Comment on PFAS in rainwater[1]

Background

Recently a study was published in Environmental Science & Technology that concluded that PFAS in rainwater in several locations exceeded Lifetime Drinking Water Health Advisory levels from the U.S. Environmental Protection Agency (EPA). Similarly, maximum permissible levels under review in EU and Denmark are exceeded. PFAS are not only present in rainwater, but also in soil and water. There these also exceed local standards.

PFAS (per- and polyfluorinated alkyl substances) have been in use since the 1940s. This group of more than 4700 man-made chemicals is in wide use in fire extinguishing foam, factories that produce or use PFAS, food and food packaging, various household products and personal care products. It is also found in water and drinking water from public drinking water systems and in shallow drinking water wells. PFAS get into environmental circulation through soil and water at or near waste sites, and through use as fertilizer from wastewater treatment plants.

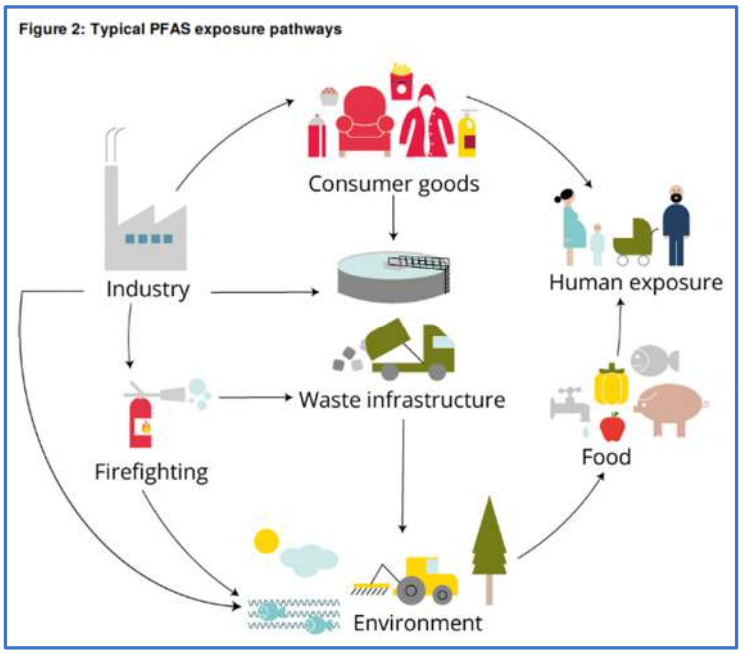

Figure 1 Typical PFAS exposure pathways (European Environment Agency / www.eea.europa.eu/publications/emerging-chemical-risks-in-europe)

PFAS accumulate over time in humans and in the environment. As PFAS are hazardous to health, their use is nowadays banned in developed countries. Unfortunately in Africa and Asia PFAS are not regulated.

In the last decades further assessment of PFAS has been going on, leading to further tightening of health advisories, reducing maximum permissible levels in drinking water to levels that can not normally be achieved. Expensive reverse osmosis appears the only way to reduce the PFAS levels. PFAS removal from water and environment will be an expensive affair that will take years to effect.

In the city setting exposure to PFAS through food and consumer goods will likely be significantly more important than through water.

PFAS have spread around the world, irrespective of the level of industrial development. Their occurrence far from the potential sources suggests that long-range atmospheric transport is an important pathway of PFAS distribution. [Per- and polyfluoroalkyl substances in water and wastewater: A critical review of their global occurrence and distribution](Kurwadkar et al., 2022)

This is further confirmed in the recent study [Outside the Safe Operating Space of a New Planetary Boundary for Per- and Polyfluoroalkyl Substances (PFAS)] (Cousins et al., 2022) which has measured the presence of PFAS in various countries as shown in figure 2.

[1] draft: Han Heijnen, International Rainwater Harvesting Alliance, 11 August 2022

