Dirty Laundry

Unravelling the corporate connections to toxic water pollution in China

GREENPEACE

Contents

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

Jamie Choi, Madeleine Cobbing, Tommy Crawford, Steve Erwood, Marietta Harjono, Martin Hojsík, Zhang Kai, Li Yifang, Tony Sadownichik, Melissa Shinn, Daniel Simons, Ilze Smit, Ma Tianjie, Diana Guio Torres, Vivien Yau, Yue Yihua, Zheng Yu, Lai Yun, Lei Yuting

Designed by:
Atomo Design

Cover photograph:
Pipe on the north side of the Youngor factory has finished dumping wastewater. The black polluted discharge is clearly visible © Greenpeace / Qiu Bo

JN 372

Published by

Greenpeace International
Ottho Heldringstraat 5
1066 AZ Amsterdam
The Netherlands

greenpeace.org

Note to the reader

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 United Nations 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 Wastewater being discharged from a pipe from the Youngor textiles factory, in Yinzhou district, Ningbo. Youngor is a major apparel and textiles brand in China.

The problem and the solution are not only a cause of local concern. This is truly a global issue.

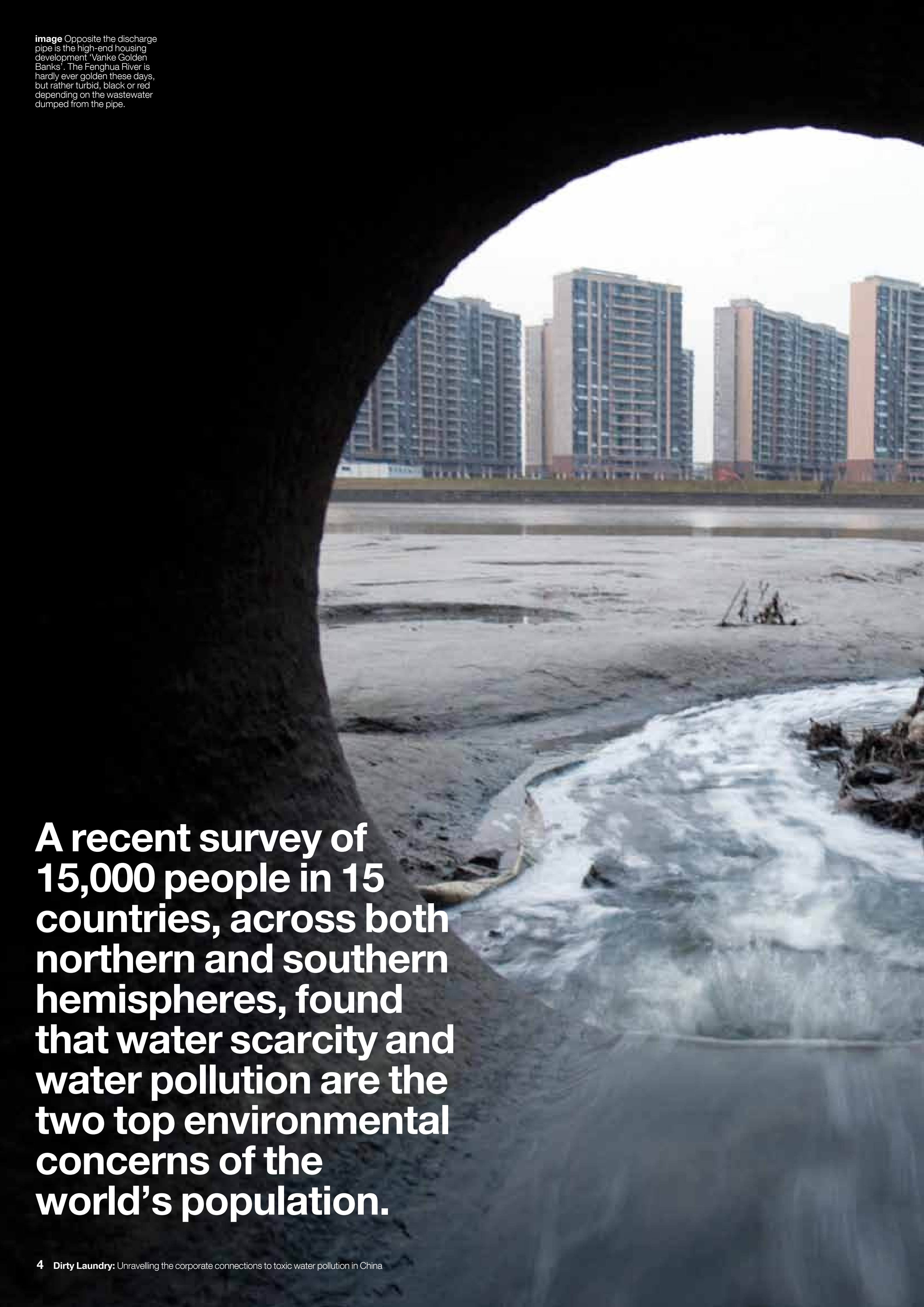

image Opposite the discharge pipe is the high-end housing development 'Vanke Golden Banks'. The Fenghua River is hardly ever golden these days, but rather turbid, black or red depending on the wastewater dumped from the pipe.

A recent survey of 15,000 people in 15 countries, across both northern and southern hemispheres, found that water scarcity and water pollution are the two top environmental concerns of the world's population.

Executive Summary

Dirty Laundry The toxic secret behind global textile brands

Unravelling the toxic threads

Building upon Greenpeace's recent investigations, *Dirty Laundry* profiles the problem of toxic water pollution that results from the release of hazardous chemicals by the textile industry in China. This water pollution poses serious and immediate threats to both our precious ecosystems and to human health. Urgent and transparent action is needed in order to eliminate the use and release of these hazardous chemicals.

Leading clothing brands source many of their products from suppliers in China. Although some of these brands have Corporate Responsibility programmes which partly address the environmental impact of their supply chain, none of the brands featured in this report have an effective strategy in place to deal with the problem of water pollution caused by industrial discharges containing hazardous substances. At best, the majority of these programmes are limited to ensuring that suppliers comply with local standards – most of which rarely consider the discharge of the hazardous and persistent chemicals highlighted in this report. It is clear that these leading brands have not yet made a significant effort to tackle the problem of eliminating the release of hazardous chemicals during the production process.

Key findings of the investigations

- The investigations that form the basis of this report focus on wastewater discharges from two facilities in China. The first facility, the Youngor Textile Complex, is located on the Yangtze River Delta. The second, Well Dyeing Factory Limited, is located on a tributary of the Pearl River Delta. Additional investigations into the supply chains that tie these facilities to national and international brands were also undertaken. **The results from these samples are indicative of a much wider problem**.
- The scientific analysis of the samples found that both manufacturing facilities were discharging a range of hazardous chemicals into the Yangtze and Pearl River deltas. Significantly, **hazardous and persistent chemicals with hormone-disrupting properties were found in the samples**. Alkylphenols (including nonylphenol) were found in wastewater samples from both facilities, and perfluorinated chemicals (PFCs), in particular perfluorooctanoic acid (PFOA) and perfluorooctane sulphonate (PFOS), were present in the wastewater from the Youngor Textile Complex. This was **despite the presence of a modern wastewater treatment plant** at the Youngor facility. The alkylphenols and PFCs found in the samples are a cause for serious concern, as these chemicals are known hormone disruptors and can be hazardous even at very low levels. Many of the substances within these groups are regulated in the Global North, for example by the EU or by international conventions.
- Our investigations further revealed that the companies behind the two facilities have commercial relationships (as suppliers) with a range of major brands, including **Abercrombie & Fitch**, **Adidas**, **Bauer Hockey**, **Calvin Klein**, **Converse**, **Cortefiel**, **H&M**, **Lacoste**, **Li Ning**, **Meters/bonwe**, **Nike**, **Phillips-Van Heusen Corporation (PVH Corp)**, **Puma** and **Youngor**, and have also been linked with a number of other Chinese and international brands. When confirming their commercial relationship with the Youngor Group, Bauer Hockey, Converse, Cortefiel, H&M, Nike and Puma informed Greenpeace that they make no use of the wet processes of the Youngor Group for the production of their garments.

However, regardless of what the aforementioned brands use these facilities for, none of these brands have in place comprehensive chemicals management policies that would allow them to have a complete overview of the hazardous chemicals used and released across their entire supply chain and to act on this information. As brand owners, they are in the best position to influence the environmental impacts of production and to work together with their suppliers to eliminate the releases of all hazardous chemicals from the production process and their products. These brands need to take responsibility for the use and release of persistent, hormone-disrupting chemicals into our critical and life-sustaining waterways. A commitment to **zero discharge** of hazardous chemicals along with a plan on how to achieve this is urgently needed in order to prevent the further accumulation of hazardous substances in the aquatic environment, and the resulting build-up in people and wildlife.

A persistent problem

The dangers associated with the use and release of persistent hazardous chemicals have been recognised, in part, by many countries in the Global North. There, policies to reduce the use and release of some priority hazardous chemicals have been implemented. Attempts to clean up some of the worst effects of decades of toxic pollution are underway, despite the very high expense of restoration programmes and the impossibility of total decontamination. By comparison, less progress has been made in many parts of the Global South to reduce the use and release of hazardous chemicals. Subsequently, lower costs and simpler regulation is something that many global brands have taken advantage of, by locating production facilities in these areas or purchasing goods from facilities located in the Global South.

Among the numerous chemicals used and released by industry, persistent substances – such as heavy metals and some hazardous organic chemicals – are a source of particularly high concern.

These hazardous chemicals pose long-term threats to human health and the environment. What makes many of these chemicals so dangerous is that they are not only persistent (meaning that they do not readily break down in the environment), but also bioaccumulative (meaning that they can build up in the food chain and can have serious, long-term effects on the organisms that ingest them). Some are able to interfere with hormone systems in people and wildlife, even at very low doses, while others are carcinogenic or reprotoxic.

Furthermore, the effects of such persistent and bioaccumulative substances are not confined to local or regional areas. Many can be transported far beyond their release point via ocean currents, atmospheric deposition and food chains. Some are even transported to remote locations, such as the polar regions, where they can accumulate. The problem and the solution are therefore not only a cause of local concern. This is a truly global issue.

Water pollution: Made in China

China has some of the worst water pollution in the world, with as much as 70% of its rivers, lakes and reservoirs being affected by all types of pollutants. About 20% of the organic pollutants from all sources in China are accounted for by discharges from industry.[1] However, the contribution of persistent, hazardous chemicals to this pollution is not properly assessed and remains largely unknown.

To explore this problem further, in 2009 Greenpeace investigated five facilities discharging industrial wastes into the Pearl River Delta and found a variety of hazardous chemicals in their wastewater. There are also signs that persistent chemicals are building up in Chinese rivers; studies have detected the persistent and hormone-disrupting pollutants alkylphenols and PFCs in fish species along the Yangtze River.[2]

Clearly, the current approach to pollution control – which relies on wastewater treatment plants, ambient quality standards and limits on certain pollutants in effluent – has not prevented industrial water pollution by hazardous and persistent chemicals. In fact, treatment plants are unable to remove many of these substances from wastewater, meaning that they either pass through the treatment process unchanged, are converted into other hazardous substances, or accumulate in treatment plant residues, such as sludge.

Textile production and its links to the pollution

The modern textile industry has a long history of migrating from one region or country to another. Most of this migration has been driven by one factor: the need to cut costs.

As well as being an important sector in China's economy, accounting for 7.6% of China's total trade volume[3], the textile industry is a large user of chemicals, many of which are hazardous and persistent, and is reported to be a major source of water pollution. The 'wet processing' of textiles, including dyeing, washing, printing and fabric finishing leads to the discharge of large quantities of wastewater containing toxic substances.

Although large-scale pollution from the textile industry has been a problem throughout its history, the more recent use of persistent and hazardous chemicals poses a greater, and often invisible, threat to ecosystems and human health.

Corporate connections and the skeletons in their closets

The global textile supply chain is complex, involving many different stages and actors. Multinational brand owners may contract suppliers directly or indirectly, through agents or importers. Normally, it is the brand owner who triggers the product development process, including research and design. **Brand owners are therefore the best placed to bring about change in the production of textiles and clothing** - through their choices of suppliers, the design of their products and the control they can exert over the use of chemicals in the production process and the final product.

The international and Chinese brands connected to the suppliers investigated in this report vary greatly in their approach to environmental sustainability and corporate social responsibility (CSR). Some of the brands – such as Li Ning, Bauer Hockey, Abercrombie & Fitch and Youngor – carry out little or no reporting on CSR issues. They do not publish a chemicals management policy, nor do they make publically available lists of chemicals banned or restricted in their products or during their manufacture. In contrast, the sportswear brands Nike, Adidas and Puma, fashion brands such as H&M and apparel companies such as Phillips-Van Heusen all publish more detailed information about their approach to managing hazardous substances in their products[4] (see Appendix 1 for details).

The policies and practices of Nike, Adidas and Puma were examined in particular detail for this report, due in part to the fact that all three have been recognised by external bodies – such as the Dow Jones Sustainability Index[5] – as leaders on sustainability issues. As part of this investigation, particular attention was paid to those policies and practices relating to the discharge of hazardous substances into water by their supply chains. Nike, Adidas and Puma all have detailed restricted substances lists specifying which substances must not be present above certain limits in their final products. However, there is no evidence that any of the brands implement measures to restrict the release of most hazardous substances into water via their suppliers' wastewater discharges, beyond the requirements of local legislation.

Responsibility for cleaning up

China has yet to develop strong legislation, monitoring and enforcement mechanisms to deal effectively with the use of hazardous chemicals and their subsequent discharge into water. Brands that source products from China need to take the lead by accepting responsibility for the problem of hazardous chemical discharges and by implementing a series of measures throughout their supply chains that go beyond the general 'environmental management' approach apparent in some Corporate Responsibility programmes.

This will require a change in the way that discharges of hazardous chemicals are dealt with. As this investigation has shown, even where modern wastewater treatment plants exist – such as at the Youngor Textile Complex – hazardous persistent chemicals can still be present in the treated wastewaters. New strategies therefore need to be adopted that will prevent the discharge of these chemicals into our water supplies by eliminating their use altogether.

Stricter regulations and enforcement mean that in much of the Global North the use of substances – such as alkylphenols and many of the PFCs – is avoided in textile manufacturing. In some instances, eliminating the use of hazardous chemicals – such as alkylphenols – and replacing them with a safer alternative has saved brands money, and even kept companies in business. Substituting with safer alternatives often enables the use and discharge of hazardous chemicals to be completely eliminated.

Yet in countries such as China, hazardous chemicals that endanger the health of people and wildlife – both locally and globally – continue to be used, even though alternatives exist. In fact, while the production of hazardous chemicals such as PFOS and nonylphenols is falling globally, it is actually on the increase in China.

It is therefore vital that brands intervene rapidly to instigate a phase-out of hazardous chemicals throughout their supply chains, starting with those that are known to be highly problematic and that have already been regulated elsewhere (see Section 4 for a list of 11 priority groups of chemicals for phase-out by the textile sector). **Given their significant economic influence, the major brands are in a unique position to lead on this phase-out within the textile industry by setting a deadline for elimination and developing a substitution plan.** They must ensure that adequate resources are devoted to the development of alternatives, to enable substitutes to become both available and economically viable.

However, despite the **urgent need for leadership and real action on the ground from innovative brands** seeking first-mover advantage, if the shift to a toxic-free future is to be effective it will also need to be enforced throughout the industry. There is therefore also a need for **governments to put in place comprehensive chemical management policies** to facilitate the shift from hazardous to non-hazardous chemicals.

Championing a better future

Toxic pollution has to be dealt with in all countries. **Hazardous, persistent and hormone-disrupting chemicals continue to be used and released, contaminating our waterways and threatening our livelihoods and our future.** As influential actors implicated as part of a broken system, brands and governments have a responsibility to act now.

The role of brands:

To this end, Greenpeace is calling on the brands and their suppliers identified in this investigation to become the **champions for a post-toxic world** – by eliminating all releases of hazardous chemicals from their supply chains and their products.

Specifically, this entails establishing clear company and supplier policies that commit their entire supply chain to the shift from hazardous to safer chemicals, accompanied by a plan of action that is matched with clear and realistic timelines.

Proper policies to eliminate the use and release of all hazardous chemicals across a company's entire supply chain should be based on a precautionary approach to chemicals management, and account for the whole product lifecycle and releases from all pathways. To be credible, these policies need to be accompanied by a plan of implementation, with clear timelines, and be matched with real and substantial action on the ground. Furthermore, steps such as knowing what hazardous chemicals their suppliers use and release, being transparent and accountable by making this data publicly available, and prioritizing 'known' hazardous chemicals for immediate elimination will be fundamental to their shift towards championing a toxic-free future.

Above all these companies need to act as leaders and innovators. The problems associated with the use and release of hazardous chemicals within the textile industry will not be fixed by severing ties with one or two polluting suppliers. The solutions are to be found in working together with suppliers to bring about systematic change in the way brands and businesses create their products. Such action requires vision, commitment and a desire to improve upon the current approach to hazardous chemicals. Every brand and supplier has the responsibility to know when and where hazardous chemicals are being used and released up and down their supply chain and to strive to eliminate them. **It will therefore be through their actions, not their words, that these brands can become agents of positive change.**

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 a **preventative approach** to chemicals management.

This commitment must be matched with an implementation plan containing intermediate short term targets, a dynamic list of priority hazardous substances requiring immediate action, and a publicly available register of data on discharge emissions and losses of hazardous substances, such as a Pollutant Release and Transfer Register (PRTR). These steps must be taken to prevent further damage to the environment and risks to health from future uses and releases of hazardous and persistent chemicals, and to avert the need for costly clean-up operations.

Governments have a choice. They can continue to expose their citizens and the environment to hazardous toxic pollution, and condemn future generations to pay for the management of contaminated sediments, whose full and final costs are incalculable. Or they can commit to creating a post-toxic world, by taking precautionary action to support truly sustainable innovation, and progressively reduce the use and release of hazardous substances **down to zero.**

The role of global citizens:

As global citizens, our power to stand up for what we believe in and to collectively influence brands and governments to make the right choices for us and future generations has never been greater than it is today.

Please join with us and support Greenpeace in calling on these brands to **champion a post-toxic world** – where our water supplies are no longer polluted with hazardous, persistent and hormone-disrupting chemicals by industry.

Together we can demand that they act NOW to detox our rivers, detox our planet and ultimately, detox our future. A post-toxic world is not only desirable, it's possible. Together we can help create it.

The time to act is now.

www.greenpeace.org/detox

image The flow of wastewater from this discharge pipe increases at dusk; the pipe leads into the Huangsha Channel, and is located northeast of the Well Dyeing Factory Ltd. A Greenpeace campaigner is investigating.

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Introduction: Water crisis, toxic pollution and the textile industry

A vital resource under threat

Clean water is both essential to the planet's ecosystems and fundamental to people's well being. It is a basic human right. As well as providing a range of critical habitats for wildlife, waterways such as rivers and lakes supply communities with vital resources – including drinking water, water for crop irrigation and foods such as fish and shellfish. These waterways also serve as a support system for industrial activity, providing water for many manufacturing and cooling processes. However, such industrial activities can affect water quality and thereby jeopardise the other resources that the rivers and lakes provide.

A recent survey of 15,000 people in 15 countries, across both northern and southern hemispheres, found that water scarcity and water pollution are the two top environmental concerns of the world's population.[1,2] Globally, water resources are being degraded by the increasing pressure of human activities. Economic and population growth places ever-greater demands on water supplies, reducing the quantity and quality of water available for wildlife, ecosystem function and human consumption. The severity of these impacts is summarised by the UN as follows:

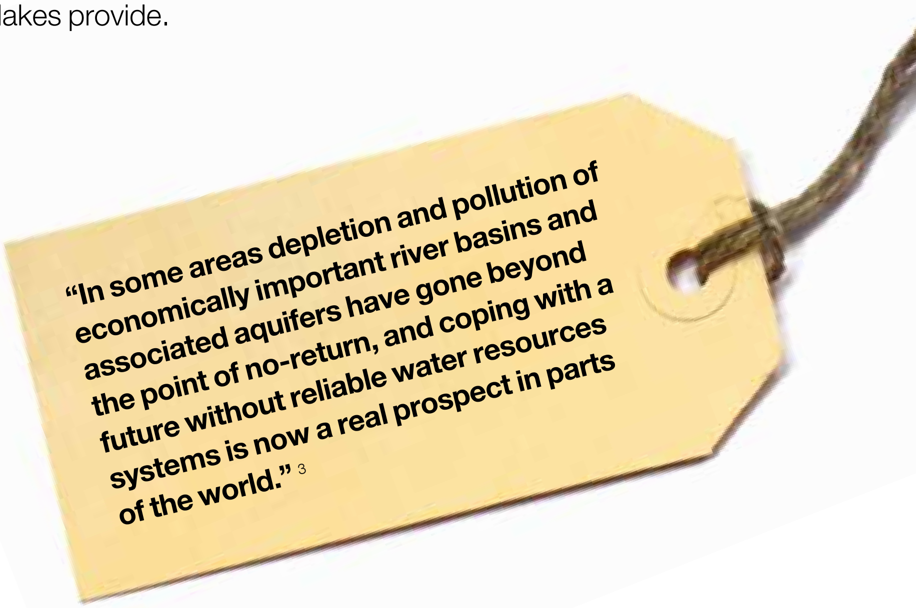


image Yellow scum left behind on the mud by the flow of wastewater from 'Pipe 1' at the Youngor Textile complex.

Important waterways in the Global South are also increasingly threatened by the build-up of hazardous substances, which are impairing their ecological health and their capacity to provide vital resources.

Nitrate and other nutrient pollution from agricultural runoff and sewage have the most obvious and visible effect on waterways, as they lead to the growth of algal blooms, which in turn deplete oxygen supplies in water.

Hazardous chemicals can be released into waterways either directly (from industrial facilities) or indirectly (through the use of industry's products in agriculture or by consumers). Some of these chemicals can persist in the environment, build up in waterways and enter the food chain – impacting adversely upon both wildlife and human health.

The Global North has many heavily industrialised freshwater and estuarine systems – such as the Rhine-Meuse-Scheldt Delta in Belgium and the Netherlands, and the Great Lakes in North America – where decades of pollution with persistent hazardous chemicals have led to high concentrations of contaminants in the sediments of rivers and harbours. In many cases, this contamination has caused long-term, irreversible damage to people, the environment and the wider economy, which is a major cause of concern for local communities, governments and industry.[4]

Important waterways in the Global South are also increasingly threatened by the build-up of hazardous substances, which are impairing their ecological health and their capacity to provide vital resources. Examples of threatened waterways include the Chao Phraya in Thailand, the Neva in Russia, the Marilao river system in the Philippines and the Riachuelo in Argentina. Coastal and marine environments and resources also suffer knock-on effects from pollutants discharged by these waterways.

According to the United Nations Environment Programme, "worldwide, it is estimated that industry is responsible for dumping 300–500 million tons of heavy metals, solvents, toxic sludge and other waste into waters each year."[5]

In high-income countries, industrial pollution is said to be stabilising or decreasing. The Organisation for Economic Co-operation and Development reports that since the 1970s, high-income countries have reduced industrial discharges of heavy metals and other persistent chemicals by 70% to 90% or more in most instances.[6] However, this is not the case for economies in the Global South, where pollution is expected to increase along with economic and industrial development.[7]

Water pollution in China:
causes, costs and concerns

> **"Over the last decade or so, China has become legendary for its ability to undercut prices for everything from consumer goods to industrial machinery. The only way for manufacturers elsewhere to compete was to move to China themselves. As Bill Powell, writing in Fortune magazine put it in March 2002, 'any CEO worth his salt these days is deciding not whether to move manufacturing capacity to China but how much and how quickly.'"**[8]

China has some of the worst water pollution in the world[9], with as much as 70% of its rivers, lakes and reservoirs being affected.[10] China's existing water shortage problem is worsening due to spiralling demand and the growing effects of climate change. Water pollution is further exacerbating the situation, with a quarter of the country's population having no access to clean drinking water.[11] Severe water shortfalls are predicted for many regions across China if no action is taken to tackle the problem.

According to a nationwide survey, industry accounted for nearly 20% of organic pollutants (expressed as Chemical Oxygen Demand)[12] discharged into water in 2007.[13] In many cases, the factories polluting critical water sources are producing goods for the US and European markets, with research indicating that about 20% to 30% of China's water pollution comes from manufacturing goods for export.[14]

Industrial discharge of hazardous substances shows no sign of abating, despite the fact that water pollution is recognised by the Chinese authorities as a cause for serious concern.[15]

The head of the State Environmental Protection Administration (SEPA)[16] acknowledged as long ago as 2006 that "in some places, environmental problems have affected people's health and social stability, and damaged our international image".[17]

Many people in China who have provided resistance to the polluting industry share this concern. According to the Ministry of Environmental Protection, anti-pollution protests have been increasing by a third every year.[18] A 2008 study of Chinese industry reports that: "Sometimes not-in-my-backyard protests force the government to move factories into less populated areas, where there will be fewer people to complain.

