Assessing PFAS in Agricultural Settings

"Things we have learned in the past 5 years"

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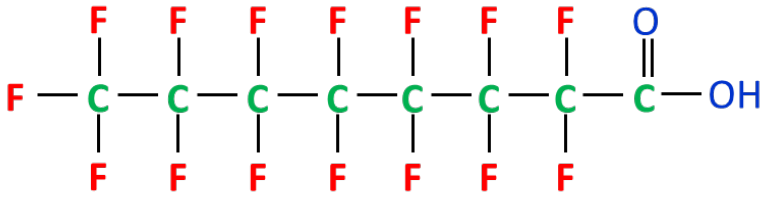
PFAS – Perfluoroalkyl Substances

Naming Conventions



Perfluorooctanoic acid (PFOA)

8 carbons

Perfluoroheptanoic acid (PFHpA)

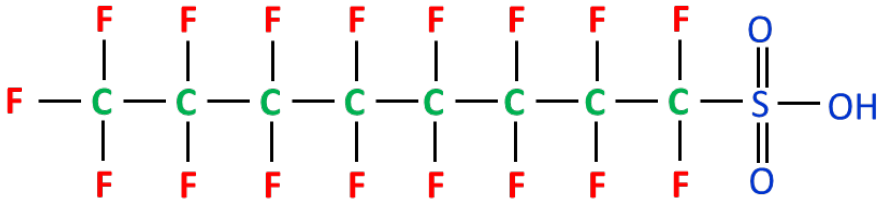
7 carbons

Perfluorononanoic acid (PFNA)

9 carbons

Perfluorodecanoic acid (PFDA)

10 carbons



Perfluorooctanesulfonic acid (PFOS)

8 carbons

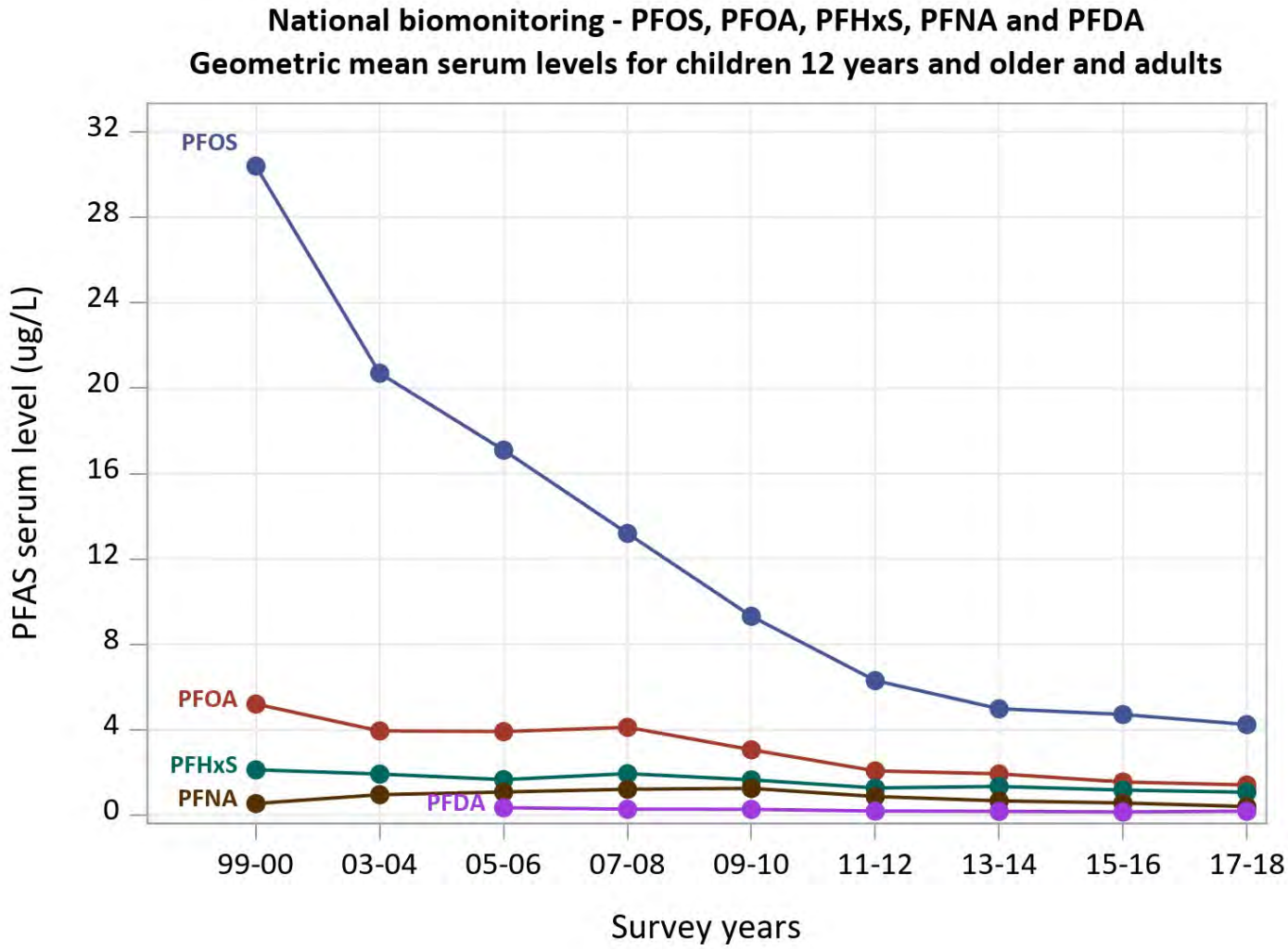
Perfluorohexanesulfonic acid (PFHxS)

6 carbons

Perfluorobutanesulfonic acid (PFBS)