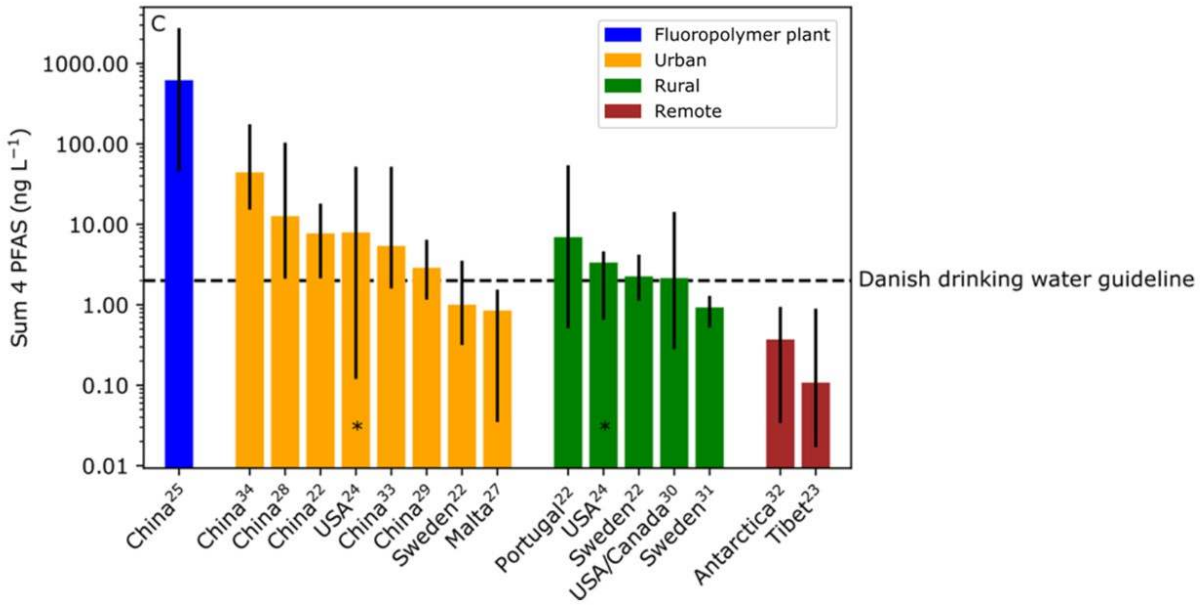

Figure 2 4PFAS concentrations in rainwater in different localities (from: https://pubs.acs.org/doi/10.1021/acs.est.2c02765)

PFAS and watersupply

Rainwater is collected and used by some 130 million people around the world as water for drinking and food preparation (IRHA assessment, 2022). The water needs to be bacteriologically and chemically safe for human consumption. When collection surfaces are clean and a first flush is used, rainwater is of good bacteriological quality, safe to drink.
Drinking water should also be chemically safe. Thus, drinking water should not contain pesticide residues or chemicals of the PFAS group at levels beyond which these constitute risks to health. Figure 2 shows that rural and remote areas in selected developed countries and Antarctica and Tibet are likely to have limited PFAS concentrations.

Knowledge of the spread of PFAS on the African continent is limited because monitoring of PFAS is challenging and often not feasible owing to the lack of analytical capacity and high cost. Although, as far as is known, PFAS concentrations in the African aquatic environment are generally lower than in more developed countries, exceedances of ecological quality standards (EQS) were reported in a few cases, providing evidence of potential ecological risks to these ecosystems. However, the number of ecosystems at risk will likely increase as urbanization and modernization increase in African countries. (Groffen et al., 2021)

The International Pollutants Elimination Network (IPEN) 2019 report on the spread of PFAS in the Middle East and Asia shows that PFAS are found in all countries studied, in dust, fish, milk, water, etc. and is generally around especially in industrial areas and cities. (International Pollutants Elimination Network (IPEN), 2019). Information on the quality of rainwater was not available. Unfortunately not many countries are yet able to regulate PFAS effectively.

The conclusion of the study by Cousins et al, is that PFAS are being spread around the globe through atmospheric movements and are found in rainwater everywhere. More so near industrial areas and in cities, and in lesser concentrations in rural and remote areas.

Water sources everywhere are being affected. Drinking water supply using surface water, shallow wells and springs that are seasonally recharged by rain, all sources, except maybe confined deep aquifers, will have PFAS.

As alternative supplies offer no safer water supply service, there is no reason not to continue using rainwater for drinking. As most instances where rainwater is used for drinking are in rural and remote areas where exposure to PFAS for now is still less, rainwater should remain safe enough to consume on a regular basis.

The study analysed the spread of PFAS in rainwater around the globe, using data from USA, Europe and China. The media headlined rainwater as a source of PFAS distribution. PFAS is anyway already everywhere by now. Don't blame the rain!

We need to be vigilant and keep an eye of PFAS and similar health risks. Further investigations are necessary to assess the effects of PFAS on public health, in particular how these link with the intake from water supply and other sources of PFAS in our daily life.

Collected rainwater is mostly of good quality, with low risk of the presence of pathogenic bacteria. Where people collect rainwater, alternative supplies are of more dubious quality, except when water is supplied by way of well-managed treated water supply. Reducing and regulating the use of pesticides, PFAS and other harmful and persistent chemicals in society remains a critical task in all countries.

So, keep using rainwater for domestic purposes including as water for drinking and food preparation.

References

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