While water pollution has severe impacts on the environment, it also has direct economic consequences for industry itself. The nationwide annual cost to industry of using polluted water was estimated in a 2007 SEPA/World Bank report at 50bn yuan ($7.5bn US dollars).[19]

According to the same source, the use of polluted water for agricultural irrigation in designated wastewater irrigation zones has an impact on yields and product quality that was estimated at 7bn yuan ($1bn) in 2003.

The produce in these zones is likely to contain heavy metals such as mercury, cadmium, lead, copper, chromium and arsenic. Human health impacts, which are harder to assess, were not considered in this study.

image A Greenpeace campaigner takes a sample of yellow-coloured wastewater from the discharge pipe of the Youngor Textille Complex.

Box 1.1 The sinister effects of hazardous chemicals in the environment

Chemicals that cause particular concern when released into the environment display one or more of the following properties:

- **persistence** (they do not readily break down in the environment);
- **bioaccumulation** (they can accumulate in organisms, and even increase in concentration as they work their way up a food chain); and
- **toxicity**.

Chemicals with these properties are described as **PBTs (persistent, bioaccumulative and toxic substances)**. Organic chemicals with these properties are sometimes referred to as **persistent organic pollutants (POPs)**, for example under the global Stockholm Convention[20]. Despite initial dilution in large volumes of water or air, such pollutants can persist long enough in the receiving environment to be transported over long distances, to concentrate in sediments and organisms, and some can cause significant harm even at what may appear to be very low concentrations.

Heavy metals are inherently persistent and some of them (for example cadmium, lead and mercury) are also able to bioaccumulate and/or are toxic. Although they occur naturally in rocks, their use by industry can release them into the environment in quantities that can damage ecosystems. Heavy metal compounds do not break down into harmless constituents but can react to form new compounds.

Some types of toxicity make it difficult to define 'safe' levels for substances, even at low doses, for example, substances may be:

- **carcinogenic** (causing cancer), **mutagenic** (able to alter genes) and/or **reprotoxic** (harmful to reproduction); or
- **endocrine disruptors** (interfering with hormone systems).

Rivers under threat

Of the numerous chemicals released by industry, heavy metals and hazardous organic substances are of particular concern (see Box 1.1). Many such chemicals pose a long-term threat to human health and eco-systems once released into the environment. In addition, some chemicals bioaccumulate – becoming more concentrated higher up the food chain – and can have serious, long-term effects on the organisms that ingest them.[21] Furthermore, the effects of such persistent and bioaccumulative substances can be global, as they may be transported far beyond their source via ocean currents, atmospheric deposition and food chains. Some have even been found to accumulate in the polar regions.[22]

The Yangtze River, also known as the Chang Jiang ('Long River'), is the longest river in China, while the Pearl River is the third longest. The delta areas of these two rivers have undergone rapid development in recent decades and both are now home to a wide range of industrial activities. Industrial pollution is pushing rivers in China, including the Yangtze and the Pearl River, beyond their ecological limits.

The Pearl River

Southern China's Pearl River Delta region illustrates the severity of the country's industrial water pollution. Adjacent to the Hong Kong and Macau special administrative regions, the Pearl River Delta has emerged as one of the world's most dynamic industrial zones.[23]

Abundant water resources from the Pearl River and its tributaries have long supported the region's industrialisation, to the extent that it is known as the "world's factory".[24] The Pearl River basin also serves as a source of drinking water for the region's 47 million inhabitants, including the populations of Guangzhou and Hong Kong.[25,26]

However, the water quality has deteriorated sharply since the region's remarkable economic growth began in the late 1970s, with more than 60% of its waterways now designated as "polluted".[27] Between 2003 and 2007, industrial wastewater discharges into the Pearl River Delta increased by 52%, from 1.6bn tonnes to 2.4bn tonnes.[28] By 2007, industry was responsible for 75% of all the wastewater discharged into the Pearl River Delta.[29]

The 2009 report *Poisoning the Pearl* – based on seven months of fieldwork in the Pearl River Delta by Greenpeace China – offered a snapshot of industrial water pollution with hazardous chemicals.[31] The report focused on five separate facilities and/or industrial areas and found that all were discharging chemicals known or suspected to be hazardous. Alarmingly, discharges from three of the five facilities contained concentrations that exceeded the limits set by Guangdong province. Of even greater concern was that several of the facilities were discharging various hazardous chemicals that are not monitored or regulated under Guangdong's effluent standards.

image Contaminated land in the Pearl River Delta region.

image Heaps of trash on the banks of he Fenghua River; the wastewater from Youngor Textile Complex is also discharged into this river.

Water quality has deteriorated sharply since the region's remarkable economic growth began in the late 1970s, with more than 60% of its waterways now designated as 'polluted'.

The Yangtze River

Throughout China's long history, the Yangtze River basin has been a centre of cultural and industrial activity.[32] Today, the area contributes around 40% of the nation's GDP,[33] the equivalent of about $1.5 trillion US dollars.[34]

Since the economic reform of the late 1970s, thousands of industrial zones have cropped up along the banks of the Yangtze, forming the so-called 'Yangtze Industrial Belt', which stretches through seven provinces. Industrial development is particularly concentrated in the Yangtze River delta region, which accounts for around one-fifth of China's entire economy.[35] It encompasses 16 cities, including Shanghai, whose 20 million people are dependent on the Yangtze for drinking water.[36] The river receives around 30bn tonnes of wastewater (including domestic sewage) annually, some of it untreated.[37,38]

While a variety of chemicals are discharged into the river by industry, perhaps the most insidious are the PBTs (see Box 1.1). In the Yangtze River, PBTs are likely to be discharged from industries such as textiles, chemicals, plastics, and non-ferrous smelting and mining.

A range of organic pollutants, including persistent substances, can already be found in the Yangtze.[39] Among the many industrial chemicals entering the food chain are the persistent hormone disruptors – known as alkylphenols and perfluorinated chemicals – which are widely used in the textile industry. Figure 1.1[40] shows how substances in these two chemical groups are present in the Yangtze River ecosystem and are bioaccumulating in fish species. This has potential consequences for humans, given that the two species sampled are on the daily menu of local communities.[41]

Persistent Chemicals in fish

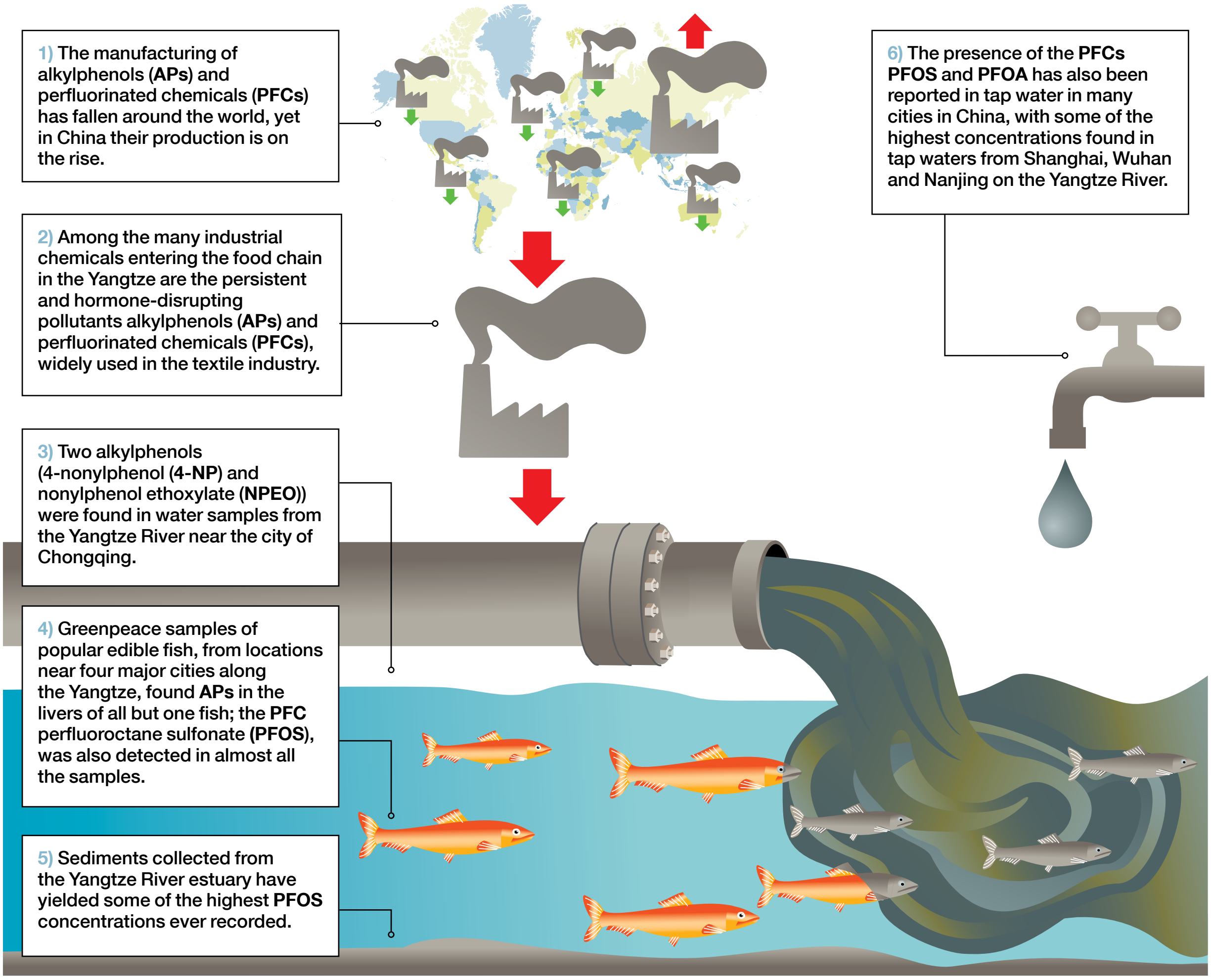


Figure 1.1 The figure shows how alkylphenols and perfluorinated chemicals are present in the Yangtze River ecosystem and how they are bioaccumulating in fish species

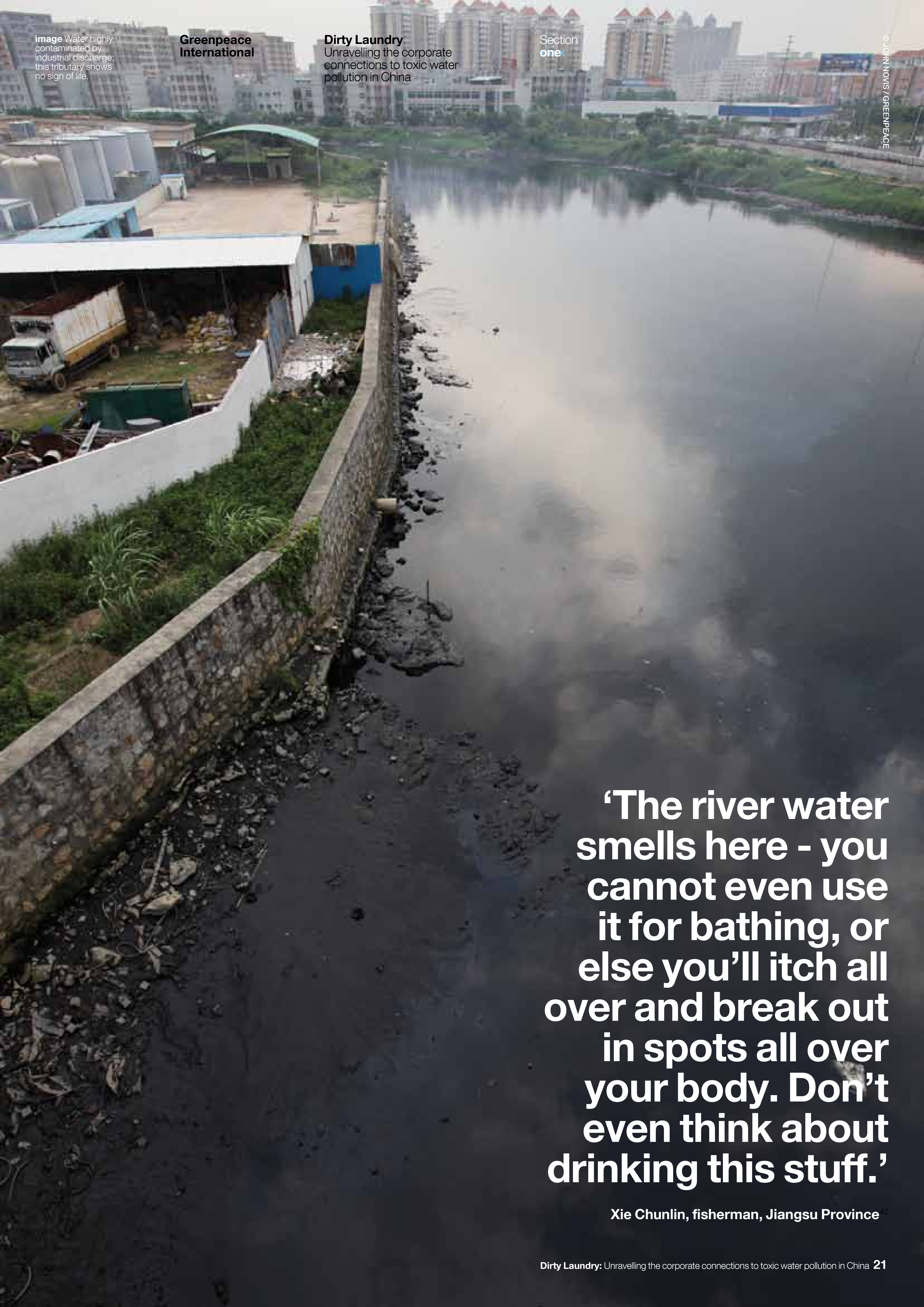


image Water highly contaminated by industrial discharge; this tributary shows no sign of life.

© JOHN NOVIS / GREENPEACE

‘The river water smells here - you cannot even use it for bathing, or else you’ll itch all over and break out in spots all over your body. Don’t even think about drinking this stuff.’

Xie Chunlin, fisherman, Jiangsu Province[42]

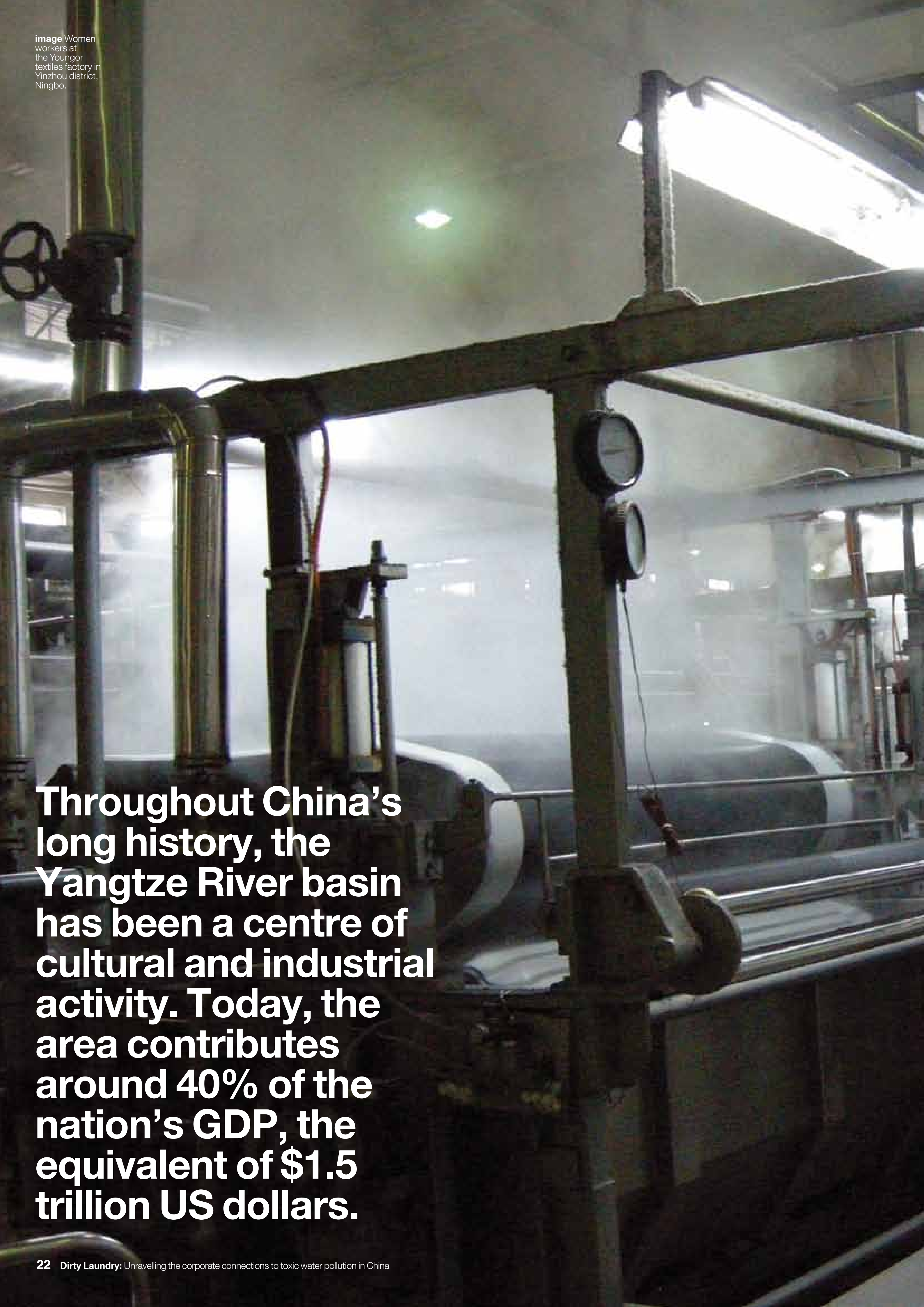


image Women workers at the Youngor textiles factory in Yinzhou district, Ningbo.

Throughout China's long history, the Yangtze River basin has been a centre of cultural and industrial activity. Today, the area contributes around 40% of the nation's GDP, the equivalent of $1.5 trillion US dollars.

Chemical use in the textile industry as a whole

The majority of chemical use in textile finishing processes occurs during 'wet processing', such as dyeing, washing, printing and fabric finishing.[43] According to surveys measuring natural resource use in all industries, textile dyeing and finishing mills use considerably more water than most – as much as 200 tonnes of water for every tonne of textiles produced.[44] Many of the chemicals used in textile production are non-hazardous, but a relatively small proportion of these chemicals are potentially hazardous.[45,46] However, in absolute terms a considerably large number of hazardous chemicals are used in textile production due to the very large number of chemicals used.[47]

For example, the Swedish Chemical Agency has estimated that there are over 10,000 substances usable in dyeing and printing processes alone - about 3,000 of which are commonly used. The availability of such a large number of chemicals for use by industry poses obvious difficulties when it comes to sharing and maintaining information about them, as well as drawing up and enforcing regulations for their use.

Figure 1.2[48] shows the different stages of textile and garment production, with a focus on the wet processing stage, where the hazardous chemicals highlighted in this report are used. Chemicals might also be used in other stages of textile production, in particular the production of raw materials such as cotton, which also involves large quantities of water and chemicals such as pesticides; this is, however, beyond the scope of this report.

The stages of textile production

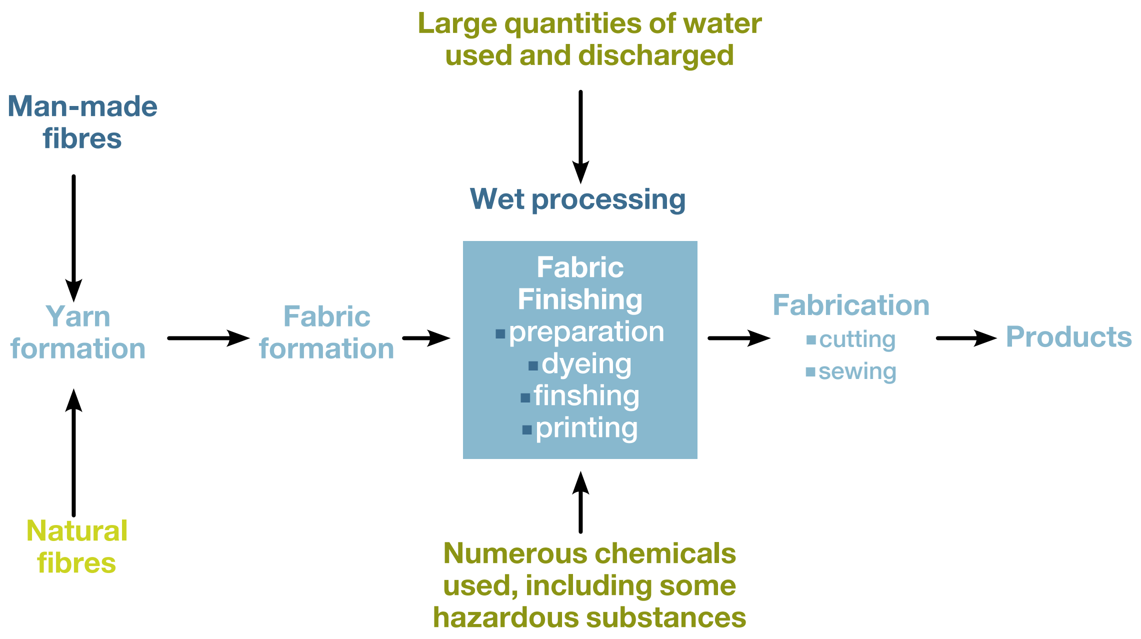


Figure 1.2 shows the different stages of textile and garment production, with a focus on the wet processing stage, where the hazardous chemicals highlighted in this report are used.

image Coils and bundles of cloth in a production chamber of the Well Dyeing Factory Ltd.

Textiles in China: A major industry, a major polluter

The textile industry is an important sector of China's economy, with more than 50,000 textile mills in the country.[49] Textile imports and exports reached a record high in 2010; the trade volume of textile products and garments increased by 23.3% year on year, to $226.77bn US dollars in 2010, accounting for 7.6% of China's total trade volume.[50] The production and export of textiles is concentrated in the eastern and south-eastern coastal areas, including Guangdong, Zhejiang, Jiangsu, Shanghai and Shandong.[51] Guangdong province, which includes the Pearl River Delta, accounts for 23% of China's total textile and clothing exports,[52] while half the national textile industry is located on the Yangtze River Delta.[53] Across China there are 164 textile industry clusters where companies specialise in manufacturing certain products,[54] for example Xintang, 'the jeans capital of the world' (see Box 1.2). Recently, some textile industry clusters have relocated to western and central China, encouraged by the State Council's 2009 Textile Restructuring and Revitalisation Plan.[55]

Since the economic reforms of the 1970s, the textile industry has become a dynamic part of China's economic growth. At the outset of the economic reform period, cheap land and abundant labour meant that low value-added industries, such as textiles, were the easiest to establish.[56] **In 1995 China became the largest exporter of textiles in the world and it has maintained that position ever since.**[57]

Although the industry has hitherto been driven by exports to the Global North, domestic demand for fashion is now increasing, alongside the rise of the new middle class. By the third quarter of 2010, the sector's nominal retail value growth had accelerated by 24% to reach 400bn yuan ($61bn US dollars) – up from an average of 18% in 2009 – indicating stronger domestic demand for clothing, shoes, hats and other textile products. This was in part a result of improving consumer confidence, coupled with rising income and strong government initiatives to boost domestic consumption.[58]

However, the Chinese textile industry is built upon the use of a large number of chemicals,[59] and together with the chemical industry is reported to be one of the most polluting sectors in the country.[60] Around 25% of the chemical compounds produced worldwide are used to a greater or lesser extent in the textile industry globally.[61] Yet beyond very general pollution parameters – such as chemical oxygen demand – there is very limited information about the discharge of specific hazardous substances into wastewater by Chinese textile manufacturers; or indeed by any industrial sector.

Through its investigations, Greenpeace China has attempted to shed more light on the levels of toxic contamination coming from industrial sources. One of the companies investigated for Greenpeace China's *Poisoning the Pearl* report[62] was the denim manufacturer Top Dragon Textile Company, which carries out sizing, dyeing, weaving and finishing at its facility in the city of Qingyuan, Guangdong province.

