A Red Card for sportswear brands

Hazardous chemicals found in World Cup merchandise

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Executive Summary

This study follows on from several previous investigations published by Greenpeace as part of its Detox campaign, which identified that hazardous chemicals are present in textile and leather products as a result of their use during manufacture.[1] This is the first study that has specifically focussed on football kit; the products bought were all manufactured and sold as part of the World Cup 2014 tournament, taking place in Brazil between June 12th and July 13th 2014.

The marketing of football shirts, boots and other accessories connected with the World Cup is a multi-billion dollar market, worth more than $5 billion annually; the top two brands – adidas and Nike – share upwards of 80 percent of the market for many soccer products.[2] Record sales of football products are expected in 2014.[3]

For this investigation, a total of thirty-three products – including twenty-one pairs of football boots, seven football shirts, four pairs of goalkeepers gloves and one ball – were bought from sixteen different countries/regions around the world: Argentina, Chile, China, Croatia, Germany, Hong Kong, Indonesia, Italy, Mexico, Netherlands, Russia, South Korea, Spain, Switzerland, Taiwan and the UK. Twenty of the products were manufactured specifically for children of various ages.

The three major sportswear brands were all represented, with sixteen products from adidas, fifteen from Nike and two from Puma. All of the products were branded either with the names of famous footballers or the national teams playing in the World Cup 2014. They were purchased either directly from the brand's stores – retail or online – or from well-known sports retailers. Most of the products were manufactured in either China or Indonesia with lesser quantities made in Vietnam, Cambodia, Bangladesh, Thailand, Argentina, Bosnia, Georgia and the Ukraine.

The products were sent to the Greenpeace Research Laboratories at the University of Exeter in the UK and a duplicate was sent to Greenpeace Germany. From there they were dispatched to independent accredited laboratories.[4] The football boots and gloves were investigated for the presence of perfluorinated chemicals (PFC); all of the products were analysed for nonylphenol ethoxylates (NPE) and phthalates, and the football boots and ball were analysed for dimethylformamide (DMF). This is the first time that Greenpeace has investigated products for the presence of DMF. For certain products, analysis was also carried out for organotins and antimony.[5]

1. Key Findings

Seventeen out of twenty one football boots contained **ionic PFC** in at least one of two sampling checks that were done on the uppers and soles of the boots. The detailed analysis results including limits of quantification (LOQ) are listed in the Appendix, Table 3.

- The textile uppers of thirteen football boots contained concentrations of **PFOA** above the EU regulatory limit for PFOS in textiles of 1 µg/m², where its marketing and use within the EU has been prohibited for certain uses since 2008. The EU regulatory limit for PFOS is taken as comparative value for PFOA which is closely related to PFOS (similar hazardous properties). In addition, the sale of textiles containing PFOA above 1 µg/m² will be prohibited in Norway from June 2014. Three of the samples contained PFOA at concentrations above the 1 µg/m² limit in both sampling checks. Our investigations have shown that concentrations of ionic PFC can vary widely, not only between products but within different parts of the same product.
- The highest concentrations of PFOA (14.5 µg/m²) were found in the adidas Predator boots, which were produced in Indonesia and bought in Switzerland.
- Nike boots contained high concentrations of PFOA too. 5.93 µg/m² were found in the Nike Tiempo boots, produced in Vietnam and bought in Mexico.

Two out of the four goalkeeper's gloves contained **ionic PFC**.

- The adidas Predator gloves contained 1.96 µg/m² PFOA; like the football boots (see above), this also exceeds the regulatory limit for PFOS (taken as a comparative value).
- The adidas gloves, as well as two pairs of football boots, contained levels of PFOA in excess of its own corporate restrictions[6] on PFOA of 1 µg/m², when both sampling checks were taken into account.

PFBS, another persistent PFC, was found in eleven items in concentrations above 1 µg/m², including the following products.

- The adidas Predator boots produced in Indonesia and sold in Germany (37.9 µg/m²).
- The Nike Mercurial boots, produced in China and sold in Germany, which had very high concentrations of PFBS (189 µg/m²) in the first analysis and 7.91 µg/m² in the second analysis.
- The Puma evoSpeed boots (34.1 µg/m²), produced in China and sold in Germany.

Nonylphenol ethoxylates (NPE) were found in the official FIFA World Cup ball (20 mg/kg), sixteen out of the 21 pairs of football boots (1.2–40 mg/kg), two out of the four pairs of gloves (27–76 mg/kg) and one out of the seven football shirts (2.1 mg/kg), indicating that NPE had been used in the manufacture of these products.

Phthalates were found in all of the football boots (2.6–150 mg/kg), three out of four of the pairs of gloves (3.8–63,000 mg/kg) and four out of seven of the shirts (14.8–153,000mg/kg).

- Very high levels of phthalates were found in the plastisol print of an adidas football shirt made and sold in Argentina (15 % phthalates) and in the wrist strap of a pair of gloves by Puma (6 % phthalates), made in the Ukraine and sold in Italy. Such high levels suggest their deliberate use as a plasticiser, contrary to the corporate policies of both these brands and above the limits set in their chemicals management programmes.[7]

Dimethylformamide (DMF)

- All twenty-one pairs of football boots tested positive for DMF; nineteen of these contained DMF at levels above the 10 mg/kg limit (up to 280 mg/kg) set by the German Committee on Hazardous Substances and the German Blue Angel ecolabel for shoes and gloves. For other countries no limit is known.

The fact that ionic PFC are widely used in the manufacture of World Cup merchandise by adidas, Nike and Puma is a cause for concern; in particular PFOA continues to be used despite corporate policies to eliminate its use. Many PFC are highly persistent and do not readily break down once released to the environment. Studies show that PFC such as PFOS and PFOA can cause adverse impacts both during development and during adulthood, in part due to their hormone disrupting properties, with impacts on the reproductive system and the immune system.

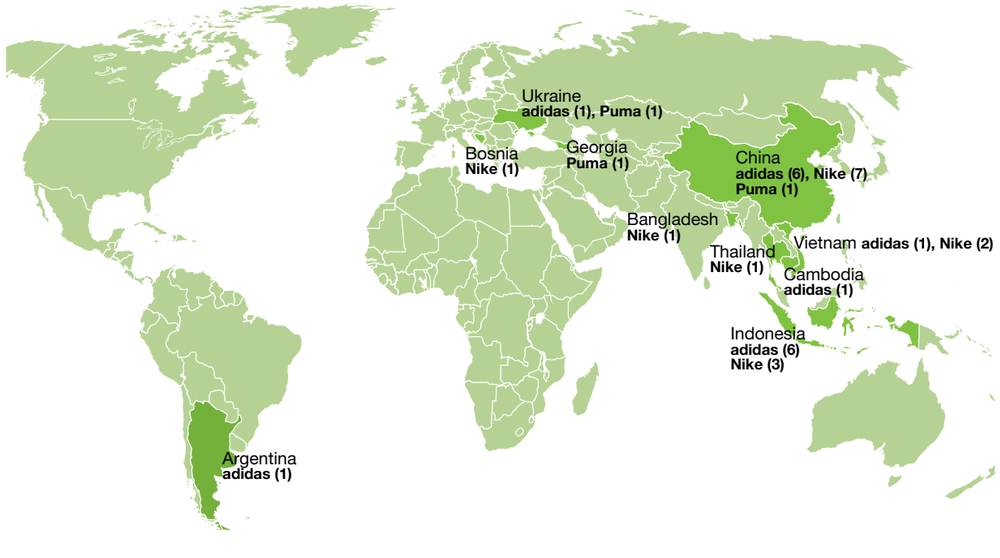
The other chemicals found are also of concern; nonylphenol ethoxylates (NPE) degrade to nonylphenols (NP), which are toxic, act as hormone disruptors, and are persistent and bioaccumulative. NP is known to accumulate in many living organisms. The presence of NPE in finished products shows that they have been used during their manufacture, which is likely to result in the release of NPE and NP in wastewater from manufacturing facilities. There are substantial concerns about the toxicity

Table 1 Which products contained hazardous chemicals.

