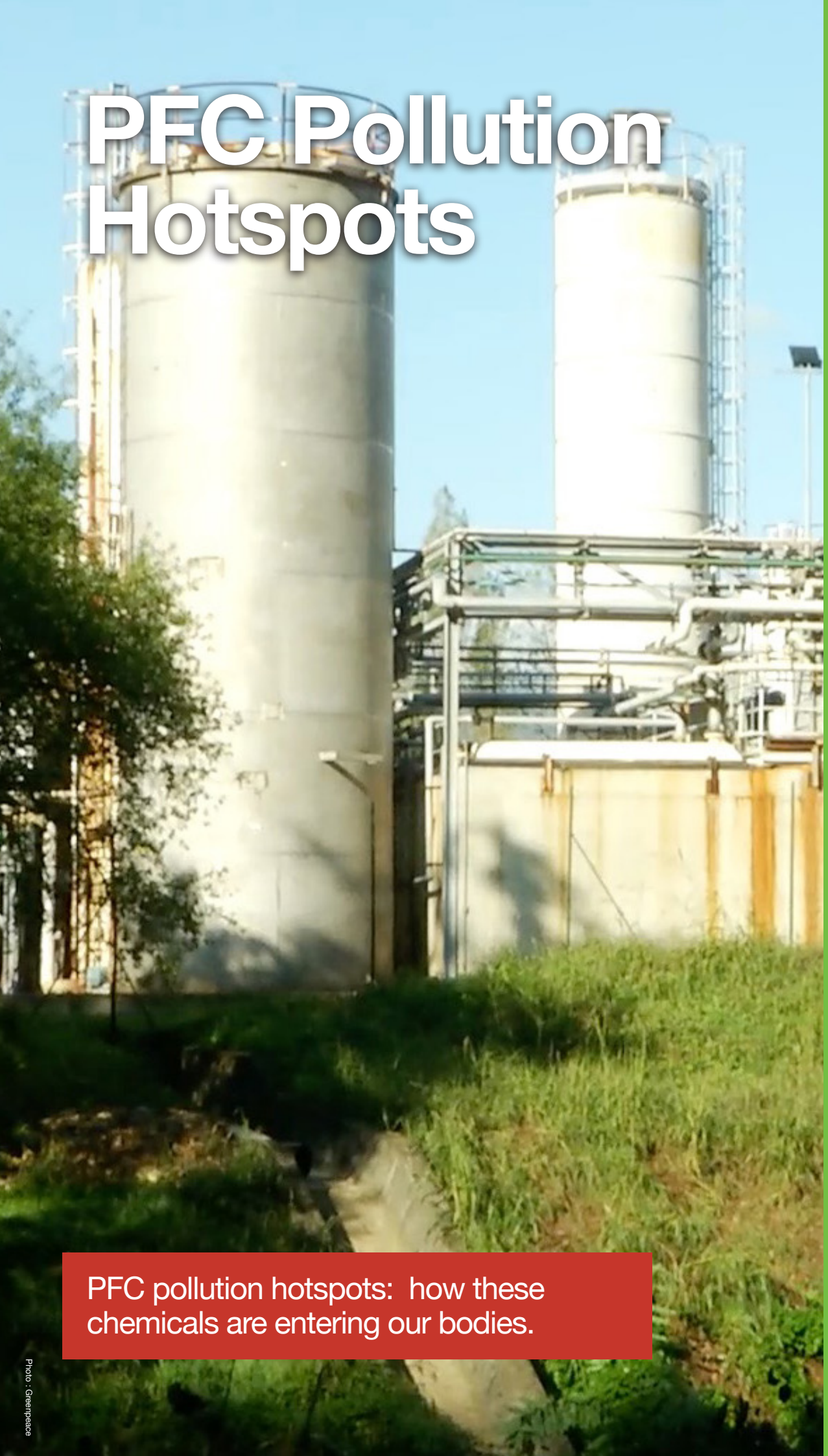
PFC Pollution Hotspots



PFC pollution hotspots: how these chemicals are entering our bodies.