Wastewater is discharged from Top Dragon's facility via an underground channel, which flows into a tributary of the Pearl River located approximately 100 metres from the factory. Greenpeace investigators took samples from the same discharge pipe twice, once during the day and once at night. The data showed a degree of variation in the quality of discharged wastewater between the two samples. Key findings were the presence of nonylphenol and two chemicals linked to dyeing and printing processes, including a benzophenone derivative in the sample taken during the day.[63] The concentration of manganese (5,390 μg/l) in the sample taken at night were in excess of the upper limit set in Guangdong's effluent standards (2,000–5,000 μg/l).

According to the Qingyuan Environmental Protection Bureau, Top Dragon was reported in 2008 as having a bad environmental record due to "improper use of water treatment facilities and pollutants in excess of standards".[64]

image Top Dragon Textile factory located in Taihe Industry complex, in Qingyuan City, Guang Dong Province. It discharges waste water into the Pearl River Delta.

"They discharge water like this every day. It is black in colour and pungent when it comes out of the pipe. Our entire village stinks on windy days; you can see foam rising from the discharged water and flying about everywhere, even into our houses. I don't know whether this factory treats its water at all. All I do know is that what comes out looks and smells like this. We dare not complain, because they have power. We are mere villagers. What could we possibly do to stop this?"

Mr Chan, a neighbour of the Top Dragon plant[65]

Box 1.2 The dirty secret behind your jeans

The manufacture of jeans illustrates some of the most visible and gross pollution caused by China's textile and clothing industry. The economy of Xintang revolves around the complete production process for jeans: from spinning, dyeing and weaving to cutting, printing, washing, sewing and bleaching. Xintang's jeans and clothing business began in the 1980s, and since then its output has skyrocketed.

Factories are located along the river that flows into the River Dong and further downstream into the Pearl River Delta. The river was once pristine, but has since become a black ditch dividing the village of Xizhou from the industrial zone. The Xizhou villagers say that when the factory discharges are severe, the river water is not merely polluted, but toxic. The smell is putrid and unbearable, and any skin contact results in itching and even septic rashes. Though villagers once fished in the river and drank its water, they now dare to do neither of these things, and must pay for tap water.

"It's not that we don't want them to make a profit. My family also has to rely on sewing jeans to make a living. However, the production process must be clean and not pollute the environment."

Lin Zhou (pseudonym), Xizhou[66]

image Wastewater discharged from a denim washing factory in Xintang, Zengcheng, where the economy is centred around textile production.

Inadequate regulation and enforcement

The existing system for controlling industrial discharges was created as part of the Water Pollution Control Law, which was enacted in 1984 and amended in 2008.[67] It consists of a comprehensive system of ambient quality standards and technology-based effluent standards. There are also Cleaner Production Standards, which require industries to reduce the use of toxic materials in general, together with a list of key hazardous substances for clean production auditing, pubished by MEP, which are related to specific industries. However, there is no mandatory regulation in China that requires industries to eliminate a specific list of toxic chemicals.[68]

There are several key reasons why the system underperforms[69]:

- It does not adequately address hazardous pollutants, some of which - even in small amounts - can endanger aquatic ecosystems and human health. Even in Guangdong, where discharge standards are more stringent, many highly hazardous chemicals found in industrial effluents in the Pearl River delta region are simply not regulated.
- Existing standards are inadequately enforced.
    - Many companies cut costs by operating their water pollution control equipment only when they expect inspection visits.
    - A large percentage of small and medium-sized businesses are not inspected due to the Environmental Protection Bureau's lack of capacity and resources.
    - Industry-related departments in local government often interfere with the enforcement of environmental laws in order to protect revenues or employment.
- There are intrinsic problems associated with the pollution control approach and its emphasis on wastewater treatment plants. While these are effective at cleaning up certain types of pollution – such as sewage or other biological wastes – they cannot cope with many hazardous chemicals. Often, hazardous chemicals will pass through the treatment process unchanged to enter the food chain and build up in downstream sediments. They can also be converted into other hazardous substances and/or accumulate in other wastes generated during the treatment process. Hazardous wastes in the form of treatment plant sludges are then created, which in turn are disposed of into landfills or through incineration, releasing the hazardous substances or their byproducts into the environment.[70,71]

image Yellow wastewater from 'Pipe 1' flows into the Fenghua River. The pipe belongs to the Youngor textiles factory.

Corporations and their suppliers have no right to treat water bodies as their private sewers.

Conclusion: Building a toxic-free future

Clean water is not only a basic human right; it is the world's most threatened essential resource. Securing clean water for current and future generations is essential for the health of ecosystems and human societies alike. It will also reduce the potential for resource conflicts, which are widely seen as a likely consequence of increasing water shortages. In this light, corporations and their suppliers have no right to treat water bodies as their private sewers.

Industrial pollution can have devastating impacts on river systems and lakes that are vital to wildlife and to the lives of billions of people. Toxic substances dumped by industry have a wide range of harmful properties – such as causing cancer, affecting the hormone system and interfering with reproductive systems. These effects can apply not only to humans, but to all living creatures. There are warning signs that hazardous substances are building up in both the Pearl and Yangtze rivers. Water quality is already badly affected in the Pearl River, while the discovery of hazardous chemicals in fish from the Yangtze shows that action is urgently needed in both of these rivers.

There is evidence that the textile industry is responsible for a large proportion of the water pollution problem in China, with its use and discharge of hazardous chemicals contributing to the chemical load in the important Pearl and Yangtze river systems.

The presence of hazardous substances in the environment shows that the traditional approach to industrial discharges is not working – wastewater treatment plants are simply not able to cope with many hazardous substances. As several decades of experience in the Global North have shown, a regulatory system where licences are given for the discharge of hazardous substances into wastewater results in the legalised pollution of rivers and seas.[72] The consequences for ecosystems and human health are severe, and the clean-up of hazardous substances is a difficult and costly process.

What is needed is a new approach to hazardous chemicals – one that addresses the problem at source rather than retrospectively. The idea of eliminating all discharges of hazardous chemicals into the aquatic environment – '**zero discharge**' – is based on the understanding that it is impossible to define safe levels for many hazardous pollutants. Redesign of products and processes to phase out the use and discharge of hazardous chemicals has proven to be the best approach; policies and practices to implement this will be outlined in sections 3 and 4.

The following section examines wastewater discharges from two textile facilities in China, painting a more accurate picture of the kinds of hazardous substances routinely discharged by some factories in a 'business-as-usual' scenario. It also outlines the product chains linking these facilities to well-known multinational clothing corporations and brands – which must ultimately take responsibility for the discharges and subsequent contamination of our waterways.

image The Youngor factory discharges its wastewater into the Fenghua River. A black ribbon of polluted wastewater can be seen in the water.

02

02

Polluters and their customers – the chain of evidence

Toxic discharges from two textile manufacturers

In 2010 and 2011, Greenpeace International undertook an investigation to assess whether hazardous chemicals were present in wastewaters discharged from two textile-manufacturing facilities in China, and to provide an indication of the types of chemicals currently being used and released by such facilities[1,2]. The first facility, the Youngor Textile Complex, is located on – and discharges wastewaters into – the Yangtze River Delta, while the second facility, Well Dyeing Factory Limited, is located on – and discharges wastewaters into – a tributary of the Pearl River Delta.

The two sites were visited in June 2010 and samples of discharged wastewaters and river sediments were collected. In March 2011, further samples were collected from the Youngor Textile Complex, to give more insight into the quantities of hazardous chemicals identified.

The sampling process was co-ordinated by the Greenpeace International Research Laboratories at Exeter University in the UK. The samples collected in June 2010 were analysed by the Greenpeace International Research Laboratories; those collected in March 2011 were sent for analysis to Omegam Laboratoria in the Netherlands.

In addition, in order to understand the full chain of evidence, Greenpeace undertook investigations to find out which brands sourced clothing from these facilities.

The results presented in this report represent the key findings of what was a detailed investigation; fuller data on all the samples taken and a technical discussion are provided in the Greenpeace Research Laboratories Technical Note.[3]

Key findings of the investigation

This report finds that both manufacturing facilities were discharging a range of hazardous chemicals into the Yangtze and Pearl River deltas. Significantly, two different groups of hazardous and persistent chemicals with hormone-disrupting properties were found in the samples: alkylphenols were found in wastewater samples from both facilities, and perfluorinated chemicals (PFCs) were found in wastewater from the Youngor Textile Complex.

The companies behind the two facilities have commercial relationships (as suppliers) with a range of major brands, including **Abercrombie & Fitch**, **Adidas**, **Bauer Hockey**, **Calvin Klein**, **Converse**, **Cortefiel**, **H&M**, **Lacoste**, **Li Ning**, **Meters/bonwe**, **Nike**, **Phillips-Van Heusen Corporation (PVH Corp)**, **Puma** and **Youngor**, and have also been linked with a number of other Chinese and international brands. When confirming their commercial relationship with the Youngor Group, Bauer Hockey, Converse, Cortefiel, H&M, Nike and Puma informed Greenpeace that they make no use of the wet processes of the Youngor Group for the production of their garments.

However, regardless of what they use these facilities for, none of the brands found to have commercial links with these two facilities have in place comprehensive chemicals management policies that would allow them to have a complete overview of the hazardous chemicals used and released across their entire supply chain, and to act on this information. As brand owners, they are in the best position to influence the environmental impacts of production and to work together with their suppliers to eliminate the releases of all hazardous chemicals from the production process and products.

Connecting the links in the chain of evidence

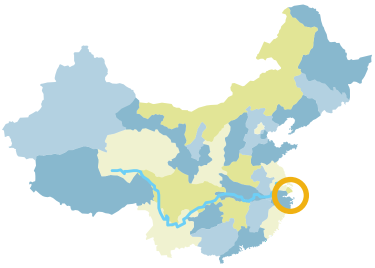
The fabric and clothing manufacturing industry commonly relies on a mixture of longer-term and shorter-term business relationships between brands and suppliers (e.g. manufacturers of fabric or clothing – or both, in the case of vertically integrated companies).

Our investigations focused on suppliers for whom we have the following types of evidence:

- direct evidence that a manufacturing facility belonging to the supplier is discharging toxic materials; and
- evidence that major international (and domestic Chinese) brands have business relationships with the supplier.

image Greenpeace campaigner is taking a sample at a discharge pipe.

China has some of the worst water pollution in the world, with as much as 70% of its rivers, lakes and reservoirs being affected.



Case study 1: Youngor Textile Complex, Ningbo, Yangtze River Delta

image Main Entrance, Youngor Textile Complex

Youngor Textile Complex – location, products, discharges

Youngor Group Co Ltd[4] is China's largest integrated textile company, with world-scale fabric manufacturing, garment making and retailing capabilities. Established in 1979, it is based in the city of Ningbo near Shanghai, in the eastern province of Zhejiang. As well as manufacturing fabrics and clothing for multiple international brands, Youngor has its own product lines that include shirts, suits, trousers, casual jackets, ties and T-shirts, all officially recognised as leading national brands.[5]

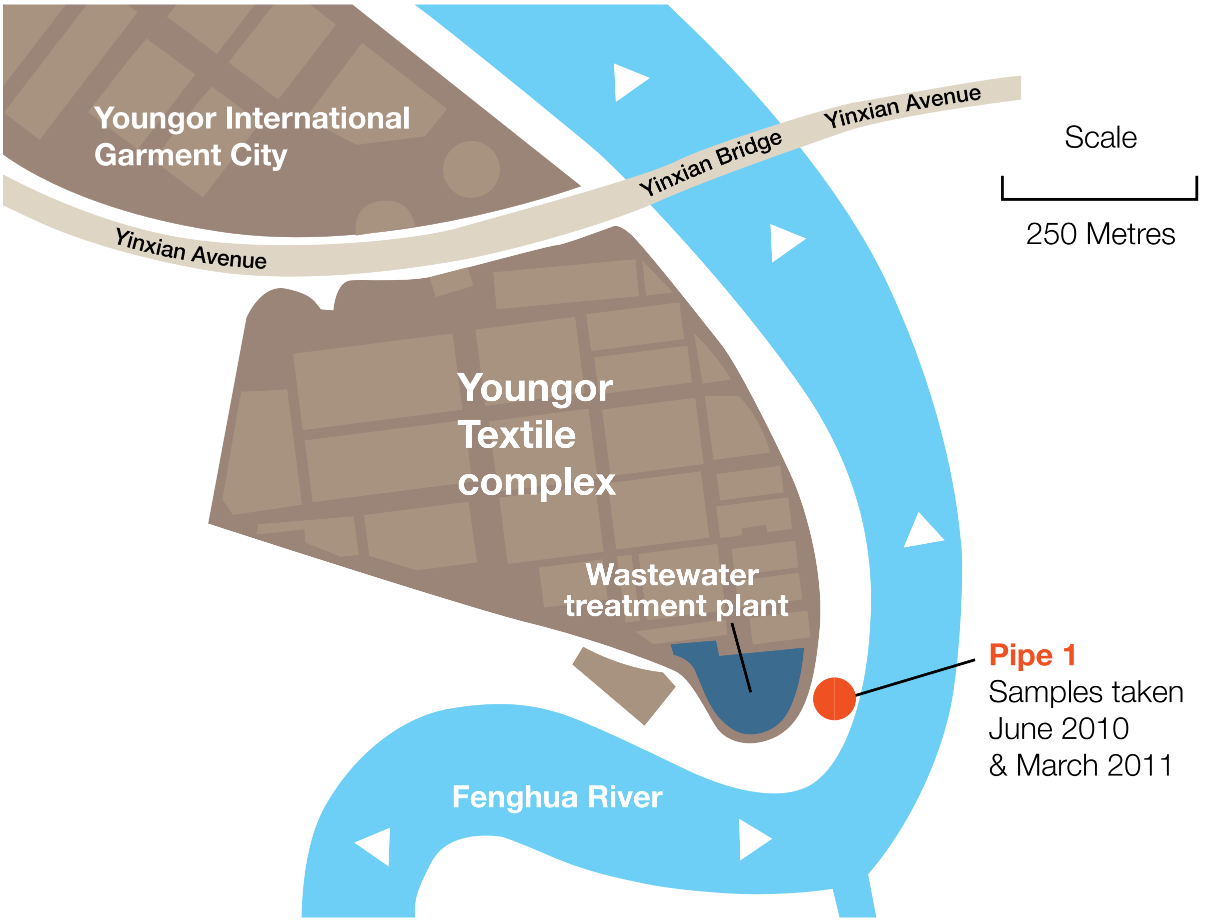
In 2003, Youngor Group Co Ltd invested 1bn yuan ($147m US dollars) to build the Youngor Textile Complex in Ningbo, which includes "a large-scale production facility for items such as high-quality dyed yarn cloth, wool fabric, printed fabric, dyed fabric and knitwear"[6]. It is now one of the major production facilities in China for high-end clothing and textiles. The company's headquarters at the complex has a research centre, a warehouse and a showroom in addition to the production facility.

The Youngor Textile Complex houses a number of individual manufacturing plants, including those of the subsidiaries Youngor Sunrise Textile Dyeing & Finishing Co, Ltd (yarn dyeing, weaving, printing and finishing), Ningbo Youngor Pants Co, Ltd (main product lines are casual and formal trousers and sportswear)[7], Ningbo Youngor Fashion Co, Ltd (five product lines, the most important of which is casual sportswear) and Ningbo Youngor Worsted Spinning, Weaving & Dyeing Co, Ltd (dyeing, spinning, weaving and finishing of worsted wool fabric), as well as a wastewater treatment plant (WWTP). Youngor Group Co Ltd states that it spent 3m yuan ($441,176) "to purchase a sewage treatment system from Japan which uses advanced processing technology to reduce emissions to safe levels, recycle water, and conserve resources."[8]

This large industrial complex occupies approximately three kilometres of the Fenghua river frontage. The Fenghua River, which flows into the Yangtze River Delta, is tidal at this location. There are no other industrial facilities with wastewater discharges into the river within the vicinity of the Youngor Textile Complex discharge pipe, which is connected to the WWTP (referred to by Greenpeace as Pipe 1).

Youngor Textile Complex[9]

Figure 2.1 Sketch map of the Youngor Textile Complex showing the location from which samples were collected. Other samples (of discharged water, rainwater and river sediments) were collected in the vicinity of this site, as detailed in the Technical Note.



Connections to multinational and domestic brands

The international clothing brands **Adidas**, **Bauer Hockey**, **Calvin Klein**, **Converse**, **Cortefiel**, **H&M**, **Lacoste**, **Nike**, **Phillips Van Heusen Corporation (PVH Corp)** and **Puma** confirmed to Greenpeace that they have an ongoing or recent business relationship with the **Youngor Group** (including subsidiaries) based in Ningbo, China. The Youngor Textile Complex also supplies the company's own brand, **Youngor**. Our analysis found that this very same complex was discharging toxic chemicals into the Fenghua River on the sampling dates between June 2010 and March 2011.

When confirming their commercial relationship with the Youngor Group, Bauer Hockey, Converse, Cortefiel, H&M, Nike and Puma informed Greenpeace that they make no use of the wet processes of the Youngor Group for the production of their garments. However, none of the brands found to have commercial links with these two facilities have in place comprehensive chemicals management policies that would allow them to have a complete overview of the hazardous chemicals used and released across their entire supply chain, and to act on this information.

Many of these companies have made public statements about the need to avoid environmental pollution. According to their respective websites, these companies seem to be concerned about water quality. However, this investigation found that toxic chemicals are being released into surrounding water and local river systems by their supplier.

Although the Converse website does not refer to the environment or sustainability, the Converse brand is owned by Nike and is covered by the same corporate responsibility report. Likewise, the Calvin Klein brand is owned by Phillips-Van Heusen and is covered by the same environmental statement. The Bauer website does not mention the environment or sustainability. (See Appendix 1 for details of all the above companies and their responses to the evidence presented in this report.)

"The clean production concept is playing an increasingly important role in Youngor's cost-control. Youngor's management is now fully aware of the importance of environmentally friendly production techniques.

Youngor Sunrise Textile and Garment Company is presently applying for the "Clean Production Company" licence from China's National Cleaner Production Center. The company is taking this opportunity to further promote cleaner production and the use of green energy."

Youngor website[11]

"Factories are responsible for 'harmful substances free' production. Factories will be held responsible and liable for all loss and damage suffered by PUMA, should any hazardous substances be found in the materials, components or final products."

Puma Handbook of Environmental Standards[12]


CONVERSE
Calvin Klein
CORTEFIEL
"Respect for the environment: It must be ensured compliance with the environmental laws and regulations applicable in each case, adopting a behaviour principle of a responsible and respectful attitude towards the environment."
Grupo Cortefiel, External Code of Conduct [13]
NIKE
"We … collaborate with factories to improve efficiency in order to avoid borrowing more water than is needed and to be able to return it as clean, or cleaner, than it was found."
Nike Inc Corporate Responsibility Report FY 07 08 09, p38[14]


LACOSTE
Lacoste does not have a statement of CSR policy but supports crocodile conservation projects: "Using for over 78 years a crocodile as a logo, the LACOSTE brand actively support projects selected by the GEF to safeguard or protect certain species of crocodiles, alligators, caiman or gavials now in danger of extinction and whose the loss would jeopardize the biological balance of their habitat areas."
Lacoste Press Kit[15]
H&M
We apply the precautionary principle in our environmental work and have adopted a preventative approach with the substitution of hazardous chemicals."
H&M Conscious Actions Sustainability Report 2010[16]
PVH
"We recognise that our supply chain processes impact the environment. While we do not have direct control over our suppliers, vendors and service providers, we […] seek to have our suppliers and vendors meet our environmental requirements with respect to wastewater treatment, hazardous chemicals, air quality and recycling."
Phillips-Van Heusen, Environmental Statement[17]

Which other firms are linked to Youngor Group Co Ltd by this chain of evidence?

Greenpeace also has evidence that the major brands **Blazek, Nautica, Macy's,** the **Oxford Apparel Group** and **Ralph Lauren** have had a business relationship with the Youngor Group Co Ltd in the recent past, but these companies did not respond to a request for comment. **Peerless Clothing** confirmed a recent business relationship that it indicates has now ended.

Blažek
macy's
Oxford Apparel
NAUTICA
RALPH LAUREN

Hazardous chemicals at the end of the pipe

The Youngor Textile Complex is a large industrial complex situated in Ningbo, on the banks of the Fenghua river, which flows into the Yangtze river delta. Wastewater samples from a pipe (referred to by Greenpeace as 'Pipe 1') that discharges from the complex's wastewater treatment plant were collected in June 2010 and again in March 2011. Two samples were collected in June 2010: one was collected during the evening of 21 June, when the flow of wastewater from the pipe was relatively low; the other was collected on the morning of 22 June, at which time the rate of discharge was observed to be substantially greater.

The further samples of wastewater taken in March 2011 were collected on three separate occasions on 8 and 9 March, within a total period of around 15 hours. During this period the colour and the temperature of the wastewater was observed to vary considerably over time. The chemical analysis found a variety of hazardous substances, including the persistent chemicals nonylphenol and perfluorinated chemicals, despite the presence of a modern wastewater treatment plant.

Nonylphenol

The most significant finding was the presence of nonylphenol at a concentration of 14µg/l in one of the samples, collected at 11am on 8 March 2011. Nonylphenol is a persistent, manmade substance that can build up in the food chain and is known to be a hormone disruptor.

Its presence in one of the three samples collected in March 2011 indicates that the Youngor Textile Complex is, at least periodically, acting as a source of this hazardous chemical to the Fenghua River.

Perfluorinated chemicals (PFCs)

The presence of several PFCs was also confirmed in the samples collected on all three occasions in March 2011; the highest concentrations were of perfluorooctanoic acid (PFOA) at between 0.13 and 0.14µg/l. Lower concentrations of other PFCs were also found (perfluorocarboxylic acids at 0.013–0.031µg/l and perfluorooctane sulphonate (PFOS) at still lower levels (0.0031–0.0087µg/l)). PFCs are manmade chemicals that are known for their long persistence in the environment; they can cause adverse effects on the liver and act as hormone disruptors (see Box 2.1).

The levels found in the samples may appear to be low, but they are similar to levels that have been found in wastewater treatment plants receiving industrial effluent, and are above background concentrations in surface waters.[18]

A chemical cocktail

A diverse array of other chemicals at low concentrations was found in the samples taken in March 2011, indicating that this wastewater is a source of a range of hazardous substances to the local aquatic environment. This chemical cocktail could be a result either of the deliberate use of these chemicals in the textile processing, or of the washing out of chemical residues from yarn or textile products, from manufacturers located elsewhere, that have been brought to the site for processing. It presents an unknown hazard, as it is impossible to predict the risks posed by such complex mixtures of chemicals.

Chemicals found in the quantitative analysis included:

- **amines** – aniline, 2-chloroaniline, methylaniline, ethylaniline and diethylaniline were quantified, as well as the carcinogenic *o*-anisidine;
- the **chlorinated volatile compounds** dichloroethane, trichloromethane (chloroform) and tetrachloroethene; and
- **di-, tri-** and **pentachlorophenols**.

The qualitative analysis of the sample taken in June 2010 detected 53 organic chemicals, though it was only possible to positively identify 12 of these. The substances identified included a trialkyl phosphate (tributyl phosphate (TBP)), as well as an anthraquinone derivative. Fewer organic chemicals were isolated from the second sample collected the following morning, when the rate of discharge from the pipe was visibly greater. Nonetheless, of the four compounds that were identified, all were also present in the sample collected the previous evening. These findings highlight the potential for variability in the composition of wastewaters discharged from single point sources over time. (See Appendix 3 for a list of the substances identified and their effects.)

Box 2.1 Perfluorinated chemicals (PFCs)

Production and use

PFCs are man-made chemicals that are not produced by natural processes and hence never occur in nature other than as a result of human activity. They are highly resistant to chemical, biological and thermal degradation,[19] and many are also relatively insoluble in both water and oils. Their unique properties have led to their widespread use as water, grease and stain-repellent finishes for textiles and papers; specialised industrial solvents and surfactants; ingredients in cosmetics, plastics[20,21], firefighting foams; and ingredients in lubricants for high-temperature applications[22].