Brand	Products	PFC ionic	NPE	Phthalates	Dimethyl formamide
adidas	**Football boots (10)**	8/10	9/10	10/10	10/10
NIKE	**Football boots (10)**	8/10	7/10	10/10	10/10
PUMA	**Football boot (1)**	1/1	0/1	1/1	1/1
adidas	**Football gloves (2)**	1/2	1/2	1/2	
NIKE	**Football gloves (1)**	1/1	0/1	1/1	
PUMA	**Football gloves (1)**	0/1	1/1	1/1	
adidas	**Football (1)**		1/1	0/1	0/1
adidas	**Football shirts (3)**		1/3	3/3	
NIKE	**Football shirts (4)**		0/4	2/4	

Shirts, gloves, boots or balls
red = contains hazardous chemicals

Figure 1 Where the products were made



of phthalates to wildlife and humans and in particular hormone-disrupting effects for some phthalates. DMF is classed as toxic to reproduction and is harmful in contact with skin.

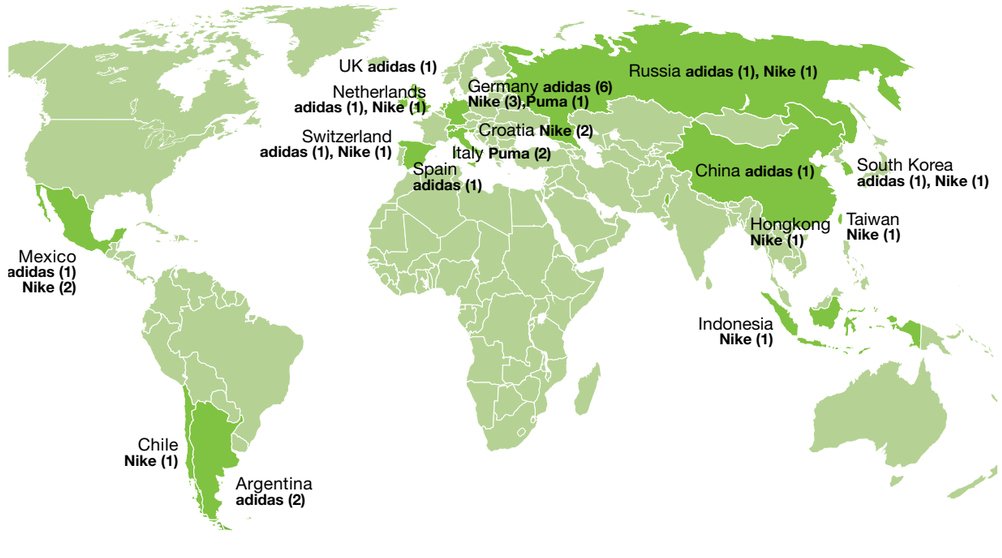
The majority of the environmental and human health impacts from these chemicals will occur in the countries where the World Cup merchandise shoes, gloves and shirts are manufactured, mainly in Asia, when chemicals used in manufacturing are released into waterways. The majority of the tested products were manufactured in China and Indonesia; smaller quantities were manufactured in Vietnam, Cambodia, Bangladesh, Thailand, as well as Argentina, Bosnia, Georgia and the Ukraine.

Who's taking corporate responsibility?

Major sports companies with a global reach have the potential to implement impactful solutions towards the elimination of hazardous substances in the industry as a whole. Using their influence, they can drive change across their supply chains and are in a position to make real progress towards a toxic-free future for our children. Greenpeace is calling on these companies to recognise the urgency of the situation and act as leaders, implementing credible programmes that will result in zero discharge of hazardous chemicals by January 1st 2020.

All three brands investigated in this report made commitments to Detox in 2011, following the launch of Greenpeace's campaign to eliminate the discharge of hazardous chemicals. Unfortunately, adidas and Nike are failing to follow through on their promises with any credible actions and are hiding behind the ineffective paper commitments of the Zero Discharge of Hazardous Chemicals (ZDHC) group.[8] Despite ignoring their individual corporate responsibility, they still promote themselves as Detox brands, using the ZDHC as a greenwash screen to avoid taking the tangible, effective and necessary individual actions needed to Detox their global supply chain. Puma is one of seventeen major clothing companies that have been identified as Leaders as a result of the credible steps they are taking to implement their public commitments to Detox their supply chains, following the launch of Greenpeace's Detox campaign in July 2011.[9]

Figure 2 Where the products were sold



The fact that each of the three sports brands investigated in this report had examples of World Cup merchandise containing hazardous chemicals, highlights the urgency with which brands need to clean up their supply chains and ensure a toxic-free future for generations to come.

Government

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

Building a Detox team

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

It doesn't stop here. Sports merchandise can also be toxic-free.

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

2. The Evidence

Despite the documented hazards associated with them, hazardous chemicals continue to be used for a variety of purposes in the manufacture process for textiles, footwear and other sporting accessories, or in the product itself: NPE are widely used as surfactants and detergents in textiles processing and as a stabiliser and emulsifier in plastics; phthalates have various uses, including as additives in plastisol prints on clothing; products are treated with per- and polyfluorinated chemicals to impart waterproofing or oil proofing properties, while dimethylformamide (DMF) is used as a solvent in the manufacture of textiles, leather and artificial leather.

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

2.1. Per- and polyfluorinated chemicals (PFC)

Twenty-five products were analysed for PFC – twenty-one football boots and four pairs of gloves. Textiles and other materials used in shoes and gloves can be treated with PFC (per/polyfluorinated chemicals) for their water and oil repellent properties. In former reports Greenpeace focussed on two different types of PFC – ionic PFC (for example, PFOS and PFOA) and volatile PFC, which are used as precursors or generated during manufacturing processes, such as fluorotelomer alcohols (FTOHs) and fluorotelomer acrylates (FTAs), which can break down into ionic PFC. For this study, the ionic PFC were investigated; two sampling checks were done on the uppers and soles of the boots and the gloves. Detailed test results including limits of quantification (LOQ) are published in a technical supplement.

- Seventeen out of the twenty-one football boots contained ionic PFC.
- The textile uppers of thirteen of these products contained PFOA, above the EU regulatory limit for PFOS in textiles of 1 µg/m², where its marketing and use within the EU has been prohibited for certain uses since 2008. PFOA has similar hazardous properties as PFOS and is closely related to PFOS. In addition, the sale of textiles containing PFOA above 1 µg/m² will be prohibited in Norway from June 2014 (see Box 1). Three of the samples contained PFOA at concentrations above the 1 µg/m² limit in both sampling checks. Our investigations have shown that concentrations of ionic PFC can vary widely not only between products but within different parts of the same product.

The results were as follows:

adidas

- The highest concentrations of 14.5 µg/m² PFOA were found in the adidas Predator boots, which were produced in Indonesia and sold in Switzerland.
- 6.81 µg/m² PFOA was found in the adidas Adizero boots, which were produced in China and sold in South Korea.
- 5.28 µg/m² PFOA was found in the adidas Adizero boots, which were produced in Indonesia and sold in China.

Nike

- High levels of PFOA (5,93 µg/m²) were found in Nike Tiempo boots, produced in Vietnam and bought in Mexico. The Nike Mercurial boots made in China and sold in Chile contained 6.61 µg/m² PFOA.

Puma

- High levels of PFOA (6.41 µg/m²) were found in the Puma evoSpeed boots, produced in China and bought in Germany.

Not only are the levels of PFOA in excess of equivalent regulations on PFOS as well as the Norwegian limits on PFOA, all three brands set a limit of 1 µg/m² PFOS in their restricted substances lists RSL.[10] Adidas also restricts PFOA to 1 µg/m². A total of six adidas boots (including the three adidas products above) therefore exceed its own restrictions on PFOA. Nike and Puma do not have a limit for PFOA in their RSL.

Two out of the four goalkeeper's gloves contained ionic PFC. The adidas Predator gloves contained 1.96 µg/m² PFOA, which is also above the regulatory limit for PFOS and adidas's own restriction on PFOA (see above). The Nike Grip3 gloves contained 2.17 µg/m², in the Puma evoPower gloves PFC were not detected.

Sixteen of the pairs of football boots and gloves were sold as children's products; ten of these samples contained concentrations of PFOA above the 1 µg/m² limit (see above); three of these samples exceeded this limit in both tests.