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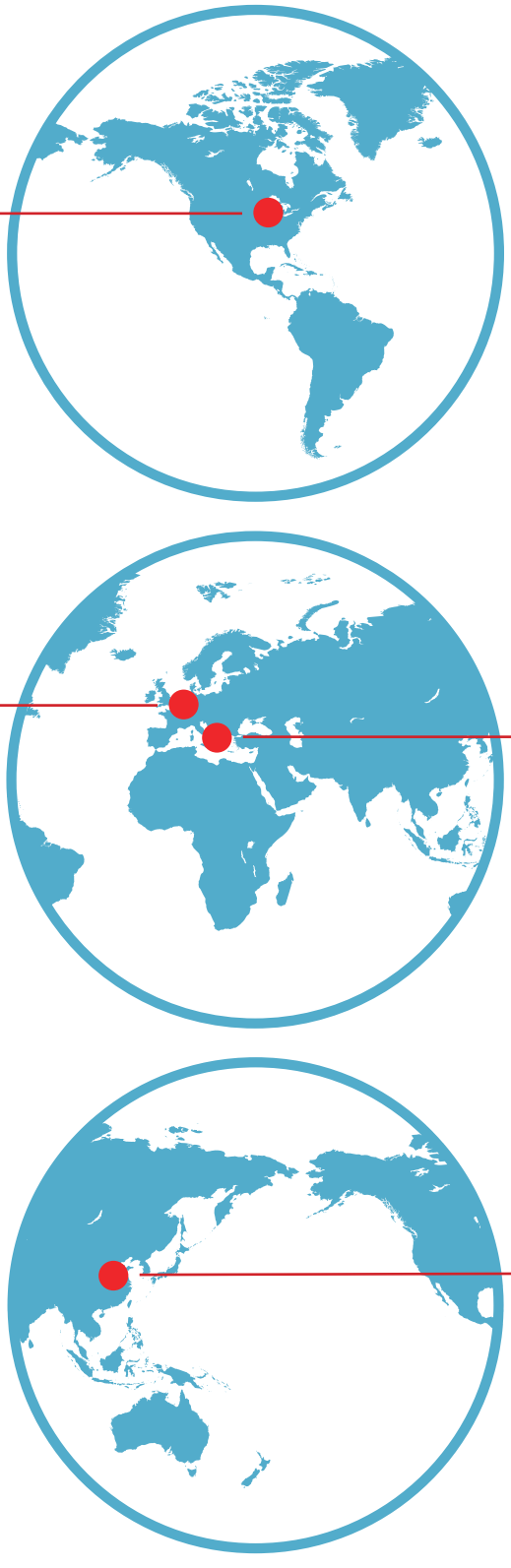
Executive Summary

The manufacture of hazardous per- and polyfluorinated chemicals (PFCs) is leading to contamination of the local environment, including surface water, drinking water, groundwater as well as air and dust. There is evidence of a recent and/or historical PFC pollution in four locations around the world where chemical companies manufacture PFCs, including those used in PTFE, also known as Teflon – in the mid-Ohio valley, USA; in Dordrecht, the Netherlands and Veneto region, Italy in Europe; and in Shandong Province, China. In the USA and Europe, pollution problems have been building up since as long ago as the 1950's, when PFC production started, dominated by the production of the PFCs PFOS and PFOA – now known to be highly persistent and toxic. A global ban on PFOS and increasing restrictions on PFOA mean their manufacture in the USA and Europe has now been stopped, although the manufacture of other PFCs, which are also potentially problematic, continues. However, global production of PFOA to make PTFE (Teflon) has now shifted to China, where the same pattern of pollution is now being replicated.

PFCs are used in many industrial processes and consumer products, and are well known for their use by the outdoor apparel industry in waterproof and dirt-repellent finishes. They are used for their unique chemical properties, especially their stability and their ability to repel both water and oil. However, PFCs are environmentally hazardous substances and many of them are persistent in the environment.[1] Once released into the environment most PFCs break down very slowly, if at all, and therefore they can remain in the environment for many years after their release and are dispersed over the entire globe.[2]

Pollution hotspots



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Mid-Ohio valley

The best known case of PFC contamination worldwide is near the DuPont facility in the Mid-Ohio valley (Ohio-West Virginia, USA). Over many years of production, this chemical plant has polluted people's drinking water – both private wells and nearby public water supplies - in Ohio and West Virginia. The hazardous and persistent PFC chemical PFOA was used by DuPont to manufacture fluoropolymers such as PTFE - better known as Teflon – from the 1950s until production is planned to end in 2015 according to a 2009 agreement[3] with its use peaking in 1990s.[4] PFOA has been identified in public drinking water in the area near the plant since 1980s,[5] with past levels in public drinking water ranging from 0.03 µg/l in Mason (WV), to 3.55 µg/l in Little Hocking (OH), with even higher levels of PFOA – up to 22.1 µg/l - found in private drinking water. [6]

PFOA is still present in drinking water from Mid-Ohio valley, at a level of 0.0631 µg/l, according to 2014 data from the US EPA,[7] despite the fact that DuPont has reduced emissions of PFOA and related chemicals from its facility and residual levels in products by 99% in 2013, working towards their elimination by 2015.[8] Drinking water pollution has also been linked to the presence of PFOA in local people: a 2006 study[9] found that the level of PFOA in residential drinking water was the primary determinant for concentrations of PFOA in the blood (serum) of people living near the chemical plant.