The PFCs manufactured over the past 60 years fall into four broad categories:

1) Perfluoroalkyl Sulfonate (PFASs) (the best-known is PFOS),
2) Perfluorinated Carboxylic Acid (PFCAs) (the best-known is PFOA),
3) Fluoropolymers (the best known is polytetrafluoroethylene (PTFE), marketed as Teflon and widely used in clothing, being the basis of Gore-tex and similar waterproof fabric and for non-stick cookware)
4) Fluorotelomer alcohols (FTOHs).[23]

Distribution in the environment

However, the durability of this group of chemicals also leads to potentially devastating consequences for the environment, as it means that they persist for long periods in nature once they are released, whether as a result of manufacturing or disposal operations or during the lifetime of a product.[24] PFOS, for example, is a compound so resistant to degradation that it is expected to persist for very long periods in the environment.[25] PFASs (especially PFOS) and PFCAs (especially PFOA) have been reported as contaminants in almost all environmental media, including freshwater, groundwater and seawater sediments and soils. Within China, PFCs including PFOS and PFOA have been reported in various environmental media including waters from many river systems.[26,27,28]

Bioaccumulation

Unlike many persistent organic pollutants (POPs), PFOS accumulates in the bodies of animals by binding to proteins in the blood, thereby building up to particularly high levels in liver tissue.[29,30,31] Numerous studies have reported PFCs in tissues of amphibians, fish, birds and mammals (from mice to far larger mammals including whales and polar bears,[32,33] as well as red and giant pandas from zoos and wildlife parks in China[34]. In the aquatic environment, PFCs have been reported in organisms at all levels of food webs.[35]

Human exposure to perfluorinated chemicals

PFOS and other PFCs have been found in blood and breast milk from people living in many countries around the world, even in remote areas such as the Canadian Arctic. In the US, average concentrations of PFOS, PFOA and Perfluorohexansulfonate (PFHxS) in blood samples have fallen in recent years, perhaps due to the discontinuation of industrial production of PFOS and related chemicals in the US in 2002.[36] Conversely, in Shenyang, China, levels of PFOS and PFOA in human blood increased between 1987 and 2002.[37] It has been suggested that sea fish and other seafood may account for the majority of human exposure in China.[38,39]

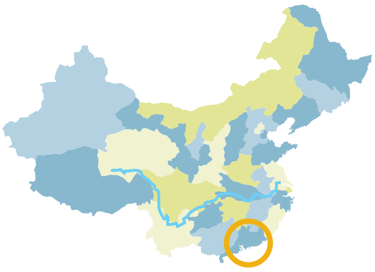
Health impacts

Studies of laboratory animals indicate that PFCs can cause adverse impacts during both development and adulthood. PFOS and PFOA have both been reported to have adverse effects on the liver in rodents and monkeys.[40,41,42,43] PFCs have also been shown to act as hormone disruptors[44] in humans as well as other animals; for example, high combined levels of PFOA and PFOS in the blood of men in Denmark were found to be associated with a reduced count of normal sperm.[45]

Regulation

In China there are currently no regulations governing the manufacture and use of PFCs. However, PFOS has recently been included among the POPs regulated by the Stockholm Convention, a global treaty to protect human health and the environment from the effects of POPs. Contracting parties to the Convention (including China) are required to take measures to restrict the production and use of PFOS, although a wide range of uses are currently exempt.[46] China is a contracting party to the Stockholm Convention, although it hasn't ratified the more recent amendment addressing PFOS.[47]

The marketing and use of PFOS have also been prohibited for certain applications within the EU[48] and in Canada[49], although many exemptions exist to those under the Stockholm Convention. Moreover, none of these restrictions apply to PFCAs and other PFCs. Furthermore, even when all uses are discontinued, the high persistence of PFOS and other PFCs will inevitably mean that they continue to be in the environment for a long period.



Case study 2: Well Dyeing Factory Limited, Zhongshan, Pearl River Delta

image Main Entrance, Well Dying Complex

Well Dyeing Factory Limited – location, products, discharges

Hazardous chemicals have also been found in the wastewater released from the discharge pipe of Well Dyeing Factory Limited, the second case study presented in this report. The complex of Well Dyeing Factory Limited is located in the Gao Ping Industry District, Sanjiao, in the city of Zhongshan in Guangdong province. It is situated on tributaries of the Pearl River Delta. The complex is one of many dyeing facilities located within the Gao Ping Industry District. It is a large complex including various production plants and a wastewater treatment plant, as well as a power generation plant, workers' dormitories and administration buildings. It manufactures a wide variety of textiles including knitted fabrics, velour, fleece and spandex. Other processes carried out include the pre-production treatment of fibres, bleaching, dyeing and textile finishing.[50,51]

The Well Dyeing complex is bordered to the west by the Shiji River and to the east by the Gaosha River. These two small rivers are both tributaries of the far larger Huangshali Channel, a part of the Pearl River Delta, which ultimately flows into the South China Sea (see Figure 2.2). The river system is tidal at this location, though the Shiji River is connected to the Huangshali channel by a sluice gate, which controls the flow of water. Other facilities unconnected to Well Dyeing are located nearby, and some of these also appear to discharge wastewaters into the Shiji River.

Greenpeace investigations revealed Pipe 1 discharging within the small channel right up to the Well Dyeing complex's perimeter wall, and on the other side of the wall within 2 metres of its wastewater treatment plant. Discharge water was sampled at a time when there was no rain (or standing surface water) for several hours preceding the sampling. This pipe discharges wastewater sporadically into the small channel, and was only observed to be discharging during the night. Our investigations indicate the discharge source of this pipe is exclusive to the Well Dyeing facility.

Well Dyeing Factory Limited[52]

Figure 2.2 Sketch map of the Well Dyeing complex showing the location from which samples were collected. Other samples (of discharged water and river sediments) were collected in the vicinity of this site, as detailed in the Technical Note.

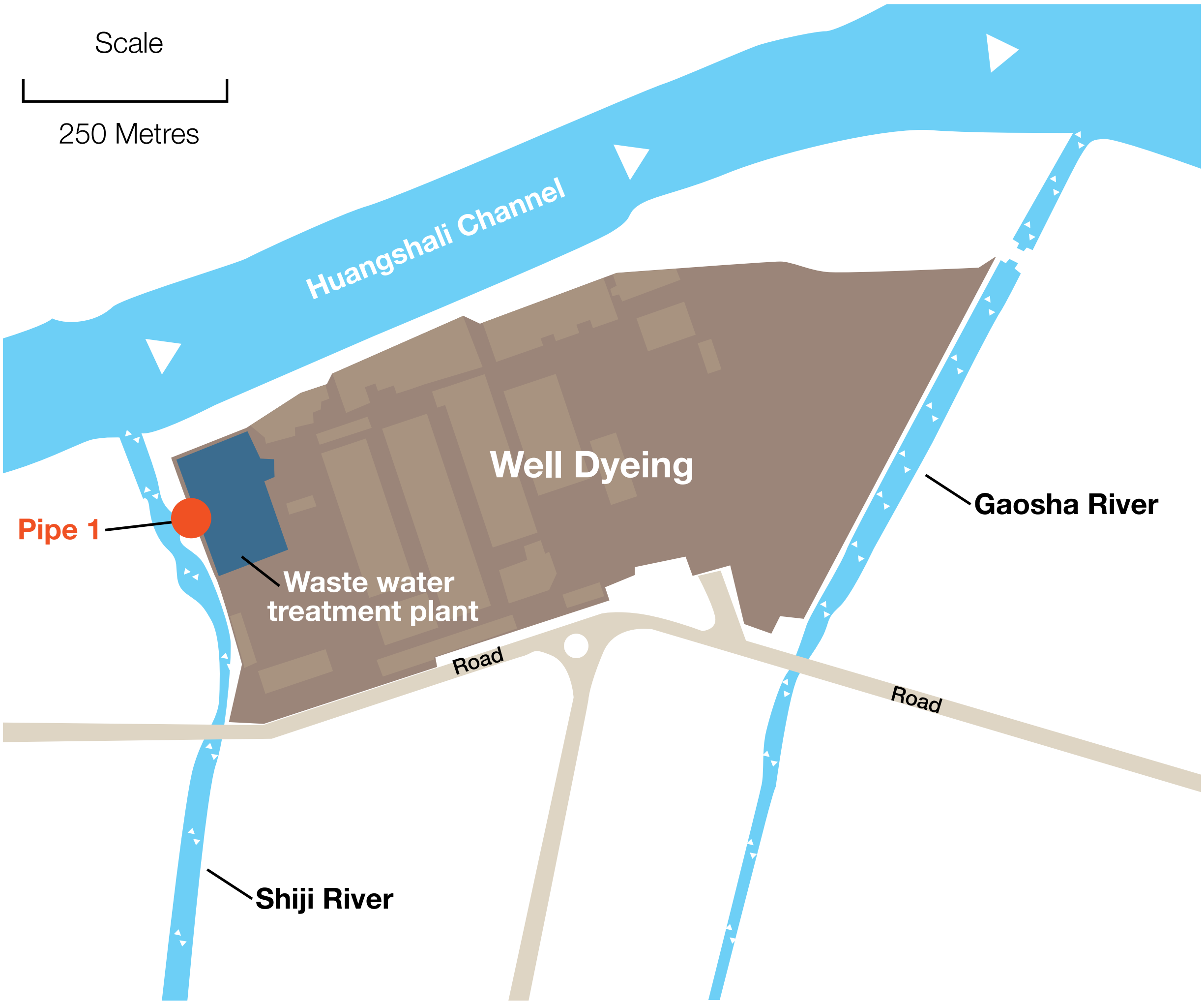


image These pools store wastewater produced from the dyeing process; they are part of the wastewater treatment plant of the Well Dyeing Factory Ltd.

Connections to multinational and domestic brands

The major brands **Abercrombie & Fitch**, **Meters/bonwe**, **Phillips-Van Heusen Corporation (PVH Corp)** and Chinese sportswear brand **Li Ning** confirmed to Greenpeace that they have an ongoing or recent business relationship with Well Dyeing Factory Limited in Zhongshan, China. Our analysis found that this facility was discharging toxic chemicals into the Shiji River in June 2010.

Phillip-Van Heusen Corporation's statement can be found on page 41 of this report. The Li Ning Company gives no information on its corporate website concerning its policies or actions on the environment or sustainability.[53] (See Appendix 1 for more information about all four of these companies above, and their responses to the evidence presented in this report.)

Which other firms are linked to Well Dyeing Factory Limited by this chain of evidence?

Greenpeace also has evidence that the major brands **Carter's, JC Penny, Kohls, Semir** and **Yishion** have recently been supplied by the same complex, but these companies did not respond to a request for comment. **American Eagle**, **GAP** and **Uniqlo** have confirmed a recent business relationship that they indicate has ended.

Hazardous chemicals at the end of the pipe

A wide range of organic chemicals were identified in a wastewater sample collected by Greenpeace in June 2010 from a pipe connected to the facility of Well Dyeing (referred to by Greenpeace as ‘Pipe 1’, see Figure 2.2). Organic substances identified included two types of alkylphenols, nonylphenols and octylphenols, which are hazardous and persistent substances with hormone-disrupting properties (see Box 2.2); others included trialkyl phosphates (TBP and TEP) and dichloroaniline (DCA) (see Appendix 3).

High levels of heavy metals - including chromium, copper and nickel - were also found in the discharged wastewater. These were predominantly bound to suspended particulates in the wastewater. These findings suggest that wastewater intermittently discharged from the Well Dyeing facility via Pipe 1 is a source of chromium, copper, nickel and, possibly, zinc to the receiving river system. These metals are known to have uses in the textile-manufacturing sector. They can have toxic effects, particularly at high concentrations (see Appendix 3, box C).

Dumping in the dark

The Greenpeace sampling team observed the Well Dyeing complex on numerous occasions. No effluent was discharged from Pipe 1 during the daytime. When the facility was visited at night, however, discharge of effluent was observed. The sample was taken during the night, when white and blue foam was floating on the Shiji River. It is a cause for concern that the discharge of large amounts of effluent (proven to contain hazardous chemicals at the time of the sampling) was observed only during the night, although it is not known if this practice was intentional or not.

The practice of hiding discharge pipes and effluent has been observed elsewhere in China as a way of making pollution from wastewater discharges less likely to be discovered.[56]

Greenpeace’s concern is that monitoring by the regulatory authorities is unlikely to be taking place during the night, so that if there were to be a discharge of prohibited substances, or of substances in excess of legal limits, it would be unlikely to be discovered by the authorities. The phenomenon of nighttime wastewater discharge therefore increases the potential for illegal discharges.

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image At low tide, the discharge pipes buried deeply in the banks of the Huangsha Channel are revealed. Greenpeace campaigners take samples to investigate water pollution.

Box 2.2 Alkylphenols and their ethoxylates

Production and use

Alkylphenols are a group of man-made chemicals that are not produced by natural processes and hence never occur in nature, other than as a result of human activity. The most widely used are **nonylphenols (NPs)**, and **octylphenols (OPs)**, which are manufactured for a range of specialised industrial uses as well as to produce alkylphenol ethoxylates (APEs). APEs are a group of non-ionic surfactants; the most widely used APEs are nonylphenol ethoxylates (NPEs) and, to a lesser extent, octylphenol ethoxylates (OPEs). NPEs are used as surfactants, emulsifiers, dispersants and wetting agents in a variety of industrial and consumer applications including textile manufacture and industrial detergents, with smaller amounts used as textile and leather finishers and as ingredients in pesticides, and water-based paints.[57,58]

Distribution and effects

These chemicals (especially NPs and their derivatives) have become widely distributed in the environment; once released to the environment, NPEs and OPEs can degrade back respectively to NPs and OPs, which are persistent, bioaccumulative and toxic to aquatic life[59,60,61]. They are common contaminants of sewage effluents and sludge[62,63,64], which may be applied as fertilisers to agricultural land. NPs have been detected in rain and snow in Europe[65,66], while residues of both NPs and OPs have been reported as contaminants in house dust[67,68], and indoor air[69,70]. Both NPs and OPs are known to accumulate in the tissues of fish and other organisms, and to biomagnify through the food chain.[71] NPs and OPs have recently also been detected in human tissues.[72]

Hormone disruptors

The most widely recognised hazard associated with NPs and OPs is their ability to mimic natural oestrogen hormones. This can lead to altered sexual development in some organisms, most notably the feminisation of fish.[73,74] Exposure to OPs caused adverse effects on male and female reproductive systems in rodents, including lower sperm production and an increase in sperm abnormalities[75,76,77], as well as DNA damage in human lymphocytes[78]. Impacts on immune system cells in vitro have also been described.[79]

Existing controls

The manufacture, use and release of NPs, OPs and their ethoxylates is not currently regulated in China. However, NPs 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 now requires prior permission.[80] Outside China, regulations addressing the manufacture, use and release of NPs, OPs and their ethoxylates do exist in some regions, for example the EU.

In Europe, for most of their former uses APEs have now been replaced by alcohol ethoxylates. In 1992 parties to the OSPAR Convention[81] decided to phase out NPEs in cleaning agents, starting with use in household products.[82] In 1998 the OSPAR Commission agreed on the target of ending discharges, emissions and losses of all hazardous substances to the marine environment by 2020. NPs and NPEs were included on the first list of chemicals for priority action towards achieving this target.[83] NPs have also been included as 'priority hazardous substances' under the EU Water Framework Directive.[84] Furthermore, within the EU, products containing greater than 0.1% of NPs or NPEs may no longer be placed on the market since January 2005, with some minor exceptions principally for 'closed-loop' industrial systems.[85]

Conclusions

The investigations conducted by Greenpeace and the evidence presented in this section have demonstrated that **two textile manufacturers have been polluting the Yangtze and Pearl River deltas with hazardous chemicals**. It has been confirmed that these suppliers have commercial relationships with a range of major brands, including **Abercrombie & Fitch**, **Adidas**, **Bauer Hockey**, **Calvin Klein**, **Converse**, **Cortefiel**, **H&M**, **Lacoste**, **Li Ning**, **Meters/bonwe**, **Nike**, **Phillips-Van Heusen Corporation (PVH Corp)**, **Puma** and **Youngor**. These suppliers have also been linked with many other Chinese and international brands. The pollution of local water supplies recorded at these facilities is occurring despite the fact that some of the above-named brands have policy statements that support the principle of zero emissions.

When confirming their commercial relationship with the Youngor Group, Bauer Hockey, Converse, Cortefiel, H&M, Nike and Puma informed Greenpeace that they make no use of the wet processing of the Youngor Group for the production of their garments. However, regardless of what they use these facilities for, none of the brands found to have commercial links with these two facilities have in place comprehensive chemicals management policies that would allow them to have a complete overview of the hazardous chemicals used and released across their entire supply chain, and to act on this information. As brand owners, they are in the best position to influence the environmental impacts of production and to work together with their suppliers to eliminate the releases of all hazardous chemicals from the production process and products.

Many of the substances identified in the wastewater samples from the two facilities are soluble in water, enabling them to remain relatively mobile within the river systems to which they are released. This means they are likely to be transported downstream, at which point it would be impossible to trace them back to the source. Some of these substances are known to be highly persistent within aquatic environments and/or able to accumulate within organisms. The ongoing release of such substances is therefore likely to lead to ever-increasing levels in the receiving environment, where in some cases they will remain for a long period of time – even after legislation may have prohibited their release.

The alkylphenols and perfluorinated chemicals found in the samples are a cause for serious concern; these substances are known hormone disruptors and can be hazardous at very low levels. Not enough is known about some of the other chemicals found, in terms of their toxicology or their potential impacts following release to the environment. However, in such cases the burden of proof should lie with the polluter to prove that the substances released are safe, in line with the precautionary principle that requires that action be taken to prevent damage to the environment even when there is scientific uncertainty (see Section 4).

Our investigations have also highlighted instances of the composition of discharged wastewater varying significantly over time, and of active discharge occurring sporadically and during the night. Effectively monitoring discharges from any facilities with either of these types of discharge pattern would be extremely difficult.

As noted in Section 1, Chinese national and provincial legislation does set controls on the discharge of certain chemical pollutants in wastewater, including some of those identified at the facilities we investigated; for example the heavy metals chromium, copper and nickel. However, the regulations do not absolutely prohibit the discharge of these hazardous chemicals; rather, they set maximum permissible levels for the substances listed. In other words, textile complexes such as the two we investigated get a 'licence to pollute' as a result of the current legislative system. What is more, the regulations simply do not address the majority of substances that we identified in wastewater.

The use of 'end-of-pipe' measures, including conventional wastewater treatment plants, cannot effectively address the presence of many hazardous substances in wastewater. In fact, our investigation showed that investment in a modern wastewater treatment plant at the Youngor Textile Complex has not prevented the release of a range of complex organic chemicals.

Clearly, our investigations could not attempt to encompass all sources of hazardous chemical discharges into the Pearl River and Yangtze River deltas. However, the documentation of hazardous chemicals discharged in the wastewater from the two industrial complexes investigated provides a clear indication of the potential for discharges to occur at other textile facilities. The problem requires much more extensive investigation, both by government authorities and by companies outsourcing their products – with a view to ending the discharge of hazardous substances. Critical to this aim will be increased transparency and disclosure of all releases of hazardous chemicals from such facilities.

The following section analyses in more detail the way in which responsibility for discharges of hazardous substances extends down the supply chain, sets out the need for clothing brands to assume their share of that responsibility, and suggests how they might begin to go about this.

image A young boy stands in front of a heavily polluted pond in Gurao, Shantou, where the economy is centered around textile production.

03

03

The need for corporate responsibility

The textile industry: a dirty past, a cleaner future?

The investigations outlined in Section 2 prove that hazardous chemicals have been discharged from two major Chinese textile-manufacturing facilities. The connections between these facilities and many major brands that use them as suppliers have also been highlighted.

The use of rivers as a dumping ground for wastewater containing hazardous chemicals is likely to be common across China, whether the wastewater is discharged directly into a river untreated or after passing through a wastewater treatment plant that cannot deal effectively with persistent hazardous chemicals. However, China is not the first place to suffer from textile industry pollution of this kind.

Progress and pollution

The modern textile industry goes back to the 19th century, with the mechanisation of spinning and weaving that began in the UK and spread from there to the rest of Europe and North America. Although the manufacture of synthetic dyes was an important factor in the emergence of the chemical industry at that time[1], the growth in the use of many of the more persistent hazardous chemicals in the textile industry began after the Second World War; for example:

- alkylphenols were first introduced into the UK in the 1940s[2];
- chlorinated flame retardants were first used on a large scale during the Second World War for military clothing, while brominated flame retardants were commercialised in the 1950s[3]; and
- perfluorinated chemicals were first manufactured in the 1940s[4] but commercialised in the 1950s[5].

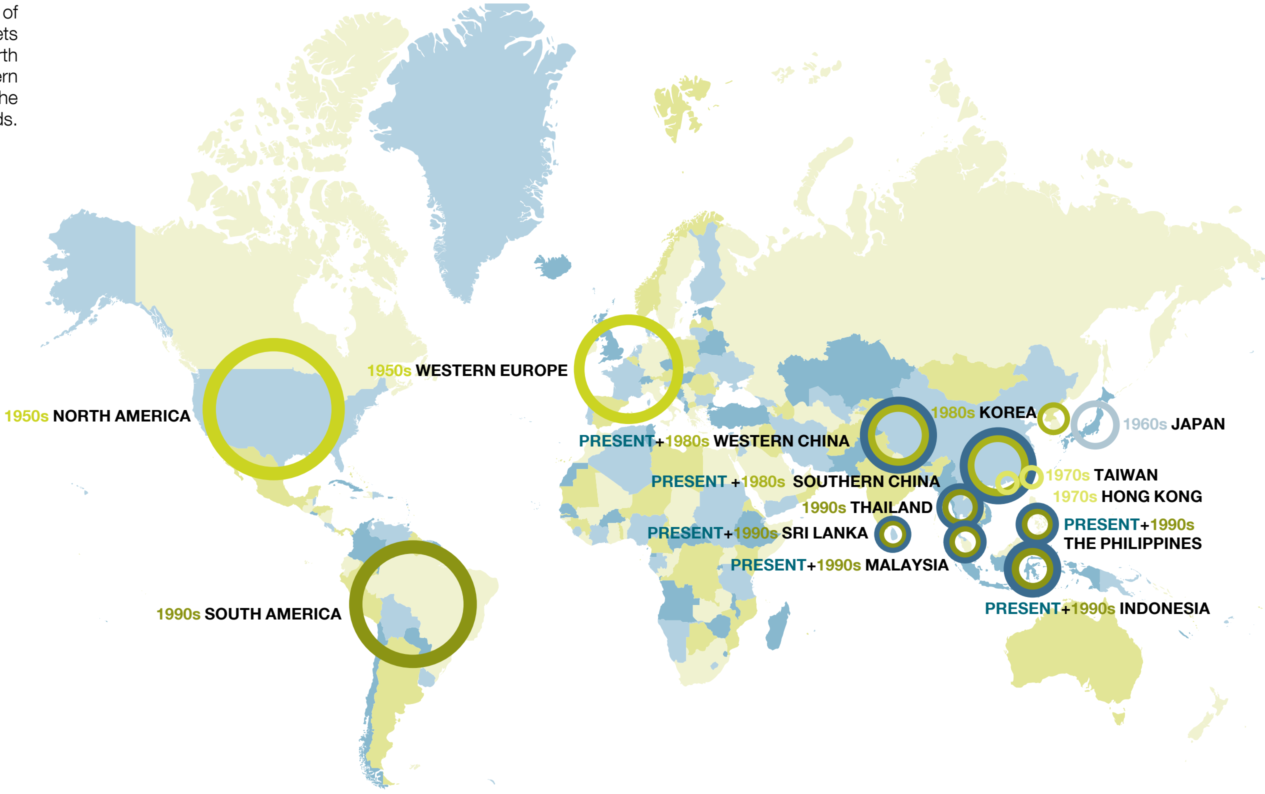
Therefore, although the manufacture of these persistent hazardous chemicals began before the Second World War, the commercial use of such chemicals increased greatly during the second half of the 20th century.

The production of textiles for global markets began to shift from North America and Western Europe to Asia in the 1950s, due to lower production costs: first to Japan, then to Hong Kong, Taiwan and Korea, which dominated the textile and clothing export markets in the 1970s and early 1980s. The most recent migration has been mainly to Southern and Eastern China, starting in the late 1980s, as well as to Indonesia, Thailand, Malaysia, the Philippines and Sri Lanka, with new suppliers in other South Asian and Latin American countries entering the market in the 1990s.[6] The latest trend within China is the transfer of textile industry clusters to Western and Central China.[7]

It has been observed that the **"success of the textile industry in China illustrates both the globalisation of an industry and the historic export of environmental degradation by western nations to China."**[8] It is certainly the case that the textile industry has been responsible for gross river pollution in the Global North in the past. For example, in the north-eastern US, numerous textile mills dumped wastewater from dyeing processes directly into rivers.[9]

Shifts in the production of textiles for the global market

Figure 3.1: Production of textiles for global markets began to shift from North America and Western Europe to Asia from the 1950s onwards.



1950s	1960s	1970s	1980s	1990s	PRESENT
NORTH AMERICA WESTERN EUROPE	JAPAN	TAIWAN HONG KONG	WESTERN CHINA SOUTHERN CHINA	SRI LANKA MALAYSIA THAILAND INDONESIA THE PHILIPPINES SOUTH AMERICA	SRI LANKA MALAYSIA THAILAND INDONESIA THE PHILIPPINES SOUTH AMERICA WESTERN CHINA SOUTHERN CHINA

The pressure to cut corners

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image Yellow wastewater from 'Pipe 1' of the Youngor textiles factory.

