

Are forever chemicals fueling a public health crisis?

The Flemish newspaper *De Standaard* published an article under the surprising headline “3M draagt een verpletterende verantwoordelijkheid (3M bears a crushing responsibility)”. The article referred to the frightful contamination in Zwijndrecht by per and polyfluoroalkyl substances (PFAS). Clearly, we have not heard the last of this. Minister Demir announced in the Flemish Parliament that 3M will be held responsible and forced to remediate the soil. It is not clear however how this task will be achieved. Also, a new descriptive soil research is currently being carried out on the 3M site, but the results are not expected soon [Cools & Poppelmonde 2021].

Please, don't tell us you didn't know

According to Robert Bilott, we face a unique health threat from a class of industrial chemicals that most Americans have never heard of. Neither have many Europeans heard of PFAS. These chemicals are widely used in everyday products such as non-stick cookware and stain-resistant fabrics, even though science has shown that they are linked to a range of deadly diseases, reproductive problems and other ailments. Bilott claims that powerful corporations are fighting to protect the use of these profitable chemical compounds and that US regulators are doing next to nothing to stop them [Gillam 2019].



Sources of PFAS [<https://www.defence.gov.au/Environment/pfas/PFAS.asp>]

In *Exposure, Poisoned Water, Corporate Greed, and One Lawyer's Twenty-Year Battle against DuPont* Bilott [2019] wrote about his fight against the chemical giant – a powerful story of malice and manipulation; about the shortcomings of environmental regulations and about a lawyer's search for truth. Bilott was determined to denounce the lies and also to debunk the many often re-occurring falsehoods and prevent one of the greatest planetary crises of the 21st century. In 1998 began a two-decade long battle with Dupont, which was to expose one of the worst cases of environmental pollution in modern history and the cover-up by the Dupont company, which blatantly endangered the health of hundreds of thousands of people. Acting on behalf of one single farmer, who was convinced that the creek on his property was being poisoned by the run-off from a nearby DuPont landfill, Bilott finally discovered the truth; about unregulated and toxic PFAS, which DuPont's own

scientists had warned about for years; about a company that continued to allow these chemicals to be carelessly dumped into nature and pollute the drinking water. The scandal went on until Bilott forced the polluters to face the consequences.

That same year, the film *Dark Waters*, with Mark Ruffalo, Anne Hathaway and Tim Robbins was also released. The film was based on the true story of the gruesome environmental secret uncovered by Bilott. In searching for the truth, Bilott put his future at risk as well as his safety and that of his family. The independent filmmaker Tod Haynes surprises audiences with his David versus Goliath story, featuring a legal fight that went on for years against DuPont, who continued to hide the dangerous chemical poisoning by Teflon. Haynes not only scrutinises the scandal; he also highlights attrition by the cynical giant, and makes pain and anger tangible in his cinematographic masterpiece. The striking prologue of *Dark Waters* conveys a sense of existential dread inspired by the abhorrent ecological pandemic and chemical contamination [<https://www.hollywoodreporter.com/lists/true-story-dark-waters-how-accurate-are-characters-1254811/>].

Bilott's and Haynes's laudable crusades are widely known thanks to coverage by reporters. Both the book and the movie provide a great deal of detail and further context.

PFAS became a priority issue in the scientific realms of chemical contaminants

The exceptional PFAS characteristics provide both a wide range of interesting industrial applications and a great deal of anxiety. In the so-called Madrid statement, fourteen experts expressed their doubts and fears regarding the use of PFAS. The statement highlights the scientific consensus at the time and the unsurpassed environmental resistance and bioaccumulation, and potential toxicity of the entire class of PFAS. These compounds are known as *forever chemicals*. The statement [Blum et al. 2015] also provides a roadmap for scientific researchers, governments, manufacturers, purchasing organisations and consumers to work together to limit the use of PFAS worldwide. Finally, it also aims at developing safer alternatives.

In its response to this statement, the FluoroCouncil endorsed the numerous political recommendations, provided they apply only to long-chain PFAS. Long-chain fluorine compounds are molecules with a backbone of seven or more carbon atoms. FluoroCouncil supported the call by the scientific and professional community to limit the production and (illegal) dumping of long-chain PFAS, but claimed that the short-chain PFAS already studied are not likely to harm human health or the environment. Presumably, they are cleared from the body more quickly and are less toxic than the long-chain compounds [Bowman 2015]. This message has only partially mitigated the existing anxiety!

After the Madrid statement, there was also the Zurich statement. On November 17, 2017, some fifty international experts gathered in Zurich for a two-day workshop. The group identified the common needs and goals of scientists and policy makers, provided interesting recommendations for cooperative actions and outlined a possible reinforcement of the PFAS dialogue platform. Yet, these recommendations were not necessarily those of official policy or incumbent governments. They do however illustrate the priority needs and issues for a safer future [Ritscher et al. 2018].

