

How PFAS end up in high concentrations in home produced chicken eggs at ambient background levels in soils

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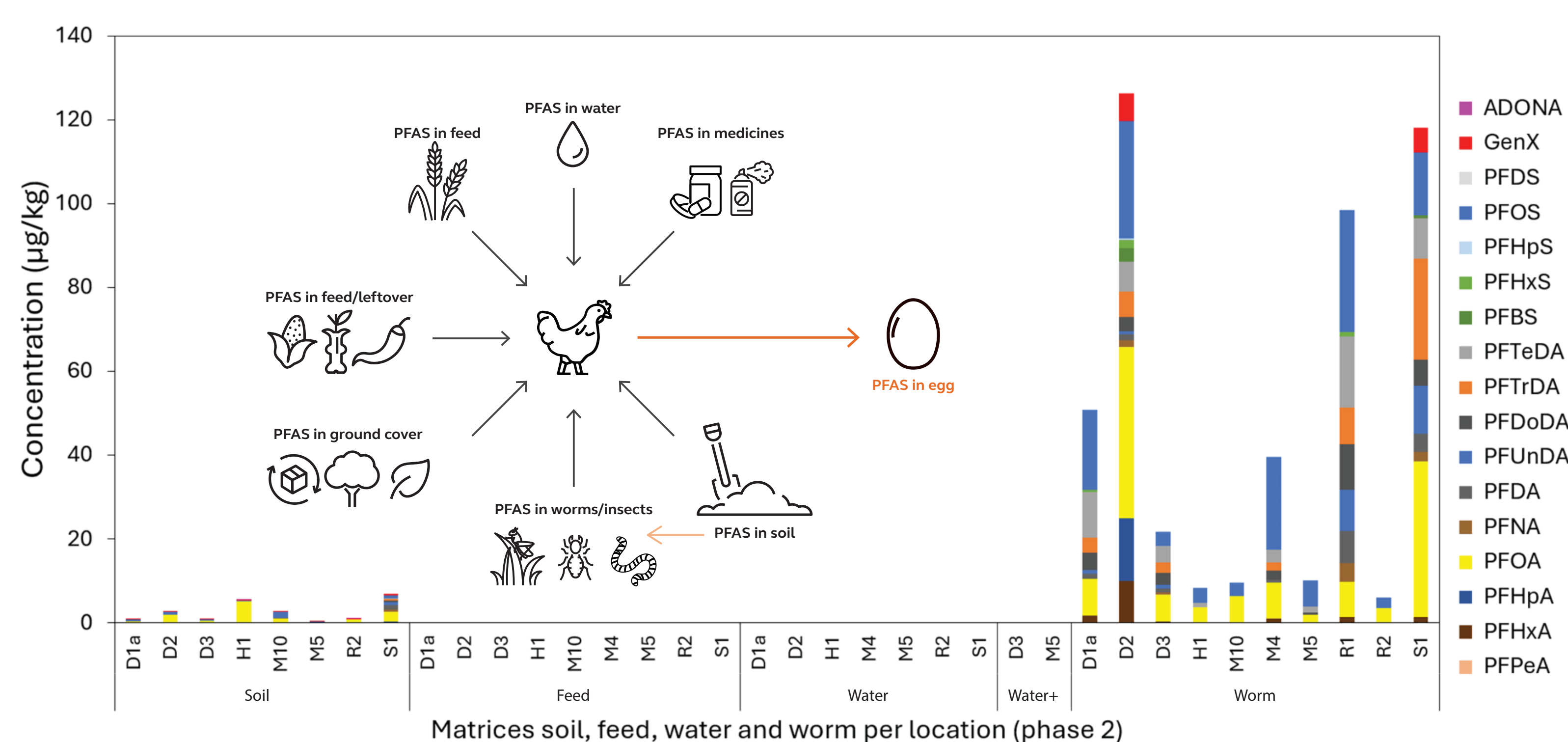


Figure 1. PFAS in soil, feed, water, water with vitamins or medicines (water+) and worms per sampled location

Summary

In an area downwind from a fluorochemical plant in the Netherlands, high concentrations of PFAS have been found in home produced chicken eggs. The concentrations of PFOS and PFOA exceed the Maximum Level for eggs (EU, 2022), in 80% of the eggs. This in contrast to the level of PFAS found in commercial eggs, which is very low. Although the eggs are sampled in an area surrounding a fluorochemical plant, the detection of high amounts of PFOS is remarkable, since the plant predominantly emitted PFOA and GenX. PFOS is the dominant PFAS detected, whereas this compound has not been used by the fluorochemical plant in their production process. Furthermore, PFOS concentrations in the soil are at approximately the same level as ambient background levels in the Netherlands in urban areas.