The role that stricter environmental controls in the Global North played in the growth of the textile industry in China has been relatively minor compared to other factors such as the availability of cheap labour.[10] However, when the pressure to cut costs is overwhelming, in part due to demand for cheap clothing from discount retail chains, investment in measures to protect the environment is easily bypassed. For example, it is reported that prices of clothing imported to the US have fallen 25% in real terms since 1995[11], leading to a constant need to slash costs, which in turn has encouraged some textile factories in China to discharge wastewater directly into rivers. Treatment of contaminated wastewater – which can address some types of pollution, although ineffective against many persistent hazardous substances (see Section 1) – costs around \$0.13 US dollars a tonne. Factories can increase profit margins substantially by sending wastewater directly into rivers, in violation of China's water-pollution laws.[12]

Nevertheless, environmental costs can be overestimated because it is assumed that 'traditional' pollution control methods will be necessary. In North Carolina in the 1980s (see Box 3.1), the future of the textile industry was threatened by the prohibitive cost of treatment that would remove alkylphenol ethoxylates (APEs) from wastewater effectively enough to comply with environmental standards. However, when the companies concerned replaced APEs in their manufacturing process with safer alternatives, these costs were avoided. As a result, the North Carolina textile industry was able to continue into the 1990s, before eventually relocating to India and China.

Unfortunately, in the process of migrating to China, India and other developing countries, the textile industry continues to rely on persistent hazardous chemicals in its processing, using wastewater treatment plants to treat discharges or dumping waste directly into rivers, instead of replacing these chemicals with safer alternatives, as was the case in North America.

Despite the lesson from industrialised countries that the use of many hazardous chemicals can be avoided in textile processing, the concern is that they will continue to be used in China and other countries where the textile industry is expanding, such as India, Pakistan, Vietnam, Cambodia and Bangladesh.[13]

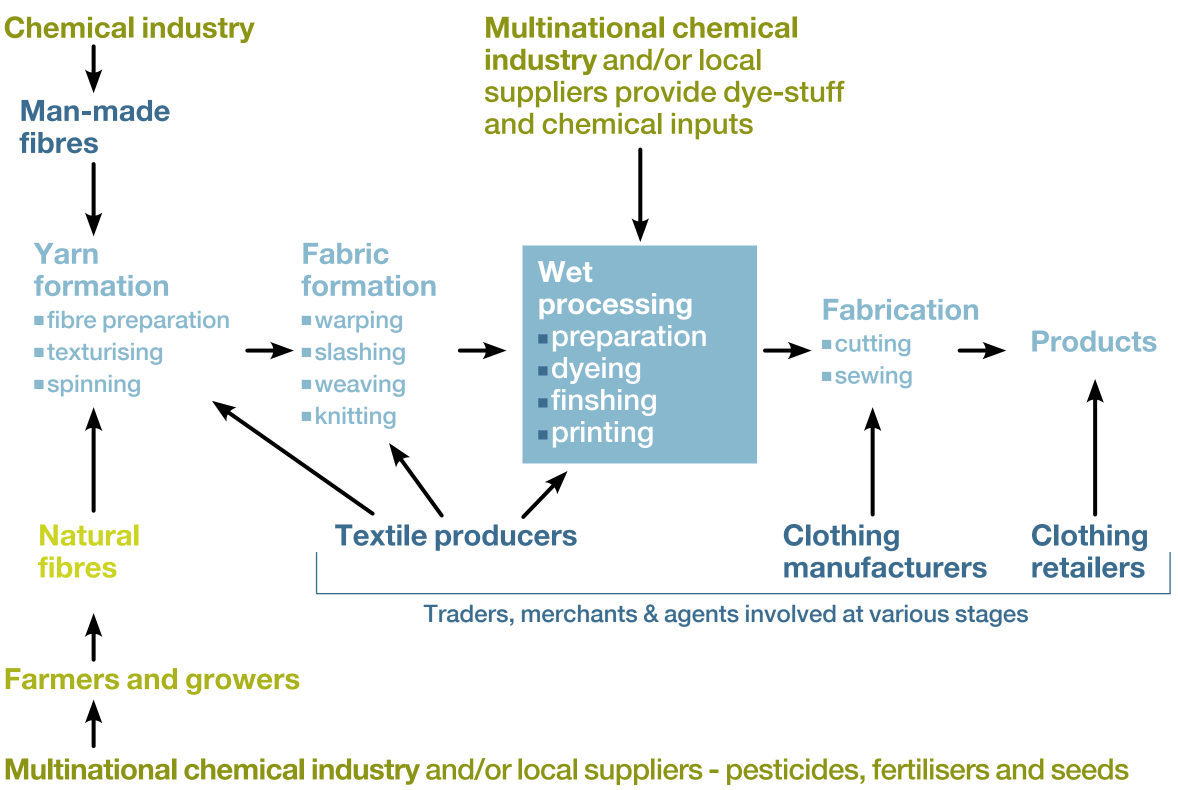
Tracing the threads of responsibility

Textile and clothing product chains can be long and complex; the various steps of textile processing and garment manufacture take place in many different countries around the globe. The global textile and garment market is currently worth more than $400bn US dollars a year; it is predicted to grow by 25% by 2020, with much of this growth coming from Asia.[14] China ranks second in the world for annual textile exports with 28% of the market (just behind the EU with 30%); it is first in the world for clothing exports, with 34% of the market[15]. Taking the two sectors together, **China has been the world's leading exporter of textiles and clothing since 1995**[16]. The EU, the US, India, Turkey, Pakistan, Indonesia, Thailand and Vietnam all rank among the top 15 exporters of textiles and clothing, according to WTO trade statistics.[17]

The major actors in the textile and clothing supply chain are multinational brand owners, raw materials suppliers, textile and clothing producers, financiers, retailers and customers. Companies are sometimes responsible for more than one link in the supply chain task: for example, the brand owner and retailer may be the same company, or the brand owner may have its own in-house production chain. Brand owners may contract suppliers directly or indirectly, through agents or importers. **Normally, it is the brand owner that triggers the product development process, including research and design.**[18] **Brand owners are therefore the best placed actors to bring about change in the industry.**[19]

The businesses involved in the textile and clothing supply chain[20]

Figure 3.2 shows the main actors involved in the textile and clothing supply chain, apart from the brand owners.



While developing countries produce half of the world's textile exports and nearly three-quarters of the world's clothing exports[21], the majority of the major clothing brands are based in the Global North. Market-leading clothing and footwear brands globally include H&M, Nike, Agiocur (Inditex) Zara, C&A and Adidas[22], while major US clothing manufacturers include Levi Strauss, Phillips-Van Heusen, VF Corporation and Warnaco[23]. In general, the textile and clothing industry is highly fragmented, with the involvement of many different brands – in the US, the 50 largest brands generated less than 40% of revenue[24], while in the EU more than 60 companies generate about 25% of revenue[25].

The complexities of the supply chain inevitably make for a lack of transparency about the various steps involved in the manufacture of products and the potential environmental impacts.

The actor in a position to demand all information on the various supply chain steps is the brand owner, although manufacturers and trade agents can also take a co-ordinating role.[26] However, brands do not usually disclose details of all their suppliers, in particular subcontractors or those several steps down the supply chain. To complicate the situation further, suppliers often contract with more than one brand, and contracts can be short-term as a result of short product cycles and volatile trends.

This report focuses on wet processing, including dyeing, finishing and printing. Of all of the finishing operations, this is where the majority of hazardous substances are used and discharged to surface water.[27] **The responsibility for pollution from wet processing lies both with the textile producers themselves and with the brands that they supply with their products.**

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Sportswear companies – influential players

Section 2 outlined the links between a number of leading clothing brands and two Chinese textile manufacturing facilities that have been found to be discharging a range of hazardous chemicals. This is despite the fact that many of these brands have already developed Corporate Social Responsibility programmes that include restrictions on certain hazardous chemicals and supply chain standards.

Although the textiles and clothing industry is heavily fragmented, the sportswear brands stand out as influential players who are well positioned to act as leaders in the shift towards a toxic-free future, due in part to their track-record of innovation in the sector. The sportswear brands with connections to the manufacturing plants outlined in Section 2 are the international brands **Adidas**, **Nike**, **Puma**, **Bauer Hockey** and **Converse** (a Nike brand), together with the Chinese sportswear brand **Li Ning**. Paradoxically, while many of these sportswear brands often promote themselves as champions of healthy lifestyles, at present they lack the policies and systems to ensure that hazardous chemicals are not released into the environment during production. What many of these brands do have in place, however, is a system of preferred suppliers where long-term relationships are cultivated and privileges are given to selected suppliers. This system has the potential to act as an ideal platform through which to develop collaborative policies and on-the-ground action to eliminate the use of toxic chemicals during the production process.

The sportswear brands are some of the largest within the whole clothing sector. In Europe, for example, Nike is the second biggest single brand and Adidas is also a major player – particularly when its Reebok brand is included – putting it on a par with market leader H&M. Also important, but with a smaller market share, is Puma.[28]

Within the global sportswear sector, Nike and Adidas have the biggest share of the sports clothing market, at 7% and 6% respectively, with Puma at 2%; however, these three companies combined make up over half of the global sports footwear market, with Nike leading on 31%, Adidas/Reebok on 22% and Puma on 7% (see Appendix 1).[29,30]

Historically, Nike was the first major sportswear company to shift its production to Asia; by the early 1980s it had closed its US factories and was sourcing almost all of its production from Asia, initially from Taiwan and Korea. As costs rose in these countries, Nike urged its suppliers to relocate to other, lower-cost countries such as Indonesia, China and Vietnam.[31] Adidas shifted production to Asia[32] at the end of the 1980s[33] and Puma not till the 1990s[34]. All three companies aroused controversy by sourcing products from factories and countries where low wages, poor working conditions and human rights problems were rampant.[35] Indeed, concerns about the right to freedom of association continue to this day.[36]

Subsequently, in response to consumer pressure, all three companies developed basic labour and environmental health standards. Since then **they have implemented Corporate Social Responsibility (CSR) programmes and in recent years have become recognised as leaders on many sustainability-related issues**; for example, they make up three of the six companies listed as sustainability leaders in the Dow Jones World Sustainability Index 2010 for the clothing, accessories and footwear, with Puma being the Industry Leader for the sector.[37,38] **However, despite sophisticated CSR and supply chain management systems, these companies have yet to take corporate responsibility for the hazardous substances discharged in wastewater by their suppliers.**

Hazardous substances in wastewater – a corporate blind spot

There are large differences in the way the clothing brands highlighted in this report approach the issue of hazardous waste. Some – such as sportswear brands Li Ning and Bauer Hockey, as well as fashion brands such as Youngor and Abercrombie & Fitch – do not publish a chemicals management policy or a list of chemicals that are banned or restricted in their products or in their manufacture (restricted substances list (RSL)).

In contrast, Nike, Adidas and Puma all publish CSR information and have a relatively sophisticated approach to managing hazardous substances in their products, with detailed RSLs specifying which substances must not be present, above certain specified limits.[39,40,41] There are also bans or restrictions on the use of certain hazardous substances in the manufacturing process, although these are usually far more limited in scope. All three companies have programmes to ensure that their suppliers implement their RSLs, with product testing procedures to ensure compliance. However, programmes to address wastewater discharges are not clearly linked with the RSLs, but are intended mostly to ensure compliance with local laws or the brands' own very general water pollution parameters.[42]

Notably, there is no evidence that any of the three aforementioned brands implement measures to restrict the release of most hazardous substances into water via their suppliers' wastewater discharges. This is despite the fact that they all have policy statements supporting the elimination of toxic emissions (which must logically include emissions to water) throughout a product's life cycle to a greater or lesser extent.

Nike's 'North Star' concept, was developed to "define what sustainable products and a sustainable company would look like". "Healthy Chemistry", with the objective being to "minimise the impact of product ingredients throughout the life cycle", is a key part of this, as is "Water Stewardship", where Nike's aim is to "collaborate with factories to improve efficiency in order to avoid borrowing more water than is needed and to be able to return it as clean, or cleaner, than it was found".[43]

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However, there is no publicly available information about the measures that Nike takes to guarantee that this objective will be implemented in practice. Key information, such as the company's suppliers guide and data on its water program, is not publicly accessible. This is despite the fact that Nike's chemicals programme has some progressive elements, such as its use of the 'Principles of Green Chemistry' as an approach for replacing hazardous substances.[44]

Adidas's Environmental Strategy is to "manage environmental effects throughout the value chain. The focus will always be on the following:

- Sustainable use of resources
- Avoidance of and reduction in emissions
- Limiting risks and chemical hazards."[45]

Under the heading 'Green Company' on its website[46], Adidas also states that "Our strategy is to become a zero-emissions company by:

- Embedding environmental best practice in everything we do
- Maximising environmental efficiency gains
- Supporting and harnessing our people's passion for a greener planet."

However, the use of the term 'zero emissions' is misleading, as the strategy is focused only on the firm's own production sites and does not include its supply chain. Nor is the elimination of discharges of hazardous substances mentioned among the strategy's targets. The targets that are mentioned, such as cutting 'relative'[47] energy use and reducing paper use, are unambitious.

Despite a relatively sophisticated system of supply chain management, including auditing and third party verification, Adidas's overall approach lacks detail on hazardous substances. For example, there are no clear criteria for the selection of hazardous substances to be prioritised for phase-out, with clear target dates. Some hazardous substances are already restricted in products, but although Adidas does require its suppliers to avoid the use of the substances listed in its RSL, there is no implementation plan on how to achieve this, apart from some limits on the discharge of heavy metals.[48]

Puma's overall approach to sustainability is to "drive our business towards cleaner, greener, safer and more sustainable systems and practices".[49] More specifically, it states "Factories are responsible for 'harmful substances free' production. Factories will be held responsible and liable for all loss and damage suffered by PUMA, should any hazardous substances be found in the materials, components or final products."[50]

"Harmful substances free production" appears to refer to the manufacturing process and emissions from it; however, in Puma's 'Handbook on Environmental Standards'[51] the use and emission of hazardous substances is not addressed among the specific steps to be taken to reduce and prevent environmental impact. Hazardous substances are considered when they are found in materials, components or final products, but not when released to the environment, with little attention given to production-related environmental standards.

Two examples of how the companies perform

The table below shows the restrictions (or lack of them) that each company imposes on the use of alkylphenols, their ethoxylates and two perfluorinated chemicals (PFCs), perfluorooctane sulphonate (PFOS) and perfluorooctanoic acid (PFOA). These substances are restricted in products partly as a response to legislation, such as the prohibition of the use of nonylphenol ethoxylates (NPEs) and nonylphenols (NPs) within the EU. Both Nike and Adidas go beyond the regulatory requirements with their restriction on PFOA, applying the same legal limit as is used for PFOS.

However, none of the firms give any information about whether they restrict the use of any of these substances in manufacturing processes[52], and no limits for their wastewater discharge are specified. This is despite the fact that some alkylphenols are listed as priority substances in the EU Water Framework Directive (see Section 2, Box 2.2).

In fact, as the investigation presented in Section 2 has revealed, limits on the concentration of a substance in the final product do not prevent its discharge in wastewater of the brands' suppliers.

How far do the brands' restrictions on alkylphenols, PFOS and PFOA go?

Table The restrictions (or lack of them) that companies impose on the use of alkylphenols, their ethoxylates and two types of PFCs.

	Scope of restriction		Alkylphenols and ethyoxylates**	PFOS**	PFOA
Nike[53]	Product Manufacturing Wastewater	yes no no	"Additional chemicals of concern" for future restriction*	Yes – limit of 1μg/m2	Yes – limit of 1μg/m2
Adidas[54]	Product Manufacturing Wastewater	yes no no	Sum of NP, OP and NPE is 1000 ppm; 100 ppm for NP as single parameter***	Yes – limit of 1μg/m2	Yes – limit of 1μg/m2
Puma[55]	Product Manufacturing Wastewater	yes no no	sum of NP, NPE, APE, OP does not exceed 1,000 mg/kg***	Yes – 1μg/m2	No
Li Ning	Product Manufacturing Wastewater	no no no	No	No	No

* In Nike's list of restricted substances for finished products. APEs (NPs, NPEs, OPs, OPEs) are on Nike's list of 'Additional Chemicals of Concern': "These chemicals are currently the focus of governmental, academic, or NGO research and may in the future be legally regulated or appear on the Nike RSL." Suppliers are asked to determine whether these substances are used, state what their function is, and avoid them if possible. However, there is no evidence as to how this very weak requirement is to be implemented, or whether discharge to wastewater is considered.

** Restricted by legislation[56]

*** NP = nonylphenols, OP = octylphenols, APE = alkylphenol ethoxylates, NPE = nonylphenol ethoxylates

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Shining the spotlight up the pipe

The effort and attention of the aforementioned brands is focused almost entirely on the final product and the demands of their consumers. All of the companies take rigorous steps through testing and verification programmes to avoid a consumer product scandal.

Until now, the problem of water pollution as a result of the persistent hazardous substances discharged by their suppliers has been mostly out of sight and out of mind. The lack of strong legislation, monitoring and enforcement in the Global South, and in China in particular, makes it difficult to deal with the discharge of hazardous substances into water effectively. The brands need to take the lead by accepting responsibility for the problem and implementing a series of targeted measures throughout their supply chains, going well beyond the general 'environmental management' approach.

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The need to claim responsibility: lessons from the electronics sector

Responsibility for a product should not be limited to its use as a consumer item; corporations that claim to take responsibility for the whole life cycle of their products must consider the use and emission of hazardous substances at each stage. The manufacturing process is a major part of this life cycle and it is unacceptable to overlook the discharge of hazardous substances into water. **Brand owners are in the best position to influence the environmental impacts of production, not only through the suppliers they choose but also through the design of their products and the control they can exert over the use of chemicals in processing and in the final product.**

The experience of another sector in dealing with environmental problems at a different stage of a product's life cycle – the end-of-life phase – may provide some useful lessons. In recent years the electronics industry has taken action at two stages of the product life cycle – design and disposal – to reduce the emission of hazardous chemicals from disposal or recycling of obsolete products (known as electronic waste or e-waste). Efforts were focused on reducing the use of brominated flame retardants (BFRs) and the plastic polyvinyl chloride (PVC); the presence of these substances in e-waste results in large amounts of toxic by-products being released during 'informal recycling', a common practice in countries such as China and India. These releases in turn harm the local environment and the health of recycling workers.

Firstly, many brands redesigned their electronics products to eliminate the use of these hazardous substances.[57] Market leaders such as Nokia, Sony Ericsson and Apple have already phased them out from their product ranges; it is predicted that over 50% of the market for mobile phones and PCs will be PVC and BFR-free by 2012.[58] These actions go much further than the requirements of EU legislation to restrict hazardous substances in electronics, which does not yet restrict either BFRs or PVC.[59]

Secondly, many multinational electronics brands have also adopted take-back programmes for their own brand's e-waste in countries where their products are sold, and where take-back legislation (such as the EU Directive on Waste Electrical and Electronic Equipment[60]) does not currently exist. This initiative follows Greenpeace campaigns for brands to adopt and implement Individual Producer Responsibility[61] worldwide.

These examples demonstrate that voluntary action by corporate brands to take responsibility for the environmental impact of their products is feasible, as well as being necessary in advance of legislation. Voluntary action is especially important in countries where legislation is unlikely to be enforced in the near future, or where it does not go far enough. Voluntary action highlights the need for legislation to level the playing field and in turn influences the development of legislation, by showing the feasibility of steps such as the phasing out of hazardous substances.

Larger brands, whether in electronics, textiles or any other sector, can and often do exert an enormous amount of pressure on their suppliers to achieve high standards and provide adequate information. Restricting and requiring information on the use of hazardous substances in a supplier's facility, and their release to the environment, should be just as much part of corporate responsibility as restriction and information on the use of such substances in products.

Not in my backyard: phasing out hazardous substances in the Global North

Although the majority of global textile production has shifted to China and other emerging economies, some remains in the Global North. The EU, the US and Canada are still leading exporters of textiles.[62] Yet regulations and pollution prevention programmes mean that discharges of certain hazardous substances by the textile industry are no longer a severe problem in these countries.

For example, the use of NPEs in the Canadian textile industry has decreased significantly since they were declared toxic under national regulations: in 2006 it was reported that the majority of textile mills had reached a 97% reduction target established by Environment Canada (the state environmental protection agency).[63] Remaining uses were primarily in oils for knitting and hosiery production equipment.[64] The largest Canadian manufacturer of furniture fabric and stretch knitted fabric, Hafner Inc, reduced its discharges from 6,800 kilograms in 2001 to 68 kilograms in 2003, and as a result also cut the chemical oxygen demand of its wastewater in half, which reduced its annual effluent disposal costs by $15,000.[65]

There are also examples from the US of the replacement of hazardous alkylphenols with safer alternatives leading not only to reduced discharges of alkylphenols, but also to financial savings in wastewater treatment, and even helping the industry to survive – see Box 3.1 about the textile industry in North Carolina.

While these examples show that the textile manufacturing industry has reduced its use of hazardous substances in the Global North, some producers of chemicals are relocating to the Global South. For instance, the rising cost of disposing of hazardous organic wastes from dyestuff manufacture is an important factor that has led international producers to shift production to southeast Asian countries and China over the last two decades.[66]

Box 3.1 Hazardous substance phase-out: a win-win scenario

In the 1980s, a large proportion of the discharges sent to publicly owned wastewater treatment plants in North Carolina came from a thriving textile industry that has now relocated to India and China. Because of the toxicity of the industry's discharges, the treatment plants were failing toxicity tests and experiencing difficulties in processing waste, with the costs payable by the polluters.

The State's Pollution Prevention Pays programme[67] identified the source of the problem as APEs, in particular the subclass NPEs.[68] Linear alcohol ethoxylates (LAEs) can perform the same function and are less toxic, but had not been adopted by textile companies because they cost about 30% more.

At first[69] attempts were made to tackle the discharges at the treatment plants through extended aeration treatment, then with activated carbon. But these expensive approaches failed to prevent the pollution. The programme then demonstrated that replacing APEs and NPEs with LAEs could solve the problem of toxic discharges. Textile companies promptly switched to LAEs, and the treatment plants began passing their toxicity tests. This kept stakeholders out of costly litigation, while improving environmental quality.[70]

If the substitution approach had not been adopted, "the level of treatment required would have been so costly that the companies would not have been able to stay in business."[71] **As a result of the successful substitution, over 100 companies remained in operation for more than a decade**.[72]

Sticking around: the continued production and use of PFCs

Whereas the replacement of alkylphenols in the textile industry has been demonstrated by textile manufacturers in a number of different countries in the Global North, the picture with PFCs is not so simple. These substances are best known for their use as non-stick coatings for cookware, but their properties are also useful for waterproof clothing.

Following a series of discoveries about the persistence, toxicity and environmental distribution of PFCs in the 1990s[73], 3M, the US manufacturer of PFOS (the most problematic of the PFCs) voluntarily stopped its production in 2000 – albeit after pressure from the US Environmental Protection Agency. It also stopped production of PFOA, having formerly sold the production rights to DuPont.[74] In 2006, again under pressure from the EPA, DuPont and other companies promised to phase out production of PFOA by 2015.[75] In contrast, it has been reported that production of PFOS in China has increased in recent years, with large-scale production beginning in 2003 and rising to over 200 tonnes per annum in 2006.[76]

Despite the concerns about their persistence and toxicity, increasing quantities of PFCs are being produced globally – around 10,000 tonnes annually, half of which is used for the impregnation of consumer textile products such as all-weather clothing, carpets and upholstery.[77] So although the use of PFOS and PFOA in textiles appears to be declining, the use of PFCs generally is increasing.[78] However, other PFCs may act as sources of PFOS and PFOA, leading to continued release of these substances to the environment.[79]

By the time the European Commission proposed controls on PFOS in 2005, most of the major uses which it suggested for prohibition had already been discontinued in Europe, including its use in carpets, upholstery, other textiles and leather, and paper and cardboard packaging products.[80,81] The former users of PFOS and PFOA have now shifted towards alternative PFC substances which are not as hazardous or persistent, although their toxicity and environmental impact still need to be examined.[82]

For example, according to the German Textile Finishing Alliance, PFOS and PFOA are no longer used for textile finishing in Germany; alternative PFCs (fluorocarbon polymers) are used, though these can contain small quantities of PFOA.[83] The German Textile Chemicals Association estimates that German companies use about 1,000 tonnes a year of formulations that contain 20% to 30% of fluorocarbons, with good formulations containing less than 1 part per million of PFOA.[84]

Non-PFC alternatives, such as fluorine-free impregnation products for textiles[85], are also available, but there is again a lack of toxicological information about these substitutes and limited information about companies implementing them. The Norwegian sporting goods company Helly Hansen stated in 2008 that from summer 2009 at the latest all its products would be free of PFCs.[86,87]

Hazardous residues in products

Clearly, the international brands highlighted in this report are largely focusing on their products rather than on other sources of release, such as their suppliers' wastewater discharges. Nevertheless, as long as hazardous chemicals are being used, products are still likely to contain residues.