Following the settlement of a class action lawsuit, a Science Panel[10] was chosen jointly by the parties in order to investigate the potential health effects of exposure to PFOA on over 69,000 residents living for over a year in districts where the public water supply was contaminated by PFOA. Very high levels of PFOA – a median of 28.2 ng/ml,[11] with a mean of 83.0 ng/ml - were found in serum in the local population, compared to median levels in the general population of 3.9 ng/ml.[12] The levels of PFOA varied according to the distance of people's houses from the plant.[13]

In two different epidemiological studies[14],[15] exposure to PFOA has been associated with both kidney and testicular cancer, and associations with prostate and ovarian cancer and non-Hodgkin lymphoma are also suggested.

Dordrecht, Netherlands

One of largest PFC production sites in Europe is in the city of Dordrecht in Netherlands, where nine manufacturing plants make many different products including Teflon. Opened in 1960[16], the plant is now owned by Chemours, a company created in 2015 as a DuPont spin-off.[17]

The hazardous and persistent PFC chemical PFOA was used in this plant up to 2012,[18] mainly for the manufacture of PTFE (eg Teflon). PFOA was recently classified as a class 2B carcinogen - possibly carcinogenic to humans - by IARC.[19] In 2015, after questions in the Dutch parliament, and following a request by the Ministry of Infrastructure and the Environment (IenM), the RIVM[20] published the results of an investigation to evaluate the risks of exposure to PFOA for residents living nearby the Dordrecht chemical plant. The report found that people living in the direct vicinity of the Dupont/Chemours factory have been exposed to PFOA in the air for many years, in excess of limit values. The report concludes that "it is likely that they have been chronically exposed to higher values of PFOA than the limit value for chronic exposure derived by RIVM". Despite the releases to the air, PFOA levels were not elevated in drinking water supplies to the population neighbouring the factory.

Several emission scenarios were used in order to estimate the likely period that people could have been exposed to PFOA above the limit value. The report states that despite the high levels of PFOA in air the risk of cancer appears to be limited, however, "in the most unfavourable case, the limit value was exceeded for 25 years. At such a level of chronic exposure to PFOA, health effects, such as on the liver, cannot be excluded".

In April 2015, a Dutch newspaper, Algemeen Dagblad, published the results of PFOA blood tests on a two residents living near the Dordrecht plant.[21] The man, a former DuPont worker, had 28.3 ng/ml of PFOA in his blood, while his wife, who didn't work at the plant, unexpectedly had 83.6 ng/ml (three times higher than her husband). No other measurements of PFOA concentrations in the blood serum of local residents have been conducted. The PFOA values recorded in the couples' whole blood are much higher than those reported in a 2010 study carried out on serum of Belgian population (where the median levels of PFOA in serum were 2.0 ng/ml - range 1.4-3.4 ng/ml)[22], despite the values detected in blood serum are not directly comparable with the concentrations recorded in whole blood. After these results were published in a Dutch newspaper, many residents living in the area signalled an interest in getting their blood tested for this chemical.[23]

As a result, the GGD[24] (the governmental Health Service) is organising the collection of blood samples from local residents in the towns of Dordrecht, Sliedrecht and Papendrecht. The aim of the study is to verify if people living near the DuPont / Chemours plant have elevated levels of PFOA in their blood. The blood samples will be taken both from long-term residents near the factory and - as control - from people who lived further away, or for a shorter time near the factory. Selected participants received an invitation in late August 2016 and the blood tests took place in September and October 2016. The results are due to be published by RIVM in mid-April 2017.

Veneto Region, Italy

A 2013 study[25] by the Italian Ministry of Environment, showed the presence of the persistent and hazardous chemicals PFCs[26] in the surface and drinking water of the Veneto Region of North East Italy. The investigation covered an area of around 150 km^2 in the provinces of Vicenza and Padua and to some extent Verona, with 350,000-400,000 people potentially exposed. This study found high concentrations of PFCs, including PFOA, in surface waters (up to 6872 ng/l for all PFCs and up to 3733 ng/l for PFOA alone) as well as drinking water (up to 3138 ng/l for all PFCs and up to 1886 ng/l for PFOA). The levels in drinking water are incredibly high, with concentrations of PFOA between 230 and 3600 times higher than those in nearby areas not affected by contamination, which ranged from 0.5 to 8 ng/l.