4 carbons

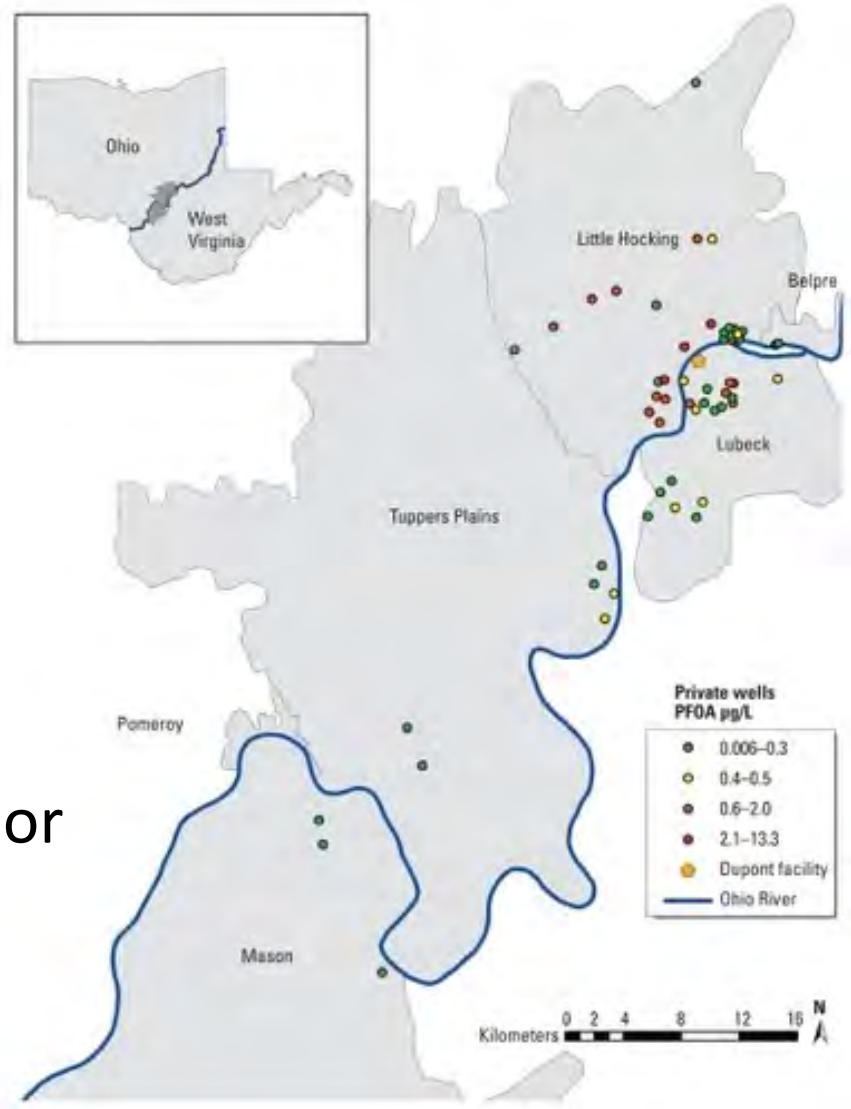
PFAS in our Blood



Source: National Report on Human Exposure to Environmental Chemicals – US CDC: https://www.cdc.gov/exposurereport/index.html

