Hidden Consequences

Section One: Rescuing our iconic rivers
Rescuing our iconic rivers

An opportunity to act, before it’s too late

Rivers provide a lifeline for the communities through which they flow and for the cities that swell on their banks. They supply vital and life-sustaining resources, including drinking water, crop irrigation, and food. They also serve as a critical support system for industrial activity, providing water for many manufacturing or cooling processes.

It is this industrial activity that often has a hidden, darker side.

This section portrays four iconic rivers in the Global South, which are increasingly being destroyed by industrial activity and the use of hazardous substances. These rivers are the Chao Phraya in Thailand, the Neva in Russia, the Marilao River System in the Philippines and the Yangtze in China.

Hazardous industrial chemicals can be found in all of these rivers. Many of these substances are persistent and can gradually accumulate in sediments and in the food chain, impacting upon critical resources, such as water for agriculture and drinking water, and contaminating wildlife and entire ecosystems. This, in turn, can cause long-term, irreversible damage to people, the environment, and the wider economy. Worse still, this damage has the potential to spread far beyond the boundaries of the rivers themselves. For example, when these rivers discharge into seas and bays, the pollutants they carry are transported even further – affecting coastal and marine environments and resources.

The evidence of pollution by persistent hazardous substances contained within this section shows that industrial production around these rivers is taking place with little regard for the ecological and human health consequences. This is happening despite the fact that industries from the Global North have had to learn difficult lessons about the serious repercussions of short-term thinking (see Section 2) and that avoiding the use and discharge of hazardous substances is both possible and more cost-effective (see Section 3).

It is not too late to act. It is still possible to limit and prevent future damage to these – and many other rivers – but new rules and responsibilities are required. It is clear that the use of pollution control or wastewater treatment does not deal effectively with all hazardous substances, and only postpones the need for more effective measures. The problem has to be tackled at its source. This means that in order to eliminate and prevent discharges of hazardous chemicals into the environment, all their uses need to be phased out – throughout the chain of production. To be effective, this action needs to be based on knowledge, which in this case requires the quantities of hazardous substances used and discharged to be reported and monitored, with full availability of data to the public.

The time to act is now. As the following four case studies demonstrate, there is an urgent need to eliminate the use and discharge of hazardous substances by industry, to rescue these precious rivers and protect the livelihoods of all those who rely upon them.
The Chao Phraya River

The Chao Phraya is the most important river system in Thailand. Comprising four major, upstream tributaries, the river flows southwards through Bangkok before emptying into the Gulf of Thailand. In 2009, the population of the Chao Phraya River basin was nearly 13 million people. Due to its profound cultural and historical significance, many revere the Chao Phraya as the ‘heart’ of Thailand, and the river basin is widely regarded as the most important food production area in the country. In addition, much of the upstream river and associated wetlands are very rich in wildlife – the Chao Phraya and its tributaries boast over 300 species of fish, for example.

The river basin is also vital to the country’s economy. Over 30,000 industrial facilities are located in the Chao Phraya basin, including pulp and paper, textile and dyeing, rubber and food production industries. However, the ongoing industrialisation competes with traditional uses such as fishing or water for agriculture, and also with the provision of safe drinking water to Thailand’s biggest metropolis – Bangkok. The river currently suffers from growing pollution, and the water quality in its lower reach – where most of the industry is located – has been classified as ‘deteriorated’, based on the Thai water quality index. Yet despite significant quantities of hazardous chemicals being manufactured and in use, little is known about the releases or about the extent of pollution caused by hazardous substances from industrial sources. This is true not only for the Chao Phraya River, the groundwater, ecosystems and agricultural land in the basin, but also for other river basins in Thailand. The absence of good data gathering systems and data management problems are partly to blame for this.

However, a number of specific studies in the Chao Phraya basin have provided clear evidence that certain effluents containing persistent, bioaccumulative and toxic chemicals, are being discharged by industry and are contaminating the river basin. For example, a study by Greenpeace in 2003 showed the presence of many toxic metals and organic pollutants in the sediments of canals and in effluents discharged into them at an industrial estate at Samut Prakarn. Substances including copper, lead, nickel and zinc were found in the sediments of one canal at between 50 and 100 times the background levels.

Phthalate esters and nonylphenols – both toxic substances – were also identified. Industrial chemicals known as perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) have also been measured in a 2009 study in water samples from the Chao Phraya River and in wastewater discharges from treatment plants at industrial estates. One sampling point was near the mouth of the Chao Phraya at the Gulf of Thailand. Here, the calculated loads of these substances entering the Gulf via the Chao Phraya had the potential to enter the food chain, given the ‘important food sources’ in the Gulf. There was also indication of tap water contamination at some locations. Both chemicals have been shown to disrupt hormone systems and are now widely found in humans. Although the studies discussed above are not designed to provide a comprehensive overview of the situation, they nonetheless demonstrate industrial contamination of water and sediments in parts of the Chao Phraya and its interconnecting canals. There is no reason to presume that these are isolated or unusual instances, but more investigation is needed in order to form a clearer picture of the situation. The potential for accumulation of persistent chemicals in the environment and bioaccumulation in wildlife and humans can already be seen, even if the scale of the problem so far is not fully clear.