The source of about 97% of the PFC contamination in the local area was identified as a wastewater treatment plant that receives discharges from many industries, in a 2013 study by ARPAV[27] (the Regional Agency of Environmental Protection of Veneto Region). The majority of the companies discharging into this plant are tanneries as well as well as tanneries, the companies discharging into this plant include the chemical company Miteni, an enterprise specializing in the production of fluorinated intermediates for different applications[28] including water repellent treatments for textiles and leather (as stated by Miteni's CEO in a recent interview[29]). Miteni[30] began manufacturing fluorinated intermediates in 1964, under the name RIMAR; it was renamed Miteni in1988 after a change in ownership, becoming a joint venture between Mitsubishi Corporation and ENI, the Italian oil company. In 2009 the company became an affiliated company of the International Chemical Investor Group (I.C.I.G.).

After the discovery of this extremely high environmental contamination, the Veneto Regional authorities started monitoring for the presence of PFCs in surface and drinking water in the area. The samples, analysed from July 2013 to May 2016, showed that while levels have dropped since the 2013 study, both short chain PFCs (eg PFBA and PFBS) and long chain PFCs (eg PFOA, PFOS), are still detectable in drinking water at concentrations of up to 1400 ng/l for PFOA, up to 110 ng/l for PFOS, and up to around 600 ng/l and 700 ng/l for PFBA and PFBS respectively,[31] despite the fact that Miteni stopped manufacturing PFOA and PFOS in 2011.[32] These values are very high compared to samples from nearby areas that are not contaminated, which are all below 10 ng/l; (140 times higher for PFOA, 11 for PFOS, 60 for PFBA and 70 for PFBS).

In May 2015 the Veneto Region, together with the Istituto Superiore di Sanità (National Institute of Health), announced the launch of a biomonitoring program of 600 local residents in order to evaluate their exposure to PFCs through analysis of human blood serum.[33] The preliminary result from the period July-April 2016, showed concentrations of PFOA of up to 754.5 ng/g (median 74.21 ng/g), PFOS up to 70.27 ng/g (median 12.0 ng/g) and for other PFCs up to 14.41 ng/g (median 0.75 ng/g) in the most exposed populations. Compared to median concentrations of PFOA and PFOS in blood serum of the general population in Italy, these levels are more than 20 times higher for PFOA and 1.9 times higher for PFOS. The median concentrations recorded in blood serum in the general population in Italy[34] are 3.59 ng/g for PFOA and 6.31 ng/g for PFOS, similar to levels recorded in people from a non-exposed area in the Veneto Region (approximatively 30 km away from the area of the most exposed population), where median levels are 2.4 ng/g for PFOA 7.5 ng/g for PFOS.[35] Unfortunately, comparable data for PFCs other than PFOA and PFOS in the general population are not available.

Shandong Province, China

Among the many chemical plants manufacturing fluorinated chemicals in the Shandong Province (China), is the Dongyuechem Company,[36] one of the largest producers of PTFE in China[37] (making approximately 37,000 tons per year[38]) – used to make Teflon, for example. As stated on the company's website[39] "the group also has been affirmed as excellent supplier by some famous company, such as DuPont, Daikin, Solvay, Haier, Hisense, Gree, Midea, Changhong and Chunlan".

High levels of PFCs[40] have been found in surface waters around this chemical plant, with total levels up to 496,000 ng/l found in the Xiaoqing River and up to 1,860,000 ng/l[41] (one of the highest concentrations ever reported - with PFOA dominating) in the river receiving effluent discharged from the chemical plant. Facilities in Shandong Province, as well other facilities in China, are scaling up their manufacture of PFOA to meet domestic and international demand, as result of a commitment by the eight leading manufacturers of fluorinated chemicals in USA and Europe to work towards the elimination of PFOA as part of the US EPA Stewardship Program.[42]

As reported in a recent study [43] PFCs have also been detected in indoor and outdoor dust samples around this plant, with a concentration pattern that decreases according to the distance from the plant for both indoor and outdoor dust samples. In indoor dust samples, for instance, the sum of PFCs was up to 180 times higher in the area 2 Km far from the plant compared to sampling sites located 20 km away. Dust is considered one the main routes of PFC exposure, together with food, drinking water and inhalation of contaminated air. The PFC signature in indoor and outdoor dust analysed in this study matched the one found within the fluorochemicals plant. According to the main findings of this study, the estimated daily intake of PFOA via indoor dust by toddlers (2-5 year olds) living 2 km from this plant, poses a risk to human health, although exposure remains within the provisional tolerable daily intake values. High levels of PFCs have also been found recently in groundwater samples around the plant (with the sum of PFCs ranging from 1.68 ng/l to 273,000 ng/l)