Another persistent PFC, the short chain PFBS was found in eleven items in concentrations greater than 1 µg/m², including:

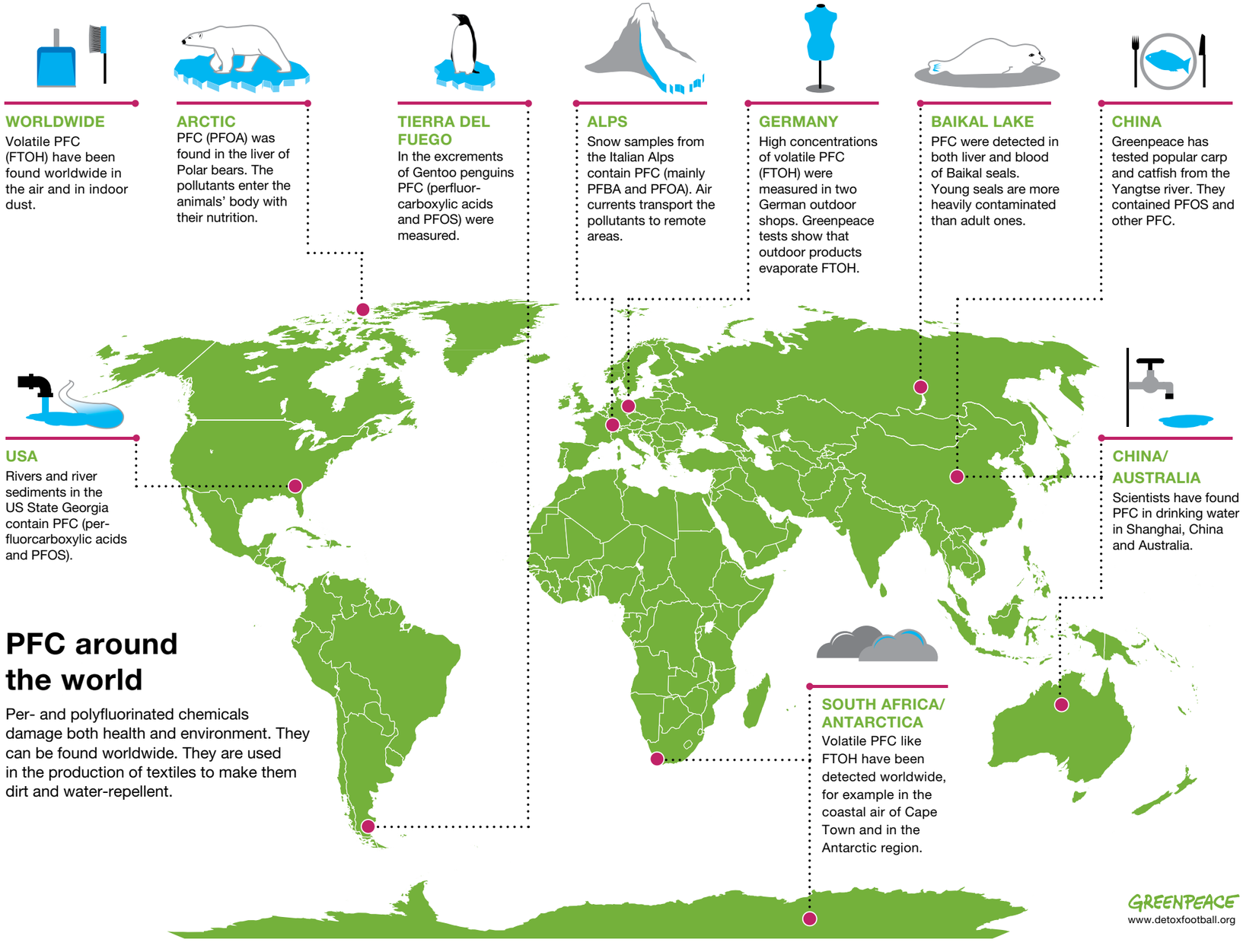
- the adidas Adizero boots produced in Indonesia and sold in China (14.5 µg/m²),

- the adidas Predator boots produced in Indonesia and sold in Germany (37.9 µg/m²),
- the Nike Mercurial boots, produced in China and sold in Germany, which had very high concentrations of PFBS (188.57 µg/m²) in the first analysis and 7.91 µg/m² in the second analysis. Quality control checks indicate that such differences in test results are a result of uneven distribution of PFC on the shoes.
- the Puma evoSpeed boots (34.1 µg/m²), produced in China and sold in Germany.

The study shows findings of long chain PFC (C10 to C14) in thirteen out of 21 tested boots, partly in concentrations higher than 1 µg/m². Some of these chemicals are SVHC (substances of very high concern) according to EU REACH regulation.

It should be noted that in Greenpeace East Asia's recent study,[11] investigations have shown that concentrations of ionic PFC can vary widely not only between products but within different parts of the same product. These variations are likely to be a characteristic of textile products treated with PFC in general, and not only the specific products tested.[12]

The results show that ionic PFC are widely used in the manufacture of World Cup merchandise by adidas, Nike and Puma; in particular PFOA continues to be used despite corporate policies to eliminate its use. In addition, nearly half of the football boots (10 out of 21) and one pair of gloves contained the very persistent PFC, PFBS. The majority of the environmental impacts from these chemicals will occur in the countries where the merchandise products are manufactured, which are mainly in Asia, when chemicals used in manufacturing are released into waterways. All of the football boots were manufactured in South East Asia (9 in China, 8 in Indonesia, 2 in Vietnam and 1 in Cambodia), with the exception of one pair, which was bought in Russia and manufactured in Bosnia.



WORLDWIDE
Volatile PFC (FTOH) have been found worldwide in the air and in indoor dust.

ARCTIC
PFC (PFOA) was found in the liver of Polar bears. The pollutants enter the animals' body with their nutrition.

TIERRA DEL FUEGO
In the excrements of Gentoo penguins PFC (perfluorcarboxylic acids and PFOS) were measured.

ALPS
Snow samples from the Italian Alps contain PFC (mainly PFBA and PFOA). Air currents transport the pollutants to remote areas.

GERMANY
High concentrations of volatile PFC (FTOH) were measured in two German outdoor shops. Greenpeace tests show that outdoor products evaporate FTOH.

BAIKAL LAKE
PFC were detected in both liver and blood of Baikal seals. Young seals are more heavily contaminated than adult ones.

CHINA
Greenpeace has tested popular carp and catfish from the Yangtse river. They contained PFOS and other PFC.

USA
Rivers and river sediments in the US State Georgia contain PFC (perfluorcarboxylic acids and PFOS).

CHINA/ AUSTRALIA
Scientists have found PFC in drinking water in Shanghai, China and Australia.

SOUTH AFRICA/ ANTARCTICA
Volatile PFC like FTOH have been detected worldwide, for example in the coastal air of Cape Town and in the Antarctic region.

PFC around the world

Per- and polyfluorinated chemicals damage both health and environment. They can be found worldwide. They are used in the production of textiles to make them dirt and water-repellent.

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Box 1 Per- and polyfluorinated chemicals (PFC)[13]

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

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

Volatile PFC such as FTOHs are generally used as precursors during manufacturing processes. However, FTOHs can be transformed into ionic PFC (such as PFOA) in the body or in the atmosphere and can also be hazardous in their own right.

The ionic PFC, PFOS, has been classified as a persistent organic pollutant (POP) under the Stockholm Convention, a global treaty that requires contracting parties to take measures to restrict the production and use of PFOS.[14] The marketing and use of PFOS within the EU has been prohibited for certain uses since 2008, with a maximum limit of 1 µg/m² set for PFOS in textiles.[15] However, there are currently no limits set for any other PFC, despite concerns about their hazardous nature and the fact that they can commonly be found at far higher concentrations in textiles.

Norway is the first country where the sale of textiles containing PFOA above 1 µg/m² will be prohibited from June 2014; certain PFC have also recently been added to a list of priority chemicals, meaning that releases to the environment must be eliminated or substantially reduced by 2020.[16] Norway, and all other countries, should enforce the elimination of PFOA (and the PFC chemical group as a whole) at much lower levels, using the best current testing technology. In addition, PFOA and four other long chain PFCAs are also classified as substances of very high concern (SVHC) within the EU under the REACH regulations (ECHA 2013).[17]

2.2. Nonylphenol ethoxylates

NPE continue to be widely used by textile manufacturers. Where NPE are used in manufacturing, the levels that remain in the final product can be influenced by the processes used, including the number of times the article was rinsed, which releases the NPE into wastewater wherever the product was manufactured. Residues of NPE in the final product are also released when the items are washed by consumers[18].