Besides PFOS, also long chain PFCA's were detected at remarkably high concentrations in the eggs. Based on the results it was concluded that direct consumption of soil by the egg-laying chickens was not the source of the high concentrations of PFAS found in the eggs.

This resulted in a quest for finding the source of these high concentrations of PFAS. At a selection of the sites, the chicken housing was sampled for possible PFAS sources - feed (including insects), soil (near the feeding unit), drinking water, packaging of the feed, bedding, vitamins, medicines and worms.

The PFAS concentrations detected in the worms were very high, this in contrast to the other possible sources analyzed. This led to the conclusion that bioaccumulation of PFAS via worms is the most likely source of PFAS for the chicken and the eggs, even at the relatively low concentrations of PFAS measured in the soils.

References

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Highlights

- Fluorochemical plant emitted PFOA and GenX
- In 80% of the eggs, the maximum level for PFAS in eggs was exceeded
- Other PFAS dominant than expected, mainly PFOS
- Different PFAS profile in soil and eggs
- Feed, water, soil, medicines and vitamins tested and could not explain the concentrations in the eggs
- Very high concentrations found in worms
- Concentrations in worms can explain the concentrations in the eggs, taking into account the bioaccumulation of PFAS in worms and selective uptake of PFAS in eggs
- Even at ambient background levels of PFOS in soil (maximum concentration was 2 µg/kg), this can cause too high concentrations in eggs via bioaccumulation in worms and consumption of the worms

Acknowledgement

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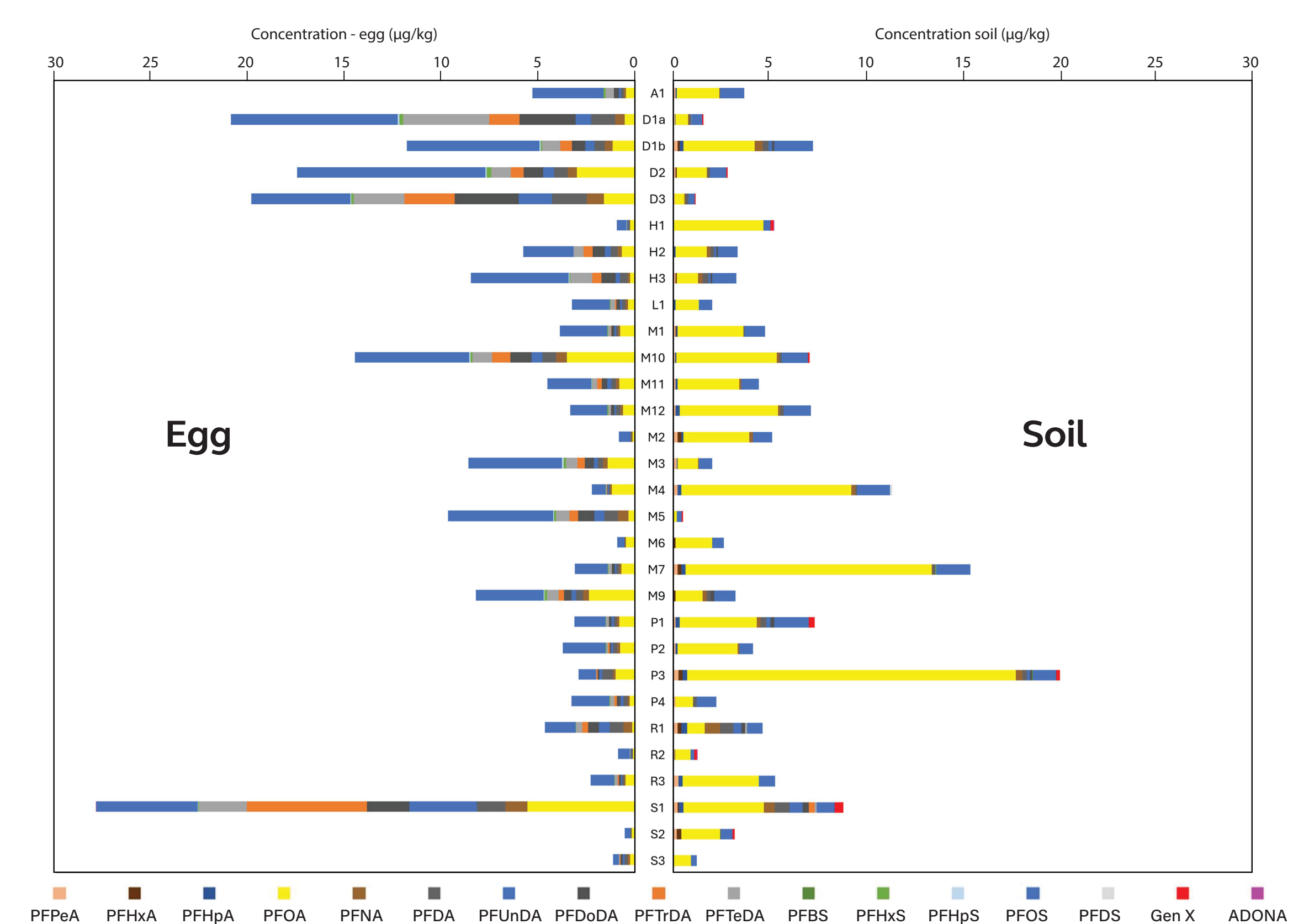