In 2006, Friends of the Earth Norway conducted tests on all-weather jackets for children, to confirm their suspicion that they were impregnated with fluorinated compounds despite the availability of more environmentally friendly impregnation products. Six jackets from five different brands were bought in the Nordic countries and investigated for fluorinated substances: a number of unbound fluorinated compounds were found, with levels for PFOS-related compounds at between <5 and 100μg/m^2 [88] , well above the EU legislative limit of 1μg/m^2 in some cases.

Despite the use of NPEs and NPs being prohibited in the EU, NPs are still being found in the sludge of EU wastewater treatment plants and in discharged treated wastewater.[89] Because legislation does not control the import of textiles and clothes containing NPEs, these substances can be released into wastewater during washing. Two studies of products in Sweden, one on hand towels and one on T-shirts, confirmed that they contained NPEs; in T-shirts, the levels were generally highest in garments produced outside the EU, particularly in Turkey and China. If the towels and T-shirts are representative, it is estimated that in 2006 about 46 tonnes of NPs were imported into Sweden in textile products and that the majority of this total ended up in the wastewater network.[90]

The study on T-shirts emphasised that the quantity of NPEs found in the product does not reflect the quantity of chemicals used in the manufacturing process, but rather how well the fabric was rinsed before it was made into an item of clothing. We should not have to choose between NP pollution in EU wastewater treatment systems on the one hand, and even greater discharges of NPs from manufacturing facilities into rivers in China and other developing countries on the other.

Conclusion

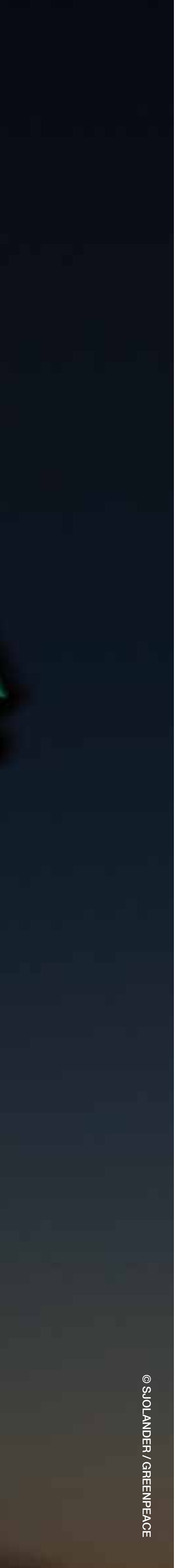
When a less hazardous substitute is available and already being used by the textile industry in some locations, substances such as NPs should not be used in textile manufacturing anywhere in the world. However, given the major differences in regulations and enforcement from country to country – and particularly between advanced and emerging economies and developing countries – achieving this objective by legislative means could be a slow and difficult process.

On the other hand, multinational corporations such as the brands highlighted in this report have the power to persuade their suppliers to phase out these substances. This goal is achievable in the short term, until legislative changes can catch up. The feasibility of rapid change in an industrial sector has been demonstrated by companies in the electronics industry with the phase-out of PVC and BFRs in their products, currently being implemented through their supply chains.[91] Until recently, many in that industry would have considered this development impossible; in fact, the availability of substitutes has increased in response to demand from the electronics brands.[92]

There is a need for rapid intervention to instigate a global phase-out of hazardous chemicals, starting with some that have already been regulated in certain markets (see Section 4 for a list of 11 priority chemicals for phase-out). Owing to their market share and high profile sportswear brands are in a unique position to take a lead within the textile industry, setting a deadline and developing a substitution plan. Provided that enough resources are used to develop alternatives, substitutes will begin to emerge.

However, the need to take action on this issue is not limited to the brands outlined in this report. All clothing brands have a duty to influence their supply chains to phase out the use and discharge of hazardous substances. Section 4 outlines the steps needed for both companies and governments to implement this phase out plan.

04



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04

Championing a toxic-free future: Prospects and recommendations

A turning point for the textile industry

Greenpeace investigations have revealed that two textile manufacturers have been discharging persistent and hazardous chemicals into rivers in China. Whilst the findings documented in this report offer a snapshot of the kind of toxic chemicals being released into our waterways, such discharges are likely to be the tip of the iceberg, given the scale of the textile manufacturing industry in China and elsewhere.

Our investigations have also linked the two facilities involved with several major brands, including sportswear companies, other clothing brands and retailers. Notably, the international brands **Abercrombie & Fitch**, **Adidas**, **Bauer Hockey**, **Calvin Klein**, **Converse**, **Cortefiel**, **H&M**, **Lacoste**, **Nike**, **Phillips-Van Heusen Corporation (PVH Corp)** and **Puma**, and the Chinese brands **Li Ning**, **Meters/bonwe** and **Youngor**, have all had products manufactured at one or the other of the facilities.

The textile industry is playing an important role in the industrialisation and development of many countries in the Global South, China in particular. Major brands with supply chains in these countries are in a unique position to work with their commercial partners to reduce the environmental impacts of textile manufacturing, and in the process help lead the shift away from hazardous and environmentally damaging chemicals, which needs to happen across all industries.

Just as some electronics brands have recently taken the lead by phasing out hazardous substances in their products, so the major clothing brands must now take responsibility for ensuring that their suppliers phase out the use and discharge of hazardous substances during the wet processing of textiles – where many hazardous substances are used and discharged into water. Part of a company's responsibility is to tackle the discharge of persistent hazardous chemicals and to avoid the serious and often far-reaching impacts these hazardous chemicals can have on the environment and on people's livelihoods.

However, to respond to this challenge effectively, a change in our whole approach to the problem of water pollution is needed. As our investigations have shown, modern wastewater treatment plants do not prevent the discharge of some hazardous, persistent chemicals into our waterways. A new strategy is therefore needed to prevent such chemicals being used in the first place, bringing about an end to their use altogether and their replacement with non-hazardous alternatives.

The role of brands:

Brands have a pivotal role to play when tackling the use and release of hazardous chemicals. Their influence extends beyond the direct use of hazardous chemicals in their products to their use and discharge in production processes, including the various stages of their supply chain. In other words, brands have the means to act immediately to eliminate the release of hazardous chemicals by working together with their suppliers and requiring that their long-term commercial partners are leading the shift from hazardous to non-hazardous chemicals.

To this end, Greenpeace is calling on the brands and the suppliers identified in this investigation to become champions for a toxic-free future, by eliminating all releases and uses of hazardous chemicals from across their supply chains and products.

Specifically, this entails establishing clear company and supplier policies that commit their entire supply chain to shift from hazardous to safer chemicals, accompanied by a plan of action that is matched with clear and realistic timelines.

Proper policies to **eliminate the releases of all hazardous chemicals across a company's entire supply chain** should be based on a **precautionary approach** to chemicals management (see Box 4.1), and account for the whole product lifecycle and **releases via all pathways**. To be credible, these policies need to be accompanied by a plan of implementation, with clear timelines, and be matched with real and substantial action on the ground.

Knowing what hazardous chemicals their suppliers use and release – and making this data publicly available – will be fundamental to the brands' shift towards championing a toxic-free future (see Box 4.2). Transparency will also be crucial with regard to showing progress made to eliminate the release and use of hazardous chemicals.

Due to the urgency of the situation, brands need to work quickly to identify the most dangerous chemicals and eliminate these as a priority. Full public accountability for, and disclosure of, what they and their suppliers are discharging into public waterways will play a key role in this work.

Above all, these brands need to act as leaders and innovators. The problems associated with the use and release of hazardous chemicals within the textile industry will not be fixed by severing ties with one or two polluting suppliers. The solutions are to be found in working together with their suppliers to bring about systematic change in the way brands and businesses create their products. Such action requires vision, commitment and a desire to improve upon the current approach to hazardous chemicals. Every brand and supplier has the responsibility to know when and where hazardous chemicals are being used and released up and down their supply chain and to strive to eliminate them. **It will therefore be through their actions, not their words, that these brands can become agents of positive change**.

Box 4.1 The precautionary principle and precautionary action

Experiences such as the pollution of the Great Lakes - where it took scientists more than 50 years to fully comprehend the impacts on human health and wildlife of persistent chemicals such as the organochlorines[2] - drove the shift to replace the failed **assimilative capacity approach** to pollution (based on the assumption that hazardous substances can be absorbed and diluted to harmless levels) with the **precautionary principle,** as laid down in the Rio Declaration.[3] The precautionary principle is based on the assumption that some hazardous substances cannot be rendered harmless by the receiving environment and that prevention of potentially serious or irreversible damage is required, even in the absence of full scientific certainty.

The precautionary principle can be defined in terms of four elements :

1) Serious or irreversible damage to ecosystems must be avoided in advance, both by preventing harm and by avoiding the potential for future harm.

2) High-quality scientific research must be employed as a key mechanism for early detection of actual and potential impacts.

3) Action to protect ecosystems is **necessary**, not simply possible, even in the presence of uncertainty, ignorance and indeterminate outcomes.

4) All future technical, social and economic developments should implement a progressive reduction in environmental burden.

In policies and practice these principles can be translated into the following:

1) Preventive action must be taken (as opposed to attempted control of pollution through allowable emission levels).

2) The preventive action should be taken promptly, rather than waiting for conclusive scientific proof of a cause-effect relationship, at which time it may be too late (and lead to the incurrence of environmental, human health and financial damage and remediation costs).

3) Prevention should be implemented through substitution (replacement of the hazardous chemical by alternative substances, materials, technologies and/or techniques).

4) Precaution requires reversal of the burden of proof (ie making the party proposing the release of a substance responsible for demonstrating that it is unlikely to cause harm, rather than the opponent being responsible for proving that a release is likely to cause harm).

For action to be truly precautionary, it must ensure that the fundamental objective – to reduce the overall chemical burden – is observed. To this end, it must recognise that the decision to prevent the discharge of a certain chemical may require a fundamental re-evaluation of the need for a product or process, and **may not always imply simple substitution with an alternative**.

Box 4.2 The right to know about chemicals

The 'right to know' in the context of workplace and community environmental law, is a term commonly used to refer to the legal principle (or recognition of this principle) whereby the individual has the right to know about the environmental hazards - including chemicals - to which they may be exposed in their daily life.

More specifically, community right-to-know aims to allow members of the public greater access to environmental information held by companies or public authorities, thereby increasing the transparency and accountability of both.

Public access to information and public participation in decision-making are essential to the push for clean production systems free of hazardous chemicals. Producers and product designers are made more accountable when communities and workers can find out what an industry is emitting into the environment or when consumers can find out what is in a product.

One way of providing information to the public is to establish pollutant release and transfer registers (PRTRs). PRTRs are based on reported quantities of releases of hazardous chemicals to the environment, facility by facility, year by year, ideally made available in a searchable online database. The Japanese PRTR, which was introduced in 2001 and covers 462 designated chemical substances (Class I) in 23 sectors and 34,830 facilities, shows a reduction of 24.5% in total annual releases (and waste transfers) of hazardous substances between 2001 and 2008. Equally revealing is that no significant reduction was observed for those industrial facilities releasing smaller quantities of designated chemical substances (Class II), which are not required to disclose their releases publicly (merely to maintain data sheets).[4]

Willingness on the part of companies and facilities to undertake full voluntary disclosure of releases and transfers is an essential element to build up authorities' willingness to implement such projects; and these can later form the basis of right-to-know policies and laws.

image A resident of Gaoping village in Sanjiao Town, Zhongshan City , sits on a tree by the river. On the opposite bank, they are busy building another new factory..

The need for government action:

Leading brands and product manufacturers are in a position to take immediate steps to eliminate hazardous chemicals. In order for this shift to be enforced throughout the industry and to reduce the risk of rogue companies continuing to pollute, it is also **necessary for governments to put in place comprehensive chemical management policies**. Legislative measures can strengthen company policies by ensuring that they evolve as new information on hazardous chemicals becomes available. Legislation also creates a level playing field, enabling safer alternatives to gain a stronger foothold in the market, which in turn makes them more cost-effective.

The most effective strategy is therefore to prevent the release of hazardous chemicals through eliminating use at source – and, as already noted, brands are best placed to take immediate action. In recognition of this, policy makers are taking the approach of increasing producer responsibility, shifting the burden of proof of safety and the responsibility to provide information on the impacts of hazardous chemicals away from governments and wider society and towards those who make and sell chemicals and the businesses that use these chemicals in their products and manufacturing processes.[5]

In the EU, the responsibility for information on the hazards of chemicals used for production and in products has now been placed with chemical producers and manufacturers of products containing chemicals.[6] All companies (both manufacturers and brands) therefore need to be fully aware of the chemicals used by their suppliers, their presence in products, their impacts and any discharges; including those into water.

Starting from this principle of producer responsibility, comprehensive chemicals management frameworks should be devised as a matter of urgency, to prevent ongoing releases into the environment that may require future clean-up and have serious impacts on the environment and on people's health and livelihoods, especially in the Global South.

To this end, Greenpeace is calling for governments to **adopt a political commitment to zero discharge**[7] of all hazardous substances **within one generation**[8], based on the **precautionary principle** and a **preventive approach** to chemicals management, with the substitution principle at its core and producer responsibility[9] to drive elimination of hazardous substances.

To implement this commitment, policies and plans are needed that establish a dynamic[10] priority hazardous substance list[11] (to be acted on immediately), intermediate targets to meet the one generation goal and a publicly available register of data about discharges, emissions and losses of hazardous substances.

Governments, as well as all brands and suppliers, should embark on the steps outlined above as a matter of urgency, beginning with a commitment to zero discharges of hazardous chemicals and a plan to implement this. It is still possible to prevent further damage to the environment and the risk to populations from hazardous and persistent chemicals, and to avert the need for costly clean-ups, but action needs to be taken now.

The role of global citizens:

As global citizens, we can collectively 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.

Please join with us and support Greenpeace in calling on these brands to **champion a post-toxic world** – where our water supplies are no longer polluted with hazardous, persistent and hormone-disrupting chemicals by industry.

Together we can demand that they act **NOW** to detox our rivers, detox our planet and, ultimately, detox our future. A post-toxic world is not only desirable, it's possible. Together we can create it.

The time to act is now.

www.greenpeace.org/detox

Box 4.3 Eleven flagship hazardous chemicals

1) Alkylphenols

Commonly used alkylphenol compounds include nonylphenols (NPs) and octylphenols and their ethoxylates, particularly nonylphenol ethoxylates. NPs are widely used in the textiles industry in cleaning and dyeing processes. They are toxic to aquatic life, persist in the environment and can accumulate in body tissue and biomagnify (increase in concentration through the food chain).[12] Their similarity to natural oestrogen hormones can disrupt sexual development in some organisms, most notably causing the feminisation of fish.[13,14]

NPs are heavily regulated in Europe and since 2005 there has been an EU-wide ban on major applications.[15]

2) Phthalates

Phthalates are a group of chemicals most commonly used to soften PVC (the plastic polyvinyl chloride). In the textile industry they are used in artificial leather, rubber and PVC and in some dyes. There are substantial concerns about the toxicity of phthalates such as DEHP (Bis(2-ethylhexyl) phthalate), which is reprotoxic in mammals, as it can interfere with development of the testes in early life.[16]

The phthalates DEHP and DBP (Dibutyl phthalate) are classed as 'toxic to reproduction' in Europe[17] and their use restricted. Under EU REACH legislation the phthalates DEHP, BBP (Benzyl butyl phthalate) and DBP are due to be banned by 2015.[18]

3) Brominated and chlorinated flame retardants

Many brominated flame retardants (BFRs) are persistent and bioaccumulative chemicals that are now present throughout the environment. Polybrominated diphenyl ethers (PBDEs) are one of the most common groups of BFRs and have been used to fireproof a wide variety of materials, including textiles.

Some PBDEs are capable of interfering with the hormone systems involved in growth and sexual development.[19] Under EU law the use of some types of PBDE is tightly restricted[20] and one PBDE has been listed as a 'priority hazardous substance' under European water law, which requires that measures be taken to eliminate its pollution of surface waters.[21,22]

4) Azo dyes

Azo dyes are one of the main types of dye used by the textile industry. However, some azo dyes break down during use and release chemicals known as aromatic amines, some of which can cause cancer.[23] The EU has banned the use of these azo dyes that release cancer-causing amines in any textiles that come into contact with human skin.[24]

5) Organotin compounds

Organotin compounds are used in biocides and as antifungal agents in a range of consumer products. Within the textile industry they have been used in products such as socks, shoes and sport clothes to prevent odour caused by the breakdown of sweat.

One of the best-known organotin compounds is tributyltin (TBT). One of its main uses was in antifouling paints for ships, until evidence emerged that it persists in the environment, builds up in the body and can affect immune and reproductive systems.[25] Its use as an antifouling paint is now largely banned. TBT has also been used in textiles.

TBT is listed as a 'priority hazardous substance' under EU regulations that require measures to be taken to eliminate its pollution of surface waters in Europe.[26] From July 2010 and January 2012 products (including consumer products) containing more than 0.1% of certain types of organotin compounds will be banned across the EU.[27]

6) Perfluorinated chemicals

Perfluorinated chemicals (PFCs) are manmade chemicals widely used by industry for their non-stick and water-repellent properties. In the textile industry they are used to make textile and leather products both water and stain-proof.

Evidence shows that many PFCs persist in the environment and can accumulate in body tissue and biomagnify (increasing in levels) through the food chain.[28,29] Once in the body some have been shown to affect the liver as well as acting as hormone disruptors, altering levels of growth and reproductive hormones.[30,31]

The best known of the PFCs is perfluorooctane sulphonate (PFOS), a compound highly resistant to degradation; it is expected to persist for very long periods in the environment.[32] PFOS is one of the 'persistent organic pollutants' restricted under the Stockholm Convention, a global treaty to protect human health and the environment, and PFOS is also prohibited within Europe[33] and in Canada[34] for certain uses.

7) Chlorobenzenes

Chlorobenzenes are persistent and bioaccumulative chemicals that have been used as solvents and biocides, in the manufacture of dyes and as chemical intermediaries. The effects of exposure depend on the type of chlorobenzene; however, they commonly affect the liver, thyroid and central nervous system. Hexachlorobenzene (HCB), the most toxic and persistent chemical of this group, is also a hormone disruptor.[35]

Within the EU, pentachlorobenzene and HCB are classified as 'priority hazardous substances' under regulations that require measures to be taken to eliminate their pollution of surface waters in Europe.[36] They are also listed as 'persistent organic pollutants' for global restriction under the Stockholm Convention, and in line with this they are prohibited or scheduled for reduction and eventual elimination in Europe.[37]

8) Chlorinated solvents

Chlorinated solvents - such as trichloroethane (TCE) - are used by textile manufacturers to dissolve other substances during manufacturing and to clean fabrics.

TCE is an ozone-depleting substance that can persist in the environment. It is also known to affect the central nervous system, liver and kidneys.[38] Since 2008 the EU has severely restricted the use of TCE in both products and fabric cleaning.[39]

9) Chlorophenols

Chlorophenols are a group of chemicals used as biocides in a wide range of applications, from pesticides to wood preservatives and textiles.

Pentachlorophenol (PCP) and its derivatives are used as biocides in the textile industry. PCP is highly toxic to humans and can affect many organs in the body. It is also highly toxic to aquatic organisms.[40] The EU banned production of PCP-containing products in 1991 and now also heavily restricts the sale and use of all goods that contain the chemical.[41]

10) Short-chain chlorinated paraffins

Short-chain chlorinated paraffins (SCCPs) are used in the textile industry as flame retardants and finishing agents for leather and textiles. They are highly toxic to aquatic organisms, do not readily break down in the environment and have a high potential to accumulate in living organisms.[42] Their use has been restricted in some applications in the EU since 2004.[43]

11) Heavy metals: cadmium, lead, mercury and chromium (VI)

Heavy metals such as cadmium, lead and mercury, have been used in certain dyes and pigments used for textiles. These metals can accumulate in the body over time and are highly toxic, with irreversible effects including damage to the nervous system (lead and mercury) or the kidneys (cadmium). Cadmium is also known to cause cancer.[44,45]

Uses of chromium (VI) include certain textile processes and leather tanning[46]: it is highly toxic even at low concentrations, including to many aquatic organisms.[47]

Within the EU cadmium, mercury and lead have been classified as 'priority hazardous substances' under regulations that require measures to be taken to eliminate their pollution of surface waters in Europe.[48] Uses of cadmium, mercury and lead have been severely restricted in Europe for some time, including certain specific uses of mercury and cadmium in textiles.[49]

image A Greenpeace campaigner takes a sample of wastewater from a discharge pipe.

Contents

All companies mentioned in this report received a letter prior to the report launching outlining the evidence found.

Where companies responded before the stated deadline with responses deemed to be relevant, extracts from these responses are included at the end of their respective brand profile.

Appendix 1

1) Main brands that have a business relationship with Youngor Textile Complex

1.1 Adidas, Herzogenaurach, Germany

"PERFORMANCE. PASSION. INTEGRITY. DIVERSITY. These are the Adidas Group values. These are the core values found in sport. Sport is the soul of the Adidas Group. We measure ourselves by these values, and we measure our business partners in the same way."[1]

The Adidas Group is the world's second largest sporting-goods company after Nike Inc, which is its only major competitor; it plans to outgrow Nike in the sporting goods industry in the next five years.

"Adidas' mission is to be the leading sports brand in the world."[2]

Adidas started out as a sport shoe factory, which is still one of its main scopes. However, it has also expanded into sports apparel, equipment and accessories, as well as producing sport-inspired fashion.

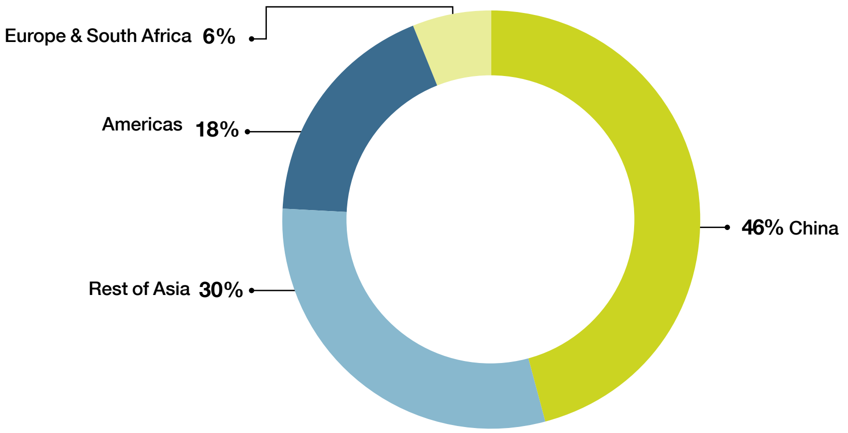
Net sales concentrated on Europe (42%) and the Americas (33%) in 2009, while Asia accounted for 25% of total sales. Adidas has put a lot of effort into retail within the last five years. At the end of 2009 the Adidas Group retail for the brands Adidas and Reebok increased to 2,212 stores. The biggest Adidas retail outlet – the 'Adidas Brand Center' – is located in Beijing.

"To minimise production costs" Adidas outsources 95% of its production to independent third party suppliers, primarily located in Asia.

"We strive to be a sustainable company, one that recognises its responsibilities towards the environment, our employees and the people who make our products."[3]

"...At the end of the manufacturing process for Adidas' goods there is a washing process, but the possibility that high concentrations of the chemicals you mentioned can occur is very low..."
Adidas' response to *Dirty Laundry*

Distribution of supplier production sites - Adidas



Appendix 1 (continued)

1.2 Bauer Hockey, Ontario, Canada[4]

"The business strategy of Bauer Performance Sports is to continue to develop and bring to market high performing products that improve the performance of athletes at all levels."[5]

Bauer Hockey was founded in Kitchener, Ontario in 1927. Bauer Hockey was owned for 12 years by Nike Inc. from 1995 to 2008, when it sold Bauer Hockey to an investor group led by Kohlberg & Company and Canadian businessman W. Graeme Roustan for $200m in cash.[6]

In 2011, Bauer announced its intention to become a public company, Bauer Performance Sports Ltd.[7] Bauer makes and markets equipment and clothing under the brands Bauer Hockey, Mission Roller Hockey and Maverik Lacrosse.[8]

The company's aims include: increasing its share of the Ice and Roller Hockey market; targeting emerging and underdeveloped consumer segments; growing apparel across all sports categories, capitalising on the rapidly growing lacrosse market and pursuing strategic acquisitions.