Box 2 Nonylphenol ethoxylates/nonylphenols (NPE/NPs)[19]

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

There have been restrictions on certain uses of NPE by industry since 2005 in the EU[20], with similar restrictions in place in the US and Canada.[21] Although there are currently no EU regulations that restrict the sale of textile products containing NPE residues, measures are currently under development within the EU, proposed by the Swedish Chemicals Agency.[22] In China NP and NPE are included in China's Piority Substance List recently released by the Ministry of Environment, which means that factories which produce or use these chemicals need to register with the local environmental office and disclose the release and transfer data to the public. NP and NPE are also in China's dangerous chemicals list and in the 12th 5-year plan for Prevention and Control of Environmental Risk of Chemicals.[23]

- Sixteen out of the twenty-one pairs of football boots contained NPE at levels between 1.2 and 40 mg/kg (LOQ 1 mg/kg).
- Two out of the four pairs of gloves contained NPE, with the gloves by adidas containing 27 mg/kg and the Puma gloves 76 mg/kg.
- The adidas official FIFA world cup ball, which was bought in Germany and made in China, contained 20 mg/kg of NPE.
- One out of the seven football shirts sampled contained NPE: the adidas shirt bought in Mexico (2.1mg/kg). Previous studies have found NPE in approximately two thirds of the textile products sampled.

2.3. Phthalates

All the products in this study were analysed for the presence of phthalates, used widely as plasticisers in plastics and a common contaminant in industrial processes and the environment.

- The highest level of phthalates in this study was found in the plastisol print of an adidas shirt manufactured and sold in Argentina, which contained 153,000 mg/kg, largely as a result of 110,000 mg/kg of the phthalate DINP and 37,000 mg/kg of DBP. Such high levels of phthalates (15 % of the product sampled) suggest their deliberate use as a plasticiser. The shirt with the printing was bought in an adidas store. In total, 4 out of the 7 shirts sampled contained phthalates (LOQ: 3mg/kg), with the remaining 3 at lower levels than the adidas shirt above.
- Phthalates were detected in all of the football boots.
- The two football boots with the highest levels of phthalates were adidas products, at 150 mg/kg and 124 mg/kg.
- Three out of the four pairs of gloves contained phthalates.
- The Puma gloves, made in the Ukraine and sold in Italy, also contained very high levels of phthalates in the waste strap part, with a total of 63,000 mg/kg, mostly made up of 62,000 mg/kg of the phthalate DEHP. This level of phthalates (6 %) suggests its deliberate use as a plasticiser. In this case these gloves were for adults. However, for comparison: the use of certain phthalates, including DEHP, is prohibited in all toys or childcare articles put on the market within the EU (with a limit of 0.1 % by weight, equivalent to 1,000 mg/kg). These levels are also well in excess of the limits set by adidas and Puma in their Restricted Substances Lists for phthalates in their products.[24]

Reports on the European rapid alert system for non-food dangerous products (RAPEX),[25] show that analysis of imported children's clothing and footwear for phthalates by European customs inspectors has resulted in their rejection or voluntary withdrawal, when found to contain phthalates at above 0.1 % (as found in both the Puma gloves and the adidas shirt sold in Argentina, although neither of these products would breach these regulations, which focus on children under three within the EU).[26]

Phthalates were found in the majority of the products tested, mostly at levels below 0.1 %, most likely as a result of their widespread use as ingredients in manufacturing, which could also include contact with materials containing phthalates after manufacture (eg. packaging), rather than due to their deliberate use as plasticisers. It is therefore necessary to systematically eliminate the use of all phthalates throughout the manufacturing and distribution chains, to progressively reduce the levels of these hazardous chemicals in products and the environment.

Box 3 Phthalates[27]

Phthalates are mainly used as plasticisers (or softeners) in plastics, especially PVC. Because phthalates are not chemically bound to the plastics, they are released into the indoor and outdoor environment during the lifetime of the products and again following disposal. Phthalates are found widely in the indoor environment, including in air and in dust. They are commonly found in human tissues, with reports of significantly higher levels of intake in children. There are substantial concerns about the toxicity of phthalates to wildlife and humans and in particular their hormone-disrupting effects. For example, DEHP – one of the most widely phthalate used to date – is known to be toxic to reproductive development in mammals, capable of interfering with development of reproductive organs in males[28] and affecting reproductive success in females.[29]

Legislation does not currently exist in any of the countries where the thirty-three tested articles were sold that prohibits the sale of clothing containing phthalates.[30] However, probably the best known legislation on phthalates is the EU-wide ban on the use of six phthalates in children's toys and childcare articles, first agreed as an emergency measure in 1999 and finally made permanent in 2005. The use of certain phthalates, including DEHP, is prohibited in all toys or childcare articles put on the market within the EU (with a limit of 0.1 % by weight, equivalent to 1,000 mg/kg), and the use of others, including DINP, is prohibited in such articles if they can be placed in the mouth by children. Such regulations have been replicated in other countries such as the US,[31] and most recently in China, where a new standard on toy safety prohibiting the use of six phthalates in children's toys was notified to the World Trade Organisation (WTO) in July 2013 and will come into force in June 2014.[32]

The definition of "childcare articles" does not include items of clothing in these regulations.[33] However, draft legislation has been proposed in China which would prohibit the presence of six phthalates, including DEHP and DINP, at concentrations above 0.1 % by weight (1,000 mg/kg), in clothes sold for babies and young children (under 36 months old).[34] Another exception is South Korea, where the restriction on six phthalates in toys and childcare articles also applies to clothing for infants under 24 months.[35]

Within the European Union, certain phthalates, including DEHP, DBP, DiBP and BBP, have been listed as Substances of Very High Concern (SVHC) under the EU's REACH Regulation.[36]

2.4. Dimethyl formamide (DMF)

All of the football boots and the ball were tested for the presence of DMF, which is a solvent used in textiles, leather and plastics. Although DMF in shoes and textiles is strictly regulated in the EU and Germany it is still widely used in South Asia and can be present in products imported to the EU.

- All twenty one pairs of football boots tested positive for DMF.
- Nineteen out of twenty-one football boots contained DMF at levels above the 10 mg/kg limit set by the German Committee on Hazardous Substances and the Blue Angel ecolabel for certain products (see Box 4).
- Concentrations of DMF above 50 mg/kg were found in six boots by Nike, five boots by adidas and the boots by Puma.
- No pattern of contamination could be discerned, as very different concentrations of DMF were found within products of the same brand and even the same model.

The results show that DMF is widely used in the manufacture of World Cup merchandise by these brands. All of the football boots were manufactured in South Asia (9 in China, 8 in Indonesia, 2 in Vietnam and 1 in Cambodia), with the exception of one pair bought in Russia which was manufactured in Bosnia.

Box 4 N,N-dimethylformamide – DMF

DMF is used as solvent in the production of polyurethane coated textiles such as artificial leather, rain and protection wear, footwear and as solvent in the production of synthetic fibres.[37] It is classified as toxic to reproduction (may cause harm to the unborn child), acutely toxic and harmful in contact with skin.[38] The German Committee on Hazardous Substances refers to DMF as a substance "for which it must be assumed from experience that there is a health-impairing effect due to intake through the skin".[39] The substance can act as a carrier for other hazardous substances (i.e. hazardous substances which are themselves not absorbed via the skin or only slightly so, but can be absorbed through the skin in combination with DMF).[40]

In addition, short-term exposure to DMF has been observed to damage the liver in animals and in humans and long-term occupational exposure to DMF by inhalation has resulted in effects on the liver and digestive disturbances in workers.[41] It is regarded as one of the most common chemicals found in industrial effluent from the production of polyurethane products and acrylic fibres.[42]
In the EU DMF is on the candidate list of Substances of Very High Concern under the EU's REACH regulation, due to its classification as toxic to reproduction.[43] In February 2014 ECHA recommended DMF as priority substance for authorisation,[44] because it is used in high volumes and has widespread applications which may pose a threat to human health. Once on the authorization list, companies can request authorisation for its use within a specific timeframe, with public consultation regarding alternatives and substitutes to take place if such a request is made. DMF is also included in several other regulatory lists, including the Swedish Chemical Agency's PRIO phase-out list,[45] the Danish EPA's List of Undesirable Substances[46] and the US EPA's list of Extremely Hazardous Substances.[47,48] The German Committee on Hazardous Substances set a maximum DMF limit value of 10 mg/kg for protective gloves.[49,50] This same limit is also set by the German Blue Angel eco-label for the use of DMF in shoes and protective gloves.