Five essential needs were outlined – reflection themes for a safer future that did not come from nowhere, but corresponded to fairly well-known concerns. The numbers are staggering as is the diversity of unregulated PFAS on the market and in the environment. According to the National Institute of Environmental Health Sciences the number of different PFAS molecules largely exceeds 4700 [<https://www.niehs.nih.gov/health/topics/agents/pfc/index.cfm#footnote>]. So the participants unanimously agreed that further research and management of PFAS requires a coordinated approach. At the same time, the participants believed that any action should target groups of PFAS rather than individual molecules. For the chemical soup of thousands of molecules – and that number is increasing day by day – a molecule-by-molecule approach is totally inadequate. The participants also felt that the exceptional durability of PFAS has not been sufficiently addressed in current assessment and management procedures. Their pronounced persistence can lead to a permanent and almost irreversible accumulation of PFAS in the environment and subsequently to increased exposure and risks to humans and animals.

The specific needs are:

- data on toxic effects, including underlying mechanisms and long-term health effects,
- continued monitoring to identify new PFAS and develop effective regulations, and
- the development of analytical techniques, including standardised methods for assessing PFAS in all kinds of (consumable) goods and not just in environmental samples.

When chemical contaminants are involved, the infamous c-word is mentioned

For extensive studies I have to refer to the scientific literature, e.g. Pelch et al. [2019]; Banwell et al. [2021]; Black et al. [2021]; Brase et al. [2021]; and Fenton et al. [2021]. It is particularly striking that there seems to be a strong link with the so-called western diseases. In all likelihood, our prosperity has led to undesirable consequences.

Epidemiological studies on the effects of PFAS exposure in humans suggest that exposure may be associated with health issues such as increased cholesterol levels, changes in liver enzymes, decreased vaccine response in children, increased risk of high blood pressure or preeclampsia in pregnant women, decreases in infant birth weight, and increased risk of kidney or testicular cancers. Concordance with experimental animal data exists for many of these negative effects.

Given there still remain uncertainties regarding the potential carcinogenicity of PFAS, the International Agency for Research on Cancer concluded that perfluorooctanoic acid (PFOA) – a perfluorinated carboxylic acid produced and used worldwide as an industrial surfactant in chemical processes as well as a material feedstock – is possibly a carcinogenic for humans and assigned the compound to Group 2B. The US Environmental Protection Agency (EPA) concluded that there is suggestive evidence of the carcinogenic potential of both PFOA and perfluorooctanesulfonic acid or PFOS in humans.

The European Council Directive 98/83/EC on the quality of water intended for human consumption was recently reviewed and, as a result, standards for PFAS in drinking water were introduced. The new Directive includes in annex a limit value of 0.1 µg per L for a sum of 20 individual PFAS, as well as a limit value of 0.5 µg per L for total PFAS concentration (we should not forget that total PFAS

concentrations are very difficult to determine, when considering that ~6000 different molecules have already been identified). Moreover, the new recommended limit in food for 4 predominant PFAS combined is 4.4 ng per kg body weight per week [EFSA 2020]. According to the EFSA risk assessment several people in Europe already exceed the new threshold level, based on blood serum data and estimated exposures.

It is quite striking that the precautionary principle was never invoked.

So, what will happen to Zwijndrecht?

There are tons of toxic PFAS in the ground where the Oosterweel tunnel is to be built. A long kept secret previous study of the soil by the company 3M had evidenced that the concentrations are thousand times higher than the accepted standards.

Huge amounts of contaminated soil – estimates put the volume at approximately one million cubic meters – will be excavated for the tunnel. There are now plans to use the extremely polluted soil in plastic bags covered with less polluting soil as noise barriers around the motorway at the mouth of the Oosterweeltunnel. This would only shift the problem without tackling or solving it. And yet, *De Standaard* claimed that 3M would have to remediate the soil. Remediation is quite different from filling huge plastic bags with contaminants.

PFAS are extremely resistant to degradation and they are also toxic. An article in *De Wereld Morgen* explains that the proposal is called “regulatory capture”. The industry exerts a very strong influence on politics, so that public health matters tend not to remain the focus of attention for very long. [<https://www.dewereldmorgen.be/artikel/2021/05/29/tonnen-toxische-pfas-als-bom-onder-oosterweeltunnel/>].

Can we look forward to free-flowing traffic around Antwerp in the future? I sincerely hope unlocking the Antwerp ring will not produce a Jevons effect. The contamination will be invisible, but remain present. The participants of the Zurich meeting believe that regulators must proactively identify and communicate which information would be needed to justify their actions. In addition, Ritscher et al. [2018] recommend actions that target groups of PFAS. I am becoming increasingly annoyed that superficial news reports [<https://www.hln.be/binnenland/spanning-binnen-vlaamse-meerderheid-over-zware-pfos-vervuiling-in-zwijndrecht-coens-demir-moet-echt-eens-weten-wat-ze-wil~a4de96e1/>] continue to refer to *one* chemical contaminant (singular). How much longer will it be before people, and especially the policy-makers, take cocktail effects seriously?

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