There is an urgent need to establish the extent of the problem and develop appropriate solutions – including the establishment of a priority substance list – with the aim of eventually eliminating all releases of hazardous substances. In this respect, a precautionary and sustainable approach to the management of hazardous substances is required, starting with more transparency and publicly accessible data.

Time is short. The fact that many of the hazardous substances identified in the Chao Phraya and in the sea water off the coast of Thailand are banned in other more developed markets, or have been prioritised for elimination by the Stockholm Convention on Persistent Organic Pollutants, should be a wake-up call to the authorities to start addressing this problem now.
‘About 30 years ago, when I was a kid, there were only orchards in this area. People made sugar, and rowing boats came in and out to transport the sugar. I used to swim in the canal. My parents and neighbours fished in this canal. We caught fish and huge river prawns that are now very expensive. We could catch plenty of them. We didn’t sell them but caught enough for our consumption.

‘Around 1973, factories began springing up. At first there was only a corn syrup factory and that didn’t really cause so much pollution. People around here began to sell their land to factory builders. Orchards disappeared and were replaced by more and more factories. When the garment bleach and dyeing factory came here, the water got worse.

‘There are about five factories of this kind today, dumping their wastewater into both canals. They usually do that during the night. In the evening, I can see the water turns dark and the foul odour gets really strong at dawn. We have petitioned the provincial office, but it has fallen on deaf ears. The factories don’t care about us and don’t tell us anything, but what they do to my community is so severe.

‘We should have the right to know what kind of substances the factories are using and how much pollution they release and how dangerous it is. I want someone to work on it. It should be the beginning of new things.’

Boonsong Nakarak – a resident of a community living by the Klong-Samrong canal and the Klong-Mahawong canal, which connect to the Chao Phraya River, Samut Prakarn province
In many areas from the upper reach to the middle reach of the Chao Phraya, water is extensively used for domestic consumption. However, it has been limited to only cleaning purposes as the water is no longer drinkable.
The Neva River

The Russian Neva, the third largest river in Europe in terms of average discharge, supplies St Petersburg and its 5 million inhabitants with all its drinking water. Despite this critical role, its waters remain largely unprotected from contamination with hazardous chemicals as a result of both formal and informal industrial activities.

St Petersburg and its surroundings are home to a large number of diverse industrial enterprises, including a substantial concentration of electric and electronic equipment manufacturers. While the final products are ‘high tech’, their production uses a wide range of hazardous chemicals, which generate large quantities of liquid wastes. In the St Petersburg area, these are either discharged directly into the Neva River or directed to one of three large common effluent treatment plants. The solid waste (sludge) from the treatment plants was, until recently, sent to landfill. Here the sludge ended up in disposal pits where it could continue to produce liquid wastes, which have the potential to pollute surface waters, groundwater and soil.

One toxic waste landfill in the Neva watershed, Krasny Bor, receives not only wastewater sludge, but also industrial organic and inorganic hazardous waste from enterprises in Leningrad Oblast, including industrial solvents, PCB-containing equipment, and pesticides. This landfill is the cause of substantial water contamination with a wide range of contaminants – including phenols and polychlorinated biphenyls (PCBs) – and illustrates the failure of traditional methods of pollution control, as the pollutants simply get transferred from one medium to another.

In addition, there are many poorer urban areas where unofficial and unregulated ‘recycling’ of electronic waste takes place. A common practice is the open burning of cables, circuit boards and other components in order to recover traces of precious metals for resale. However, such activities may also release hazardous chemicals, including PCBs, brominated flame retardants (BFRs) and toxic heavy metals. Their release further exposes humans and the environment to significant quantities of these substances and adds to the pollution in the Neva River basin.

An investigation by Greenpeace in 2010 showed the presence of a variety of toxic metals and persistent organic chemicals in some industrial effluents, in the sludge of certain wastewater treatment plants, in river sediments, and in soils where electronic waste ‘recycling’ had been carried out. The results demonstrated considerable contamination by industrial substances, including chemicals with persistent and bioaccumulative properties.

Together, these factors highlight the urgent need for systematic assessment of industrial pollution of the Neva and the environs of St Petersburg. Although an official system for monitoring the water quality in the Neva basin is in place, only a relatively small range of persistent and potentially hazardous chemicals are routinely measured in the surface water by the state agency. As a result, only limited information on persistent organic pollutants (POPs) or heavy metal contaminants in the Neva River and its sediments are available. Similarly, monitoring of industrial effluents, whether directly discharged into rivers or sent to treatment plants, is not comprehensive. There is no disclosure of the data to the public and there is little incentive for companies to substitute hazardous chemicals or implement pre-treatment measures.