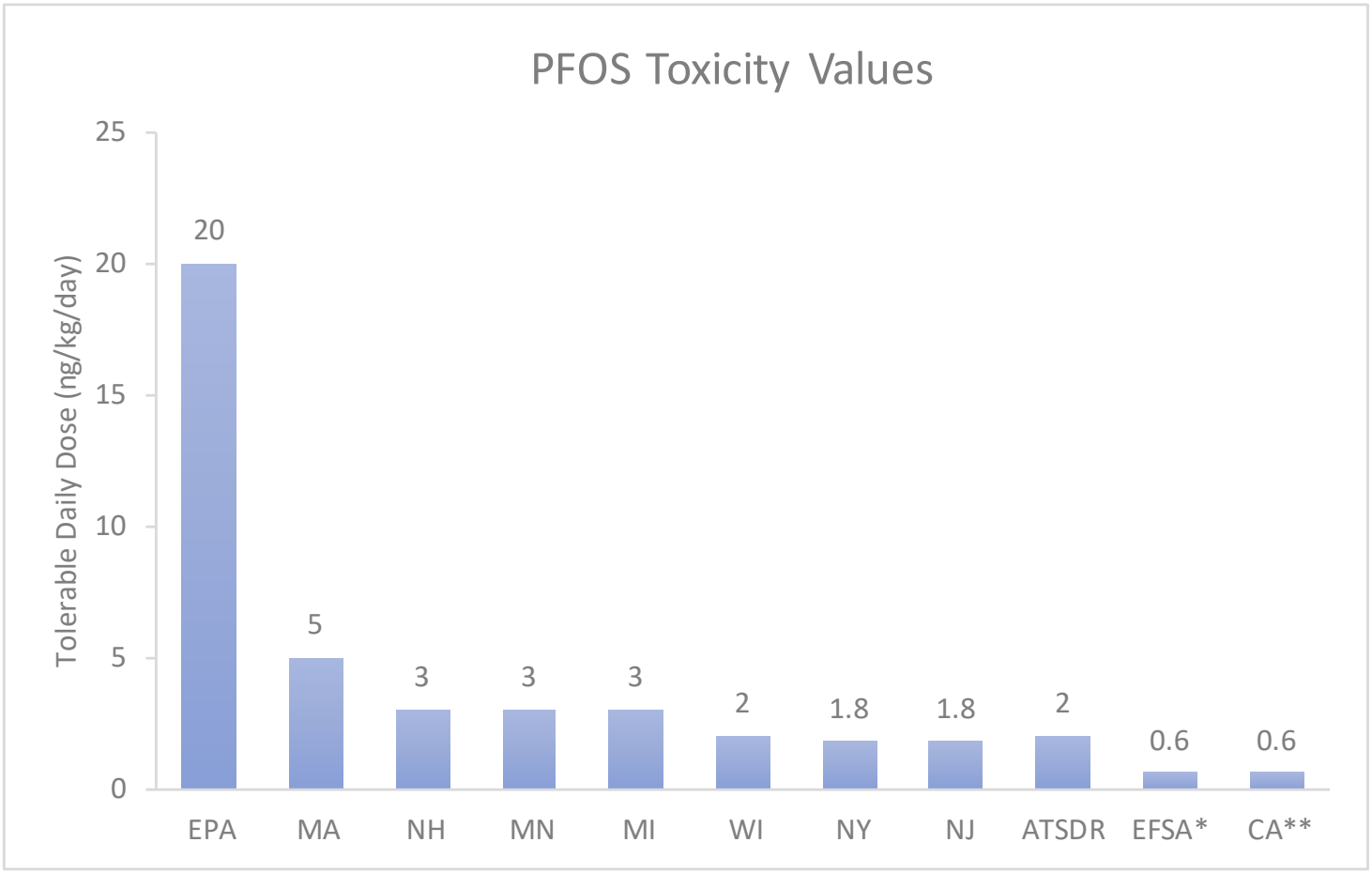
Health Effects Associated with PFAS

- increased cholesterol levels
- decreased vaccine response in children
- changes in liver enzymes
- increase risk of high blood pressure or preeclampsia in pregnant women
- small decreases in infant birth weight
- increased risk of kidney cancer or testicular cancer.



Source: https://www.atsdr.cdc.gov/pfas/health-effects/index.html

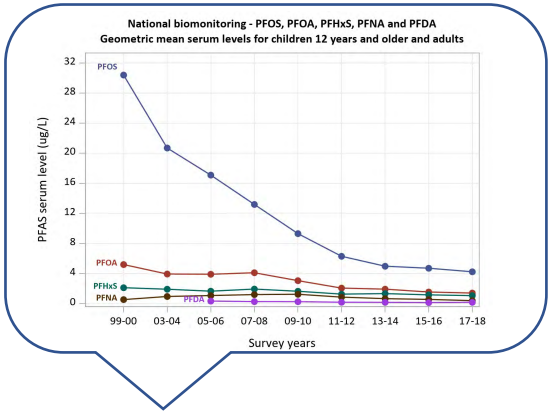
Changing thinking on the toxicity of PFAS



EFSA* - Human data, immune system toxicity, sum of PFOA, PFOS, PFNA, PFHxS
CA** - Human data, changes in cholesterol, proposed

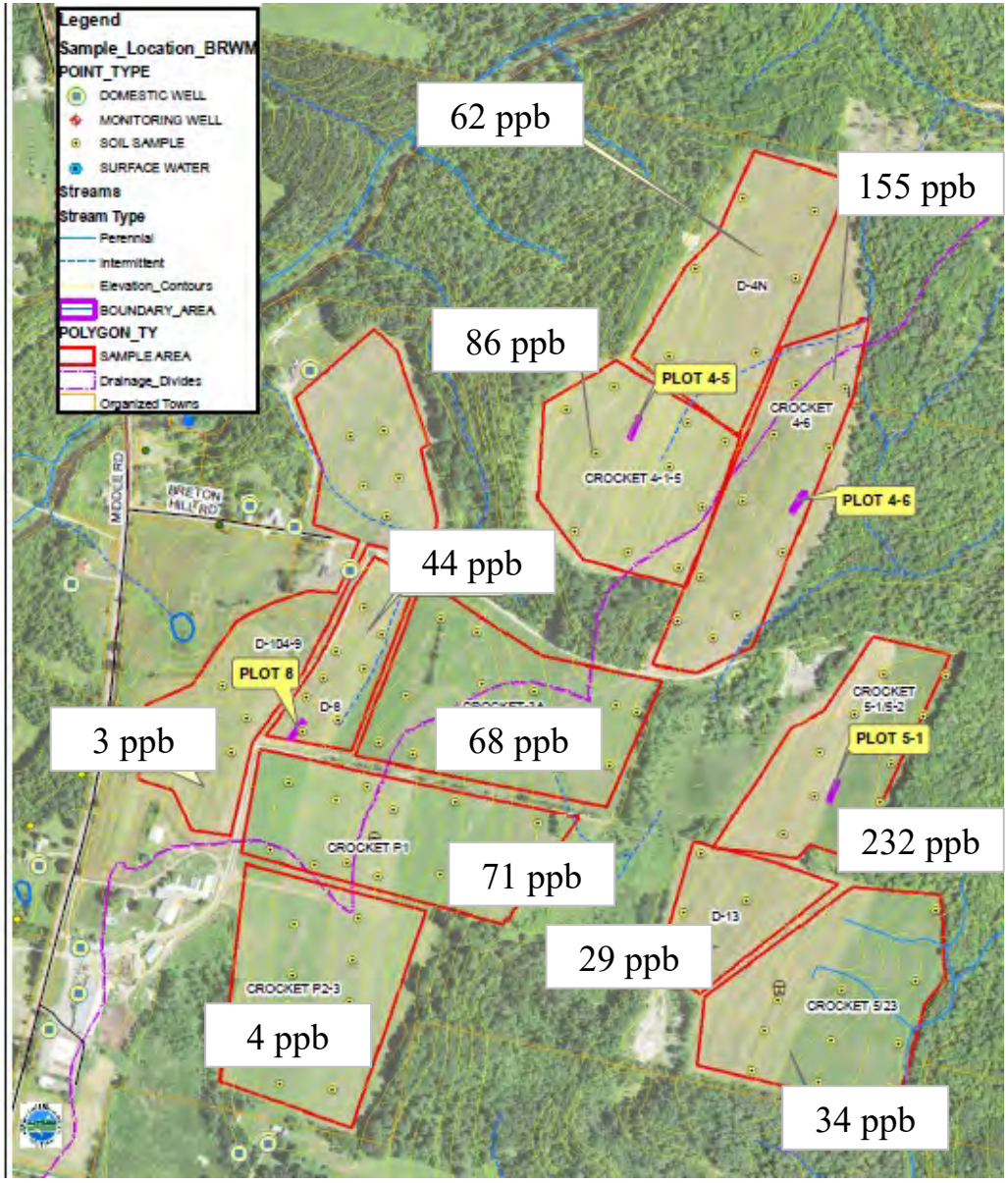
How much is too much PFAS in food?