3. Keep the game beautiful – kick out hazardous chemicals

The importance of football and the World Cup market for sportswear brands

The marketing of football shirts, boots and other accessories connected with the World Cup is a multi-billion dollar market, worth more than $5 billion annually; the top two brands – adidas and Nike – share upwards of 80 percent of the market for many soccer products.[51] Record sales of football products are expected in 2014.[52]

Adidas, the official sponsor of the World Cup, has traditionally dominated soccer pitches. Adidas will have a "dominant role" at the finals in Brazil, according to chief executive Herbert Hainer; it will be sponsoring eight teams, including reigning champions Spain, Argentina, Colombia, Germany, Japan, Mexico, Nigeria and Russia.[53] Adidas expects its net profit from the World Cup 2014 to reach 830–930 million euros (after falling sales overall last year),[54] and is targeting record annual soccer-related sales of 2 billion euros ($2.8 billion) for 2014.[55] Its sales in 2012 were 1.7 billion euros.[56]

Nike is the market leader in sales of all sports goods. Nike's involvement in the World Cup market has also increased in recent years; it also claims to be "the world's leading football brand" according to Trevor Edwards, president of Nike brands. It will be providing kit for 10 teams at this year's World Cup finals – Australia, Brazil, Croatia, England, France, Greece, Netherlands, Portugal, South Korea and United States. According to Nike, its football business is worth about two billion dollars.[57]

Puma is also providing kit for eight sides at the World Cup, including Italy, Switzerland and four teams from Africa.[58]

Hazardous chemicals in adidas, Nike and Puma products – a chronology

Previous Greenpeace studies have examined a variety of products by adidas, Nike and Puma, among other sportswear and fashion brands. The studies, dating from 2011 to the present, have consistently found a variety of hazardous chemicals in products from all three of these brands. Several different types of products have been tested, from T-shirts and tracksuits to swimwear and outerwear, for both children and adults.

All of the studies investigated products for the presence of NPs/NPE, with a wider range of chemicals added in successive studies, firstly per/polyflourinated chemicals and phthalates, and finally antimony in polyester and organotins.

The results summarised in Table 2 show that hazardous chemicals were found in more than half of the majority of samples tested for each of the brands and that there is no significant difference between the results from one study to the next.

Table 2 Product testing results in adidas, Nike and Puma articles from Greenpeace studies 2011–2013

Greenpeace study	Brand	Products	AP/APE	Ionic PFC	Volatile PFC	Phthalates	Antimony in polyester	Organotins
Dirty Laundry 2: Hung out to Dry[59]	adidas	Polo shirt, Dress, 2 Football shirts, 2 Tracksuit trousers, T-shirt, Tracksuit jacket, Sweatshirt	4 of 9					
	NIKE	6 T-shirts, Tracksuit jacket, Polo shirt, Sport shirt, Tank top	5 of 10					
	PUMA	4 T-shirts, Football shirt, Sport shorts, Tracksuit jacket, Football shirt, Sport shirt	6 of 8					
Chemistry for any weather[60]	adidas	Terrex Feather Jacket (for women)	1	1	1	1		
Swimwear contains hazardous chemicals[61]	adidas	Swimsuit	1	1	0	1		
	NIKE	Swimsuit	1	0	0	1		
	NIKE	Swim shorts	1	1	0	1		
	PUMA	Swim shorts	0	1	0	1		
Chemistry for any weather – Part II[62]	adidas	TX GTX ActS j (jacket)	0	1	1	1		
A little story about the monsters in your closet[63]	adidas	Trousers & Pullover set, 4 T-shirts, Coat, Shoes, Football shirt, Swimwear, Top, Swimsuit	6 of 11	3	2 of 3	4 of 6	5 of 7	2 of 4
	NIKE	Coat, 5 T-shirts, Shoes, Running top, Wind jacket	5 of 9	2	1 of 2	3	5	0 of 4
	PUMA	2 x Shoes, Football shirt, 3 T-shirts	5 of 6	1	0	1	3	3 of 4

Shirts, gloves, boots or balls (red = contains hazardous chemicals)

Corporate commitments to Detox

This new Greenpeace study confirms that several different hazardous chemicals – including PFC, NPE and phthalates – continue to be used by major sportswear brands. For the first time, the widespread use of DMF has also been highlighted. The use of these chemicals during the manufacture of sportswear items such as football boots, gloves and shirts for the World Cup 2014 will lead to the release of these hazardous chemicals into waterways in the countries of production, as well as throughout their life cycle in the countries where the products were sold.

This clearly confirms that in spite of decades of regulation and corporate responsibility programmes, hazardous chemicals – including the 11 priority groups identified for the textile sector by Greenpeace[64] – continue to be used by supply chain manufacturers of clothes for many well-known brands. Residues of hazardous chemicals are present in a wide range of textiles, as well as in footwear and sporting accessories. Even where regulations have been introduced, so-called "acceptable" limits of these chemicals have allowed releases from a multitude of sources, from the manufacturing processes through to the final products. For some of these chemicals this has resulted in their build-up in the environment and in some cases their accumulation in animal and humans over the years.

The findings of this study show that both, companies and governments, need thorough and comprehensive plans to achieve the elimination of hazardous chemicals, including those used in textiles, footwear and sporting accessories manufacturing, and therefore prevent residues of these chemicals from contaminating consumer products, as well their release from manufacturing facilities. Some companies have taken on the challenge to be Detox Leaders and have begun this process.

Puma is one of these leaders and is implementing a credible action plan to fulfil its commitment. The findings of this report show that clearly, there is more work for Puma to do. In contrast, although both adidas and Nike have made commitments to Detox and promote themselves as Detox brands, neither of them have an effective plan to eliminate the use of hazardous chemicals within their supply chains or their products.

Despite committing to Detox two years ago, there is insufficient evidence of any credible outcomes on the ground for either adidas or Nike. Each of these companies has repeatedly rejected its responsibility to take individual corporate action to eliminate any of the hazardous chemicals identified and to provide credible transparency to the public. Rather than actively supporting the public's "Right to Know" about hazardous chemical pollution from their individual suppliers, these companies prefer to shield themselves under the umbrella of collective inaction – the ZDHC Group[65] – which has so far done little more than set up tools, processes and conduct pilot studies. Adidas and Nike are 'spinning' their public promises into public relations exercises, instead of taking the urgent action necessary to credibly progress the real elimination of hazardous chemicals.

For example, neither adidas nor Nike acknowledges the necessity to eliminate all PFC; as members of the ZDHC Group JRM they are committed to the limited collective target to phase out long chain PFC by January 2015.[66] Puma has made an individual commitment to eliminate long chain PFC by 2015,[67] and in addition, its testing procedure "covers all perfluorinated chemicals. As a first step Puma is addressing the most commonly used PFOA/PFOS while recognizing that under the precautionary principle there needs to be a substitution of all PFC with non-fluorinated alternatives".[68] Puma has also published a case study on substituting perfluorinated chemicals on Subsport.org.[69]

The big players need to raise their game!

The Detox commitment – to eliminate the use of all hazardous chemicals by no later than January 1st 2020 – is necessarily ambitious, to match the urgency of the problem. But it is achievable, so long as companies make adequate commitments and then do not compromise on their implementation.

As a result of actions taken by some of the companies that have committed to Detox, significant changes have taken place. For example, the public's "Right to Know" about the chemical-by-chemical discharge from an individual supply chain facility used by a brand is becoming a reality. This has been continually rejected by parts of the textile industry and considered almost impossible before the Detox campaign began. Today, several companies – including Mango, Fast Retailing (Uniqlo), Inditex, H&M, Benetton, Valentino, G-Star, M&S, Limited Brands, C&A, Puma, Coop, Canepa and Esprit – have ensured the publication of data from some of their suppliers about discharge of hazardous chemicals, on the global online platform IPE.[70]

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

This level of transparency on the use and discharge of hazardous chemicals is completely lacking from both adidas and Nike, and is an important step towards achieving the Detox objective of eliminating the use and discharge of hazardous substances.

