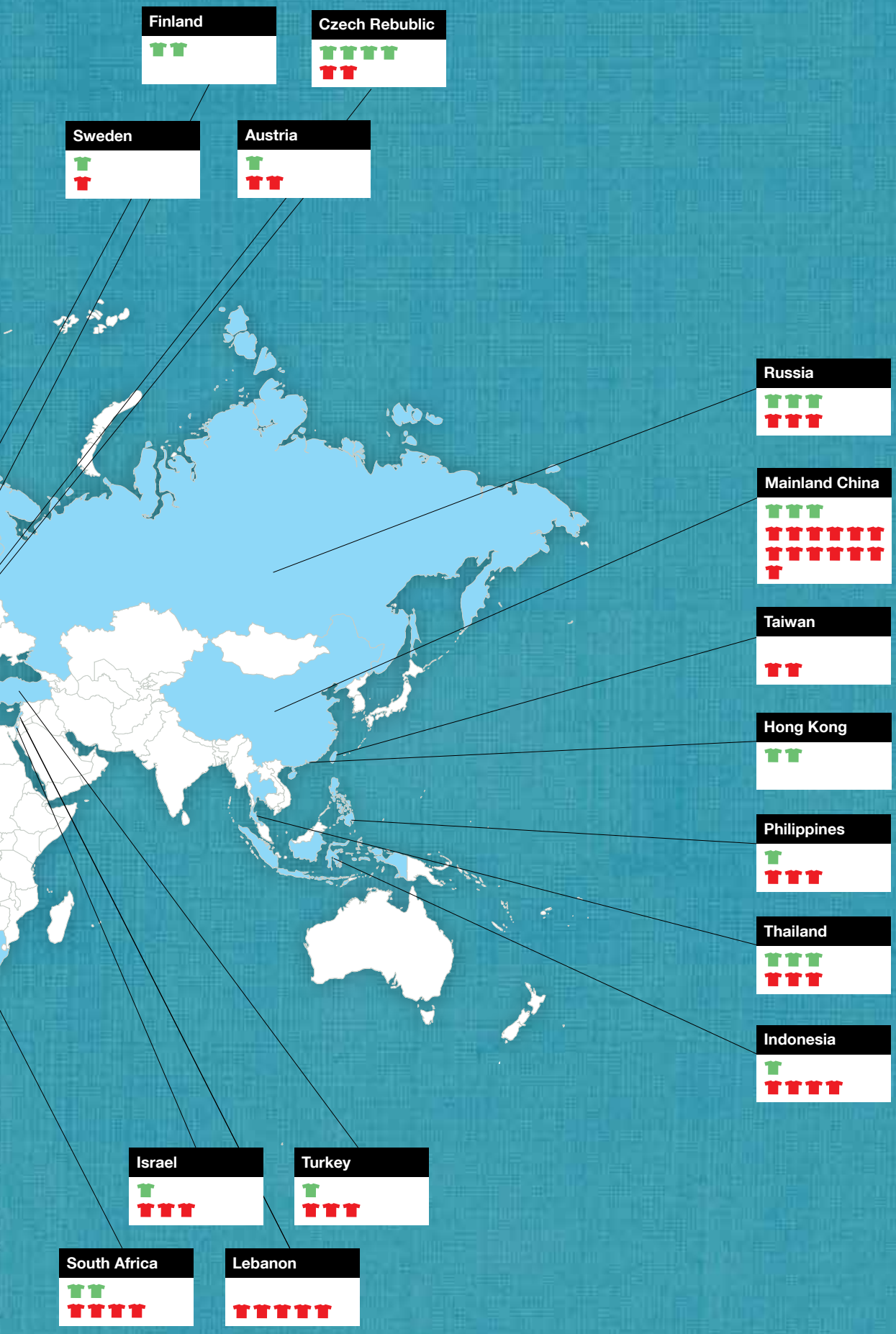
There have been restrictions in some countries on certain uses of NPEs by industry for almost 20 years.[23] Although there are currently no regulations that restrict the sale of products containing NPE residues, measures are currently under development within the EU.[24] Once released to the environment, NPEs degrade to nonylphenol, known to be toxic primarily due to being a hormone disruptor, persistent and bioaccumulative (known to accumulate in living organisms). The levels of NPEs detected in all articles are not known to constitute any direct health risk to the wearers of the clothing (for more information about NPEs and NP, please see page 20).

Table 2 The number of samples in which NPEs were identified, by product brand, with the percentage of positive results for each brand.

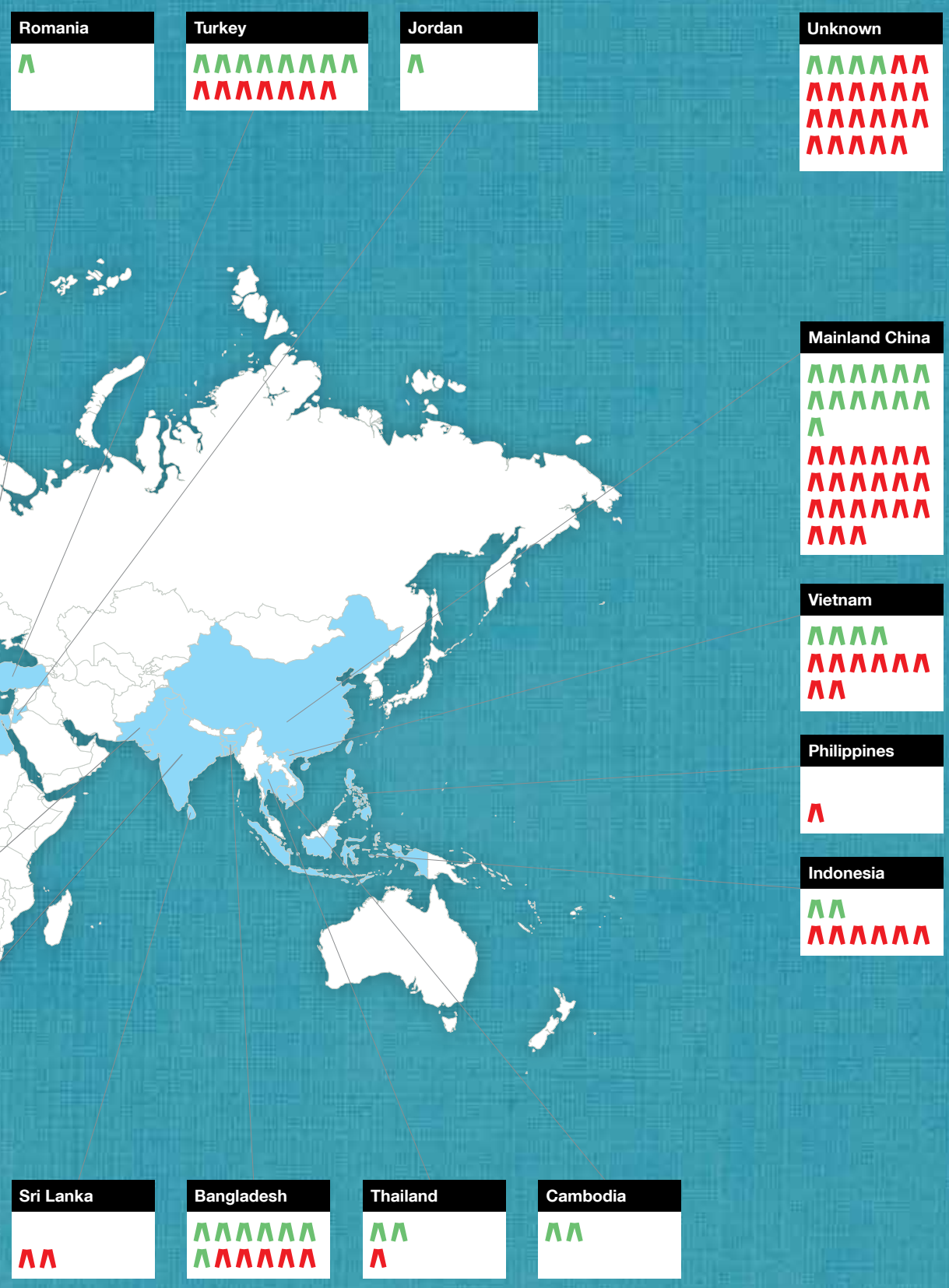
	No. of samples	No. tested positive	Percentage of samples tested positive
GIORGIO ARMANI	9	5	56%
benetton	9	3	33%
Blažek	4	2	50%
C&A	6	5	83%
Calvin Klein	8	7	88%
DIESEL	9	3	33%
ESPRIT	9	6	67%
GAP	9	7	78%
H&M	6	2	33%
JACK & JONES	5	3	60%
Levi's	11	7	64%
MANGO	10	6	60%
YOUR M&S	6	4	67%
Meters/bonwe	4	3	75%
ONLY	4	4	100%
TOMMY HILFIGER	9	6	67%
VANCL 凡客诚品	4	4	100%
VERO MODA	5	4	80%
VICTORIA'S SECRET	4	2	50%
ZARA	10	6	60%

The number of samples in which NPEs were identified, by place of sale, with the percentage of positive results for each brand.




Finland
Czech Rebublic
Sweden
Austria
Russia
Mainland China
Taiwan
Hong Kong
Philippines
Thailand
Indonesia
Israel
Turkey
South Africa
Lebanon

The number of samples in which NPEs were identified by place of manufacture, with percentage of positive results for each country.


Romania
Turkey
Jordan
Unknown
Mainland China
Vietnam
Philippines
Indonesia
Sri Lanka
Bangladesh
Thailand
Cambodia

Box 1. Nonylphenol (NP) and Nonylphenol ethoxylates (NPEs)

Nonylphenol ethoxylates (NPEs): NPEs are a group of man-made chemicals that do not occur in nature other than as a result of human activity. These compounds belong to a broader group of chemicals known as alkylphenol ethoxylates (APEs), chemicals most widely used as surfactants, including in formulations used by textile manufacturers. Once released to wastewater treatment plants, or directly into the environment, NPEs degrade to nonylphenol.[25] Due to concerns about their hazardous properties, there have been restrictions on the use of NPEs in some regions for almost 20 years.[26]

Nonylphenol (NP): NP is manufactured for a variety of specialised industrialised uses, including the manufacture of NPEs. Following use, NPEs can break back down into the NP from which they were produced.[27] NP is known to be persistent, bioaccumulative and toxic, and is able to act as a hormone disruptor.[28] NP is known to accumulate in the tissues of fish and other organisms.[29] NP has also recently been detected in human tissue.[30] In some regions, the manufacture, use and release of NP and NPEs have been regulated for many years.

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 north-east Atlantic by 2020.[31] NP has also been included as a "priority hazardous substance" under the EU Water Framework Directive.[32] 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.[33] However, the restriction on treated textile products imported from outside the EU has yet to be developed. Elsewhere, NP and NPEs have very recently been 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.[34]

Phthalates – key findings

The 31 articles bearing a plastisol print of an image, logo or text were investigated for the presence of a range of phthalates within the printed fabric. In this study the detection limit for individual phthalates was 3 ppm.[35]

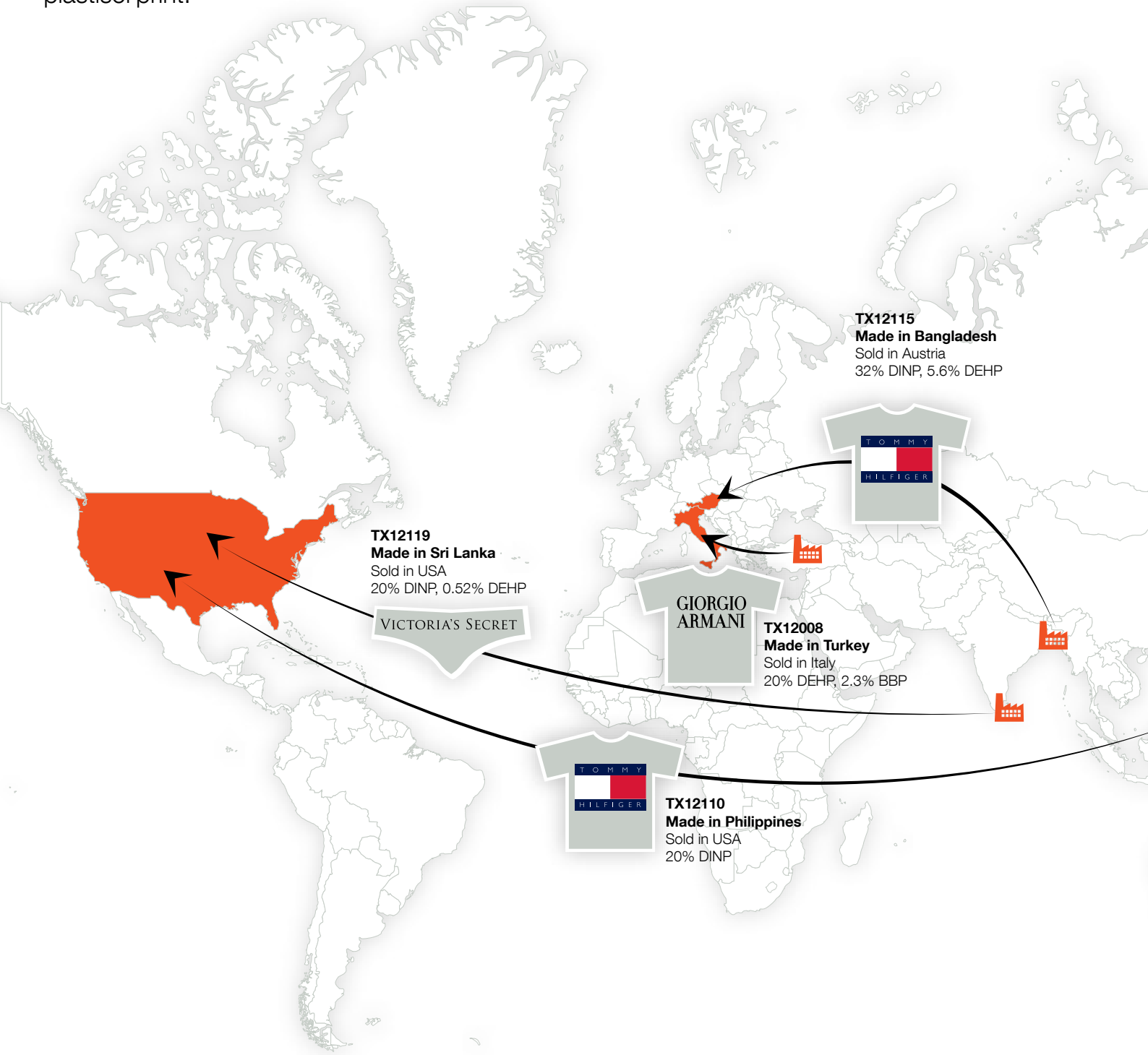
- Phthalates were detected in all 31 of the samples of the plastisol printed fabric. Very high total concentrations were found in four of the samples, at levels of up to 37.6% by weight, indicating their deliberate use as plasticisers in the plastisol print. Of these four garments, two of the products were manufactured for Tommy Hilfiger (37.6% and 20%), one for Armani (22.3%), and one for Victoria's Secret (0.52%).
- Two of the four products were sold in the US, one was sold in Austria and one was sold in Italy. The four products were manufactured in Turkey, Philippines, Bangladesh and Sri Lanka.
- The predominant phthalates with high concentrations identified in the four samples were di-2-ethylhexyl phthalate (DEHP), diisononyl phthalate (DINP) and benzyl butyl phthalate (BBP). DEHP and BBP are known to be toxic to the reproductive system, and have been listed as "substances of very high concern" under the EU regulation REACH. DINP is also toxic at high doses and has some hormone disrupting effects. Phthalates in plastisol formulations are not tightly bound to the plastic and can therefore be released from the product over time (for more information on phthalates see Box 2).