EPA ATSDR FDA



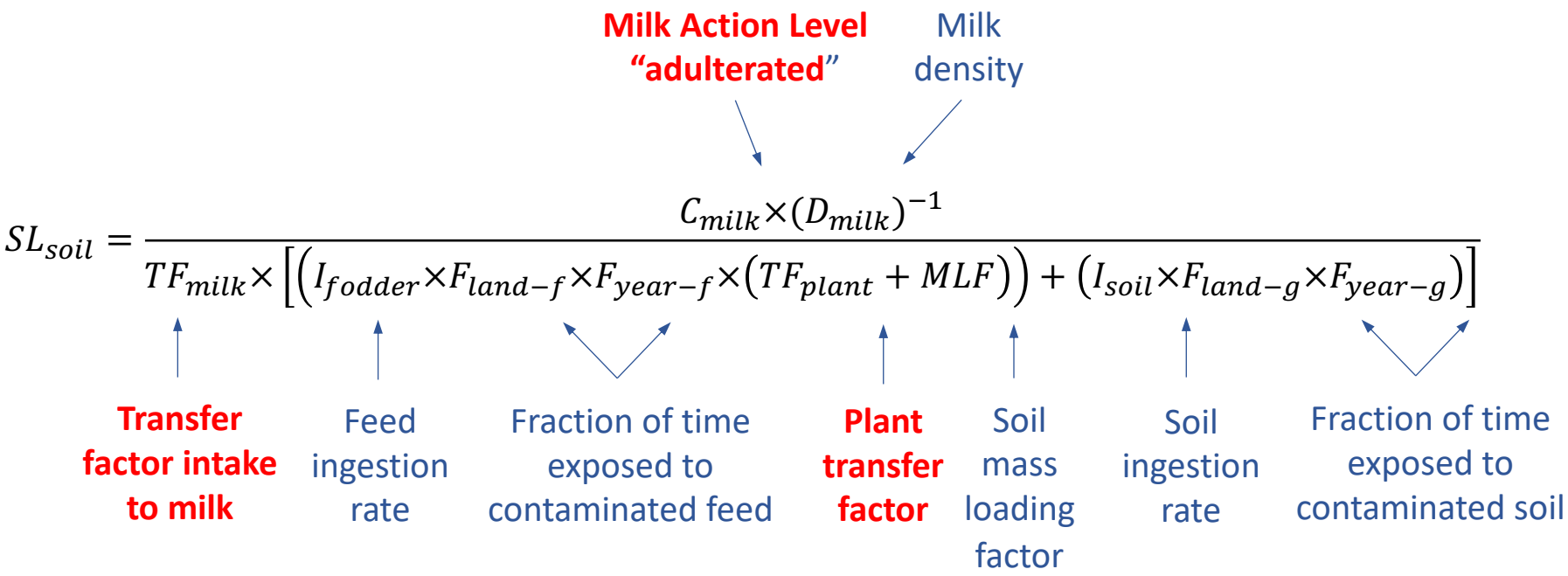
$$\frac{Toxicity\ Value}{Consumption\ Rate} \times Relative\ Source\ Contribution$$

PFAS in soil of agricultural land from the application of biosolids



- *Average* PFOS levels in fields range from low of 29 ppb to high of 232 ppb.

How much is too much PFOS in soil?