Box 5 Elements of an effective Detox plan

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

- core principles
- transparency
- elimination

An adequate approach needs to be hazard-based, comprehensive and have credible definitions for the **"Precautionary Principle"**[71], zero discharge of hazardous chemicals, individual corporate accountability[72], and the public's **"Right to Know"**[73] about the use and discharge of hazardous chemicals from a company's supply chain facilities, and their presence in the final product. Together, a commitment to these principles frames the practices that are necessary to progress towards zero hazardous chemicals use.

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

- Adopt a credible commitment to phase out the use, from their global supply chain and all products, of all hazardous chemicals by January 1st 2020.
- Start disclosing – in the months following a commitment and at regular (at least annually) and relevant intervals afterwards – information on the releases of hazardous chemicals that are still used at their suppliers' facilities to the public, especially to local/national inhabitants (e.g. using credible public information platforms[74]).
- Commit to the elimination of the 11 priority chemical groups within a reasonable timeline, and set clear and credible intermediate progress targets for the elimination of other hazardous chemicals beyond these groups. Introduce non-hazardous chemistry by the earliest specific date possible: responsible companies will act now and not wait until December 31st 2019 to eliminate their hazardous chemicals use.

Governments: a political commitment to zero discharge is vital

Credible actions taken by companies need to be matched with credible regulatory action from governments, to level the playing field and to send a strong message to the textile industry, as well as other sectors, that the use and release of hazardous chemicals is not acceptable.

Although many of the Detox principles (see Box 5) are accepted by governmental bodies, this is not yet reflected by the thorough implementation of bans and restrictions on hazardous chemicals that will lead to their elimination by no later than January 1st, 2020. Specific regulation needs to be targeted at each of the hazardous chemicals found in the children's clothing in this report, to address the particular problems posed by each chemical group.

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

Many of the chemicals within the 11 priority groups of hazardous chemicals identified are already regulated in some places, in one form or another, including some PFC, certain APE (alkylphenol ethoxylates, which include NPE)

and phthalates.[75] However, the fact that these hazardous chemicals appear to be so widely present in clothing products and are also found in examples of effluent from the manufacturing supply chain,[76] means that there can be only one conclusion: existing regulations are failing to protect human health and the environment.

The Detox team needs star players

In the two years since the public launch of Greenpeace's Detox campaign, companies that are Detox Leaders have ensured to begin the publication of hazardous chemicals discharge data from many of their facilities – an achievement previously rejected by the textile industry as unrealistic. Communities local to textile manufacturers and the wider public have now begun to gain their "Right to Know" about pollution from textile facilities. This, combined with information about current levels of hazardous chemicals in certain products, such as the findings presented in this report, is the starting point for the progressive reduction and elimination of hazardous chemicals pollutants into local waterways and in consumer products.

This report should remind Detox Leaders such as Puma of the urgency of eliminating hazardous chemicals use in the supply chain and the need to apply their efforts comprehensively. Companies that continue to greenwash – adidas and Nike – need to act immediately to address the inadequacies in their policy and practice and join the Detox revolution. The path to zero discharge requires every company to invest sufficient resources with urgency and there is no excuse to delay taking the first step. As big players – with over 80 % of the World Cup merchandise market between them – their influence on global supply chains for textiles and sporting goods is significant.

What people can do

Everyone – from sports fans, to parents, global citizens and consumers – can be part of the Detox team. Together we can influence adidas and Nike to become the star players of the Detox challenge.

Main products

Nike
Mercurial

Adidas
Predator Men

Puma
evoSPEED

Nike
Hypervenom

Adidas
Adizero f50 Special Edition

Adidas
Adizero f50

Adidas
Predator Children

Adidas
11Pro

Adidas
Nitrocharge

Adidas
Predator

Nike
GK Grip

Puma
evoPOWER Grip

Adidas
Brazuca

Appendix
Summary of results

Table 3 Summary of results from sampling of football boots, gloves, ball and shirts, showing sum of PFC, PFBS, PFOA, sum of nonylphenol ethoxylates (NPE), sum of phthalates, dimethylformamide (DMF), antimony and organotins

Sample code	Brand	Place of sale	Country of manufacture	Type of product	Material	PFC*			Nonylphenol-ethoxylate mg/kg	sum Phthalate* mg/kg	DMF (A) mg/kg	Antimony mg/kg	Organotins mg/kg
						sum ionic PFC µg/m²*	PFBS µg/m²	PFOA µg/m²					
KI14002/SWI02	adidas	Switzerland	Indonesia	Boots: Predator LZ TRX BE, men	synthetic textiles & leather	1) 29.1 sole: ND 2) 29.3	1) 6.05 sole: <0.69 2) <0.97	1) 9.57 sole: <0.46 2) 14.5	11	7.1	40		
KI14004a/b/NL03/04	adidas	Netherlands	China	Boots: adizero F50 TRX FG, boys	no information, synthetic textiles & leather	1) 14.2 sole: 7.21 2) 112.3 sole: 6.95	1) 1.64 sole: 0.77 2) 107.6 sole: <0.88	1) 2.55 sole: 4.07 2) 0.95 sole: 4.71	1.2	107	15		
KI14007/DE03	adidas	Germany	Indonesia	Boots: Predator Absolado LZ TRX FG J, boys	Upper: Synthetic Lining: textile/synthetic Inner sole: textile Outer sole: synthetic	1) 45.7 2) 20.5	1) 37.9 2) 12.6	1) 0.67 2) 3.81	3.9	74.0	89		
KI14008/DE04	adidas	Germany	Cambodia	Boots: 11pro Questra TRX FG J, boys	Upper: Synthetic Lining: textile/synthetic Inner sole: textile Outer sole: synthetic	ND	<0.78	<0.52	10	51.0	82		
KI14026/DE11	adidas	Germany	Indonesia	Boots: nitrocharge 3.0 TRX FG J, boys	Upper: Synthetic Lining: textile Inner Sole: textile Outer sole: synthetic	1) ND sole: 1.63 2) sole: ND	1) <0.93 sole: <0.33 2) sole: <0.31	1) <0.62 sole: 1.63 2) sole: <0.20	4.4	64.8	20		
KI14017/CH01	adidas	China	Indonesia	Boots: adizero F5 TRX TF, youth/ unisex	synthetic textile & leather	1) 26 2) 13.01	1) 14.5 2)13.01	1) 5.28 2) <0.51	2.6	45.0	62		
KI14023/ARG01/02	adidas	Argentina	China	Boots: adizero F50 TRX FG, men	synthetic textile & leather	1) 2.1 2) 3.74	1) <0.46 2) <1.30	1) 0.65 2) <0.87	5.3	150	25		
KI1402 8/UK01	adidas	UK	Indonesia	Boots: nitrocharge 3.0 TRX FG, boys	Lining: textile, sole and other parts: synthetic	ND	<1.07	<0.72	6.4	124	80		
KI14030/RU02	adidas	Russia	China	Boots: F50 adizero TRX FG, men	synthetic textile & leather, with plastisol print	1) 13.8 sole: n.q. 2) 5.91	1) 2.35 <0.3 2)<0.54	1) 3.93 0.37 2) 2.30	<1	69.6	24		
KI14033/KR03/04	adidas	South Korea	China	Boots: F50 adizero TRX FG, youth	synthetic textile & leather	1) 3.16 2) 12.8	1) <0.55 2) <0.66	1) <0.37 2) 6.81	8.2	27	130		
KI14010 (1)/DE06 KI14010/2/DE06	adidas	Germany	Ukraine	Goalkeeper gloves: PRED FS JUNIOR, boys	Body: 63 % Polyester/ 37 % Polyurethane Palm: 88 % Latex/12 % Cotton Outer hand: 88 % Latex/12 % Cotton	1.0	<0.35	<0.24	27	1) 3.8 (outer) 2) ND (inner, wrist strap)			
KI14015 (1)/ES01 KI14015/2/ES01	adidas	Spain	Indonesia	Goalkeeper gloves: PRED JUN IC, boys	Body: 70 % polyurethane, 30 % polyester Palm: 70 % Natural Rubber, 25 % Ethylene Vinyl Acetate, 5 % Polyester Outer hand: 83 % Ethylene Vinyl Acetate, 15 % Polyester, 2 % other	1) 8.17 2) 2.75	1) <0.23 2) <0.17	1) 1.41 2) 1.96	<1	1) ND (outer) 2) ND (inner, wrist strap)			
KI14005/DE01	adidas	Germany	China	official FIFA World Cup ball: Brazuca OMB, unisex	no information, synthetic textiles & leather				20	ND			
KI14006/DE02	adidas	Germany	China	Shirt: DFB Away JSY Y, boys	Shell: 100 % Polyester, included small plastisol print, labelled as 'climacool®'				<1	ND		93	
KI14022a/b (1)/MX03 KI14022a/b (2)/MX03	adidas	Mexico	Vietnam	Shirt: FMF A JSY Y, children, unisex	100 % polyester with plastisol print				2.1	1) 41.0 (badge) 2) 48.0 (print)		133	
KI14024b (2)/ARG03 KI14024a/ARG04	adidas	Argentina	Argentina	Shirt: AFA H JSY, men	100 % polyester with plastisol print				<1	1) 100 (badge) 2) 153000 (printed number)		176	0.09**
KI14001/SWI01	Nike	Switzerland	China	Boots: JR MERCURIAL VICTORY IV FG, boys	no information, synthetic textiles & leather	1) 17.1 2) 11.47	1) 13.7 2) 10.97	1) 2.49 2) 0.53	17	49.0	200		