Phthalates were detected in all the remaining 27 articles, although the concentrations recorded would be too low to indicate their deliberate use as plasticisers. The identified phthalates may be present due to contamination of other substances in the plastisol formulation, the use of phthalates at the manufacturing facility, or even from contact with phthalate-bearing materials after manufacture, up to the point when the products were purchased and separately sealed for analysis.

image Scientist Iryna Labunska works at the Greenpeace Research Laboratories at Exeter University.

image Scientist Samantha Hetherington works at the Greenpeace Research Laboratories at Exeter University.

Very high total concentrations of phthalates found in four samples, at levels of up to 37.6% by weight, indicating their deliberate use as plasticisers in the plastisol print.



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TX12119

TX12115

Box 2. Phthalate esters (Phthalates)

Phthalates are mainly used as plasticisers (or softeners) in plastics, especially PVC (eg, in cables and other flexible components) and as ingredients in personal care products, inks, adhesives, sealants and surface coatings. The use of phthalates, particularly as a plasticiser in PVC, results in large-scale losses to the environment (both indoors and outdoors) during the lifetime of the products and again following disposal, mainly because phthalates are not chemically bound to the polymer chains. Phthalates have been found to leach from food packaging materials and contaminate corresponding food products[36,37], from tubing material used for drug products manufacturing[38], and from PVC blood bags that primarily contained di-2-ethylhexyl phthalate (DEHP).[39] Thus, phthalates are found widely in the indoor environment, including in air and dust[40,41,42,43] at concentrations that commonly reflect the prevalence of plastics and certain textiles within the rooms sampled.[44] Once plastic products are disposed to municipal landfills, phthalates – particularly diisobutyl phthalate (DIBP) and di-n-butyl phthalate (DnBP) – may continue to leach, finally reaching groundwater.[45] Phthalates are commonly found in human tissues, including in blood, breast milk and, as metabolites, in urine[46,47,48,49] with reports of significantly higher levels of intake in children.[50] In humans and other animals, they are relatively rapidly metabolised to their monoester forms, but these are frequently more toxic than the parent compound.[51]

There are substantial concerns about the toxicity of phthalates to wildlife and humans.[52] For example, DEHP, one of the most widely used to date, is known to be toxic to reproductive development in mammals, capable (in its monoester form, MEHP) of interfering with development of the testes in early life.[53,54] In addition, adverse impacts on female reproductive success in adult rats and on development of the young have been reported following exposure to this chemical.[55,56,57]

Benzyl butyl phthalate (BBP) and dibutyl phthalate (DBP) have also been reported to exert reproductive toxicity.[58]

Other commonly used phthalates, including the isomeric forms diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP), are of concern because of observed effects on the liver and kidney, albeit at higher doses. DINP has also been found[59] to exhibit anti-androgenic effects on reproductive development of Wistar rats, though less prominent than DEHP, DBP and BBP. However, further safety evaluation of DINP should be undertaken

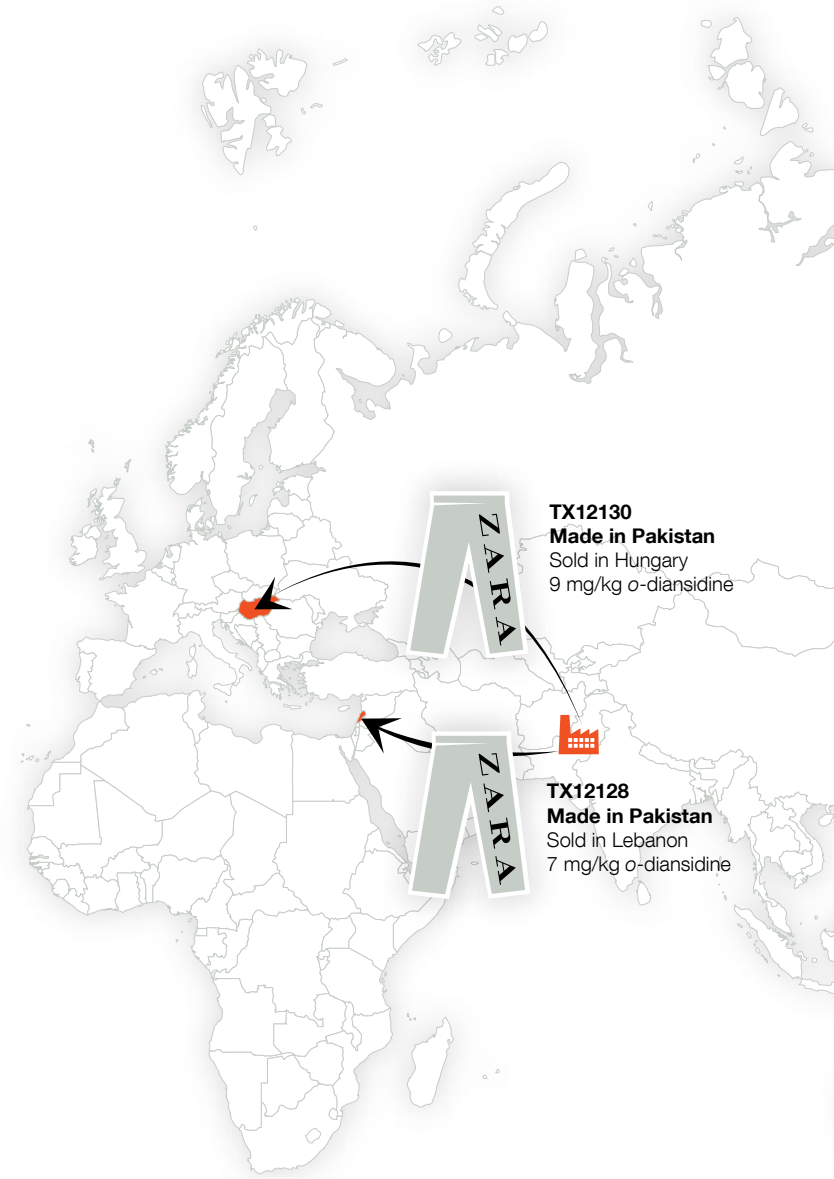
At present, there are relatively few controls on the marketing and use of phthalates, despite their toxicity, the volumes used and their propensity to leach out of products throughout their lifetime. Of the controls that do exist, however, probably the best known is the EU-wide ban on the use of six phthalates in children's toys and childcare articles, first agreed as an emergency measure in 1999 and finally made permanent in 2005.[60] While this addresses one important exposure route, exposures through other consumer products have so far largely escaped regulation. Within the EU, four phthalates (DBP, BBP, DEHP and DIBP), have been included on the candidate list of "substances of very high concern" that will require justification and authorisation for their continued use under the REACH Regulation.[61] DEHP is listed as a priority substance under the EU Water Framework directive, a regulation designed to improve the quality of water within the EU.[62] DEHP and DnBP have also been identified as substances for priority action under the OSPAR convention, under which signatory countries have agreed a target of cessation of discharges, emissions and losses of all hazardous substances to the marine environment of the north-east Atlantic by 2020, the "one generation" cessation target.[63] In August 2012, despite a European Commission ruling from June 2012,[64] the Danish Ministry of Environment announced plans to introduce a wider ban on marketing and use for four hormone-disrupting phthalates: DEHP, DBP, BBP and DIBP.[65]

Amines from azo dyes

- All of the products were also investigated for carcinogenic amines, which can be released from some azo dyes, except for seven garments that were white.
- **Amines** were detected in two out of the 134 articles, above the detection limit of 5 ppm; both products were manufactured in Pakistan for Zara, and sold in either Lebanon or Hungary.
- The levels recorded for these two items were below the regulatory limit set within the EU (30 ppm)[66] and also fell below the stricter limits set for products sold within China (20 mg/kg)[67].

Amines are used in the manufacture of azo dyes and can subsequently be released when they are chemically broken down.[68] The amine found in the samples - *o*-dianisidine – is cancer causing and has been classified as possibly cancer causing to humans and certain uses are regulated in the EU and elsewhere, along with other cancer-causing amines.[69] The levels found in these samples were below the strictest of these regulatory limits[70], however, any detectable presence of such a carcinogenic compound is of concern due to its intrinsic hazardous properties.

It is not possible to quantify the specific risks for the wearer due to the level of amine that was released under the conditions of the test (7 or 9 ppm). Nevertheless brands need to eliminate hazardous chemicals from the manufacture of their products and as part of this address the presence of any dyes that can release carcinogenic compounds from clothes, even if the level of the amine released is below a limit set by regulation.



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Box 3. Carcinogenic amines released by certain azo dyes

Certain azo dyes can break down under reductive conditions[71] to release aromatic amines. This release can take place under a number of conditions, including within the body. Reduction can occur in many different types of cells, including within intestinal and skin bacteria.[72,73,74] Some, though not all, aromatic amines that can be released from azo dyes have been shown to be carcinogenic.[75] Azo dyes are manufactured using the same amines that can be later released through reduction. It is therefore possible for commercial azo dye formulations to contain residues of amines used in their manufacture. Furthermore, certain carcinogenic amines have been detected as residues in other amines that are used for azo dye manufacture, providing an additional route for contamination of commercial azo dye formulations with carcinogenic amines.[76] These sources could contribute to the presence of carcinogenic amines at trace levels within textile products. Animal studies have shown that 3,3'-dimethoxybenzidine (also known as *o*-dianisidine), together with certain other benzidines, can have a carcinogenic effect, increasing tumour incidence in many organs.[77,78,79] There is clear evidence that exposure to benzidine-based dyes has caused bladder cancer in humans. However, the carcinogenicity of *o*-dianisidine alone has not been conclusively demonstrated in humans through epidemiological studies, partly because it is manufactured and used together with other amines that are known human carcinogens, making it difficult to demonstrate that o-dianisidine contributed to cancers seen in workers.[80] The International Agency for Research on Cancer (IARC) has classified o-dianisidine as possibly carcinogenic to humans (class 2B),[81] and similarly the US Department of Health and Human Service lists *o*-dianisidine and dyes that are metabolised to *o*-dianisidine as reasonably anticipated to be human carcinogens.[82]

Legislation exists in certain countries, including EU member states and China, that prohibits the sale of products containing dyes that can degrade under specific test conditions to form carcinogenic amines at concentration above set limits, for textile articles which may come into direct contact with human skin. The EU regulation lists 22 compounds (including *o*-dianisidine), with a limit of 30 mg/kg.[83] The regulation in China sets a limit of 20 mg/kg and lists the same compounds as the EU regulation, as well as two additional compounds.[84]

Amines were found in two articles above the detection limit of 5 ppm. The articles were manufactured in Pakistan for Zara.

Some of the branded products analysed for this report.


TX12002


TX12015

TX12041


TX12058


TX12070


TX12137


TX12059


TX12096


TX12075


TX12010


TX12121


TX12140


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TX12047

Chemical screening – key results

The screening aspect of the study highlights the diverse range of chemical residues that can be present within textile products as a whole. One or more additional chemicals were identified in a subset of 63 samples, representing a selection of the brands, using a qualitative chemical screening approach. The concentrations of these chemicals were not measured, but the results show that a complex array of chemical residues can remain in finished textile products, perhaps as a consequence of their use in manufacture, and where used these chemicals can therefore be discharged in effluents generated by textile factories, and in laundry wash-waters after the products are sold.