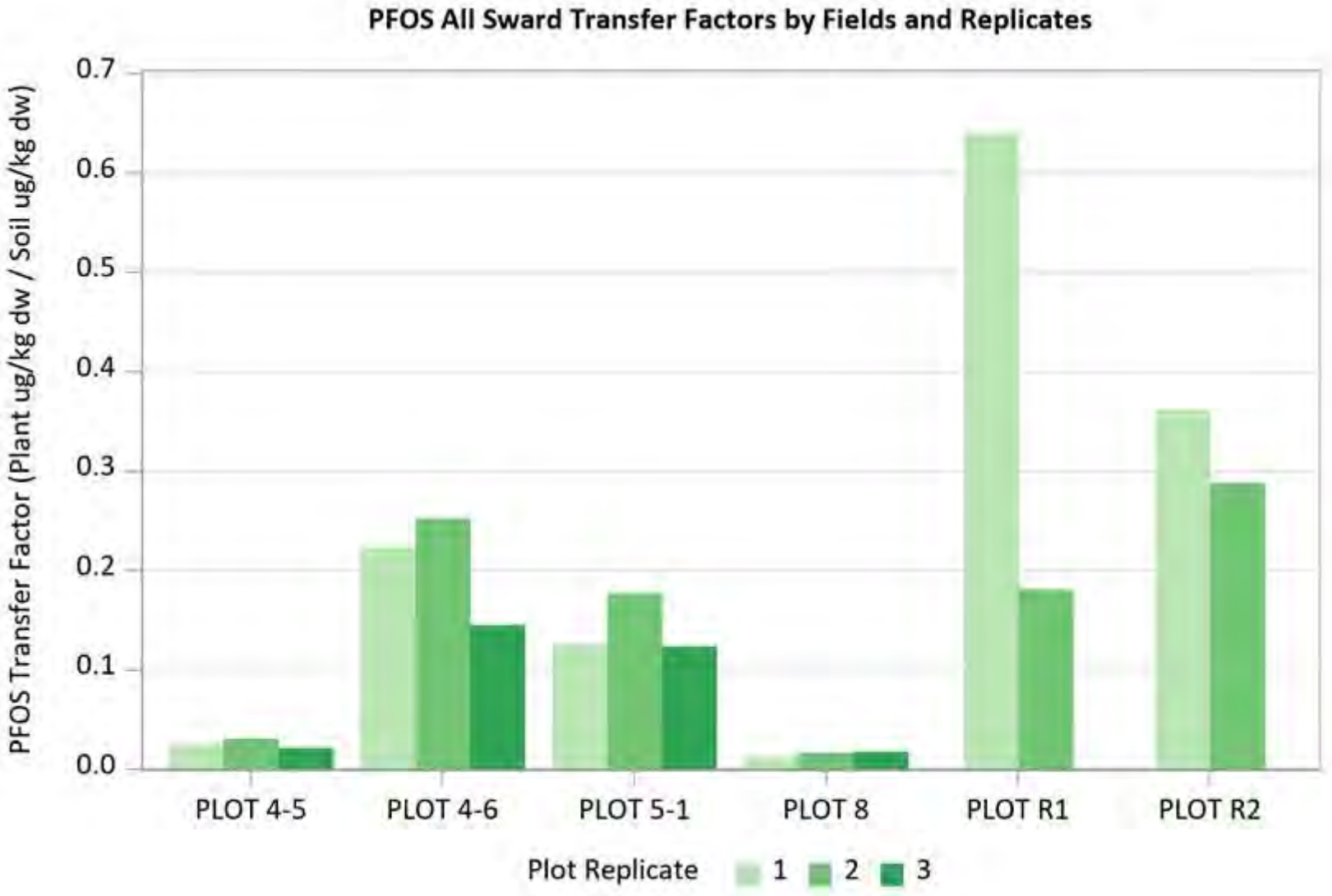


Source: Modified equation from U.S. EPA Preliminary Remediation Goals for Radionuclides, consumption of milk back calculated to soil - https://epa-prgs.ornl.gov/radionuclides/users_guide.html