The company does not refer to CSR, the environment or sustainability; the only announcement on the website is under the heading: Corporate Governance.

"Bauer Performance Sports Ltd.'s Board of Directors considers good corporate governance to be an integral part of the effective and efficient operation of the company and essential to the enhancement of long-term shareholder value. Bauer Performance Sports Ltd. is committed to full and fair disclosure and providing timely, accurate and complete compliance with the corporate governance standards of Canadian securities regulators and the Toronto Stock Exchange. Bauer Performance Sports Ltd.'s governance system incorporates transparency and high standards of ethics and discipline that embrace best practices in corporate governance for our shareholders."[9]

1.3 Cortefiel SA, Madrid, Spain

"Cortefiel is the Group's original brand. Created in 1946, it targets men and women aged between 35 and 45."[10]

The brand Cortefiel is one of four major brands of the Cortefiel Group. It is present in 64 countries and has 1,729 points of sale.[11] Grupo Cortefiel has generated retail sales of €1.4bn in 2009.[12] This translates into sales of roughly €520m for the brand Cortefiel.

The Cortefiel Group has a Code of Conduct which applies to suppliers and includes compliance with environmental regulations.[13] It has published a Sustainability Report that gives details of its suppliers in China, Hong Kong and Spain. 62% of all garment purchases are from Asia, while only 36% of payments go to suppliers in Asian countries.[14]

Point 10 of the Code of Conduct states: "Respect for the environment: It must be ensured compliance with the environmental laws and regulations applicable in each case, adopting a behaviour principle of a responsible and respectful attitude towards the environment.

1.4 H&M Hennes & Mauritz AB, Stockholm, Sweden

H&M was established in Sweden in 1947, and today sells clothing for women, men and children. It also sells cosmetics, accessories and shoes. H&M employs 87,000 people, in over 2,200 concept stores in 40 countries, as well as in 100 design centres, 16 production offices, and at its headquarters in Stockholm, Sweden.

"Quality is a central issue, from the idea stage all the way to the end customer. The quality work includes extensive testing, as well as ensuring that the goods are produced with the least possible environmental impact and under good working conditions. H&M does not own any production factories. Production of goods is outsourced to independent suppliers, primarily in Asia and Europe, through H&M's local production offices."[15]

H&M sources everything from around 700 independent suppliers, primarily in Asia and Europe. Global sales (turnover) in 2010 was €14bn[16], probably making H&M the world's second largest speciality clothing retailer[17].

H&M's latest CSR report[18] was published on 14 April 2011. H&Ms own highlights include:

- Announcing a target for all cotton to come from more sustainable sources by 2020.
- A total of 68,000 cotton farmers were educated on more sustainable farming practices through engagement in the Better Cotton Initiative (BCI).
- Using more organic cotton than ever before in its products, a total of 15,000 tonnes. This makes H&M one of the largest users of organic cotton in the world (2009: rank 5).
- Turning 1,600 tonnes of recycled materials into new clothes.
- Playing an active role in forming the Sustainable Apparel Coalition, working to create a universal index to show the environmental impact and fair labour practices for clothing and footwear production.
- A global ban on sand-blasting for all its products.
- Saving 50 million litres of water in denim production relative to previous production methods.

"We welcome your campaign as it deals with an important topic, and we fully share your ambitions and efforts to eliminate discharges of hazardous chemicals. Any aim to put light on the effects of industrial water pollution, wherever it might appear, should be encouraged and is something we all benefit from."

"Ningbo Youngor Yinchen Uniform produces blazers and trousers for H&M, but the very fabric used for these garments comes from fabric suppliers/textile mills outside of the Youngor Garment city."
H&M's response to *Dirty Laundry*

1.5 Lacoste, Paris, France

Lacoste expresses itself through a large collection of apparel for women, men and children, footwear, fragrances, leather goods, eyewear, watches, belts, home textiles, mobile phones and fashion jewellery.[19] Lacoste SA is owned 65% by the Lacoste family and 35% by Devanlay (Maus family). Lacoste SA Devanlay is Lacoste's worldwide licensee.[20]

Lacoste is present in over 114 countries with the US, France, UK, Italy and Spain being the most important markets.

An official CSR report was not found, however, the Lacoste brand actively support "*projects selected by the Global Environment Facility to safeguard or protect certain species of crocodiles, alligators, caiman or gavials now in danger of extinction and whose the loss would jeopardise the biological balance of their habitat areas.*"[21]

"We have been committing ourselves to the respect of the environment, notably through the protection of biodiversity, and have asked our worldwide licensees to act accordingly. We thus consider very seriously the matter you have raised and have immediately investigated it."
Lacoste's response to *Dirty Laundry*

1.6 Phillips-Van Heusen Corporation (PVH Corp), New York, USA

PVH Corp is the world's largest shirt and neckwear company.[22] PVH Corp provides products to many popular US department stores and sells its products directly to customers through about 700 outlet stores under the brand names Van Heusen, IZOD, Bass and Calvin Klein.[23] PVH Corp licenses its heritage brands globally for a range of products through approximately 40 domestic and 50 international licence agreements covering approximately 150 territories.[24]

Its products are mainly casual apparel and sportswear.[25] It has a range of private brands: Van Heusen, Calvin Klein, Tommy Hilfiger, IZOD, ARROW, Bass, and GH Bass & Co.[26,27] Further brands include Chaps, DKNY, Donald J Trump Signature Collection, Geoffrey Beene, IKE BEHAR, J Garcia, JOE Joseph Abboud, Kenneth Cole New York, Kenneth Cole Reaction, Michael Kors, Nautica, Sea John, Ted Baker, Timberland and Jones New York.[28]

CSR seems to play an important (albeit relatively new) role in PVH Corp's self-image and outward communication: *"Central to our identity is a genuine commitment to corporate responsibility, a fundamental component of how we run our business that is directly linked to our strategies and practices."*[29] PVH Corp's Environmental Statement includes the following: *"We recognise that our supply chain processes impact the environment. While we do not have direct control over our suppliers, vendors and service providers, we […] seek to have our suppliers and vendors meet our environmental requirements with respect to wastewater treatment, hazardous chemicals, air quality and recycling."*[30]

1.7 **Nike**, Oregon, USA

"There is no finish line for environmental efforts – we can always go further".[31]

Nike is the leading seller of athletic footwear and apparel in the world; it sells its products through its own stores and internet sales, and through a mix of independent distributors and licensees, in over 170 countries around the world.

In the US, Nike owns 254 retail stores, 102 Cole Haan stores, 35 Converse stores and 7 Hurley stores. Outside the US, the company offers its products through 202 Nike stores as well as 57 Cole Haan stores. The company also offers its products across various countries through the websites, Nike.com, nikestore.com and nikewomen.com.

In 2010, 35% of global sales were in North America, 20% in Western Europe, 11% in emerging markets and 9% in Greater China.

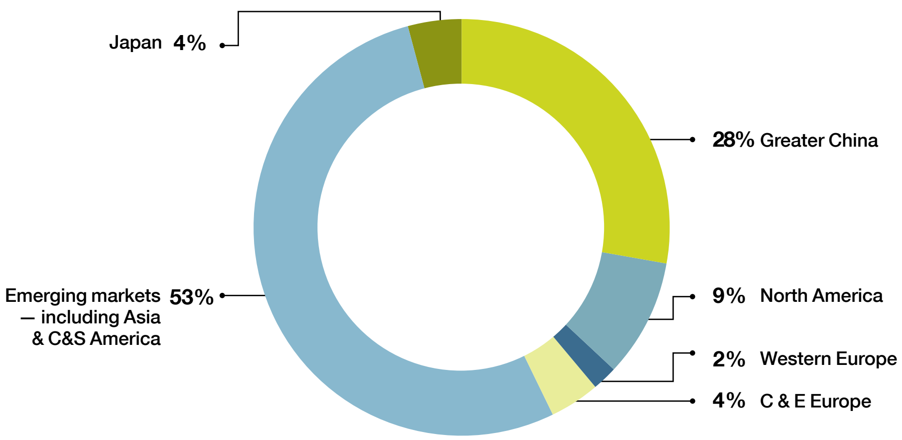
Nike lists 612 contract factories in its 2009 Corporate Responsibility report.[32]

"Our commitment is to create extraordinary performance products for athletes while managing our business within nature's limits."

"We are continuously working toward improving water usage and management of water in our supply chain and welcome Greenpeace's stewardship in this area. We hope this can be the beginning of a dialogue that will lead to raising industry standards in this area."

"Nike Inc currently sources from two factories in the Youngor Group Co, Ningbo Youngor Knitting and Underwear and Ningbo Youngor Sportswear in Zhejiang Province.These factories are cut-and-sew facilities. They do not have manufacturing processes that include use of the chemicals called out in your letter. In addition, neither factory sources materials from the Youngor Dye House."
Nike's response to *Dirty Laundry*

Distribution of Nike contract factories globally



Appendix 1 (continued)

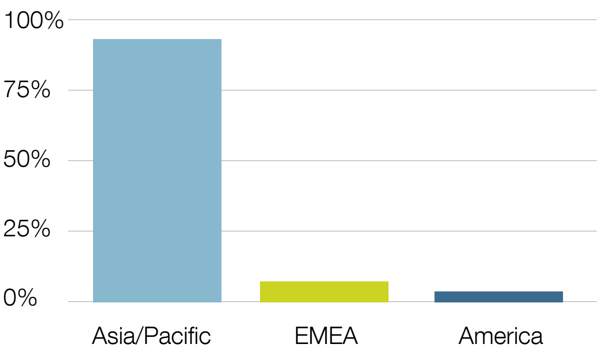
1.8 Puma, Herzogenaurach, Germany

"At Puma, we believe that our position as the creative leader in Sportlifestyle gives us the opportunity and the responsibility to contribute to a better world for the generations to come."

The Puma Vision is: Fair, Honest, Positive, Creative[33]

Puma designs and develops footwear, apparel and accessories. Its Sport Fashion features collaborations with renowned designer labels such as Alexander McQueen, Mihara Yasuhiro and Sergio Rossi. It has a relatively smaller share of the sportswear market in comparison with Nike and Adidas.

Sourcing markets/Units



Puma distributes its products in more than 120 countries and at the end of 2007 Puma had 116 Concept Stores. This number is expected to be significantly higher now. 47% of its sales are in Europe and the Middle East (EMEA), 27% in the Americas and 22% in Asia/Pacific.

Puma has its own internal sourcing company by the name of 'World Cat' and is therefore not reliant on external sourcing agencies. The main focus of World Cat is on the Asian sourcing market, with over 90% of suppliers located in Asia.[34] Puma does not publish an up-to-date list of suppliers, although information from 2005 shows that 28% of its suppliers were located in China at that point in time.

"The protection of the environment is extremely important to PUMA. Our aim is not only to make the production of our products transparent and environmentally friendly for our partners and target groups, but also to continually improve our standards."
Sustainability Report 2007/8

"After having received your letter we immediately contacted the supplier Youngor Knitting and can confirm that Puma has a commercial relationship with ready-made garment producer Youngor Knitting, which is part of the Youngor Group, via its national company Puma Japan...Youngor Knitting annually produces 20,000 t-shirts, jackets and pants for Puma Japan...However, the fabrics mostly originate from Taiwan and Japan and from producers which Puma nominated, therefore not from the own-manufacturing of the Youngor Group in Ningbo...The manufacturer working for Puma Japan only has facilities for cutting and tailoring."
Puma's response to *Dirty Laundry*

1.9 Youngor, Ningbo, near Shanghai, China

YOUNGOR

"Youngor's commitment to social responsibility began early, and announced a policy of 'honesty, pragmatism, responsibility, and harmony' and began making altruism a top priority for the group."[35]

Youngor is China's largest integrated textile company, with world-scale fabric manufacturing, garment making and retailing capabilities. It is based in Ningbo city, near Shanghai, in China's eastern Zhejiang province, and was established in 1979. Li Rucheng, the CEO, developed the small garment manufacturing company into an international garment and textile giant.

Youngor is the world's largest menswear manufacturer, with a production capacity of 80 million clothing items a year. In 2009 it was ranked first by the National Garment Association as the company with the highest sales revenue and sales profit.[36]

Youngor's product line includes shirts, suits, trousers, casual jackets, ties and T-shirts, all officially recognised as leading national brands. In future, Youngor aims to promote its brand image with three branch styles: casual-fashion wear (GY - Green Youngor); business wear (Youngor CEO); and officials' wear (MAYOR & YOUNGOR).[37]

31% of sales revenues are generated on the domestic Chinese market, with 69% coming from international markets, mainly the US, Europe and Japan.[38]

The company is not only a brand it is also a supplier. Youngor has established 156 subsidiaries nationwide to offer pre-sales, sales, and post-sales customer service.

Youngor Knitting's website states that it "*…is now supplying Lacoste, Abercrombie&Fitch, Polo Ralph Lauren, Adidas, Youngor, Perry Ellis, Calvin Klein and other world-renowned clients with 8,000 tons of knitted fabrics and 1.2 million dozens of T-shirts, casualwear items, and sportswear items.*"[39] Further famous brands with links to Youngor subsidiaries are Nike, Puma and Hummel.[40]

In 2008, Youngor acquired Smart Shirts Limited, the former menswear division of Kellwood, one of the top five companies in the US clothing industry, and the Xin Ma Group, one of the top three garment manufacturers in Hong Kong.[41]

Currently, Youngor has more than 100 branches, 400 exclusive shops and 2,000 retail outlets in China.[42] In 2001, Youngor opened its giant flagship store, the largest of its kind in China, in Shanghai's Nanjing Road – China's first commercial street.[43] Through Smart Shirts it has access to outlets in hundreds of US department stores.[44]

"Youngor Sunrise Textile and Garment Company is presently applying for the 'Clean Production Company' licence from China's National Cleaner Production Centre. The company is taking this opportunity to further promote cleaner production and the use of green energy."[45]

"We take the problem which Greenpeace raised seriously and we will work with Greenpeace to find a solution."
Youngor's response to *Dirty Laundry*

Appendix 1 (continued)

2) Main brands that have a business relationship with Well Dyeing Factory Ltd.

2.1. Abercrombie & Fitch, Ohio USA

The A&F brand profiles itself as an international, classical, near-luxury, and youthful All-American lifestyle brand.[46,47] Its specialties are premium-priced goods rather than necessities.[48,49]

Abercrombie & Fitch sells its own brand of clothing and accessories to a customer base that is primarily under 30 years old. It sells the vast majority of its wares in American malls through its four different store brands (Abercrombie & Fitch, abercrombie, Hollister, and Gilly Hicks), each of which caters to different age groups.[50]

Abercrombie & Fitch operated 38 international stores at the end of 2009 and plans to open 29 new international stores in 2010. These include 25 mall-based Hollister stores, its first Gilly Hicks store in the UK, and flagship stores in Denmark and Japan. Accelerated international expansion is part of ANF's growth strategy with international sales increased 102% in Q1 2010.[51] Abercrombie & Fitch opened its first Asian flagship in Japan in December 2009.[52,53]

There is no CSR report publicly available.

"Abercrombie & Fitch is a member of the Apparel Mills and Sundries Program through Business for Social Responsibility (BSR) ... The onus on this issue is shared with the Well Dyeing Factory to accept the initiative and become a participant in the BSR program."
Abercrombie & Fitch's response to ***Dirty Laundry***

2.2 Meters/bonwe, Shanghai, China

The company initiated an "*outsourced production and combined retail of company-owned and franchisee sales"* business model in China, through sourcing from over 300 suppliers concentrated in the Yangtze River Delta and Pearl River Delta, and setting up 300 franchisees and company-owned stores throughout mainland China.[54]

There are now about 3,000 franchised stores within China and total sales of ¥7bn in 2008, ranking first among all the local and international casual wear brands in the domestic market.[55]

"The company sees environmental protection as an important part of its sustainable development strategy and aims to guide its environmental protection and sustainable development strategy with reference to international standards."[56]

2.3 Philips van Heusen Corporation (PVH Corp), New York, USA

(see 1.6 above)

2.4 Li Ning, Beijing, China

"A world-leading brand in the sporting goods industry."[57]

Li Ning Company Limited was founded by the Olympic gold medal-winning gymnast Li Ning in Beijing, China in 1989.

Li Ning is engaged in brand marketing, research and development, design, manufacturing, distribution and retail of footwear, apparel, accessories and equipment for sport and leisure under its own Li-Ning brand and five others, in a multi-brand business development strategy, mainly in the Peoples Republic of China (PRC).

Li Ning's popularity and success to date is mainly based on the domestic market; the Group calls itself one of the leading sportswear brands in China.[58] In 2010 there were 7,478 Li Ning brand retail stores in China (made up of 7,004 brand franchises and 474 directly-managed retail stores in 18 provinces and municipalities).[59] Li Ning has more than 30 subsidiaries in China, one in the US, one in Germany and one in Spain.[60]

The manufacturing of Li Ning products is undertaken by Guangdong Li Ning Sports Development Company Ltd other independent third party manufacturers.[61] *"We will continue to engage contract manufacturers in the production of our products and contract manufacturers will remain as our major suppliers in the near future. As there is an abundant supply of contract manufacturers in the PRC and we will continue to focus on product development and brand management, we have no intention to expand our manufacturing operations in the foreseeable future."*

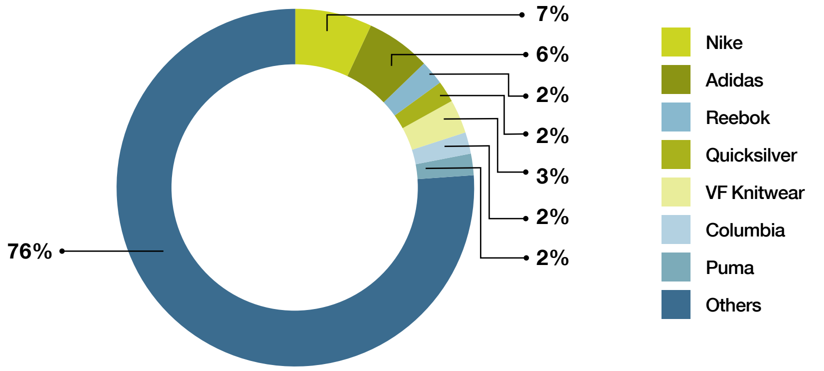
In 2009, Li Ning published its first CSR report, which was also the first in the Chinese sporting goods industry.[62] The report *"...sets out the requirements for suppliers in performing their social responsibilities in respect of labour, safety and environmental protection, which are used by the Group as one of the criteria in identifying new suppliers and assessing the existing suppliers. Enterprises are a part of the community and both the natural and the social environment are indispensable to enterprises. While creating commercial value, the Group keeps a close eye on the harmonious coexistence of itself with the nature and the society in pursuit of sustainable development."*

"We take the problem Greenpeace raised seriously. Well Dyeing is our fibre supplier. We have confirmed that Well Dyeing has received Greenpeace's letter. We have asked them to investigate their pollutant discharge immediately and report back to us. We asked Well Dyeing to proactively contact Greenpeace and cooperate with you."
Li Ning's response to *Dirty Laundry*

3. The global market shares of sportswear companies

In general, the textile and clothing industry is highly fragmented, including a wide range of brands. In the US, the 50 largest brands generated less than 40% of revenue[63], and in the EU, more than 60 companies generated about 25% of revenue[64]. The sportswear industry is less fragmented with a few large companies, in particular Nike and Adidas, having a high level of influence. The following charts show the market shares of sportswear companies.

Athletic Apparel - Global Market Shares[65]



Athletic Footwear - Global Market Shares[66]

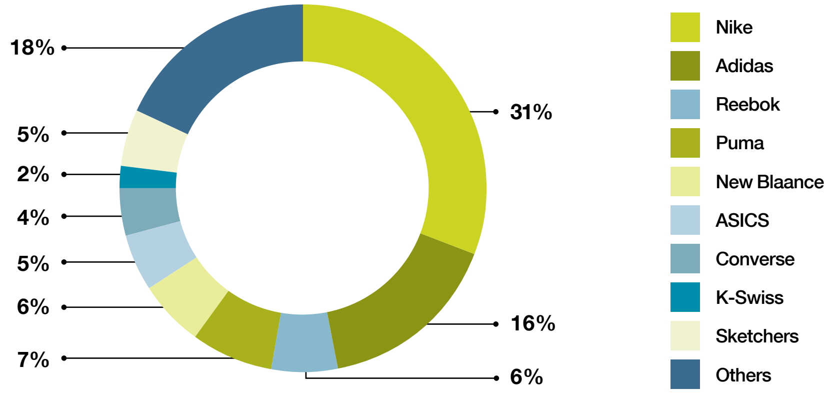


image Textile factory at the Pearl River Delta.

Appendix 2

Profiles of other brands linked with Youngor Textile Complex

Blažek Praha, Czech Republic

Blažek Praha was established in 1992. Today it is first among apparel manufacturers in the Czech market. Its main activity is the manufacture and sale of men's clothing.[1]

"Apart from suits, shirts, ties, coats and cloaks, Blažek offers jackets, pullovers, t-shirts, jeans, underwear and accessories, including a whole collection of shoes and bags as well."[2]

Revenues from production in 2010 were 400m Czech koruna (€16m), and from retail sales in 2010 350m koruna (€14m). Blažek employs 98 people.[3]

Blažek does not refer to environmental issues on its website, but focuses mainly on social topics, such as equal opportunities, fair play and human potential.[4]

Macy's, Cincinnati Ohio, USA

Macy's Inc has corporate offices in Cincinnati and New York and is one of the US' premier retailers, with fiscal 2010 sales of $25 billion.[5] Macy's Inc employs approximately 166,000 people[6] and is recognised as a retail industry leader in developing private brand merchandise.[7]

CSR is important for Macy's self-image and outward communication; *"At Macy's, Inc. we believe that contributing to a more sustainable environment is good business practice and the right thing to do for future generations. As a leading national retailer with a significant workforce, we have the opportunity to make a meaningful difference in improving the environment. And we will do so by using resources more efficiently, providing eco-friendly products that meet customer expectations and striving to reduce our overall impact on the environment."*[8]

Nautica, New York USA

Founded in 1983, Nautica has evolved from a collection of men's outerwear to a leading global lifestyle brand, with products ranging from men's, women's and children's apparel and accessories to a complete home collection.[9] *"Products including Nautica Golf, fragrances, neckware, footwear, watches, hosiery, eyewear, rainwear, leather belts, wallets, gloves, scarves, and home furnishings are also licensed across the globe in over 20 countries."*[10]

Nautica was bought by VF Corporation in 2003.[11] VF Corporation, a leader in branded quality apparel also owns brands like Lee, Wrangler, Reef, Vans and Eastpak.[12] Base mainly in the US, there are about 200 Nautica brand stores operated by independent licensees throughout the world, with the majority located in southeast Europe, Central America and China.[13]

The VF Corporation has Global Compliance Principles that include the environment: *"Facilities should have policies and procedures in place to ensure environmental impacts are minimised with respect to energy, air emissions, water, waste, hazardous materials and other significant environmental risks. Facilities are expected to make sustainable improvements in environmental performance and require the same of their suppliers and sub-contractors."*[14]

Oxford Apparel Group, Atlanta, Georgia, USA

Oxford Apparel produces branded and private label dress shirts, suited separates, sport shirts, casual slacks, outerwear, sweaters, jeans, swimwear, western wear and golf apparel. It also sells products under the Oxford Golf and various Ely & Walker trademarks, and the Hathaway trademark.[15]

Oxford Apparel used to be part of Oxford Industries; in January 2011 it was sold to Li & Fung USA; Oxford Apparel generates about $220m a year.[16] Oxford Apparel products are sold to a variety of department stores, mass merchants, speciality catalogue retailers, discount retailers, speciality retailers, 'green grass' golf merchants and Internet retailers throughout the US.