- The most commonly found chemicals were **alkanes**[85], with one or more of these substances found in 59 of the 63 items tested; some kinds of alkanes can have toxicological effects[86], although alkanes are biodegradable.
- **Benzyl benzoate** was the second most commonly identified compound, being found in 12 items; although it is also a readily biodegradable substance, used in some dye formulations,[87] it has been classified as toxic to aquatic life with long-lasting effects.[88]
- A further 13 industrial chemicals or chemical groups were identified in smaller numbers of the samples, four of which are classified[89] as toxic or very toxic to aquatic life with long-lasting effects; **benzophenone, 1,1'-biphenyl, butylated hydroxytoluene (BHT), benzyl naphthyl ether.**
- **Nonylphenol** was also detected in one sample, even though NPEs were not present above the detection limit in that sample.

The presence of hazardous chemicals in a product generally indicates that they are used in its manufacture, with a high probability that they are being discharged into local water systems within manufacturing wastewaters. However, in many cases, the level of a particular chemical in a product cannot be linked to the amount that is used or released via a discharge pipe at a specific production location or facility into the local water system during manufacture. For example, NPEs are washed out from materials during manufacture in one or more of the cycles of production, resulting in varying levels of NPEs in the final product. Therefore, it would not be unusual for a finished product with a low level of NPEs to have been manufactured using larger quantities of NPEs than a finished article with a higher level.

The results for the NPEs are generally consistent with the previous study, where 67% of the articles tested positive for the presence of NPEs (above 1 ppm), with levels ranging from just above 1 ppm to 27,000 ppm, compared to 63 % of articles in the current study, for which levels ranged from just above 1 ppm to 45,000 ppm.

image Scientist Kevin Brigden working at the Greenpeace Research Laboratories at Exeter University.

However, a greater percentage (9%) of samples had concentrations of NPEs above 1,000 ppm, the "business as usual" limit set by Oeko-Tex,[90] which only covers a narrow range of NPEs, compared to the previous investigation, where only 2 out of 78 samples (3%) were above this level. In total, 28 items had concentrations of NPEs above 100ppm, the limit set by some brands in Restricted Substances Lists (RSLs) for their own products. For example, C&A[91] sets a limit of 100 ppm and Mango requires no detection of NPEs for use in manufacturing[92].

As with Greenpeace's previous investigation,[93] this study cannot indicate the extent to which NPEs, or any of the other hazardous substances, are used or discharged in the manufacture of products for each brand as a whole, or for any specific production facility. Similarly, no estimate can be made of the extent to which these hazardous chemicals are used, or discharged during the textile processing in each place of manufacture, or in each facility in that place. **Nonetheless, the results clearly indicate the variety of hazardous substances used in textile manufacturing and in particular that the use of NPEs continues to be widespread throughout the global textile industry, during the manufacture of products for a host of major international brands.**

image Greenpeace Research Laboratories at Exeter University.

image © Lance Lee / Greenpeace

#3

Fast fashion: more fashion, more toxics

The brands in this study include some "fast fashion" brands, which deliver new fashion trends in increasingly short cycles in response to customer preferences. From the early 1990s brands looked for ways to increase their profits by encouraging consumers to buy more clothes and to buy them more frequently. Faced with pricing pressure from low-cost supermarket brands such as Walmart, fashion companies shifted the bulk of their manufacturing to the Global South.

Brands such as Zara, H&M, Gap, and Benetton focussed on speeding up fashion cycles by presenting trends to consumers mid-season. It is now the norm to have six to eight fashion seasons compared to the traditional two to four collections a year for many high street brands.[94] To achieve this, they needed increasingly short turnaround times, from design through to the finished article, bringing the production of the more high fashion items closer to the point of sale, while keeping basic items manufactured in the Far East[95], as well as some dyeing and wet processing.

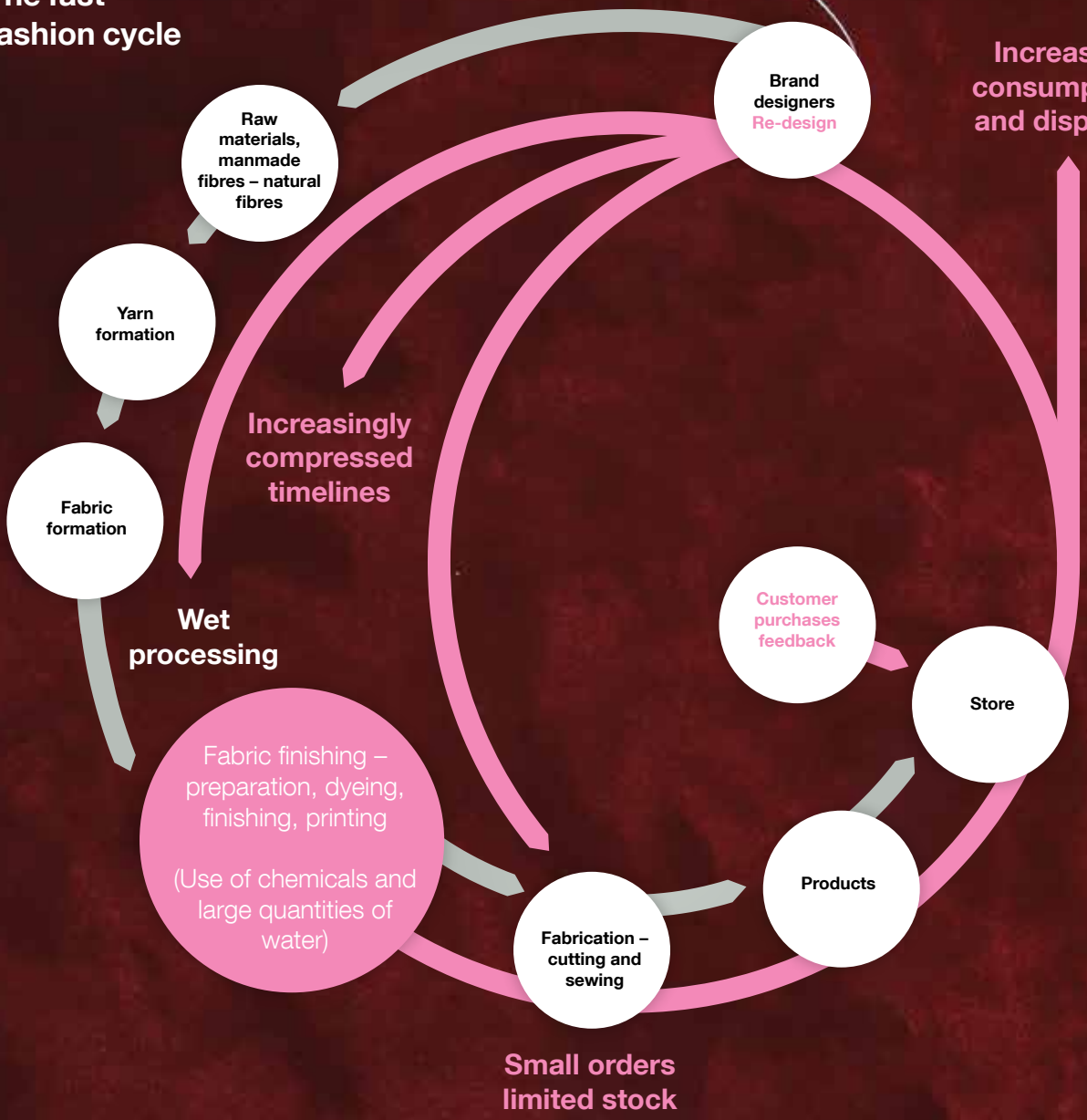
Known as "just in time" manufacturing, new technological systems links all parts of the supply chain together to reduce the time needed for a garment to be produced. Zara, a leading proponent of fast fashion, can put together a clothing range in 7 to 30 days and then replenish bestsellers in the stores in just five days. These faster-changing fashion products are made possible by pressuring suppliers to deliver to ever-tighter deadlines that inevitably encourage the cutting of labour costs and environmentally irresponsible practices[96].

It is reported that, every year, around 80 billion garments are produced worldwide – the equivalent of just over 11 garments a year for every person on the planet.[97] However, the consumption of garments is not evenly distributed. In Germany, for example, 5.97 billion garments, including 1 billion t-shirts, were consumed in 2011, the equivalent of 70 garments for every person.[98]

A key part of this huge turnover in clothes is their disposability. Some consumers will imitate certain celebrities and refuse to wear any item of clothing more than once.[99] This, combined with poor quality and low prices, can lead to a throwaway mind-set and shorter lifespans for clothes – even though the fabric itself could last for decades. A large proportion of these thrown-away clothes gets dumped in landfills or is incinerated. In Germany, 1 million tonnes of clothing are thrown away every year.[100] In the US the 13.1 million tonnes of textiles generated in 2010 made up 5.3% of municipal waste,[101] while in the UK it is 1 million tonnes a year.[102]

image Scientist Melissa Wang works at the Greenpeace Research Laboratories in Exeter University.

The fast fashion cycle



Above all, it is the increased volumes of clothing being made, sold and thrown away that magnify the human and environmental costs of our clothes at every stage of their life cycle. The number of clothes that people buy has increased massively in recent decades. In the UK, people buy roughly four times as many clothes as they did in 1980.[103] Furthermore, fast fashion is now expanding beyond the traditional consumer markets of the Global North. Zara, which currently manufactures about 850 million pieces of clothing every year[104], recently opened stores in Bulgaria, Kazakhstan and India in 2010, and in Australia, Taiwan, Azerbaijan, South Africa and Peru in 2011.[105]

The Spanish retailer also entered China in 2006 with a store in Shanghai. It now operates over 100 stores in more than 40 Chinese cities and over 300 Inditex stores in China across eight banners, making China one of its largest international divisions outside its Spanish home market.[106]

Environmental Impact

These huge and growing quantities of clothes amplify the environmental impacts of garments throughout their life cycle, starting with the large quantities of water and chemicals such as pesticides used in the production of fibres such as cotton. Textile dyeing and finishing also uses considerable quantities of water – as much as 200 tonnes of water for every tonne of textiles produced[107] - and a large number of chemicals and their mixtures, some of which are hazardous. There are, for example, more than 10,000 types of dyestuffs for dyeing and printing that can be used.[108]

When persistent, toxic and bio-accumulative chemicals are used or released, the environmental impact of fast fashion builds up over the years. These pollutants can persist long enough in the receiving environment to concentrate in sediments and/or organisms, and for some to be transported over long distances. Furthermore, some can cause significant harm even at what may appear to be very low concentrations.

Therefore, even the apparently small, but cumulative quantities of a substance such as NPE in individual items of clothing, which are legally allowed, can still be damaging, contributing to the widespread dispersal of NPEs across the planet. These discharges are not only from the facilities that manufacture the clothes, but via the billions of garments sold every year, many of which are likely to contain NPE residues that are washed out and released into public wastewater systems during laundering, and also when they are discarded or otherwise disposed of.

The brands' Detox statuses

Engaged Detox brands are those brands that have made a credible zero discharge commitment and are taking some steps to implement this. Implementation plans are on the right track but need to become more concrete, and more steps need to be taken faster. For example, Puma, Nike, Adidas, and Li Ning need to join H&M and C&A, and most recently Marks & Spencer, in their commitment to local online disclosure of releases of hazardous chemicals by some of their suppliers, within the next three months. All these joint roadmap brands, plus C&A, need to join H&M and Marks & Spencer by setting clearer timelines and end dates and verification procedures that will show they have "reached zero discharge" for widely used hazardous substances such as NPEs.

Detox greenwashers are those brands that have declared a Zero Discharge intention and have joined the joint roadmap activities and process, but have not made a credible individual commitment or action plan in their own right. For example, G-Star Raw, Jack Wolfskin, and Levi's. These brands need to revise their partial commitment to clearly adopt the complete paradigm shift to hazardous chemicals elimination, and develop an individual action plan to implement this Detox commitment.

Detox laggards or villains; Laggards are those brands with chemicals management policies and programmes that have yet to make a credible commitment to Zero Discharges. For example, Zara, PVH (Calvin Klein, Tommy Hilfiger), Mango, and GAP. Villains are those brands with little or no policy or programme for chemicals management, and no commitment to Zero Discharges. For example, Esprit, Metersbonwe, Victoria's Secret. These brands need to make a publicly credible Detox commitment that transforms their approach to hazardous chemicals. (See: Key steps to detox our clothes, page 40).

Time to "Detox" our clothes

The dispersal of hazardous chemicals from our clothes into water systems – when they are manufactured and after they are sold – can only be addressed by the rapid and transparent elimination of their use at source. Following Greenpeace's Detox campaign in 2011, a number of sportswear and fashion brands took up the Greenpeace Detox challenge[109] and made individual commitments to zero discharge of hazardous substances by 1 January 2020.[110,111]

Six of these brands – the sportswear brands Puma, Nike, Adidas and Li-Ning, and the fashion brands H&M and C&A – are now collaborating on the further development and implementation of both their individual and collective implementation plans towards zero discharge of hazardous chemicals,[112] which set out the steps that they mean to take to achieve their commitments. Through their collective "draft joint roadmap", others are invited to partner in this endeavour. Unfortunately, the roadmap has so far failed to set clear dates and timelines to achieve full elimination of all uses of widely used hazardous chemicals. It also does not make a clear commitment to concrete deliverables such as the disclosure of hazardous chemical discharges at the manufacturing factories locally and online.

More recent members of the joint roadmap development process (nicknamed the ZDHC[113]), Levi Strauss[114] and G-Star Raw,[115] while adopting partial public Zero Discharge declarations, have failed to make a sufficiently credible commitment at the level needed to achieve a full paradigm shift in their approach to hazardous chemicals[116]. Levi Strauss and G Star Raw can only currently be given a "greenwash status", unless they replace their current attempt to gain public benefit by using some selective "Detox-sounding" language with a comprehensive, credible commitment to real "zero discharges".