Hay PFOS Uptake Study

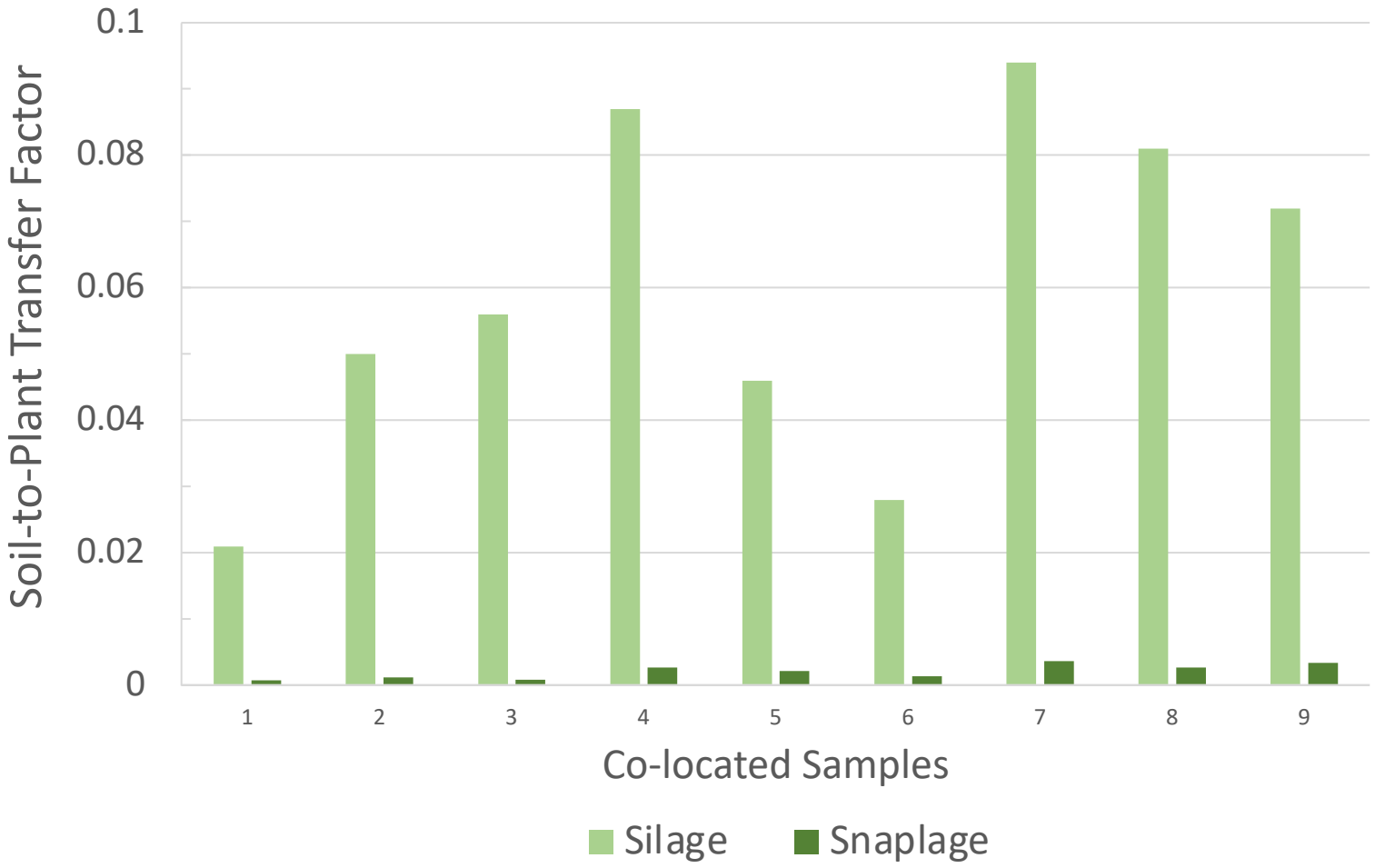
Uptake of PFOS by hay can vary by field

- Preliminary Results -

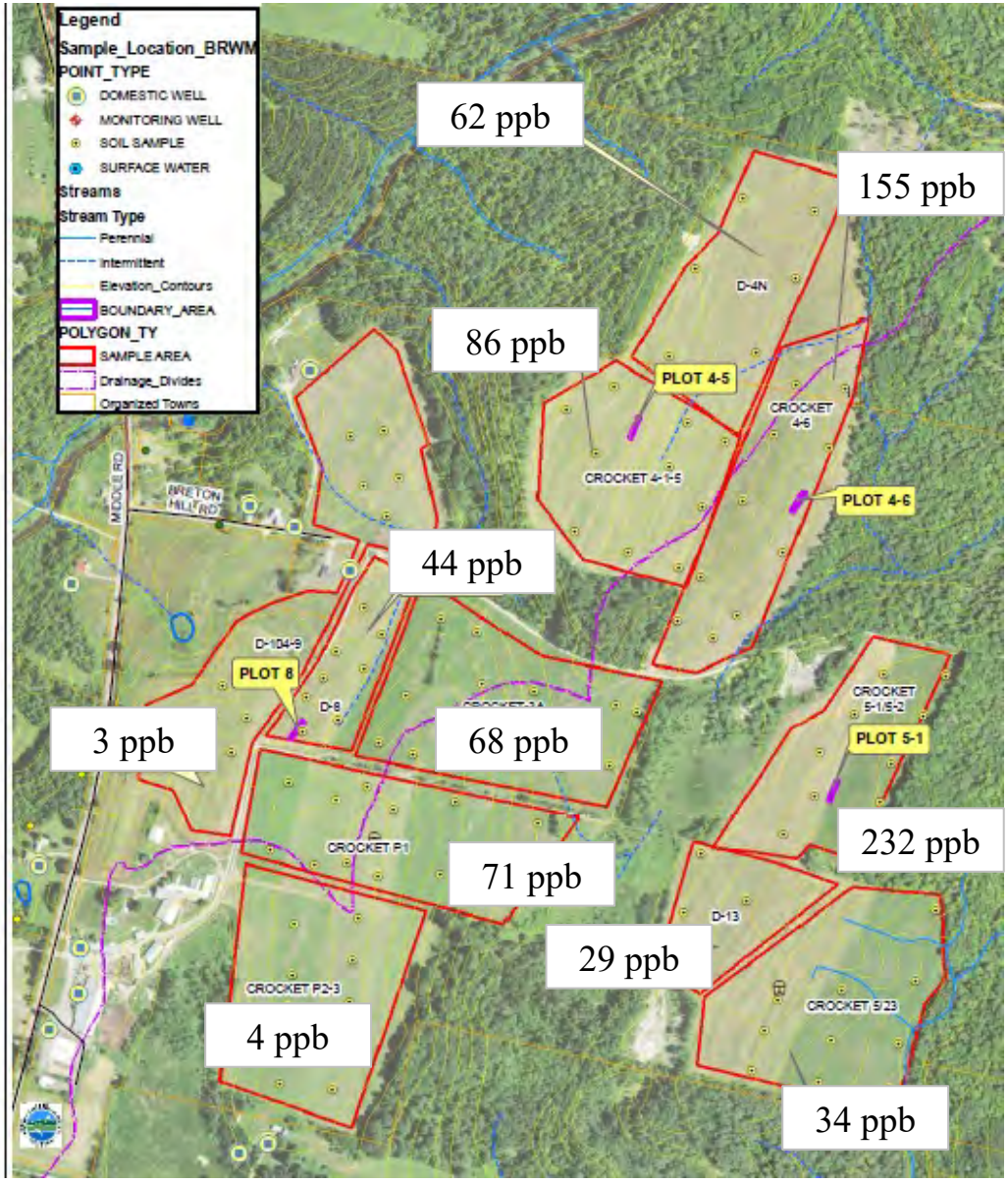


Corn Silage PFOS Uptake Study

Uptake of PFOS can vary by plant tissue