Figure 2. PFAS in eggs (µg/kg ww) versus PFAS in soil (µg/kg dw) per sampled location

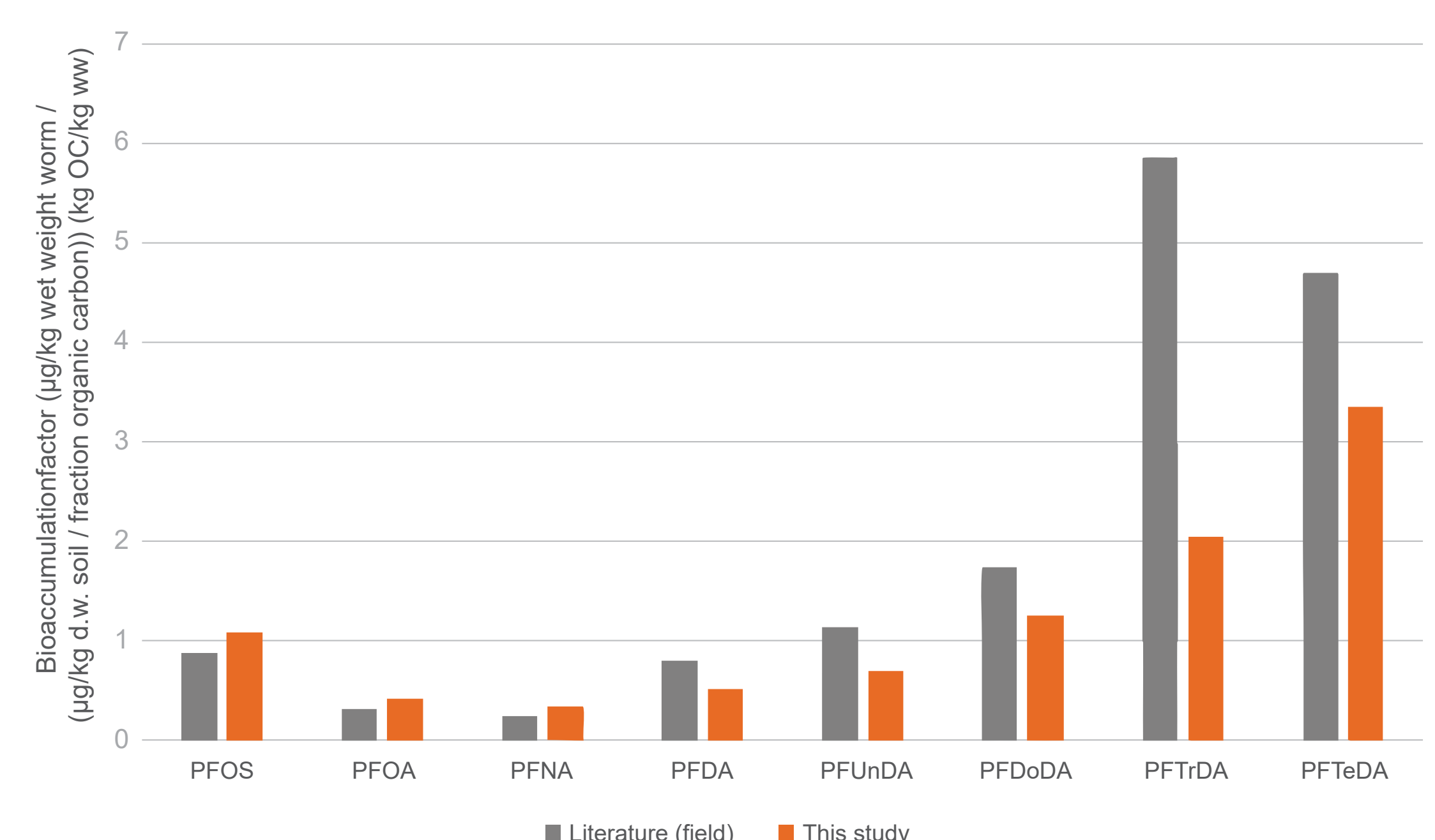


Figure 3. Bioaccumulation factors of PFAS in worms calculated in this study versus values from literature (Burkhard, and Votava, 2022). Values from field studies have been given. BAF is expressed as concentration in worm (µg/kg wet weight) per PFAS concentration in TOC of soil (µg PFAS/kg TOC, dry weight)