Clearly the chemical management tools and systems currently operating to control these hazardous chemicals are still insufficient. Despite the fact that several brands have had bans on the use of APEOs for some time[117] and have established detection limits and procedures for enforcement and raising awareness, they are clearly not achieving zero discharge – eliminating the releases of these substances entirely down to the limits of what is technically feasible to detect – from either their products or their manufacturing facilities.

However, some progress is being made. H&M, for example, has taken action after Greenpeace uncovered the NPE contamination of its products,[118] by committing to a process to investigate and work to eliminate all NPEs entering its supply chain[119].

It should also be noted that some of the brands mentioned in this report are significantly more advanced than others within the textile sector, for their programmes for chemicals management, detailed protocols for supplier management, and the publication of their Restricted Substances Lists (RSLs), including H&M, C&A, Mango and Marks & Spencer (the latter having just published an ambitious and concrete commitment to Zero Discharges).[120]

Unfortunately, one of the critical applications of the precautionary principle has not yet been sufficiently integrated – if at all – into companies' supply chain operations: to ensure that inherently hazardous substances are eliminated, rather than merely "managed". **The reality is, there are no "environmentally acceptable" or "safe" levels of use and discharge for inherently hazardous substances, and the sooner companies eliminate all uses, the better the environmental and health outcomes can be.**

While only managing[121] inherently hazardous substances is inappropriate, not even acknowledging the concern about hazardous substance use in textiles is even worse. Many other brands in this sector do not even publish their full RSLs or provide information on whether they restrict APEOs – including some of the brands highlighted in this study. Zara (Inditex) does not make its RSL publicly available.[122] GAP describes its RSL, but it is not apparently publicly available.[123] PVH mentions its RSL list and policy, but does not publish either of them.[124] Worse still, some of the other brands in this study, such as Esprit, Metersbonwe and Victoria's Secret, are either completely non-transparent to their customers, or irresponsibly show no public awareness of the issue of hazardous chemical use in their products and their supply chain, as there is no publicly available information on their websites about RSL lists or relevant policies.

However, transparency that will drive real change should go beyond just making their RSLs available. Brands should perform an inventory of all chemicals used or released during the production processes of making their articles, and screen those chemicals for intrinsic hazardous properties. These are necessary steps towards making a comprehensive sectorial black list for progressive elimination, including a priority list for immediate action with concrete short-term elimination timelines.

Brands also need to ensure that details of the uses and discharges of individual hazardous chemicals by their supply chains are disclosed and updated regularly to concerned parties, including the local community, for each facility. This chemical by chemical disclosure is necessary to empower these local communities to act as a "watchdog" for each brand's real practices on the ground, will greatly help brands and suppliers to be accountable to local communities and workers, and will raise overall awareness about local water contamination.

What the brands say

ZARA

"All of Inditex's activities are conducted ethically and responsibly, including actions in different areas such as product health and safety, control of the supply chain and the connection between our actions and the community. All of Inditex's products are respectful of the environment and health and safety. By implementing the strictest international standards, Inditex assures customers that its products meet stringent health, safety and ethical standards." [125]

Levi's

"From the way we make our products to how we run the company, we're committed to restoring the environment. Consumers expect this from us, employees demand it, and the planet requires it."

Chip Bergh, President and CEO, Levi Strauss & Co. [126]

TOMMY HILFIGER Calvin Klein

"We are committed to incorporating sustainability into all aspects of our operations and have a fundamental responsibility to minimize our impact on the environment. We acknowledge that we depend on the earth's limited natural resources for our business and that it is imperative that we operate in a manner that supports conservation and responsibly addresses environmental challenges around the world." [127]

ESPRIT

"As an apparel company, we integrate corporate conscience into every part of our business, from looking for the most ecologically friendly source of materials, designing with values of sustainability, manufacturing in a responsible manner to our interaction with customers for charitable purposes. It is our ultimate goal to work towards a green future and be at the forefront of the development of sustainability in this industry."[128]

Mr Ronald Van Der Vis, Executive Director and Group CEO

GAP

"Product safety is a top priority for Gap Inc. We strive to design and sell clothing that does not pose any safety threat to our customers."[129]

GAP has a Clean Water mark that's stamped on denim, acknowledging Gap Inc's denim wastewater treatment programme [130]

MANGO

"However, beyond the legislation, protecting the environment and the health of individuals are commitments we identify with and are committed to; for this reason, since the commencement of this project, we have implemented other actions that go beyond strict compliance with the legislation. [...] Since it is our intention to advance progressively in such aspects, we have also decided to completely eliminate certain substances from our production processes, focusing our system more on elimination and substitution, and consequently on the principle of precaution." [131]

Mango has "Made in Green" certification, awarded by the Textile Technology Institute (AITEX). This certificate guarantees that garments and accessories comply with the international standard for hazardous substances, the Oeko-Tex Standard100. [132]

C&A

"A major part of our CSR policy is water stewardship, and we recognize the urgent need to eliminate industrial releases of hazardous chemicals." [135]

Introduction to C&A Zero Discharge commitment.

Meters/bonwe

The company sees environmental protection as an important part of its sustainable development strategy, actively takes the environmental responsibility, increases resource utility rate and strengthens waste management. [133]

VICTORIA'S SECRET

"We believe in doing what is right in our industry, our community and our world. This includes conducting our business in an environmentally responsible way. To this end, we are always looking for ways to reduce our environmental impact." [136]

YOUR M&S

"Marks & Spencer fully acknowledges and understands the seriousness of the problem of hazardous chemicals, and is committed to zero discharge of hazardous chemicals from the whole life cycle associated with the production and use of its textile and apparel products across all pathways of release (discharges, emissions and losses) in our supply chains by 1 January 2020."[134]

image © Lance Lee / Greenpeace

#4

Conclusions and recommendations

This study has demonstrated the presence of a number of different hazardous chemicals within a broad range of textile products, either incorporated deliberately within the materials of the product or as unwanted residues remaining from their use during the manufacturing process.

As a consequence, hazardous chemicals could be released at each point of an article's life cycle, with discharges into aquatic systems such as rivers, seas and lakes being the principal route and therefore areas of concern. These discharges can occur at the local manufacturing facilities that use them and – after the products containing residues are sold to consumers – when they are washed. The sheer volume of clothing being manufactured and sold, in part a consequence of the "fast fashion" phenomenon, magnifies the problem, particularly when pollution from hazardous chemicals, especially toxic, persistent and bio-accumulative chemicals, is concerned.

The use of hazardous chemicals by the textile industry is a widespread and pervasive problem that the international clothing industry is still not addressing adequately, as our assessment of their policies and current chemical management tools shows.

Transparency: Holding the brands to account

There is no question that this is a big challenge for the brands, so to achieve the goal of zero discharges, they need to be held to account on their commitments. People at either end of the fashion chain require more transparency about the hazardous chemicals used to make their clothes, and how much of these get released into the environment. In particular, communities living near production facilities have the right to know what is coming out of those factories.

For every product that was found to contain one or more hazardous substance in this study there is a facility discharging unknown amounts of these substances into the local environment. The challenge for the brands concerned is to address the questions: **Where are these facilities located? Which hazardous chemicals are being used and discharged? And in what quantities?**

Elimination: Step one to zero discharges

As global players, clothing brands have the opportunity to work on global solutions to eliminate the use of hazardous substances throughout their product lines, and to drive a change in practice throughout their supply chains. For the brands that have already engaged, this work now needs to focus on more concrete elimination plans for certain hazardous substances, with ambitious timelines to ensure that full elimination is achieved. **Furthermore, there is an urgent need for more brands to commit to zero discharge of hazardous chemicals by 1 January 2020.**

Brands also need to set a clear short-term deadline for fully eliminating any remaining use of chemicals such as APEs. This will send an important signal to the supply chain and encourage chemical producers to increase the supply of non-hazardous alternatives – a challenge the joint roadmap recognises in its background work of investigating available alternatives. Lower detection limits for methods used to monitor chemicals in formulations, products and waste streams, as well as restricted substance policies and better enforcement of the brands restrictions on use of hazardous chemicals, also have a role to play.

The focus on levels in products – while helpful - is not sufficient to drive the reduction and elimination of releases at the level of the manufacturing facility. The use of hazardous chemicals by suppliers needs to be subject to much greater scrutiny, through the creation of mechanisms to ensure transparency so that local populations can verify that discharges are indeed being eliminated.

Key steps to Detox our clothes

To effectively resolve the pollution of our waters with hazardous chemicals, brands should:

1 Adopt a credible commitment to phase out the use, from their global supply chain and all products, of all toxic chemicals by 1 January 2020.

Credible means based on the unambiguous adoption of three fundamental principles – precaution[137], comprehensive and complete elimination (zero discharge)[138] and right-to-know.[139]

2 Walk the talk by:

- Committing to disclose, at regular and relevant intervals (at least annually), information on the releases of toxic chemicals that are still used at their supplier's facilities to the public, especially to local /national inhabitants (eg. using credible public information platforms[140]).
- Establishing clear and ambitious deadlines (with a fixed date) for elimination of priority substances such as APEs and PFCs.

Therefore, brands that already have credible commitments to zero discharges must likewise act on their Detox pledge and **ensure that steps towards achieving a zero discharge is actually happening in practice.** They should do this firstly by setting specific target dates for the rapid elimination of the use and discharge of certain hazardous chemicals, and secondly by ensuring credible transparency about the chemicals used and discharged by textile manufacturers, following the lead of H&M and Marks & Spencer, who have – in addition to their Zero Discharge by 2020 commitment – set clear intermediate targets for eliminating PFCs (by end of 2012 and mid 2016 respectively), as well as engaging an initial group of their Chinese suppliers in local transparency of their discharges.[141]

As the deadline for achieving zero discharges draws nearer, the need for such comprehensive elimination plans grows increasingly urgent; as a priority these need to address the use of certain hazardous substances highlighted by Greenpeace[142], including sufficient investment of brands' resources.

Other brands need to join this Detox paradigm shift to eliminate hazardous chemicals, through credible individual Detox commitments to zero discharges of hazardous substances, along with a programme that can deliver results on the ground. Commitments with the necessary integrity – such as that just made by Marks & Spencer – will show transparency and a real ambition to follow-through.

Suppliers also have a crucial role to play here, by taking responsibility for making a thorough inventory of all the chemicals used, and screen for hazardous substances that they use and identifying the points where these substances are discharged to the environment. **Transparency of information, between suppliers, brands and critically, with local communities will help with the substitution of hazardous substances with safer alternatives.**

Finally, brands that have so far barely acknowledged their part in the toxic cycle of clothing urgently need to take responsibility for the hazardous substances used in their products and the manufacturing processes of their suppliers. Ignorance of the problem can no longer be an excuse.

The need for government action

Governments need to do their share as well, and adopt a political commitment to "zero discharge" of all hazardous chemicals within one generation, based on the precautionary principle and including a preventative approach by avoiding the production and use, and therefore, exposure to hazardous chemicals.

This commitment must be matched with an 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).

Governments must adopt comprehensive chemicals management policies and regulations in order to:

- level the playing field and make leading brands' actions a reality throughout the entire sector and beyond, as many of the hazardous chemicals used in textiles are also in use in other sectors;
- give industry a clear direction by showing that hazardous chemicals have no place in a sustainable society, which will in turn drive innovation towards safer alternatives; and
- prevent ongoing releases into the environment that may require future clean-up and have serious impacts upon the environment and on people's health and livelihoods, especially in the Global South.

The role of "People Power"

The unassuming role of consumers in the chain of pollution that begins with the use of hazardous chemicals in textile production has also been highlighted by this report. It is inevitable that clothing products containing hazardous chemicals because they were manufactured using hazardous chemicals will release these substances when they are bought and washed by consumers – wherever they are in the world.

As global citizens we can 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 APEs and other hazardous chemicals in their supply chains; and
- Demand that governments act to restrict the sales and import of products containing hazardous chemicals.

Sign up to receive the Greenpeace newsletter in order to stay up-to-date with the latest developments within the Detox campaign and find out about opportunities to take part in collective activities to create a toxic-free future.

Together we can demand that governments and brands act NOW to start Detoxing our rivers, Detox our clothing and ultimately, Detox our futures.

A post-toxic world is not only desirable, it's possible. Together we can create it.

www.greenpeace.org/detox

Appendix 1

Table A1: Concentrations of NPEs, carcinogenic amines and phthalates in all articles tested

Details of all articles, including the concentrations of NPEs, carcinogenic amines and phthalates. For NPEs, * indicates the analysis of a section of fabric bearing a plastisol print; for carcinogenic amines "<5 mg/kg" indicates that all quantified amines were below the detection limit (<5 mg/kg) and where a specific amine is listed, all other quantified amines in that sample were below the detection limit (<5 mg/kg); For phthalates, the total concentration of the 9 quantified phthalates is given (mg/kg), with the individual phthalate concentrations provided in Appendix 2; "–" indicates not tested, either due to being undyed fabric (for carcinogenic amines) or article without a medium/large sized plastisol print (for phthalates). TX12066 was not tested as the item was identical to TX12068.