Table 3 Summary of results from sampling of football boots, gloves, ball and shirts, showing sum of PFC, PFBS, PFOA, sum of nonylphenol ethoxylates (NPE), sum of phthalates, dimethylformamide (DMF), antimony and organotins

Sample code	Brand	Place of sale	Country of manufacture	Type of product	Material	PFC*			Nonylphenol-ethoxylate mg/kg	sum Phthalate* mg/kg	DMF (A) mg/kg	Antimony mg/kg	Organotins mg/kg
						sum ionic PFC µg/m²*	PFBS µg/m²	PFOA µg/m²					
KI14011/DE07	Nike	Germany	China	Boots: JR MERCURIAL VICTORY IV TF, boys	Upper: Synthetic Lining: textile/synthetic Inner sole: textile Outer sole: synthetic	1) 191.4 sole: ND 2) 19.73	1) 188.6 sole: <0.7 2) 7.91	1) <0.36 sole:<0.46 2) 8.16	18	62.2	280		
KI14025/DE09	Nike	Germany	Indonesia	Boots: JR HYPERVENOM PHELON TF, boys	Upper: Synthetic Lining: textile/synthetic Inner Sole: textile Outer sole: synthetic	1) 16.3 2) 16.17	1) 3.59 2) 15.08	1) 5.91 2) 0.68	40	29.1	12		
KI14013/ID01	Nike	Indonesia	China	Boots: JR MERCURIAL VICTORY IV FG, boys/unisex	No information on labels, synthetic textile and leather	16.5 sole: 2.30	14.9 sole:<0.59	<0.53 sole:<0.39	3.8	133	72		
KI14014/HK01	Nike	Hongkong	Vietnam	Boots: HYPERVENOM PHADE IC, boys	Upper: synthetic leather	0.3	<0.37	0.3	<1	37.0	9		
KI14016/TW01	Nike	Taiwan	Indonesia	Boots: Mercurial Victory IV FG, boys	Breathable mesh, leather, thermoplastic polyurethane, PHYLON, rubber, alloy, plastisol print of logo	ND	<0.71	<0.47	2.4	63.0	9		
KI14018/CR01	Nike	Croatia	Indonesia	Boots: HYPERVENOM PHATAL FG, adults	Leather, textile, synthetic material	1) 8.68 2) ND	1) <0.66 2) <0.88	1) 6.05 2) <0.59	<1	7.1	200		
KI14020/MX01	Nike	Mexico	Vietnam	Boots: JR TIEMPO NATURAL IV 509081, boys	Lining: textile sole and other parts: synthetic	1) 14.2 2) 8.24	1) <0.95 2) <0.98	1) 5.93 2) 5.46	<1	42.7	18		
KI14027b/a/CL01/02	Nike	Chile	China	Boots: MERCURIAL VAPOR IX FG, men	Upper: synthetic	1) 11.5 2) ND	1) <0.79 2) <0.37	1) 6.61 2) <0.24	9.6	76.0	100		
KI14029/RU01	Nike	Russia	Bosnia	Boots: MERCURIAL VAPOR IX FG, adults	synthetic textile & leather, with plastisol print	ND	<0.67	<0.45	10	58.1	80		
KI14021 (1)/MX02 KI14021/2/MX02	Nike	Mexico	China	Goalkeeper's gloves: Nike GK Grip3, boys	48 % latex, 25 % polyester, 25 % ethyl vinyl acetate, 2 % polyurethane	1) 15.5 2) 3.16	1) 14.4 2) <0.45	1) <0.41 2) 2.17	<1	1) 12.7 (outer) 2) 11.6 (inner, wrist strap)			
KI14032/KR10/02 KI14032/2/KR01/02	Nike	South Korea	Thailand	Shirt: Korea Stadium	no information, textile with large plastisol print				<1	1) 38.0 (printed number) 2) ND (badge)		63	ND
KI14003a/NL01 KI14003a/2/NL1	Nike	Netherlands	Bangladesh	Shirt: Netherlands Stadium, men	body: 96 % polyester, 4 % cotton; back panel: 100 % polyester: 'Dri-fit'				<1	1) ND (badge) 2) 14.8 (printed number)		86	ND
KI14012/DE08	Nike	Germany	China	Shirt: Brasil Replica CBF B SS Home REP, boys	100 % polyester; 'dri-fit'				<1	ND		57	
KI14019/CR02	Nike	Croatia	China	Shirt: Croatia Stadium, boys	100 % polyester				<1	ND		139	
KI14009/DE05	Puma	Germany	China	Boots: evoSPEED 1.2 FG, male	no information, synthetic textile & leather	1) 34.1 2) 21.8	1) 34.1 2) 9.95	1) <0.42 2) 6.41	<1	106	95		
KI14031 (1)/ITA2 KI14031/2/ITA2	Puma	Italy	Ukraine	Goalkeepers gloves: evoPOWER Grip 2 RC, adult	no information, synthetic textile and other materials	ND	<1.08	<0.72+	76	1) 62.0 (outer) 2) 63,000 (inner, wrist strap)			

Notes:
* Some products or product parts (such as the sole) were sampled more than once, the results are identified as such. Detailed test results and detection limits are published in the technical supplement.
** The 0.09 mg/kg total organotins were made up of 0.04 mg/kg dioctyltin and 0.05 mg/kg monooctyltin.
In addition to the thirty-three products in this study, a Puma shirt (Italia Kids Home Rep), bought in Italy and made in Georgia, was analysed only for organotins, which were not detected.

Method PFC analysis
Concentration for PFC is given in microgram PFC per square meter textile/fabric (µg/m²). Method: soxhlet extraction with methanol, extract purified using solid phase extraction (SPE), a range of ionic PFC quantified using high performance liquid chromatography (HPLC) combined with tandem mass spectrometry (HPLC-MS/MS).

Method phthalate analysis
concentration of phthalates is given in milligram per kilogram (mg/kg = ppm), < x: concentration below limit of quantification (LOQ).
Method: extraction with ethyl acetate:cyclohexane (1:1) using deuterated (D8)-napthalene as a quality control standard, analysis in the extracts by gas chromatography/mass spectrometry (GC/MS), detection limit of 3 mg/kg for each individual phthalate unless otherwise indicated in the table.

Method NPE analysis
Extraction with acetonitrile-water mixture (70:30), analysed with reversed-phase HPLC liquid chromatography along with tandem mass spectrometry (LC-MS/MS), quantification carried out for each of 17 individual nonylphenol ethoxylates (4-20 ethoxylate groups). presented concentrations are the sum of the concentrations of individual nonylphenol ethoxylates with 4-20 ethoxylate groups, with a detection limit of 1 mg/kg.

Method organotin analysis
Extraction with methanol, oragnotins derivatised using sodium tetraethylborate and extracted into hexane, analysis with gaschromatography/mass spectrometry (GC/MS), with a detection limit of 0.1 mg/kg for each individual organotins.