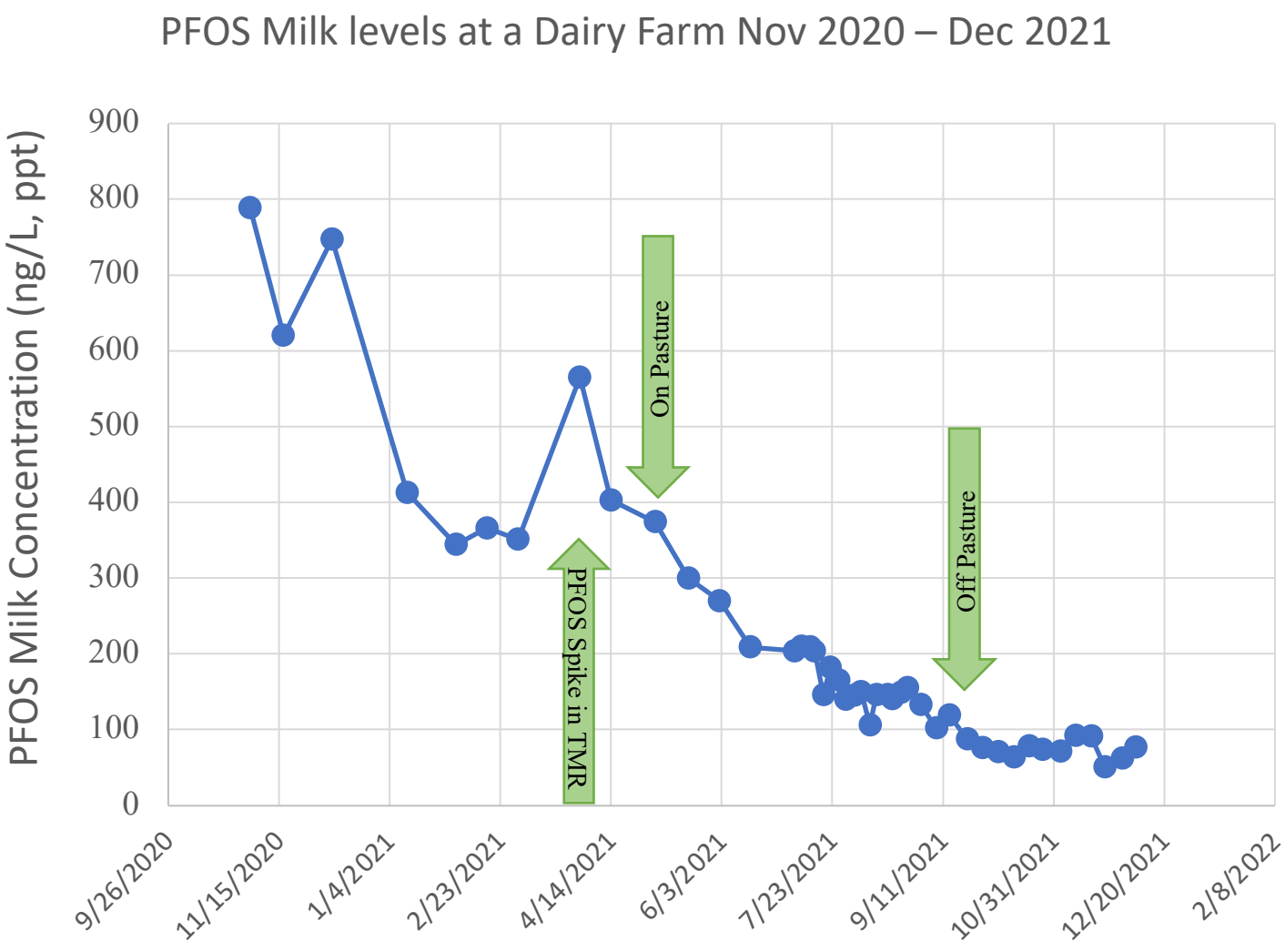


Actions to Mitigate Exposure to PFOS

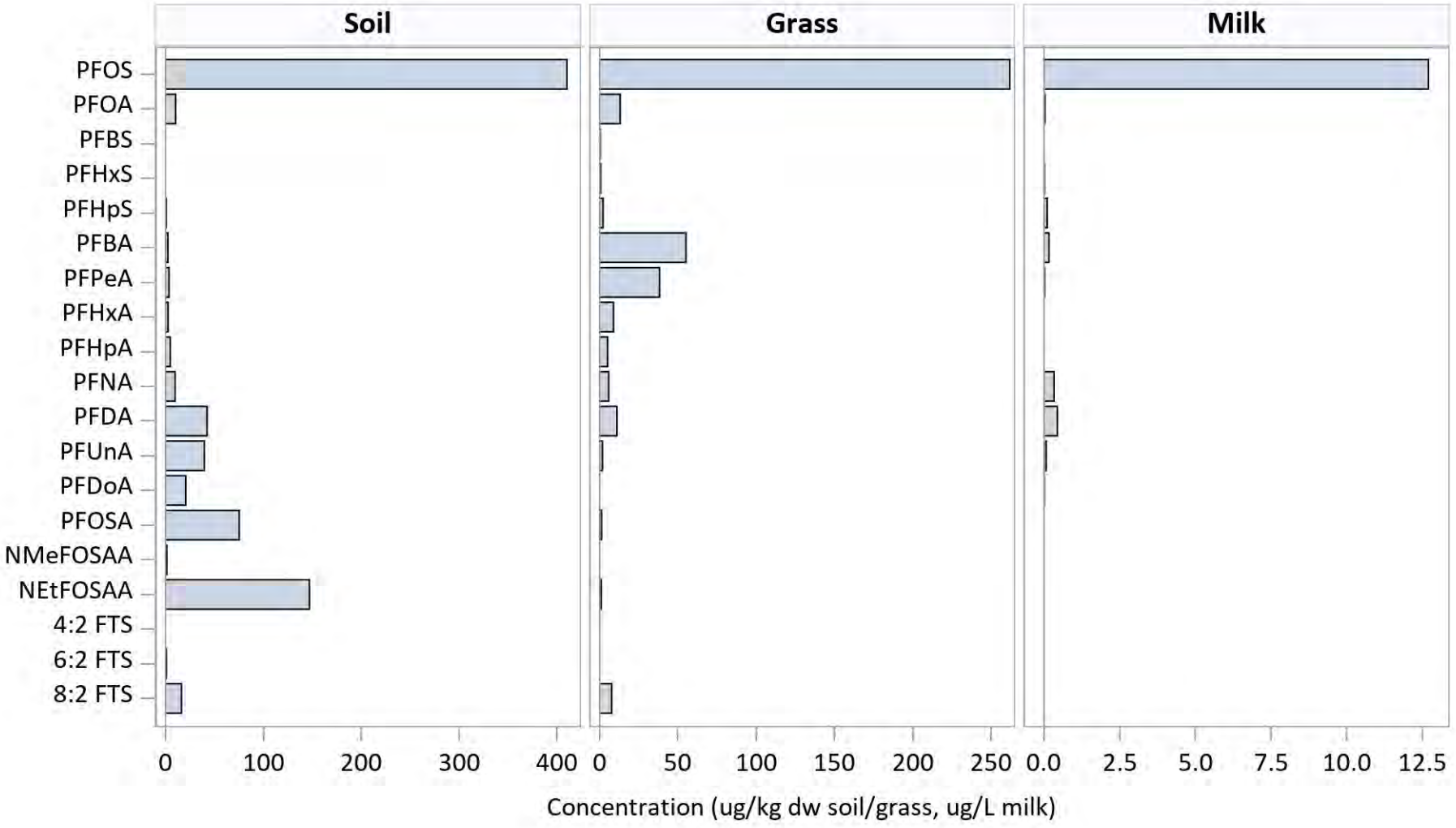


- Convert pasture fields to corn grown for snaplage.
- Change fields used for grazing.