A study carried out in 2008[45] on the presence of PFCs in whole human blood of adults from different Chinese cities showed that people from Zouping, a city that is 35-40 km away from the above mentioned fluorochemicals plant, had the highest median levels of PFOA (3.26 ng/ml) in whole blood, compared to samples from the other cities investigated in the study (where the median PFOA concentrations were between 1.04 and 1.78 ng/ml). Unlike the Zouping samples, the profile of PFCs in these other cities was dominated by PFOS, at 51 to 67% of the total concentration. The pattern of PFCs detected in the blood of people from Zouping, with PFOA dominating (at 45% of the total concentration of PFCs detected), were found to be comparable to that recorded in other studies carried out on people living near a fluorinated chemicals centre in Fuxin (China).

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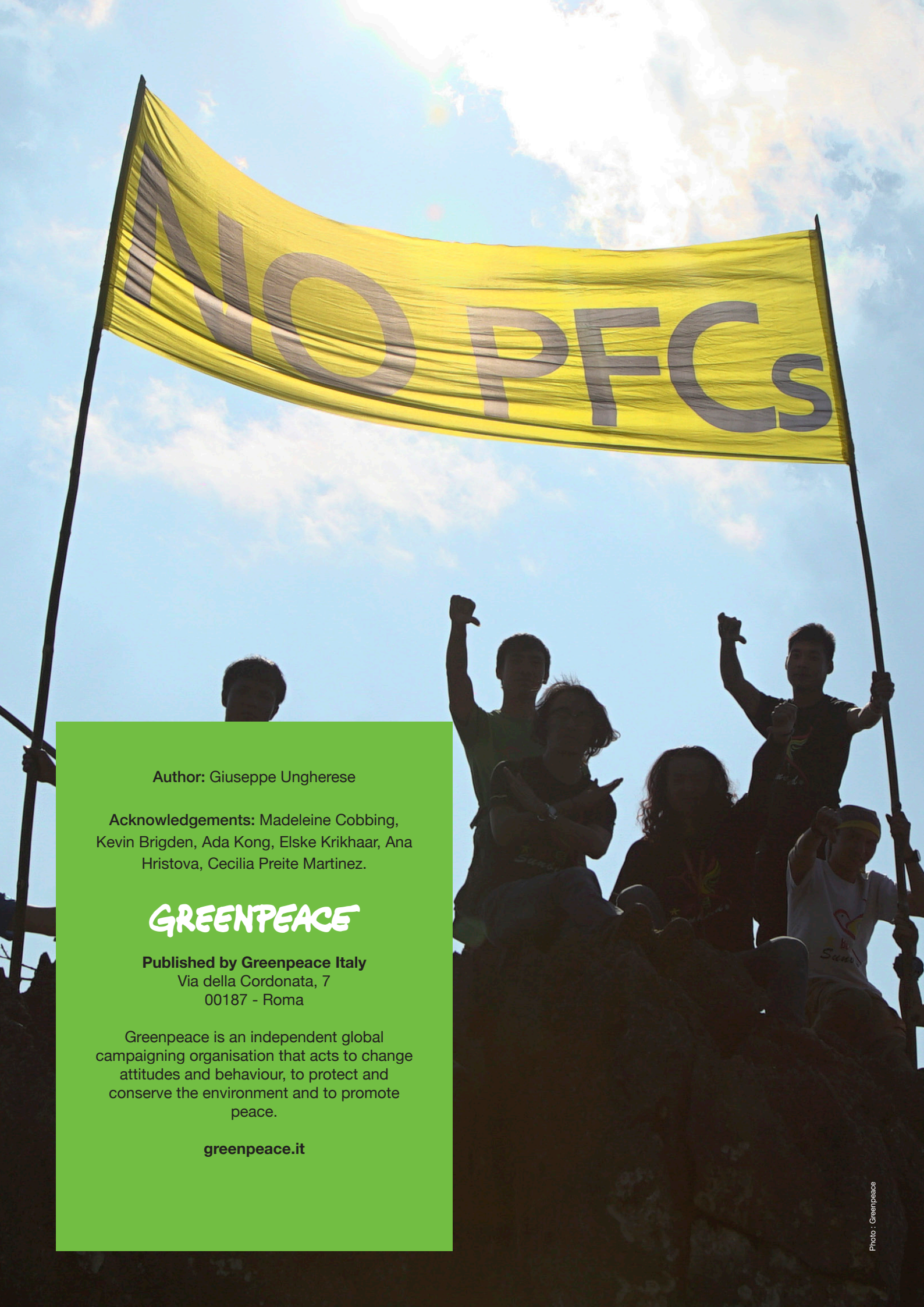

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