Sample code	Brand	Place of sale	Place of manufacture	Kind of product	Man Woman Child	Fabric	NPEs (mg/kg)	Amines (mg/kg)	Phthalates, total (mg/kg)
TX12001	Armani	Thailand	Mainland China	underwear	woman	96% polyamide, 4% elastane	32	<5	-
TX12002	Armani	Sweden	Mainland China	shirt	---	unknown	43	<5	-
TX12003	Armani	Switzerland	Mainland China	jeans	man	100% cotton excluded decorations	<1	<5	-
TX12004	Armani	UK	Vietnam	polo shirt	man	98% cotton, 2 % elastane	4.8	<5	-
TX12005	Armani	USA	Indonesia	underwear	woman	85% polyamide, 16% elastane	1.2	<5	-
TX12006	Armani	Russia	Thailand	underwear	man	100% cotton	<1	<5	-
TX12007	Armani	Italy	Vietnam	underwear	woman	90% cotton, 10% elastane	<1	<5	-
TX12008	Armani	Italy	Turkey	t-shirt	man	100% cotton	* <1	<5	223 440
TX12009	Armani	France	Indonesia	bra	woman	87% nylon, 13% elastane	8.1	<5	-
TX12010	Benetton	Mexico	Romania	t-shirt	child	100% cotton	* <1	<5	128
TX12011	Benetton	Czech Republic	Tunisia	t-shirt	child	100% organic cotton	* <1	-	33
TX12012	Benetton	Switzerland	Cambodia	hoodie	man	100% cotton	<1	<5	-
TX12013	Benetton	UK	Bangladesh	t-shirt	child	100 % cotton	* <1	-	47
TX12014	Benetton	Russia	Cambodia	t-shirt	child	100% cotton	<1	<5	-
TX12015	Benetton	Italy	Mainland China	jacket	child	outside: 70% cotton, 30% polyamide Inside: 100% polyester	95	<5	-
TX12016	Benetton	Italy	Egypt	sweatshirt	child	100% cotton	11	<5	-
TX12017	Benetton	Belgium	Bangladesh	t-shirt (part of a set)	child	100% cotton	<1	<5	-
TX12018	Benetton	France	India	trousers	child	100% cotton	6.3	<5	-
TX12019	Vero Moda	Mainland China	unknown	top	woman	61% cotton, 37% polyster,2% elastane	31	<5	-
TX12020	Vero Moda	Mainland China	unknown	top	woman	100% polyester	6.3	<5	-
TX12021	Vero Moda	Denmark	India	blouse	woman	unknown	45	<5	-
TX12022	Vero Moda	Denmark	India	top	woman	100% cotton	<1	<5	-
TX12023	Vero Moda	Lebanon	India	dress	woman	100% polyester	130	<5	-
TX12024	Only	Mainland China	unknown	jeans	woman	99% cotton, 1% elastane	5.5	<5	-
TX12025	Only	Mainland China	unknown	t-shirt	woman	Fabric 1- 86% viscose rayon, 5% elastane; Fabric 2-62% viscose rayon, 38% polyester	* 32	-	18
TX12026	Only	Denmark	Mainland China	jeans	woman	unknown	730	<5	-
TX12027	Only	Norway	Turkey	jeans	woman	unknown	38	<5	-
TX12028	Jack &Jones	Mainland China	unknown	t-shirt	man	95% cotton, 5% elastane	* <1	<5	14
TX12029	Jack &Jones	Mainland China	unknown	underwear	man	96% cotton, 4% elastane	2 100	<5	-
TX12030	Jack &Jones	Netherlands	Bangladesh	polo shirt	man	100% cotton	<1	<5	-
TX12031	Jack & Jones	Denmark	Turkey	jeans	woman	unknown	17	<5	-
TX12032	Jack & Jones	Lebanon	Bangladesh	t-shirt	man	85% cotton, 15% viscose	* 4.6	<5	17
TX12033	Calvin Klein	Germany	Egypt	underwear	man	82% polyester, 18% elastane	9.0	<5	-
TX12034	Calvin Klein	Philippines	Mainland China	underwear	man	95% cotton, 5% elastane	20	<5	-
TX12035	Calvin Klein	Mexico	Mexico	jeans	man	100% cotton	56	<5	-
TX12036	Calvin Klein	Netherlands	Jordan	underwear	woman	95% cotton, 5% elastane	<1	<5	-
TX12037	Calvin Klein	USA	Vietnam	jeans	man	100% cotton exclusive of decoration	73	<5	-

Sample code	Brand	Place of sale	Place of manufacture	Kind of product	Man Woman Child	Fabric	NPEs (mg/kg)	Amines (mg/kg)	Phthalates, total (mg/kg)
TX12038	Calvin Klein	South Africa	Thailand	underwear	man	100% cotton	14	<5	-
TX12039	Calvin Klein	Indonesia	Vietnam	underwear	man	92% cotton; 8% Lycra	5.6	<5	-
TX12040	Calvin Klein	Canada	India	t-shirt	man	100% cotton	* 4 000	<5	9
TX12041	C&A	Mexico	Mexico	t-shirt	man	100% cotton	* 45 000	<5	61
TX12042	C&A	Switzerland	unknown	top	child	100% cotton	6.9	-	-
TX12043	C&A	Switzerland	unknown	jacket	child	96% polyester, 4% elastane	64	<5	-
TX12044	C&A	Belgium	unknown	t-shirt	man	100% cotton	* <1	<5	33
TX12045	C&A	Hungary	unknown	t-shirt	child	100% cotton	* 1.7	<5	18
TX12046	C&A	France	unknown	trousers	child	70% cotton, 30% polyester	63	<5	-
TX12047	Diesel	Germany	Morocco	jeans	man	98% cotton, 2% polyurethane	710	<5	-
TX12048	Diesel	Czech Republic	Turkey	vest top	woman	100% cotton	<1	<5	-
TX12049	Diesel	Spain	Mainland China	shorts	man	100% cotton	<1	<5	-
TX12050	Diesel	Russia	Mainland China	t-shirt	man	100% cotton	* 6.6	<5	56
TX12051	Diesel	Italy	Tunisia	jeans	man	100% cotton	<1	<5	-
TX12052	Diesel	Austria	Tunisia	trousers	woman	76% cotton, 22% polyester, 2% elastane	<1	<5	-
TX12053	Diesel	South Africa	India	t-shirt	man	100% cotton	<1	<5	-
TX12054	Diesel	Israel	Mainland China	t-shirt	man	100% cotton	* 16	<5	83
TX12055	Diesel	Hungary	Mainland China	t-shirt	man	100% cotton	* <1	<5	57
TX12056	Esprit	Mainland China	Mainland China	bra	woman	surface 90% cotton, 10% elastane; inside - 100% polyster	<1	<5	-
TX12057	Esprit	Hong Kong	Mainland China	dress	woman	shell: 96% polyester, 4% elastane; lining: 100% polyester	<1	<5	-
TX12058	Esprit	Germany	unknown	t-shirt	youth	100% cotton	* 770	-	14
TX12059	Esprit	Thailand	Mainland China	jacket	woman	100% cotton	460	<5	-
TX12060	Esprit	Finland	Turkey	t-shirt	woman	unknown	<1	<5	-
TX12061	Esprit	Switzerland	unknown	dress	woman	100% cotton	1.1	-	-
TX12062	Esprit	Russia	Mainland China	coat	woman	unknown	17	<5	-
TX12063	Esprit	Belgium	unknown	t-shirt	child	100% cotton	27	<5	-
TX12064	Esprit	Indonesia	Indonesia	dress	woman	outer 100% polyester; inside 100% nylon	66	<5	-
TX12065	Gap	Thailand	Indonesia	jeans	child	99% cotton, 1% elastane	<1	<5	-
TX12066	Gap	Philippines	Indonesia	beach shirt	child	body: 80% polyester, 20% elastane. sleeve: 80% nylon, 20% elastane	-	-	-
TX12067	Gap	Mexico	Mexico	jeans	man	70% cotton, 27% polyester, 3% elastane	920	<5	-
TX12068	Gap	USA	Indonesia	beach shirt	child	body: 80% polyester, 20% elastane. sleeve: 80% nylon, 20% elastane	* <1	<5	14
TX12069	Gap	South Africa	Bangladesh	trousers	man	100% cotton	1.3	<5	-
TX12070	Gap	South Africa	Vietnam	raincoat	child	100% cotton	* 700	<5	14
TX12071	Gap	Israel	Vietnam	dress	woman	100% polyester	43	<5	-
TX12072	Gap	France	Vietnam	t-shirt	child	100% cotton	* 110	<5	25

Sample code	Brand	Place of sale	Place of manufacture	Kind of product	Man Woman Child	Fabric	NPEs (mg/kg)	Amines (mg/kg)	Phthalates, total (mg/kg)
TX12073	Gap	Indonesia	Pakistan	jeans	child	100% cotton	3.8	<5	-
TX12074	Gap	Canada	Indonesia	t-shirt	child	80% nylon 20% elastane	* 8.6	<5	26
TX12075	H&M	Denmark	Turkey	t-shirt	child	unknown	* <1	<5	23
TX12076	H&M	Spain	India	dress	woman	100% polyester	8.7	<5	-
TX12077	H&M	Belgium	Mainland China	sweater	man	100% cotton	<1	<5	-
TX12078	H&M	Lebanon	Mainland China	top	woman	100% polyester	1.6	<5	-
TX12079	H&M	Hungary	Bangladesh	underwear	woman	86% polyamide, 14% elastane	<1	<5	-
TX12080	H&M	France	Mainland China	trousers	child	85% cotton, 14% polyester, 1% elastane	<1	<5	-
TX12081	Levi's	Hong Kong	Vietnam	jeans	man	100% cotton	<1	<5	-
TX12082	Levi's	Taiwan	Mainland China	t-shirt	man	100% cotton	* 9.7	<5	-
TX12083	Levi's	Thailand	Thailand	denim shirt	woman	100% cotton	<1	<5	-
TX12084	Levi's	Philippines	Mainland China	jeans	man	100% cotton	600	<5	-
TX12085	Levi's	Mexico	Mexico	jeans	woman	99% cotton, 1% elastane	3 100	<5	-
TX12086	Levi's	Switzerland	Turkey	t-shirt	man	100% Cotton	* <1	<5	12
TX12087	Levi's	USA	Mexico	jeans	man	100% cotton	4 100	<5	-
TX12088	Levi's	South Africa	Vietnam	jeans	woman	100% Cotton	5.7	<5	-
TX12089	Levi's	Belgium	Mainland China	t-shirt	man	100% cotton	80	<5	-
TX12090	Levi's	Turkey	Unknown	hoodie	man	unknown	18	<5	-
TX12091	Levi's	Indonesia	Mainland China	t-shirt	man	100% cotton	* <1	<5	138
TX12092	Mango	Philippines	Bangladesh	t-shirt	woman	100% cotton	<1	<5	-
TX12093	Mango	Netherlands	Vietnam	jacket	woman	98% cotton, 2% elastane. lining: 100% polyester	<1	<5	-
TX12094	Mango	Finland	Mainland China	t-shirt	woman	unknown	<1	<5	-
TX12095	Mango	UK	Mainland China	jeans	woman	100% cotton	1 400	<5	-
TX12096	Mango	Spain	Turkey	t-shirt	woman	100% cotton	9 800	<5	-
TX12097	Mango	Austria	Morocco	trousers	woman	100% polyester	7.2	<5	-
TX12098	Mango	South Africa	Turkey	t-shirt	woman	100% cotton	* <1	<5	13
TX12099	Mango	Turkey	Bangladesh	rumper suit	woman	55% linen, 45% cotton	1 500	<5	-
TX12100	Mango	Lebanon	Indonesia	coat	woman	100% polyester	15	<5	-
TX12101	Mango	Israel	Mainland China	dress	woman	100% polyester	1.3	<5	-
TX12102	Marks & Spencer	Thailand	Mainland China	underwear	woman	80% silk, 13% polyamide, 7% elastane	2 100	<5	-
TX12103	Marks & Spencer	Philippines	Indonesia	shorts	man	68% cotton, 32% polyamide	620	<5	-
TX12104	Marks & Spencer	UK	India	underwear	woman	95 % cotton, 5% elastane	<1	<5	-
TX12105	Marks & Spencer	UK	Turkey	pyjama top(pt set)	child	100% cotton	* <1	<5	15
TX12106	Marks & Spencer	Turkey	Turkey	t-shirt	woman	100% linen	84	<5	-
TX12107	Marks & Spencer	Indonesia	Turkey	top	woman	100% polyester	550	<5	-
TX12108	Tommy Hilfiger	Mexico	Mexico	jeans	man	100% cotton	500	<5	-
TX12109	Tommy Hilfiger	Sweden	Vietnam	polo shirt	---	unknown	<1	<5	-
TX12110	Tommy Hilfiger	USA	Philippines	t-shirt	man	100% cotton exclusive of decoration	* 26	<5	200 013