In order to address the problem of hazardous chemicals, it is therefore necessary to first identify the sources, range and quantities of hazardous chemicals being released into the river basin by industry, and to provide full public access to this data. As the situation in the Neva illustrates, pollution is caused by hazardous chemicals at both ends of a product’s life cycle – in its manufacturing and its disposal. This demonstrates the urgent need for a chemical management strategy that is based on a political commitment to ‘zero discharge’ of all hazardous substances, including both those present in products, and those found in industrial releases.
The Slavyanka, a tributary of the Neva. The Neva remains largely unprotected from contamination with hazardous chemicals as a result of both formal and informal industrial activities.
The Krasnenkaya river, a tributary of the Neva.
Hidden Consequences: The costs of industrial water pollution on people, planet and profit

Section one

Greenpeace International
The Marilao River System

The extensive Marilao River System in the province of Bulacan, near Manila in the Philippines, now holds the dubious distinction of being labelled by the Blacksmith Institute as one of the world’s dirtiest rivers.36

The report by the Institute points to the high levels of pollution being due to wastes received from various sources, including tanneries, gold and precious metals refineries, a legacy of lead-smelting waste, from numerous municipal dumpsites, and from small-scale lead recycling facilities along the river. A monitoring programme for the Marilao River System – set up in 2008 with the Asian Development Bank37 – confirmed the contamination of the Marilao River System by heavy metals, with the levels of many exceeding the surface water standards38 set by the Department of Environment (DENR-EMB)39 at one or more monitoring stations. Furthermore, in a number of groundwater samples the levels of manganese, zinc, nickel and cadmium in groundwater exceeded the Philippines National Drinking Water Standard. At least one of the groundwater sources sampled was being used as drinking water by the local community.40

The monitoring programme report also documents river sediment samples with levels of metal contaminants – notably of copper, nickel, mercury and lead – that exceed the limits set under the US Washington State sediment standards.41 This contamination is most likely a result of a long-term build up of these persistent metal pollutants over many years.42

Shellfish and freshwater fish from the Marilao River System, widely consumed by the population in the area and in metropolitan Manila, also displayed evidence of metal contamination, in some cases with levels in excess of established limits for human consumption.

The report observes a correlation between the monitored river contamination and the levels of heavy metal pollutants – manganese, zinc and nickel – that were found in fish. The report also warns that the heavy metals present in the edible fish and shellfish can, as a result of their consumption, potentially bioaccumulate in humans over the years, leading to the possibility of “certain diseases and ailments”.43

Case Study: The Philippines

The need for the rehabilitation of the Marilao, Meycauayan and Obando rivers has been recognised by authorities in the Philippines. In 2008, the DENR and the Provincial Government of Bulacan established the country’s first Water Quality Management Area (WQMA)44, including a draft 10-year action and implementation plan45. However, while this plan covers the clean-up of the existing contamination and wastewater treatment for ongoing discharges, it contains very few concrete measures to prevent future contamination by addressing the problem at source and eliminating the actual use of hazardous chemicals. As the plan stands at the moment, it is questionable whether it will be able to fully deliver on its goal of achieving complete control over the source of the pollution. However, it is clear that any effort undertaken to clean up the existing damage to the river system will entail massive costs for the provincial government.

Already, the consequences for the national economy have been demonstrated by the scale of the estimated clean-up costs46 – which are prohibitive in a country such as the Philippines. Experience from the Global North (see Section 2) would also suggest that these costs are just the beginning. In this situation, the authorities are rightly focusing on controlling the sources of pollution, yet their proposed plan will not completely eliminate the use and discharge of hazardous chemicals, such as heavy metals.

There is an urgent need to implement plans for clean production and to eliminate discharges of hazardous chemicals into the river basin, with the priority on substituting the most hazardous substances with safer alternatives (see Section 3). The creation of a national Pollution Release and Transfer Register (PRTR), supported by UNITAR, would be a first step47, followed by a more comprehensive list of priority substances to be tackled48 and a robust strategy aiming to eliminate all releases of hazardous chemicals within one generation.
Greenpeace International

Hidden Consequences
The costs of industrial water pollution on people, planet and profit

Section one

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A Greenpeace volunteer talks to a local resident beside Marilao River in Bulacan. The river has been identified by the DENR as one of the Philippines’ 50 dead rivers due to heavy pollution.
Workers operate a machine that separates various layers of animal skins to be processed inside a tanning facility located in Meycauayan, Bulacan, north of Metro Manila.
The Yangtze River

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

Commercial activity has prospered; over a billion tons of cargo passed through Yangtze River ports in 2008, and these convenient national and international transport links and abundant water resources also offer vital advantages to industry. Industrial developments are particularly concentrated in the Yangtze River Delta region. Major industries there include raw chemicals and chemical products, chemical fibres, petroleum refining, coking and nuclear fuel processing, smelting and pressing of ferrous metals, transport, electric equipment and machinery, telecom, textiles, and computers and other electronics.