Li & Fung Limited, the parent company of LF USA, has a large section on corporate responsibility on its website, but little information regarding the environment, of which most is climate-change related. The only statement related to suppliers or subsidiaries is: *"We regularly report on our progress on various environmental measures through the annual reports of our subsidiary companies and, at the group level, through various means such as the UN Global Compact Communication on Progress Report."*[17]

Profiles of other brands linked with Well Dyeing Complex

Peerless Clothing Inc, Montreal, Quebec, Canada & New York, USA

"Largest manufacturer of men's clothing in North America."[18]

The company does not advertise itself and generally keeps a very low profile. It produces licensed clothes for a large variety of brands. These include designer labels such as Lauren Ralph Lauren, Calvin Klein, DKNY, Tallia Orange, Sean John, Michael Kors, Joseph Abboud, Elie Tahari, Izod, Van Heusen, Bill Blas and Hickey.[19]

"Founded in 1919, Peerless Clothing, Inc. is the largest domestic producer of men's tailored clothing in North America ... The company supplies men's tailored clothing to most every major department and specialty store retailer in the United States." [20]

"Peerless Clothing has doubled its revenue in the past few years…"[21]

"Upon review of your letter to Peerless Clothing Inc, I would like to inform you that we no longer use Youngor Group."
Peerless' response to *Dirty Laundry*

Polo Ralph Lauren, New York, USA

"Our Company is a global leader in the design, marketing and distribution of premium lifestyle products including men's, women's and children's apparel, accessories, fragrances and home furnishings." [22]

"Our brand names include Polo by Ralph Lauren, Ralph Lauren Purple Label, Ralph Lauren Women's Collection, Black Label, Blue Label, Lauren by Ralph Lauren, RRL, RLX, Rugby, Ralph Lauren Childrenswear, American Living, Chaps and Club Monaco, among others."[23]

Ralph Lauren contracts to over 400 different manufacturers worldwide. In fiscal 2010, over 98% of Ralph Lauren products (by dollar volume) were produced outside the US, primarily in Asia, Europe and South America.[24] *"None of the manufacturers we use produce our products exclusively."*[25]

No CSR or statements on the environment from Polo Ralph Lauren could be found.

American Eagle, Pittsburg, PA, USA

American Eagle (AEO) is a mall-based apparel and accessories retailer that sells its own brands and products throughout the US and Canada. AEO operates three different chains, each of which targets a different segment of customers within the broad 15-40 age group.[26] The overwhelming majority of AEO's sales come from its namesake American Eagle operations.[27]

The first three outlets in China, scheduled to open in early 2011, are earmarked for Hong Kong, Beijing and Shanghai.[28,29]

AEO has a CSR programme that includes four key focus areas: Supply Chain Factories, Environment, Employees and Communities. *"Our environmental strategy is built on four pillars: conserve resources, minimise waste, improve product and packaging, and enhance engagement. We still have a long way to go in developing our comprehensive sustainability programme, but step by step, we are beginning to reduce our environmental footprint."* [30]

"We are familiar with Well Dyeing and understand that it has supplied fabric for our garments in the past. We have confirmed that Well Dyeing does not have any fabric programmes currently in development for our garments at this time."
American Eagles' response to *Dirty Laundry*

Carters (CRI), Atlanta, Georgia, USA

Carter's produces casual apparel, accessories, bedding, room décor, toys for babies, toddlers and kids. Carter's is the leading brand of children's clothing in the US today.[31]

Carter's CSR programme focuses almost exclusively on children's charity. It makes the following reference to the environment in its Annual Report 2010: *"We are subject to various federal, state, and local laws that govern activities or operations that may have adverse environmental effects. Noncompliance with these laws and regulations can result in significant liabilities, penalties, and costs. Generally, compliance with environmental laws has not had a material impact on our operations, but there can be no assurance that future compliance with such laws will not have a material adverse effect on our operations."*[32]

Appendix 2 (continued)

GAP, San Francisco, California, USA

Gap Inc is one of the world's largest speciality retailers, with more than 3,000 stores. In the long term, Gap plans on expanding their international operations from their current base of 332 stores (as of May 2010) in Europe and Asia. Its international operations are split between the Gap and Banana Republic - Old Navy does not have stores outside of North America.[33] Gap currently has franchise agreements in place for 24 countries on four continents; 130 franchise stores are open in Asia, Europe, Latin America and the Middle East. In 2010 Gap plans to open stores its first stores in Australia and China.[34] Apart from improving international and online sales, the company is also looking to revive its flagging sales and market share in North America.[35]

The CSR report is very comprehensive and centres around the mantra "Embracing our responsibility".[36]

"Around the world, we're reducing waste, saving energy, and incorporating sustainable design into everything from our products to our stores."[37]

"Clean Water Program: We're requiring special treatment of water used to launder Gap, Banana Republic, and Old Navy denim to ensure that it's clean and safe when it leaves the denim laundry."[38]

"We work hard to ensure our business is handled in a socially and environmentally responsible manner, and we take claims such as these very seriously."
Gap's response to *Dirty Laundry*

JC Penney, Texas, USA

JC Penney (JCP) produces its own private brands in addition to selling products from other companies, with a high reliance on private-label goods. Brands include Call It Spring, Bisou Bisou, Arizona, I (love) Ronson, Decree, Cindy Crawford Collection, J Ferrar, JOE, Linden Street, a.n.a. American Living, Mango, Modern Bride, Nicole, Okie Dokie, Ambrielle, Alan B Worthington, Olsenboye, One Kiss, Sephora, Stafford, St John's Bay, Studio, Supergirl, cooks and Liz Claiborne.[39]

JC Penney's has 1,108 department stores.

JCP has *"Matters of Principle"* in environmental responsibility that commit the company to *"…. continually review its operations for the purpose of assessing their potential impact on the environment or on related human health or safety issues; and develop and implement plans, programmes, and policies for eliminating or minimising significant threats to the environment or to human health or safety that may be identified. (...)"* [40]

Kohls, Wisconsin, USA

Kohl's (KSS) is a US department store chain that sells a mix of items including men's and women's apparel, home decor, and accessories. The department store appeals to middle-class consumers by selling discounted branded and private label clothing and home goods. It competes with other US national department stores such as JC Penney and Macy's Inc.[41] As of year-end 2010, it operated 1,089 stores and also offers online shopping. It has no stores outside of the US.[42]

Kohl's has a website on Advancing Environmental Solutions[43] as well as a CSR report (2010), where it is stated: *"Kohl's Environmental Mission: Kohl's is committed to protecting and conserving the environment by innovative solutions that encourage long-term sustainability."* [44]

Semir, Wenzhou City, China

The Semir Brand, established in 1996, has become a leading brand in China's casual clothing industry. The brand now has over 3,000 outlets across China. Its clothes are designed with a focus on vitality and fashion and are targeted at a younger audience.

Semir follows the environmental policy of "strictly following laws, preventing pollution, conserving resources, and continuous improvement." The company proactively develops high-quality strategic suppliers and strictly controls production according to quality assurance system procedures.[45]

A Semir advertisement saying **"I can't stop global warming, but at least I look good"** received criticism from many environmentalists and net citizens.[46]

Uniqlo, Yamaguchi, Japan

Fast Retailing is the holding company for Uniqlo, which is a retail chain operator specialising in in-house designed casual clothing for men and women of all ages. It operates 829 stores under the name of UNIQLO, mostly in Japan but with international outlets, as well as having an online store. With worldwide sales of €7.31bn in 2009, Uniqlo ranks fourth among worldwide apparel speciality stores (not including department stores).[47] About 75% of its sales are from Japan.[48]

Fast Retailing's CSR Report 2011 has statements regarding production and its supply chain: *"Fast Retailing complies with environmental laws and keeps abreast of issues facing the international community and the global environment. We believe the first thing Fast Retailing can do to minimise its environmental impact is to improve management efficiency."*[49]

With regard to its business and major environmental Impacts, it lists among other things: *"Carrying out environmental initiatives at factories. We introduced the FR Environmental Standards at material factories and commenced monitoring."*[50]

Yishion, Humen DongGuan City, China

Yishion sells casual wear and sports wear. It has 19 regional offices in China and over 3,000 franchised stores. Since 2003, operations have been expanded to Bahrain, Hong Kong, Iran, Jordan, Kuwait, Malaysia, Oman, Qatar, Saudi Arabia, United Arab Emirates and Vietnam.[51]

Yishion supported the anti-drugs campaign in China and educational programmes to help people in need. However, there is no information publicly available about the environment or sustainability.

Appendix 3

Background information on the hazardous chemicals found in the sampling

This section provides further information on some of the organic chemicals found in the samples of effluent collected from Youngor Textile Complex (Pipe 1) and Well Dyeing Complex (Pipe 1) and on the heavy metals found at high concentrations in the effluent collected from Well Dyeing Complex (Pipe 1). For details of all of the chemicals found and the effects of key substances see the full technical report by the Greenpeace Research Laboratories.[1]

Organic Chemicals

The presence of this diverse array of chemicals at concentrations in the low or sub parts per billion range indicates that the effluent discharged from these two facilities is acting as a point source (in some cases a periodic point source) of a range of hazardous substances to the local aquatic environment. On the basis of information available, it is not possible to determine the specific sources of these various substances in the wastewater within the facilities, though they could include the deliberate use of these chemicals in processing and finishing operations on the site or the washing out of residues of such chemicals or their degradation products from yarn, fabric or textile products brought on to the site for processing from manufacturers located elsewhere. Further detailed investigations of activities taking place within the facility would be necessary in order to determine likely sources.

What are these organic chemicals?

Organic chemicals isolated in samples	Manufacturing facility and sample reference where found	Where and how they are used, particularly in the textile industry	Known effects on the environment and human health
Alkylphenols (nonylphenol and octylphenol)	Youngor Textile Complex; 14µg/l nonylphenol in the effluent collected from Pipe 1 at 1100 on 8th March 2011 (CN11001) Well Dyeing (CN10013, effluent, Pipe 1), nonylphenol and octylphenol.	These chemicals are formed by the breakdown of nonyl phenol ethoxylates (NPEs) and octyl phenol ethoxylates (OPEs) respectively, substances which are used as detergents,,surfactants and dispersants (eg. during dyeing) in numerous industrial processes, including during the manufacture of textiles. Nonyl and octyl phenols do also have other industrial uses in their own right.	Nonyl phenols (NPs) and octyl phenols (OPs) are well known persistent and bioaccumulative environmental contaminants, with hormone-disrupting properties for many aquatic organisms. More information on these substances is presented in Box 2.2.
Perfluorinated chemicals	Youngor Textile Complex; in all 3 samples collected March 2011 (CN11001, CN11002, CN11003) perfluoroctanoic acid (PFOA) was found at concentrations between 0.13 and 0.14 µg/l (130-140 ng/l). Other perfluorocarboxylic acids were also found, though at concentrations around an order of magnitude lower (0.013-0.031 µg/l, 13-31 ng/l), while perfluoroctane sulphonate (PFOS) was present at lower levels again (0.0031-0.0087 µg/l, 3.1-8.7 ng/l).	The unique properties of perflourinated chemicals (PFCs) have led to their widespread use as water-, grease- and stain-repellent finishes for textiles and papers; specialised industrial solvents and surfactants; ingredients in cosmetics, plastics[2,3], firefighting foams; and ingredients in lubricants for high-temperature applications.[4] See Box 2.1.	PFCs are man-made chemicals which are not produced by natural processes and hence never occur in nature other than as a result of human activity. They are highly resistant to chemical, biological and thermal degradation[5], and many are also relatively insoluble in both water and oils. PFCs bioaccumulate, including in humans and have a range of impacts on the environment and human health, for example they impact the developing immune system, and have adverse effects on the liver in mammals.[6,7,8,9,10,11] Some have also been shown to act as hormone disruptors.[12] See Box 2.1.

Organic chemicals isolated in samples	Manufacturing facility and sample reference where found	Where and how they are used, particularly in the textile industry	Known effects on the environment and human health
Trialkyl phosphates, including tributylphosphate (TBP), triethylphosphate (TEP) and tris (2-ethylhexyl) phosphate (TEHP)	Youngor Textile Complex TBP was found in effluent from Pipe 1 (sample CN10042. TEHP was found in effluent samples CN11001, CN11002 & CN11003. Well Dyeing: TBP and TEP were found in effluent from Pipe 1 (sample CN10013,	Tributyl phosphate (TBP) is widely used in various industrial processes, including by the textile industry due to its properties as a strong wetting agent and strong polar solvent.	TBP is continuously lost to the air and water during use; it degrades slowly or moderately in the environment. TBP is toxic to aquatic life, for example some protozoa species, and can have acute toxicity to fish.
Quinone and di-ketone derviaties; eg. the anthraquinone (AQ) derivative amino-anthraquinone and the benzophenon derivative methyl 2-benzoylbenzoate	Youngor Textile Complex amino-anthraquinone in effluent from Pipe 1 (samples CN10042 & CN10050,) Well Dyeing; the benzophenone derivative methyl 2-bezoylbenzoate in effluent from Pipe 1 (Sample CN10013).	Synthetic AQs are widely used in dyeing operations (second in bulk only to azo dyes[13], most commonly for cotton, cellulose-based fibres and some synthetic fabrics[14]. The AQ derivative identified (amino-anthraquinone) is a common intermediate in the synthesis of a range of AQ dyes, many of which can degrade to release amino-anthraquinone.[15] The benzophenone derivative, methyl 2-benzoylbenzoate, has uses as a photoinitiator in UV-curable inks.	Many AQ derivatives are known to be toxic to animals and/or plants (see e.g. Sendelbach 1989[16] for a review of early evidence); indeed, their ability to cause oxidative damage to DNA in dividing cells has led to their use in very controlled doses as anti-tumour drugs, among other medical applications.[17] Amino-anthraquinone has been shown to be carcinogenic in laboratory studies, as well as damaging to the kidneys. Its degradation products are toxic to aquatic life as well as being persistent. More information on AQ and its derivatives and the toxicity of methyl 2-bezoylbenzoate is given in Box D in the Technical Note.[18]
Amines from the breakdown of Azo dyes, including aniline, chlorinated anilines such as dichloroaniline (DCA or 2-chloroaniline), methylaniline, ethylaniline and diethylaniline as well as o-anisidine	Youngor Textile Complex; in all 3 effluent samples collected March 2011 (CN11001, CN11002, CN11003), aniline, 2-chloroaniline, methylaniline, ethylaniline and diethylaniline were found (at concentrations ranging from 0.1-2.1 µg/l)k, as well as the carcinogenic form o-anisidine (at 0.07-0.08 µg/l). Well Dyeing (CN10013, Pipe 1) dichloroaniline (DCA)	Azo dyes are one of the main types of dye used by the textile industry. However, some azo dyes break down during use and release chemicals known as aromatic amines, some of which can cause cancer.[19] The EU has restricted the use of azo dyes that release cancer-causing amines in any textiles that come into contact with human skin.[20]	Anilines are an important class of environmental water pollutants due to their wide usage and high solubility in water. The release of anilines into the environment within industrial effluents has been previously reported, including within effluents from the textile sector.[21,22] Aniline and its chlorinated derivatives, including mono-, di- and trichlorinated isomers, are toxic to a wide range of aquatic organisms.[23]
Chlorophenols - di-, tri- and pentachlorophenols	Youngor Textile Complex: di-, tri- and pentachlorophenols in effluent from samples CN11001, CN11002 & CN11003) in the range of 0.03-0.06 µg/l	Chlorophenols are a group of chemicals used as biocides in a wide range of applications, from pesticides to wood preservatives and textiles. The EU banned production of PCP-containing products in 1991 and now also heavily restricts the sale and use of all goods that contain the chemical.[24]	PCP is highly toxic to humans and can affect many organs in the body. It is also highly toxic to aquatic organisms.[25]
Chorinated solvents (dichloroethane, trichloromethane & tetrachloroethene) were present at low concentrations.	Youngor Textile Complex: dichloroethane (0.9 µg/l in CN11003), trichloromethane/ chloroform (all three samples at 0.9-4.8 µg/l) and tetrachloroethene (0.4 µg/l in CN11002 and CN11003),	Chlorinated solvents, such as trichloroethane (TCE), are used by textile manufacturers to dissolve other substances during manufacturing and to clean fabrics. Since 2008 the EU has severely restricted the use of TCE in both products and fabric cleaning.[26]	Chlorinated solvents are volatile compounds, some of which are persistent and resist biodegradation.. For example, TCE is an ozone-depleting substance that can persist in the environment. It is also known to affect the central nervous system, liver and kidneys.[27,28]

Heavy Metals

In addition to the organic chemicals identified, the wastewater sample from Well Dyeing Complex pipe 1 (CN10013) also contained concentrations of dissolved chromium (42 µg/l), copper (24 µg/l) and nickel (37 µg/l) at levels that were slightly elevated (2-4 times higher) above levels typically found in uncontaminated surface waters. Background surface waters concentrations of dissolved chromium and copper are both typically below 10 µg/l, and often far lower, while those of nickel are generally below 20 µg/l.[29,30,31,32] The levels of dissolved chromium, copper and nickel in these samples were considerably lower than their maximum allowable concentrations under the Guangdong effluent standard[33] and effluent standards specific to the textile industry.[34]

Far higher total concentrations (dissolved forms plus those bound to suspended particulates) were found for most metals in the whole (unfiltered) sample from pipe 1 (CN10013) – total chromium (2820 µg/l), copper (13400 µg/l) and nickel (2800 µg/l). These metals were present almost exclusively (99% or more) in particulate-bound forms.

image: A Greenpeace campaigner takes a sample from a wastewater discharge pipe.

Metals

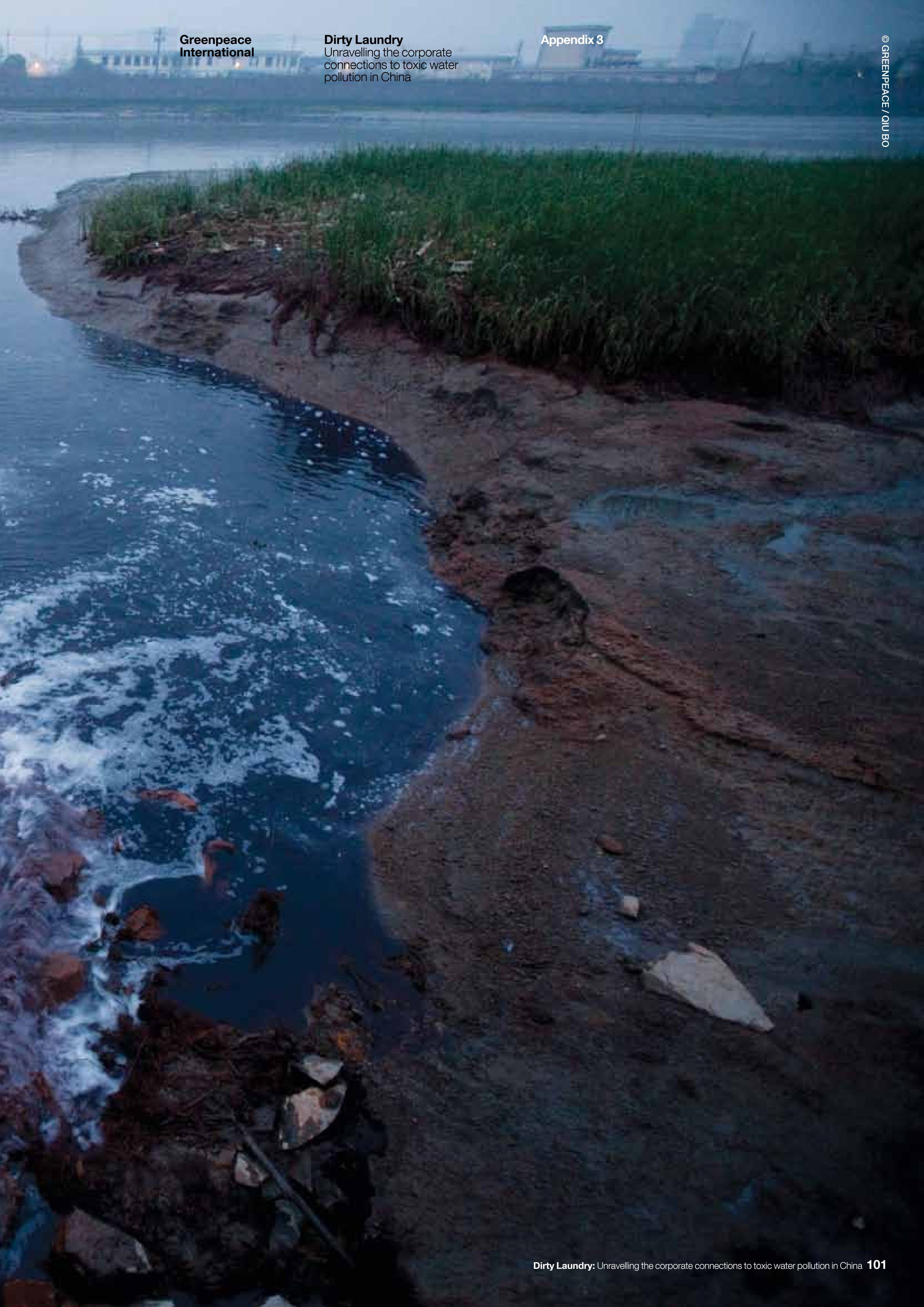
Chromium (Cr) is primarily used in the metallurgical industry (in stainless steel and other alloys), as well as in various industrial processes including leather tanning and certain textile processes.[35,36] Hexavalent chromium compounds are used in metal finishing (chrome plating), and also in certain textile manufacturing processes, in wood preservatives and as corrosion inhibitors.[37,38] Chromium normally exists in the environment in trivalent Cr(III) forms which generally have very low solubility in water and tend to rapidly precipitate or adsorb onto suspended particles and bottom sediments; hexavalent Cr(VI) forms can exist, though far less frequently, and these compounds are usually converted rapidly to trivalent Cr(III) compounds by reducing compounds. Hexavalent forms tend to be readily soluble in water and therefore can be highly mobile in aquatic environments.[39,40,41] Uncontaminated surface water typically contains less than 10 µg/l of chromium, and concentrations in uncontaminated freshwater sediments are typically below 100 mg/kg.[42,43] Chromium (III) is an essential nutrient for animals and plants, though large doses may be harmful. In contrast, hexavalent chromium is highly toxic even at low concentrations, including for many aquatic organisms.[44] Hexavalent chromium compounds are also corrosive, and in humans allergic skin reactions readily occur following exposure, independent of dose.[45] Furthermore, hexavalent chromium is a known human carcinogen under some circumstances.[46] The Chinese national wastewater discharge standard and the equivalent Guangdong Province standard set the same maximum permissible concentrations of 1500 µg/l (1.5 mg/L) total chromium, and of 500 µg/l (0.5 mg/L) hexavalent chromium.[47.48]

Copper (Cu) is a widely used metal, primarily as a pure metal or as part of mixtures (alloys) with other metals, though there are also many other uses of copper compounds, including within metal finishing processes and textile manufacturing, including dyeing processes.[49] The manufacture of plumbing materials is one of the main uses of main uses of copper metal and alloys, in part due to the malleability and thermal conductivity of copper.[50] Levels of copper in the environment are typically quite low, commonly less than 50 mg/kg in uncontaminated freshwater sediments.[51] Background concentration of dissolved copper in uncontaminated surface waters can vary significantly, but levels are typically below 10 µg/l, and often far lower.[52,53] Copper is an important element for humans and animals in low doses. However, exposure to high levels of bioavailable copper can lead to bioaccumulation and toxic effects.[54] Releases of copper to aquatic systems are of particular concern as many aquatic organisms are extremely sensitive to copper, particularly in soluble forms which are generally far more bioavailable and toxic to a wide range of aquatic plants and animals[55,56] with some effects occurring even at very low concentrations[57]. The Chinese national wastewater discharge standard and the equivalent Guangdong Province standard set the same maximum permissible concentrations of copper of between 500 and 2000 µg/l (0.5 - 2.0 mg/L) depending on how the receiving water body is used.[58,59,60]

Nickel as a metal and its alloys, as well as nickel compounds, has many industrial uses, including in metal plating, the manufacture of plumbing and electronic devices, in catalysts, batteries, pigments and ceramics.[61,62] Nickel is also used in certain textile dyes (eg phthalocyanine dyes), but to a lesser extent than other metals such as copper and chromium.[63]

Levels of nickel in the environment are typically low, with uncontaminated freshwater sediments generally containing below 60 mg/kg nickel and concentrations in uncontaminated surface waters typically below 20 µg/l.[64,65,66] Although nickel bound to sediments and soils is generally persistent, water-soluble nickel compounds can be quite mobile. Very small amounts of nickel are essential for normal growth and reproduction in most animals and plants, and this is most likely also true for humans.[67] However, toxic and carcinogenic effects can result from exposure to higher concentrations for a wide range of life forms, including gastrointestinal and cardiac effects.[68,69] In humans, a significant proportion of the population (2-5%) are also nickel sensitive, and effects can occur in sensitised individuals at far lower concentrations.[70] For some aquatic organisms, impacts can occur at very low nickel concentrations.[71] Furthermore, some nickel compounds have been classified as carcinogenic to humans, and there is also evidence of carcinogenicity in animals.[72,73] The Chinese national wastewater discharge standard and the equivalent Guangdong Province standard set the same maximum permissible concentrations of nickel of 1000 µg/l (1.0 mg/L) .[74,75]

image: At 5am in the morning, large quantities of polluted water pour out from the discharge pipe of the Youngor textiles factory, in Yinzhou district, Ningbo. The discharge pipe flows directly into the Fenghua River.



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Executive Summary

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Section 1

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Section 2

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