Sample code	Brand	Place of sale	Place of manufacture	Kind of product	Man Woman Child	Fabric	NPEs (mg/kg)	Amines (mg/kg)	Phthalates, total (mg/kg)
TX12111	Tommy Hilfiger	Spain	Turkey	top	woman	80% polyester, 20% viscose excluding decoration	30	<5	-
TX12112	Tommy Hilfiger	Russia	Turkey	jeans	man	100% cotton	17	<5	-
TX12113	Tommy Hilfiger	Russia	Mainland China	shirt	man	100% cotton	<1	<5	-
TX12114	Tommy Hilfiger	Italy	Sri Lanka	t-shirt	woman	96% cotton, 4% elastane excluding decoration	3.9	<5	-
TX12115	Tommy Hilfiger	Austria	Bangladesh	t-shirt	man	100% cotton	* 8.6	<5	660 079
TX12116	Tommy Hilfiger	Canada	Bangladesh	shorts	man	100% cotton exclusive of decoration	<1	<5	-
TX12117	Victoria's Secret	Netherlands	Mainland China	bra	woman	65% nylon, 35% elastane	<1	<5	-
TX12118	Victoria's Secret	Netherlands	Mainland China	bra	woman	satin- 90% nylon,10 % elastane; embroidery - 62% polyester, 38% nylon excluding decorations	<1	<5	-
TX12119	Victoria's Secret	USA	Sri Lanka	underwear	woman	95% cotton, 5% elastane	* 7.0	<5	5217
TX12120	Victoria's Secret	Canada	Mainland China	camisole top	woman	100% nylon excluding decoration	10	<5	-
TX12121	Zara	Mainland China	Mainland China	jacket	child	100% polyester	2 600	<5	-
TX12122	Zara	Taiwan	Bangladesh	trousers	child	polyurethane fiber	79	<5	-
TX12123	Zara	Germany	India	dress	woman	100% polyurethane	9.6	<5	-
TX12124	Zara	Thailand	Bangladesh	jeans	woman	98% cotton, 2% elastane	<1	<5	-
TX12125	Zara	Denmark	Turkey	t-shirt	---	unknown	* <1	-	4
TX12126	Zara	Spain	Vietnam	coat	child	outershell: 100% polyester. body lining: 65% polyester, 35% cotton. filling: 100% polyester	25	<5	-
TX12127	Zara	Turkey	Spain	shorts	woman	outer-100% cotton; inner-67% polyester, 33% cotton	<1	<5	-
TX12128	Zara	Lebanon	Pakistan	jeans	child	100% cotton	19	*o*-dianisidine (7 mg/kg)	-
TX12129	Zara	Israel	Morocco	dress	woman	100% polyester	<1	<5	-
TX12130	Zara	Hungary	Pakistan	jeans	child	100% cotton	29	*o*-dianisidine (9 mg/kg)	-
TX12131	Metersbonwe	Mainland China	Mainland China	skirt	woman	100% viscose rayon	<1	<5	-
TX12132	Metersbonwe	Mainland China	Mainland China	t-shirt	man	100% cotton	* 140	<5	10
TX12133	Metersbonwe	Mainland China	Mainland China	jeans	man	79.1% cotton, 18.7% polyester, 2.2% other	2 100	<5	-
TX12134	Metersbonwe	Mainland China	Mainland China	sweater	man	100% cotton	1 500	<5	-
TX12135	Vancl	Mainland China	unknown	underwear	man	100% cotton	7.6	<5	-
TX12136	Vancl	Mainland China	unknown	t-shirt	woman	50% cotton, 50% modal (modified cellulose)	* 8.5	<5	87
TX12137	Vancl	Mainland China	unknown	cardigan	child	67% polyster, 33% cotton	140	<5	-
TX12138	Vancl	Mainland China	unknown	jeans	man	100% cotton	150	<5	-
TX12139	Blažek	Czech Republic	unknown	jean shorts	man	97% cotton 3% elasten	330	<5	-
TX12140	Blažek	Czech Republic	unknown	shirt	man	75%cotton, 20% PA, 5% EA	47	<5	-
TX12141	Blažek	Czech Republic	unknown	t-shirt	man	50% cotton, 45% modal, 5% elastane	<1	<5	-
TX12142	Blažek	Czech Republic	unknown	underwear	man	50% cotton/45% modal, 5% elastene	<1	<5	-

Appendix 2

Table A2: Concentrations of individual phthalates in the 31 articles tested

Concentrations (mg/kg), in plastisol printed fabric, of the following phthalates; dimethyl phthalate (DMP), diethyl phthalate (DEP), di-n-butyl phthalate (DnBP), diisobutyl phthalate (DIBP), butyl benzyl phthalate (BBP), di-2-ethylhexyl phthalate (DEHP), di-n-octyl phthalate (DnOP), diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP).

Sample code	Brand	Place of sale	Place of manufacture	DMP	DEP	DnBP	BBP	DEHP	DnOP	DINP	DIDP	DIBP
TX12008	Armani	Italy	Turkey	< 3.0	13	17	23 000	200 000	< 3.0	<3.0	<3.0	410
TX12010	Benetton	Mexico	Romania	< 3.0	29	11	55	9.6	< 3.0	< 3.0	< 3.0	23
TX12011	Benetton	Czech Republic	Tunisia	< 3.0	9.4	5.2	7	4.8	< 3.0	< 3.0	< 3.0	6.3
TX12013	Benetton	UK	Bangladesh	< 3.0	11	20	9.1	< 3.0	< 3.0	< 3.0	< 3.0	7.3
TX12025	Only	Mainland China	unknown	< 3.0	3.3	4	< 3.0	5.9	< 3.0	< 3.0	< 3.0	4.8
TX12028	Jack & Jones	Mainland China	unknown	< 3.0	< 3.0	3.7	< 3.0	5.8	< 3.0	< 3.0	< 3.0	4.4
TX12032	Jack & Jones	Lebanon	Bangladesh	< 3.0	3.7	9.8	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	3.5
TX12040	Calvin Klein	Canada	India	< 3.0	< 3.0	4.7	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	4.1
TX12041	C&A	Mexico	Mexico	< 3.0	< 3.0	4.5	< 3.0	42	< 3.0	14	< 3.0	< 3.0
TX12044	C&A	Belgium	Unknown	< 3.0	< 3.0	4	< 3.0	13	< 3.0	< 3.0	< 3.0	16
TX12045	C&A	Hungry	Unknown	< 3.0	< 3.0	4.5	8.9	< 3.0	< 3.0	< 3.0	< 3.0	4.4
TX12050	Diesel	Russia	Mainland China	< 3.0	8.5	15	< 3.0	24	< 3.0	< 3.0	< 3.0	8.5
TX12054	Diesel	Israel	Mainland China	< 3.0	8.1	22	< 3.0	16	< 3.0	< 3.0	< 3.0	37
TX12055	Diesel	Hungry	Mainland China	< 3.0	< 3.0	< 3.0	< 3.0	53	< 3.0	< 3.0	< 3.0	3.9
TX12058	Esprit	Germany	Unknown	< 3.0	< 3.0	3.4	< 3.0	5.6	< 3.0	< 3.0	< 3.0	5.3
TX12068	Gap	USA	Indonesia	< 3.0	5.8	4.2	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	4.4
TX12070	GAP	South Africa	Vietnam	< 3.0	< 3.0	4.5	< 3.0	6.3	< 3.0	< 3.0	< 3.0	3
TX12072	Gap	France	Vietnam	< 3.0	5.8	13	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	6.5
TX12074	Gap	Canada	Indonesia	< 3.0	18	3.2	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	4.5
TX12075	H&M	Denmark	Turkey	< 3.0	16	< 3.0	< 3.0	3.8	< 3.0	< 3.0	< 3.0	3
TX12082	Levi's	Taiwan	Mainland China	< 3.0	23	6.5	< 3.0	4.4	< 3.0	< 3.0	< 3.0	< 3.0
TX12086	Levi's	Switzerland	Turkey	< 3.0	3.3	< 3.0	< 3.0	5.1	< 3.0	< 3.0	< 3.0	3.5
TX12091	Levi's	Indonesia	Mainland China	< 3.0	5.8	4	< 3.0	120	< 3.0	< 3.0	< 3.0	7.9
TX12098	Mango	South Africa	Turkey	< 3.0	< 3.0	9.8	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	3.4
TX12105	Marks & Spencer	UK	Turkey	< 3.0	< 3.0	< 3.0	< 3.0	15	< 3.0	< 3.0	< 3.0	< 3.0
TX12110	Tommy Hilfiger	USA	Philippines	< 3.0	3.6	4.7	< 3.0	< 3.0	< 3.0	200 000	< 3.0	4.6
TX12115	Tommy Hilfiger	Austria	Bangladesh	< 3.0	4.9	21	23	56 000	11	320 000	< 3.0	19
TX12119	Victoria's Secret	USA	Sri Lanka	< 3.0	6.2	3.1	4	5 200	< 3.0	< 3.0	< 3.0	3.4
TX12125	Zara	Denmark	Turkey	< 3.0	< 3.0	< 3.0	< 3.0	3.8	< 3.0	< 3.0	< 3.0	< 3.0
TX12132	Metersbonwe	Mainland China	Mainland China	< 3.0	< 3.0	< 3.0	< 3.0	3.4	< 3.0	< 3.0	< 3.0	6.1
TX12136	Vancl	Mainland China	unknown	< 3.0	3	22	< 3.0	58	< 3.0	< 3.0	< 3.0	3.9

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Appendix 3

Table A3: Additional substances identified using qualitative chemical screening

Additional substances identified in individual items by qualitative chemical screening, including the total number of compounds isolated and reliably identified for each sample.

Sample code	Brand	No. of chemicals isolated	No. of chemicals reliably identified	Linear alkanes	Benzophenone	Benzyl benzoate	1,1'-Biphenyl	2,6-Di-tert-butyl-4-methyl-phenol	Ethanol, 2-(2-butoxy-ethoxy)- & derivatives*
TX12001	Armani	12	8	6		Y			
TX12002	Armani	13	5	4		Y			
TX12003	Armani	26	13	12		Y			
TX12004	Armani	17	9	9					
TX12005	Armani	26	5	5					
TX12006	Armani	19	7	7					
TX12007	Armani	6	5	3	Y	Y			
TX12008	Armani	9	7	7					
TX12009	Armani	13	1	0					
TX12010	Benetton	15	10	10					
TX12011	Benetton	33	14	11		Y			
TX12012	Benetton	18	12	10		Y			
TX12013	Benetton	11	6	5					
TX12014	Benetton	19	11	9					
TX12015	Benetton	21	13	11		Y	Y		
TX12016	Benetton	17	10	8					
TX12017	Benetton	22	10	7					
TX12018	Benetton	7	5	4					
TX12019	Vero Moda	7	7	7					
TX12020	Vero Moda	0	0	0					
TX12021	Vero Moda	15	11	11					
TX12022	Vero Moda	43	14	13					
TX12023	Vero Moda	9	8	8					
TX12024	Only	19	12	11					
TX12025	Only	1	0	0					
TX12026	Only	12	9	8					
TX12027	Only	16	12	10					
TX12028	Jack & Jones	56	15	13					
TX12029	Jack & Jones	20	11	8					
TX12030	Jack & Jones	28	14	12					
TX12031	Jack & Jones	26	11	11					
TX12032	Jack & Jones	17	12	11					
TX12033	Calvin Klein	20	6	6					
TX12034	Calvin Klein	20	15	13		Y			
TX12035	Calvin Klein	46	14	13					
TX12056	Esprit	11	1	0					
TX12057	Esprit	7	7	7					
TX12058	Esprit	19	6	6					
TX12059	Esprit	13	7	7					

Nonylphenol	Hexadecanoic acid (& esters*)	Octadec -anoic, -enoic and -adienoic acid (& esters*)	Amyrin	α-Amyrenone	Sitosterol	Cholesterol	Squalene	Others
							Y	
		Y						
				Y	Y			
					Y			
					Y			
	butyl*				Y			
				Y	Y			
	methyl*	methyl”					Y	
				Y				
					Y			
				Y				
					Y			
		methyl*						
				Y			Y	
	methyl*	methyl*		Y				
				Y			Y	
				Y				
	octadecyl*							
				Y				
								octyl-diphenylamine

Sample code	Brand	No. of chemicals isolated	No. of chemicals reliably identified	Linear alkanes	Benzophenone	Benzyl benzoate	1,1'-Biphenyl	2,6-Di-tert-butyl-4-methyl-phenol	Ethanol, 2-(2-butoxy-ethoxy)- & derivatives*
TX12060	Esprit	27	9	7		Y			
TX12061	Esprit	17	8	6					
TX12062	Esprit	14	3	2					
TX12063	Esprit	35	14	11		Y			
TX12064	Esprit	14	5	4					
TX12081	Levi's	24	11	8					
TX12082	Levi's	15	9	7					
TX12083	Levi's	61	14	11		Y			
TX12084	Levi's	38	17	11		Y			
TX12085	Levi's	32	11	9					
TX12086	Levi's	24	10	7					
TX12087	Levi's	38	14	10	Y				
TX12088	Levi's	31	13	9					Y
TX12089	Levi's	32	10	9					
TX12090	Levi's	15	10	10					
TX12091	Levi's	22	5	5			Y		
TX12121	Zara	56	15	13					
TX12122	Zara	58	13	9				Y	
TX12123	Zara	18	5	3					
TX12124	Zara	60	11	11					
TX12125	Zara	44	13	11					
TX12126	Zara	30	9	8				Y	
TX12127	Zara	35	13	7					acetate*
TX12128	Zara	28	4	3					

Nonylphenol	Hexadecanoic acid (& esters*)	Octadec -anoic, -enoic and -adienoic acid (& esters*)	Amyrin	α-Amyrenone	Sitosterol	Cholesterol	Squalene	Others
					Y			
				Y	Y			
					Y			
					Y			benzenemethanamine, N-(phenylmethyl-
		methyl*						
			Y	Y	Y			
	Y				Y			
				Y				Ethanol, 2-(tetradecyloxy)-
			Y	Y	Y	Y	Y	
	isopropyl*							Bis(2-ethylhexyl) maleate
				Y	Y	Y		
		isopropyl*		Y	Y			
				Y	Y	Y		
					Y			
								Benzene, 1,1'-(3-methyl-1-propene-1,3-diyl)bis-
				Y	Y			Benzyl naphthyl ether
	methyl*	methyl*						
				Y	Y			
Y	Y	Y		Y	Y			
				Y				

Endnotes

1 Armani, Benetton, Blazek, C&A, Calvin Klein, Diesel, Esprit, Gap, H&M, Jack & Jones, Levi's, Mango, Marks & Spencer, Metersbonwe, Only, Tommy Hilfiger, Vancl, Vero Moda, Victoria's Secret, and Zara.

2 The phthalates that were identified in the four samples with high concentrations were DEHP and DINP, with one sample also containing BBP. DEHP and BBP are known to be toxic to the reproductive system and have been listed as "substances of very high concern" under the EU regulation REACH. DINP is also toxic at high doses and has some hormone disrupting effects.