The delta region alone accounts for around one-fifth of China’s entire economy. It includes 16 cities, among them Shanghai, whose 20 million people are dependent on the Yangtze for drinking water.

The river receives around 30 billion tons of wastewater every year (including domestic sewage), some of it untreated. According to Müller et al (2008), the quantity of pollutants disposed of into the Yangtze may be ‘one of the world’s largest’, albeit diluted by the enormous volume of water in the river. Approximately 15% of the river failed to meet the standard for use as a drinking water source in 2008.

While a great variety of chemicals are inevitably discharged by industry every day, perhaps the most insidious are the persistent and bioaccumulative substances. Despite the dilution factor mentioned above, these substances can be subsequently re-concentrated back to harmful levels in sediments and biota.

Inevitably, such chemicals will eventually become problematic if their discharge is continued. In an interview with Greenpeace, Dr. Beat Müller of the Swiss Federal Institute of Aquatic Science and Technology recalled that in Europe during the 1950s and 60s the attitude that ‘dilution is the solution to pollution’ had disastrous effects, as levels of persistent chemicals built up over time in sediments and wildlife. Existing data suggests that there is no room for complacency. A range of organic pollutants, including persistent substances, has already been found in the Yangtze.

Combined with other pollutants, such as increasing quantities of nutrients from sewage and agriculture discharging into the estuary and East China Sea, it is considered that the loads of pollutants in the Yangtze could have a ‘disastrous effect’ on the estuarine and marine area. Persistent substances that have the potential to accumulate in the food chain could have serious consequences for fisheries in this area.

In a 2010 study, Greenpeace looked at samples of popular edible fish – wild southern catfish and common carp – from locations near four major cities along the Yangtze. Alkylphenols (APs) – a group of persistent hazardous chemicals with hormone disrupting properties – were recorded in the livers of all but one fish. The results support the bioaccumulation of APs in the fish species along the Yangtze and show that APs are widespread in fish along the Yangtze – with consequences for human exposure since the two species sampled are commonly eaten.

Another persistent industrial chemical, perfluorooctane sulfonate (PFOS), was also detected in almost all the samples. The beginnings of long-term build-up of bioaccumulative and hazardous substances in the Yangtze River food chain seem very clear; the widespread pollution by these and other hazardous chemicals released by industrial processes could undermine the health of the river and the sustainability of the region’s economy.
In addition to the enormous quantities of wastewater discharged into the Yangtze River Basin on a daily basis, industrial accidents can also result in serious additional pollution. With thousands of chemical enterprises operating in the Yangtze River Basin, the danger of an accidental release of hazardous chemicals into waterways is present for as long as these substances remain in use. Pollution incidents may have immediate and large-scale consequences for local communities, ecosystems and the economy – for example, if drinking water sources are affected. In one incident in the Yangtze River basin, water supplies to nearly 1 million people were suspended when malfunctioning equipment at a fertiliser plant caused serious river pollution. In another region, a serious explosion at a chemical factory, which caused five deaths, released 100 tonnes of benzene and other chemicals, and lead to the temporary shutdown of tap water supplies for 3.5 million people.

It should not be assumed that the Yangtze River has an unlimited capacity to absorb and dilute industrial pollution. There is grave concern for the Yangtze River, because of the sheer scale of the industrial development that is taking place and because of the huge number of people whose livelihoods depend upon its waters. Contamination by hazardous chemicals is already measurable despite the volume of the river, and is also threatening the East China Sea. A plan that leads to ‘zero discharge’ of hazardous substances needs to be urgently implemented in order to avoid the potentially enormous costs of remediation, and before China’s rapid economic growth pushes the Yangtze beyond its ecological limits.

‘Many chemical and industrial enterprises are built along rivers so that they can dump the waste into water easily. Excessive use of fertilisers and pesticides also pollute underground water. The contaminated water has directly affected soil, crops and food.’

Chen Zhizhou, a health expert with the Cancer Research Institute affiliated to the Chinese Academy of Medical Sciences
‘The river water smells here – you can’t even use it for bathing, or else you’ll itch and break out in little red spots all over your body. Don’t even think about drinking this stuff.’

Xie Chunlin, a local fisherman at Yanglingang, Fuqiao, in Taicang

Image: Families who fish and drink water from the Yangtze river have noticed that the water has a strange flavour. They have reported the worsening pollution and requested the installation of tap water for their village, but years have passed with no action being taken.
Hidden Consequences
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