Method antimony analysis
Extraction with mixture of nitric acid and hydrochloric acid (4:1), microwave-assisted digestion with a temperature ramp to 180°C, diluted with deionised water, analysed by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), with a detection limit of 5 mg/kg.

Method DMF analysis
Extraction with methanol, analysis (identification and quantification) by gas chromatography/mass spectrometry (GC/MS).

Table 4 Product testing results for adidas, Nike and Puma articles from Greenpeace studies 2011–2013

Date of study	Brand	Product	AP/APE mg/kg	Ionic PFC µg/m²	Volatile PFC µg/m²	Phthalates mg/kg	Antimony in polyester mg/kg	Organotin total mg/kg
2011[77]	**adidas**	Polo shirt	18					
		Dress	14					
		Football shirt	2.0					
		Tracksuit trousers	1.1					
		T-shirt	<1					
		Football shirt	<1					
		Tracksuit jacket	<1					
		Sweatshirt	<1					
		Tracksuit trousers	<1					
	Nike	T-shirt	810					
		T-shirt	660					
		T-shirt	12					
		Tracksuit jacket	2.0					
		Polo shirt	1.2					
		T-shirt	<1					
		Sport shirt	<1					
		T-shirt	<1					
		T-shirt	<1					
		Tank top	<1					
	Puma	T-shirt	210					
		Football shirt	47					
		Sport shorts	14					
		Tracksuit jacket	12					
		T-shirt	4.4					
		Football shirt	1.8					
		T-shirt	1.2					
		Sport shirt	<1					
		T-shirt	<1					
2012[78]	**adidas**	Terrex Feather Jacket (for women)	20 (NP 8)	1.69 µg/m²	104.6 µg/m²	16		
2013[79]	**adidas**	Swimsuit	30 mg/kg	7,9 µg/m²	ND	5 mg/kg		
	Nike	Swimsuit	71 mg/kg	ND	ND	3 mg/kg		
		Swim shorts	16 mg/kg	2,6 µg/m²	ND	5 mg/kg		
	Puma	Swim shorts	ND	1,8 µg/m²	ND	8 mg/kg		
2013[80]	**adidas**	TX GTX ActS j (jacket)	ND	5.06 µg/m²	270.4 µg/m²	17 mg/kg		
2013[81]	**adidas**	Trousers & pullover set	8.7	-	-	-	208	-
		T-shirt	<1.0	-	-	44	184	<0.1
		Coat	1.8	0.159 µg/m²	181 µg/m²	-	105	-
		Shoes	16	2.23 µg/m²	390 µg/m²	-	-	0.28–106
		Football shirt	<1.0	-	-	50	49	<0.1
		Swimwear	<1.0	15.8 µg/m²	ND	12	100	-
		T-shirt	<1.0	-	-	54	197	-
		Top	<1.0	-	-	-	46	-
		T-shirt	19	-	-	21	242	0.22–0.48
		T-shirt	38	-	-	45	135	-
		Swimsuit	8.7	-	-	-	293	-
	Nike	Coat	2.4	2.08 µg/m²	557 µg/m²	15	14	-
		T-shirt	<1.0	-	-	31	-	<0.1
		T-shirt	<1.0	-	-	-	-	<0.1
		Shoes	6.3	2.29 µg/m²	ND	-	-	<0.1
		T-shirt	<1.0	-	-	-	119	-
		Running top	2.5	-	-	-	64	<0.1
		T-shirt	5.6	-	-	65	-	-
		T-shirt	<1.0	-	-	-	73	-
		Wind jacket	22	-	-	-	104	-
	Puma	Shoes	7.3	19.7 µg/m²	ND	-	-	<0.1–401
		Football shirt	25	-	-	-	126	<0.1
		T-shirt	5.5	-	-	-	147	-
		Shoes	340	-	-	-	-	0.44–105
		T-shirt	<1.0	-	-	-	-	-
		T-shirt	17	-	-	120	154	<0.1–0.48

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See more at: **http://www.vanguardngr.com/2014/03/nike-overtake-adidas-world-cup-teams-battle/#sthash.4jKz9150.dpuf**

4 The 33 products were purchased in March 2014. While still in the store, purchased products were immediately sealed in individual identical clean polyethylene bags. From shirts 2 identical items were bought, pairs of shoes or gloves were divided. Each item was packaged separately. Sealed bags containing the products were sent to the Greenpeace Research Laboratories at the University of Exeter in the UK and the duplicate was sent to Greenpeace Germany. Subsamples were taken from each article and dispatched to independent accredited laboratories for a range of analyses as detailed in this report (perfluorinated chemicals, nonylphenolethoxylates, phthalates and dimethylformamide). In addition, some articles were analysed for antimony and organotins, which are not discussed in this report; articles with fabrics composed of polyester, or a blend of polyester and other fibres, were analysed at the Greenpeace Research Laboratories to determine the concentration of antimony within the polyester fibre; four samples were analysed for the presence of organotins at an independent accredited laboratory. Details of the individual articles and results for the sum of all of these chemicals are provided in the Appendix (Table 3).

5 For certain products, analysis was also carried out for organotins and antimony (see note 4). All the results are detailed in the Appendix (Table 3).

6 Adidas Group Restricted Substances List (A-01 Requirements). September 2013. **http://www.adidas-group.com/media/filer_public/85/09/850915ac-f85f-4533-8e87-3c84c8093193/a01_sept_2013_en.pdf**
Limits in products: 1 µg/m² of PFOS & PFOA

Nike Manufacturing Restricted Substances List (2011). **http://www.nikeincchemistry.com/restricted-substance-list**
Limits in products: 1 µg/m² of PFOS. Limit for PFOA is "to be determined".

Puma Handbook of Environmental Standards (2012). Vol. 2. Chemicals Management, see p.70. **http://about.puma.com/wp-content/themes/aboutPUMA_theme/media/pdf/PUMASafeEnvironmentHandbook-Vol2_final.pdf**
The limit for PFOS in Puma's RSL/M-RSL is 1 µg/m².

7 Puma Handbook of Environmental Standards (2012), op. cit. Puma's limit for the sum of Phthalates is 'not detected'. Adidas Group Restricted Substances List (A-01 Requirements), op. cit. Adidas sets a limit in products of 500 mg/kg for both adults and children.

8 Zero Discharge of Hazardous Chemicals Group. Joint Roadmap. **http://www.roadmaptozero.com**

9 Companies that have made Detox commitments and are taking credible actions to implement these are: Puma, H&M, M&S, C&A, Zara, Mango, Esprit, Levi's, Uniqlo, Benetton, Victoria's Secret, G-Star Raw, Valentino, Coop, Canepa, Burberry, Primark.

10 Adidas Group Restricted Substances List (A-01 Requirements), op. cit.
Limits in products: 1 µg/m² of PFOS & PFOA.

Nike Manufacturing Restricted Substances List (2011), op. cit.
Limits in products: 1 µg/m² of PFOS
Limit for PFOA is to be determined.

Puma Handbook of Environmental Standards (2012), op. cit. see p.70. The limit for PFOS in Puma's RSL/M-RSL is 1 µg/m².

11 Greenpeace (2014). A little story about the monsters in your closet. op. cit.
For five articles (3 waterproof clothing articles, 1 footwear article and 1 swimwear article), two different portions from each article were analysed separately for ionic PFC to determine variation in concentrations in different parts of the article.

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

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50 TRGS 401 applies to activities involving skin contact with substances, preparations or articles. The German TRGS concretizes the requirements of the Hazardous Substances Ordinance (GefStoffV). Under the Hazardous Substances Ordinance the employer has a duty within the framework of his risk assessment to identify and assess the nature, extent and duration of the dermal hazard and to lay down the protective measures required to prevent or minimise the hazard due to skin contact.

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

65 Zero Discharge of Hazardous Chemicals Group. Joint Roadmap, op. cit.

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67 PUMA will phase-out the use of long-chain perfluorinated chemicals (PFC's), beginning January 1, 2015. This means that all products manufactured from 2015 onwards will use technologies based on short-chain repellent or alternative chemistries, however, short chain PFC could still be used. **http://about.puma.com/wp-content/themes/aboutPUMA_theme/media/pdf/2013/2013_03_05psen.pdf**

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

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

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

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

74 **http://www.ipe.org.cn/En/**

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