3 Amines are used in the manufacture of azo dyes and can subsequently be released when they are chemically broken down. The amine found in the samples – o-dianisidine – is cancer causing, and possibly cancer causing in humans, and is regulated in the EU and elsewhere along with other cancer-causing amines. The levels found in these samples were below the strictest of these regulatory limits. However, any detectable presence of such a carcinogenic compound is of concern due to its intrinsic hazardous properties.

4 This was the second of three investigations by Greenpeace looking at the discharge of hazardous substances from the textile industry and their presence in clothing sold by major brands. NPEs were found in 78 articles, two thirds of the garments tested, demonstrating their use during the manufacturing process and their inevitable discharge to rivers in the country of origin.

5 There have been restrictions on the use of NPEs by industry for almost 20 years. Although there are currently no regulations that restrict the sale of products containing NPE residues, measures are currently under development within the EU. Once released to the environment, NPEs degrade to nonylphenols, which are known to be toxic, through acting as hormone disruptor, persistent and bioaccumulative (accumulates in living organisms). Nonylphenol is known to accumulate in living organisms.

6 ppm = parts per million

7 A summary of the number of samples containing NPEs within various ranges of concentration is given in:
Brigden K, Labunska I, House E, Santillo D & Johnston P (2012). Hazardous chemicals in branded textile products on sale in 29 places during 2012. Greenpeace Research Laboratories Technical Report 06/2012. http://www.greenpeace.org/international/big-fashion-stitch-up

8 Greenpeace (2011a). Dirty Laundry 2: Hung Out to Dry. Unravelling the toxic trail from pipes to products. Greenpeace International, 2011. http://www.greenpeace.org/international/en/publications/reports/Dirty-Laundry-2

9 Oxfam (2004). Trading away our rights: women working in global supply chains. http://www.offsetwarehouse.com/data/files/resources/taor.pdf. Accessed 4 September 2012

10 Siegle, Lucy (2011). To Die For: is Fashion Wearing out the World? Fourth Estate

11 This was the second of three investigations by Greenpeace looking at the discharge of hazardous substances from the textile industry and their presence in clothing sold by major brands. NPEs were found in 78 articles, two thirds of the products, demonstrating their use during the manufacturing process and their inevitable discharge to rivers in the country of origin.

12 For more information on previous investigations, see www.greenpeace.org/detox

13 Greenpeace (2011b). Dirty Laundry. Unraveling the corporate connections to toxic water pollution in China. Greenpeace International, 2011. http://www. greenpeace.org/dirtylaundryreport

14 Greenpeace (2012). Dirty Laundry: Reloaded How big brands are making consumers unwitting accomplices in the toxic water cycle. Greenpeace International, 2012. http://www.greenpeace.org/international/en/publications/Campaign-reports/Toxics-reports/Dirty-Laundry-Reloaded

15 ENDs (2012a). Chemicals in clothing imports may harm rivers. ENDS Report 451, 29 August 2012, p. 19, reporting on a new study by the UK Environment Agency, due to be published at the end of 2012, which also found that 29 out of 100 samples of cotton pants had levels of NPEs up to 1,800 ppm.

16 Greenpeace International employed a system aimed at ensuring only authentic brand products were tested. Campaigners in national and regional Greenpeace offices were asked to purchase products from authorised dealers only. This required identifying authorised sellers by visiting the brand websites or the websites of well-known department stores. In cases of uncertainty, other measures were taken to ensure that only authentic products were purchased, including obtaining written confirmation from brands about the locations of their authorised dealers, taking pictures of the stores selling brand products, and keeping the receipts for, and labels and tags of, the products purchased.

17 For a full description of the methodology, see: Brigden K et al (2012) op cit.

18 "Zero" or "Elimination" needs to be verified using the best technology available. For NPEs, (for which there are no natural background levels), residues in textiles can be verified with a detection limit of 1ppm, as shown by this study. As technology develops the achievable detection limit may progressively decrease.

19 A summary of the number of samples containing NPEs within various ranges of concentration is given in Brigden K et al (2012) op cit.

20 In the five countries of manufacture where NPEs were not detected, only a small number of articles were tested – Cambodia (2 articles), Jordan (1 article), Romania (1 article), Spain (1 article), and Tunisia (3 articles) – and therefore cannot be taken to indicate that textile products manufactured in these countries in general do not contain detectable residues of NPEs.

21 Our sample code: TX12041

22 Our sample code: TX12096

23 For example:

The Recommendation agreed by the Paris Commission (now part of the OSPAR Commission) in 1992 required the phase-out of NPEs from domestic cleaning agents by 1995, and from industrial cleaning agents by the year 2000.

PARCOM (1992).PARCOM Recommendation 92/8 on nonylphenolethoxylates, OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, OSPAR Commission, London: 1 p.

OSPAR (1998). OSPAR Strategy with Regard to Hazardous Substances, OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, OSPAR 98/14/1 Annex 34

EU (2001). Decision No 2455/2001/EC of the European Parliament and of the Council of 20 November 2001 establishing the List of Priority Substances in the field of Water Policy and amending Directive 2000/60/EC, Official Journal L 249, 17/09/2002: 27-30

24 The Swedish government has recently submitted notifications of intent to propose restrictions on the sale of textile and leather articles containing residues of nonylphenol or NPEs within the EU (KEMI 2012).

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/

25 OSPAR (2004). Nonylphenol/nonylphenol ethoxylates, OSPAR Priority Substances Series 2001, updated 2004, OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, OSPAR Commission, London, ISBN 0-946956-79-0: 20 pp. http://www.ospar.org/documents/dbase/publications/p00136_BD%20on%20nonylphenol.pdf

26 PARCOM (1992) op cit. OSPAR (1998) op cit.

27 OSPAR (2004) op cit.

28 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

Jobling S, Reynolds T, White R, Parker MG & Sumpter JP (1995). A variety of environmentally persistent chemicals, including some phthalate plasticizers, are weakly estrogenic. Environmental Health Perspectives 103(6): 582-587

29 OSPAR (2004) op cit.

30 Lopez-Espinosa MJ, Freire C, Arrebola JP, Navea N, Taoufiki J, Fernandez MF, Ballesteros O, Prada R & Olea N (2009). Nonylphenol and octylphenol in adipose tissue of women in southern Spain. Chemosphere 76(6): 847-852

31 OSPAR (1998) op cit.

32 EU (2001) op cit.

33 EU (2003). Directive 2003/53/EC of the European Parliament and of the Council of 18 June 2003, amending for the 26th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement), now entry number 46 of annex 17 of COMMISSION REGULATION (EC) No 552/2009 of 22 June 2009 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annex XVII. Official Journal L 164. 26.6.2009: 7-31

34 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

35 As technology develops, the detection limit for phthalates in textiles of 3 mg/kg (ppm) may progressively decrease.

36 Fierens T, Servaes K, Van Holderbeke M, Geerts L, De Henauw S, Sioen I & Vanermen G (2012). Analysis of phthalates in food products and packaging materials sold on the Belgian market. Food and Chemical Toxicology 50(7): 2575-2583

37 Fasano E, Bono-Blay F, Cirillo T, Montuori P & Lacorte S (2012). Migration of phthalates, alkylphenols, bisphenol A and di(2-ethylhexyl) adipate from food packaging. Food Control 27(1): 132-138

38 Jenke DR, Story J & Lalani R (2006). Extractables/leachables from plastic tubing used in product manufacturing. International Journal of Pharmaceutics 315(1–2): 75-92

39 Ferri M, Chiellini F, Pili G, Grimaldi L, Florio ET, Pili S, Cucci F & Latini G (2012). Di-(2-ethylhexyl)-phthalate migration from irradiated poly(vinyl chloride) blood bags for graft-vs-host disease prevention. International Journal of Pharmaceutics 430(1–2):Pages 86-88

40 Langer S, Weschler CJ, Fischer A, Bekö G, Toftum L & Clausen G (2010). Phthalate and PAH concentrations in dust collected from Danish homes and daycare centers. Atmospheric Environment 44(19):2294-2301

41 Otake T, Yoshinaga J & Yanagisawa Y (2001). Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD. Environmental Science and Technology 35(15): 3099-3102

42 Butte W & Heinzow B (2002). Pollutants in house dust as indicators of indoor contamination. Reviews in Environmental Contamination and Toxicology 175: 1-46

43 Fromme H, Lahrz T, Piloty M, Gebhart H, Oddoy A & Rüden H (2004). Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany). Indoor Air 14 (3): 188-195

44 Abb M, Heinrich T, Sorkau E & Lorenz W (2009). Phthalates in house dust. Environment International 35(6): 965-970

45 Liu H, Liang Y, Zhang D, Wang C, Liang H & Cai H (2010). Impact of MSW landfill on the environmental contamination of phthalate esters. Waste Management 30(8–9):1569-1576

46 Colon I, Caro D, Bourdony CJ & Rosario O (2000). Identification of phthalate esters in the serum of young Puerto Rican girls with premature breast development. Environmental Health Perspectives 108(9): 895-900

47 Blount BC, Silva MJ, Caudill SP, Needham LL, Pirkle JL, Sampson EJ, Lucier GW, Jackson RJ & Brock JW (2000). Levels of seven urinary phthalate metabolites in a human reference population. Environmental Health Perspectives 108(10): 979-982

48 Silva MJ, Barr DB, Reidy JA, Malek NA, Hodge CC, Caudill SP, Brock JW, Needham LL & Calafat AM (2004). Urinary levels of seven phthalate metabolites in the US population from the National Health and Nutrition Examination Survey (NHANES) 1999-2000. Environmental Health Perspectives 112(3): 331-338

49 Guerranti C, Sbordoni I, Fanello EL, Borghini F, Corsi I & Focardi SI (2012). Levels of phthalates in human milk samples from central Italy. Microchemical Journal, in press, corrected proof.

50 Koch HM, Preuss R & Angerer J (2006). Di-2-ethylhexyl phthalate (DEHP): human metabolism and internal exposure—an update and latest results. Int. J. Androl. 29: 155–165

51 Dalgaard M, Nellemann C, Lam HR, Sorensen IK & Ladefoged O (2001). The acute effects of mono(2-ethylhexyl)phthalate (MEHP) on testes of prepubertal Wistar rats. Toxicology Letters 122: 69-79

52 For further details on the health effects of various phthalates, see: Brigden K et al (2012) op cit.

53 Howdeshell KL, Wilson VS, Furr J, Lambright CR, Rider CV, Blystone CR, Hotchkiss AK & Gray Jr LE (2008). A mixture of five phthalate esters inhibits fetal testicular testosterone production in the Sprague Dawley rat in a cumulative dose additive manner. Toxicol. Sci. 105: 153–165

54 Lin H, Ge R-S, Chen G-R, Hu G-X, Dong L, Lian Q-Q, Hardy DO, Sottas CM, Li X-K & Hardy MP (2008). Involvement of testicular growth factors in fetal Leydig cell aggregation after exposure to phthalate in utero. Proc. Natl Acad. Sci. USA 105(20): 7218–7222

55 Lovekamp-Swan T & Davis BJ (2003). Mechanisms of phthalate ester toxicity in the female reproductive system. Environmental Health Perspectives 111(2): 139-145

56 Grande SW, Andrade AJ, Talsness CE, Grote K & Chahoud I (2006). A dose–response study following in utero and lactational exposure to di(2-ethylhexyl)phthalate: effects on female rat reproductive development. Toxicol. Sci. 91: 247–254

57 Gray Jr LE, Laskey J & Ostby J (2006). Chronic di-n-butyl phthalate exposure in rats reduces fertility and alters ovarian function during pregnancy in female Long Evans hooded rats. Toxicol. Sci. 93: 189–195

58 Ema M & Miyawaki E (2002). Effects on development of the reproductive system in male offspring of rats given butyl benzyl phthalate during late pregnancy. Reproductive Toxicology 16: 71-76

Mylchreest E, Sar M, Wallace DG & Foster PMD (2002). Fetal testosterone insufficiency and abnormal proliferation of Leydig cells and gonocytes in rats exposed to di(n-butyl) phthalate. Reproductive Toxicology 16: 19-28

Aso S, Ehara H, Miyata K, Hosyuyama S, Shiraishi K, Umano T & Minobe Y (2005). A two-generation reproductive toxicity study of butyl benzyl phthalate in rats. Journal of Toxicological Sciences 30(SI): 39-58

59 Environmental Health Perspectives 108(10): 979-982
Boberg J, Christiansen S, Axelstad M, Kledal TS, Vinggaard AM, Dalgaard M, Nellemann C & Hass U (2011). Reproductive and behavioral effects of diisononyl phthalate (DINP) in perinatally exposed rats. Reproductive Toxicology 31(2): 200-209

60 EC (2005). Directive 2005/84/EC of the European Parliament and of the Council of 14 December 2005 amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles). Official Journal of the European Communities L344, 27.12.2005: 40-43
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:344:0040:0043:EN

61 ECHA (2010) Candidate List of Substances of Very High Concern for Authorisation, publ. European Chemicals Agency (ECHA), 13.01.2010
http://www.precidip.com/data/files/pdf/Candidate_List_of_Substances_of_Very_High_Concern_for_authorisation.pdf (accessed 23.08.2012)

62 EU (2008). Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council. Official Journal of the European Union L 348:84-97

63 OSPAR (1998) op cit.

64 ENDS (2012b). Danish Phthalate ban unnecessary – experts. ENDS Europe, 15 June 2012.
http://www.endseurope.com/29054/danish-phthalate-ban-unnecessary-experts. Accessed 23 August 2012

65 DMOE (2012). Danish Ministry of the Environment protects consumers from dangerous phthalates. Announcement by the Danish Ministry of the Environment, 23 August 2012.
http://www.mim.dk/Nyheder/20120823_ftalater.htm (in Danish)

66 EU (2002) Directive 2002/61/EC of the European Parliament and of the Council of 19 July 2002 amending for the 19th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (azocolourants).
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:243:0015:0018:EN:PDF

67 SAPRC (2012). GB18401-2010, National general safety technical code for textile products. General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, Standardisation Administration of the People's Republic of China (SAPRC)

68 This reductive release can take place under a number of conditions, including within the body; reduction can occur in many different types of cells, including within intestinal and skin bacteria bacteria. See:

Golka K, Kopps S & Myslak ZW (2004). Carcinogenicity of azo colorants: influence of solubility and bioavailability. Toxicology Letters 151(1): 203-210

Rafi F, Hall JD, Cerniglia CE (1997). Mutagenicity of azo dyes used in foods, drugs and cosmetics before and after reduction by Clostridium species from the human intestinal tract. Food and Chemical Toxicology 35(9): 897-901

ARC (2008). International Agency for Research on Cancer (IARC) monographs on the evaluation of the carcinogenic risk of chemicals to humans. Volume 99; Some Aromatic Amines, Organic Dyes, and Related Exposures.
http://monographs.iarc.fr/ENG/Monographs/vol99/mono99.pdf

69 Specifically the regulations relate to the use of azo dyes in textiles that can release more than a certain amount of the amine under test conditions. EU (2002) op cit.

70 SAPRC (2012) op ed.

71 Amines used in the manufacture of azo dyes can subsequently be released when they are chemically broken down.

72 Golka K, Kopps S, Myslak ZW (2004) op cit.

73 Rafi F, Hall JD & Cerniglia CE (1997) op cit.

74 IARC (2008) op cit.

75 IARC (1987). Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs Volumes 1 to 42, supplement 7. International Agency for Research on Cancer (IARC).
http://monographs.iarc.fr/ENG/Monographs/suppl7/index.php

IARC (1998) Aromatic amines. In: International Agency for Research on Cancer (IARC) monographs on the evaluation of the carcinogenic risk of chemicals to humans. Volume 4; Some aromatic amines, hydrazine and related substances, N-nitroso compounds and miscellaneous alkylating agents, updated 1998.
http://monographs.iarc.fr/ENG/Monographs/vol4/volume4.pdf

76 IARC (2008) op cit.

77 Haley TJ (1975). Benzidine revisited: A review of the literature and problems associated with the use of benzidine and its congeners. Clinical Toxicology 8(1): 13-42

78 Morgan DL, Dunnick JK, Goehl T, Jokinen MP, Matthews HB, Zeiger E & Mennear JH (1994). Summary of the National Toxicology Program Benzidine Dye Initiative. Environmental Health Perspectives 102(suppl 12): 63-78

79 IARC (2008) op cit.

80 DHHS (2011). 3,3' Dimethoxybenzidine and dyes metabolized to 3,3'-dimethoxybenzidine. Report on carcinogens, 12th Edition. US Department of Health and Human Service. Public Health Service National Toxicology Program.
http://ntp.niehs.nih.gov/ntp/roc/twelfth/roc12.pdf **7**

81 IARC (1998) op cit.

82 DHHS (2011) op cit.

83 EU (2002) op cit.

84 SAPRC (2012) op cit.

85 Medium and long-chained linear alkanes (from C16 to C36) were commonly identified in the samples investigated.

86 Some medium and long-chained linear alkanes.

87 IPPC (2003). Reference document on best available techniques for the textiles industry, Integrated Pollution Prevention and Control (IPPC), European Commission

88 Classified under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). The Globally Harmonised System of Classification and Labelling of Chemicals (GHS), a system set up under the UN, provides a way of assessing the hazardous properties of chemicals through the use of hazard statements (UN 2011). The hazard statements used for individual substances within Section 3.4 are a composite of information drawn from a number of sources including material safety data sheets (MSDSs) supplied by Sigma-Aldrich (http://www.sigmaaldrich.com); Landolt-Börnstein (http://lb.chemie.uni-hamburg.de); Merck Millipore (http://www.millipore.com); Alfa (http://www.alfa.com); ACROS (http:// www.acros.be). See Brigden K et al (2012) op cit. for further details.

89 Classified under GHS. For full details of the classification codes see: Brigden K et al (2012) op cit.

90 The Oeko-tex standard is a global product label designed for consumers who specifically hope to buy textiles that claim to be more environmentally responsible, which sets a limit of 100ppm for NP and OP individually and a limit for total NPEs/OPEs of 1000 ppm. Oeko-tex (2011). https://www.oeko-tex.com/en/press/newsroom/pressrelease_18501.html?excludeId=18501, accessed 4. 10.2012.

Oek-tex (and presumably some other standards) only include a limited range of NPEs in the standard (Greenpeace 2012 op cit).

91 C&A Restricted Substance List, May 2012

92 Mango (2007). Specification and control manual of hazardous substances in garments and accessories, June 2007.
http://www.mango.com/web/oi/servicios/company/IN/empresa/rsc/manual.pdf

93 Greenpeace International (2011a) op cit.

94 Oxfam (2004) op cit.

95 Ethical Fashion Forum (2012). Fast fashion, cheap fashion.
http://www.ethicalfashionforum.com/the-issues/fast-fashion-cheap-fashion
Accessed 4 September 2012

96 Oxfam (2004) op cit.

97 Siegle, Lucy (2011) op cit.

98 Statistisches Bundesamt (2011). Imports of clothing.

99 Siegle, Lucy (2011) op cit.

100 http://www.fairwertung.org/ Accessed 5 September 2011

101 According to the US Environmental Protection Agency, an estimated 13.1 million tonnes of textiles were generated in 2010, or 5.3% of total municipal solid waste (MSW) generation.
http://www.epa.gov/osw/conserve/materials/textiles.htm

102 DEFRA (2011). Sustainable Clothing Roadmap, Progress Report, page 2.
http://www.defra.gov.uk/publications/files/pb13461-clothing-actionplan-110518.pdf

103 Xavier Research (2008). Apparel Supply Demand in the United Kingdom: What happens next? Textrends.org, Xavier Research, updated October 2008.

http://www.textrends.org/freedox/Apparel%20Supply-Demand%20in%20the%20UK%20-%20What%20Happens%20Next.pdf

104 Inditex (2011). In 2011, 835,524,467 garments were released onto the market. Annual Report 2011, p.259.
http://www.inditex.com/en/shareholders_and_investors/investor_relations/annual_reports

105 http://www.just-style.com/management-briefing/speed-to-market-breaks-down-fashion-barriers_id114807.aspx
Accessed 5 September 2012

106 http://www.just-style.com/news/inditex-to-launch-chinese-zara-site_id115445.aspx

107 Greer L, Keane SE & Lin X (2010). NRDC's ten best practices for textile mills to save money and reduce pollution: A practical guide for responsible sourcing. New York: Natural Resources Defense Council, p.3
http://www.nrdc.org/international/cleanbydesign/files/rsifullguide.pdf

108 Swedish Chemical Agency (1997). Chemical in Textiles, p.19.
http://www.kemi.se/upload/Trycksaker/Pdf/Rapporter/Report_5_97_Chemicals_in_textiles.pdf

109 http://www.greenpeace.org/international/en/campaigns/toxics/water/detox/

110 Puma: http://about.puma.com/?page_id=10

Nike: http://nikeinc.com/news/nike-roadmap-toward-zero-discharge-of-hazardous-chemicals

Adidas: http://www.adidas-group.com/en/sustainability/assets/statements/aG_Individual%20Roadmap_November%2018_2011.pdf

H&M: http://about.hm.com/gb/corporateresponsibility/environment/hmengageswithgreenpeace__Greenpeace.nhtml

C&A will publish its individual action plan on 20 January 2012. Li-Ning will first focus on implementing the joint roadmap and is committed to publishing its individual action plan but a deadline has not yet been defined.

111 See http://www.roadmaptozero.com/pdf/Joint_Roadmap_November_2011.pdf: (1) page 5: "... in a span of only 8 years…" and (2) point 3.1 :"The first year of the roadmap, 2012,… The 2020 timeline is incredibly ambitious given the scope and global nature of what has to be achieved, in a span of only 8 years…"

112 The Joint Roadmap is available on the companies' websites:

Puma: http://about.puma.com/?page_id=10

Nike: http://nikeinc.com/news/adidas-group-ca-hm-li-ning-nike-and-puma-partner-to-reach-zero-discharge-by-2020

Adidas: http://www.adidas-group.com/en/sustainability/statements/2011/Joint_Roadmap_Zero_Discharge_Nov_2011.aspx

H&M: http://about.hm.com/gb/corporateresponsibility/environment/actionplantohelpleadourindustrytozerodischarge__Action_plan_zero_discharge.nhtml

C&A: http://www.c-and-a.com/uk/en/corporate/fileadmin/templates/master/img/fashion_updates/International_Press_Releases/111118_StatementJointRoadmap-EN.pdf

Li-Ning: http://www.li-ning.com/info/info.html?swf=news.swf (If accessing in China), for the commitment and the company's statement in Chinese

113 ZDHC stands for "Zero Discharge of Hazardous Chemicals".

114 http://levistrauss.com/sites/levistrauss.com/files/librarydocument/2012/6/ls-co-zdhc-commitment.pdf. Accessed 11 September 2012.

115 http://www.g-star.com/en/corporate-responsibility/responsible-supply-chain/joint-roadmap/#/en-sk/corporate-responsibility/responsible-supply-chain/joint-roadmap/ Accessed 30 September 2012.

116 http://www.greenpeace.org/international/en/news/Blogs/makingwaves/g-star-raw-trying-to-pull-the-wool/blog/40838/

117 NPEs, also called NPEOs, are part of a broader group of chemicals know as APEs or APEOs. For example, H&M claims to have an APEO usage ban in place since 2009, and Marks & Spencer since 1998.

118 Greenpeace (2011a) op cit.

119 http://about.hm.com/content/hm/AboutSection/en/About/Sustainability/Commitments/Use-Resources-Responsibly/Chemicals/Zero-Discharge.html

Conscious Action Sustainability Report 2011, page 73

http://about.hm.com/content/dam/hm/about/documents/masterlanguage/CSR/reports/Conscious%20Actions%20Sustainability%20Report%202011.pdf

Both accessed 18 September 2012.

120 http://corporate.marksandspencer.com/documents/specific/howwedobusiness/chemicals/agreement_with_greenpeace

121 Meaning to trying to limit and the release of the hazardous chemicals, rather then phasing them out.

122 Inditex has two internal standards relating to its products which include the use and restriction of hazardous chemicals; it refers to its Inditex refers to its "Reference Manual Clear to Wear", which could include a Restricted Substances List, but does not make this publicly available.
http://www.inditex.com/en/shareholders_and_investors/investor_relations/annual_reports (Annual Report 2010, p.83)

123 http://www.gapinc.com/content/csr/html/OurResponsibility/governance/productsafety.html

124 "Our RSL Task Force is currently working to merge the PVH and Tommy Hilfiger standards in developing one comprehensive PVH RSL Policy to be distributed to all of our suppliers." (p.43)
http://www.pvcsr.com/csr2010/Pdfs/PVH-CSR-2011-Environment.pdf

However, there is no access to its RSL (2009 version or later) or its RSL policy.

125 Inditex press kit http://inditex.com/en/press/information/press_kit

126 http://www.levistrauss.com/sustainability/planet Accessed 11 September 2012.

127 http://www.pvhcsr.com/csr2011/Environment.aspx Accessed 11 September 2012.

128 Esprit, FY2010/2011 Annual Report
http://www.esprit.com/index.php?command=Display&navi_id=3708.

129 http://www.gapinc.com/content/csr/html/OurResponsibility/governance/productsafety.html.
Accessed 11 September 2012.

130 Gap Inc, Annual Report 2011, p.10 & 12.
http://www.gapinc.com/content/attachments/gapinc/GapInc_AR_11.pdf

131 http://www.mango.com/web/oi/servicios/company/IN/empresa/rsc/manual.pdf
Accessed 12 September 2012.

132 http://shop.mango.com/home.faces?state=she_006_IN
Sustainability Report 2010.

133 Metersbonwe (2011). Metersbonwe 2011 CSR report, p.8.

134 http://corporate.marksandspencer.com/documents/specific/howwedobusiness/chemicals/agreement_with_greenpeace

135 http://www.candacr.com/en?content=zero-discharge

136 http://www.limitedbrands.com/responsibility/environment/environment_overview.aspx

137 This means "caution practiced in the context of uncertainty". An action (eg. use of a chemical substance and/or process) should not be taken if the consequences are uncertain and potentially dangerous.

138 "Zero" means zero use of all hazardous substances, via all pathways of release, ie. discharges, emissions and losses, from global supply-chains and all products. "Elimination" means "not detectable", to the limits of current technology, and where only naturally occurring (where relevant) background levels are acceptable.

139 All local communities sharing their water systems with the production of apparel/footwear and/or the products produced, all workers within this global supplier chain, and all customers, have a right to know on an ongoing basis, precisely what substances are being released, from precisely what facilities during production, and from the products themselves.

140 For example, IPE in China.
http://www.ipe.org.cn/En/pollution/index.aspx

141 http://corporate.marksandspencer.com/documents/specific/howwedobusiness/chemicals/agreement_with_greenpeace

142 Greenpeace has identified a preliminary list of well recognised hazardous chemicals for the textile industry as follows:

1. Alkylphenols; 2. Phthalates; 3. Brominated and chlorinated flame retardants; 4. Azo dyes; 5. Organotin compounds; 6. Perfluorinated chemicals; 7. Chlorobenzenes; 8. Chlorinated solvents; 9. Chlorophenols; 10. Short chain chlorinated paraffins; 11. Heavy metals, cadmium, lead, mercury and chromium (VI).

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

greenpeace.org