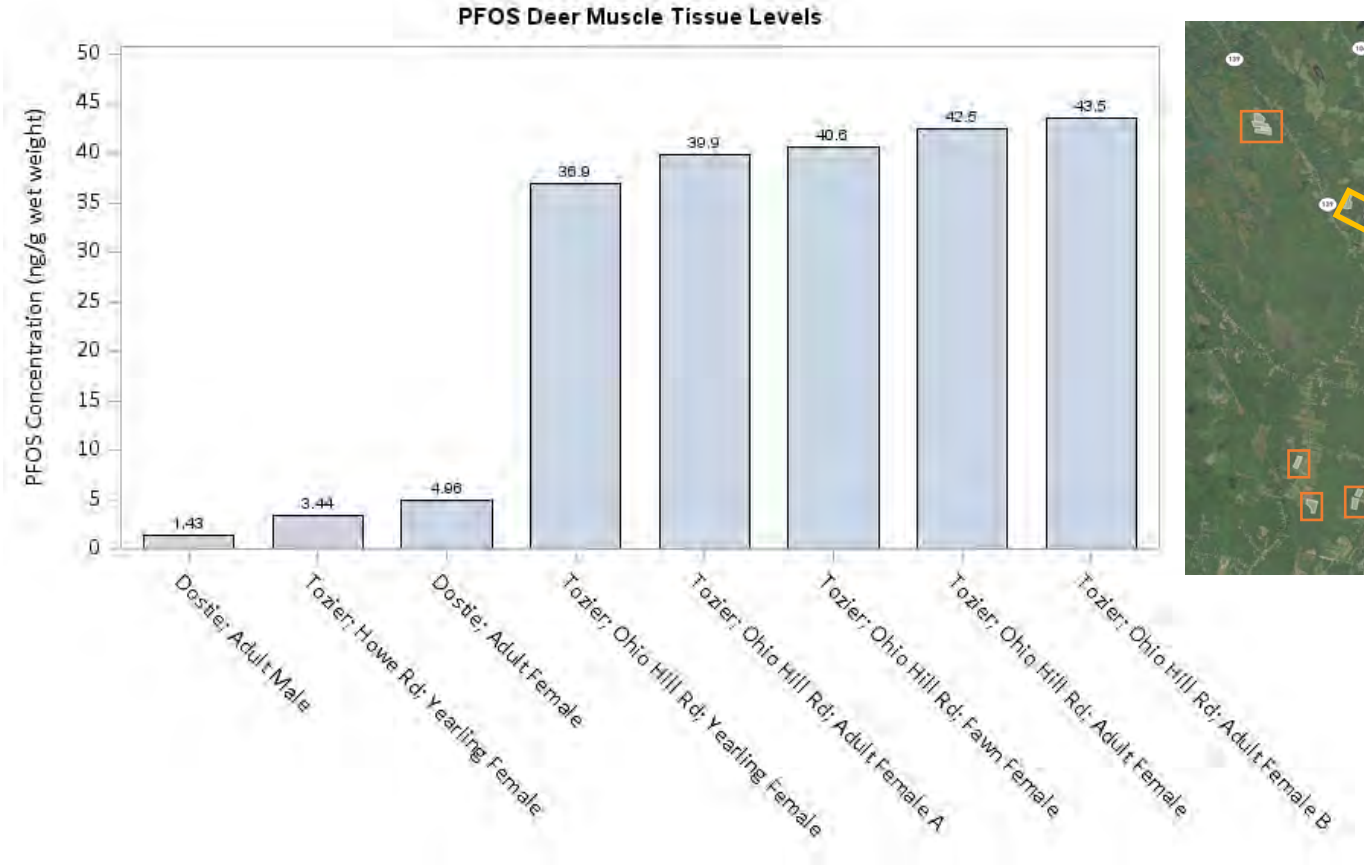
Progress in Reducing PFOS in Milk

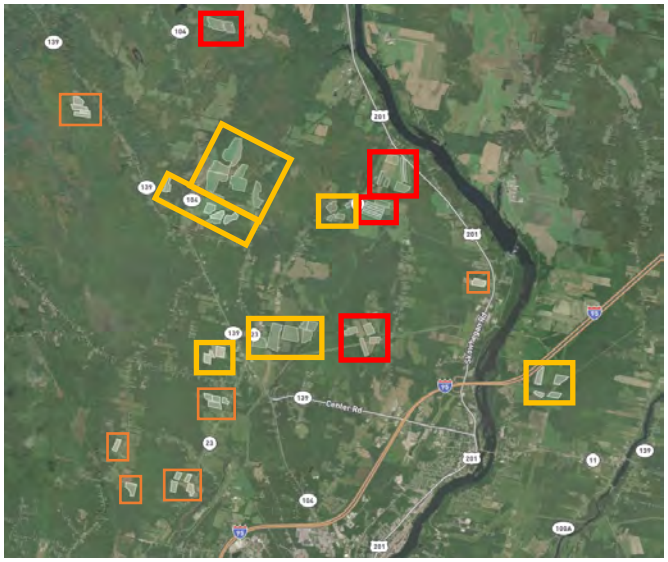


PFAS move differently between media

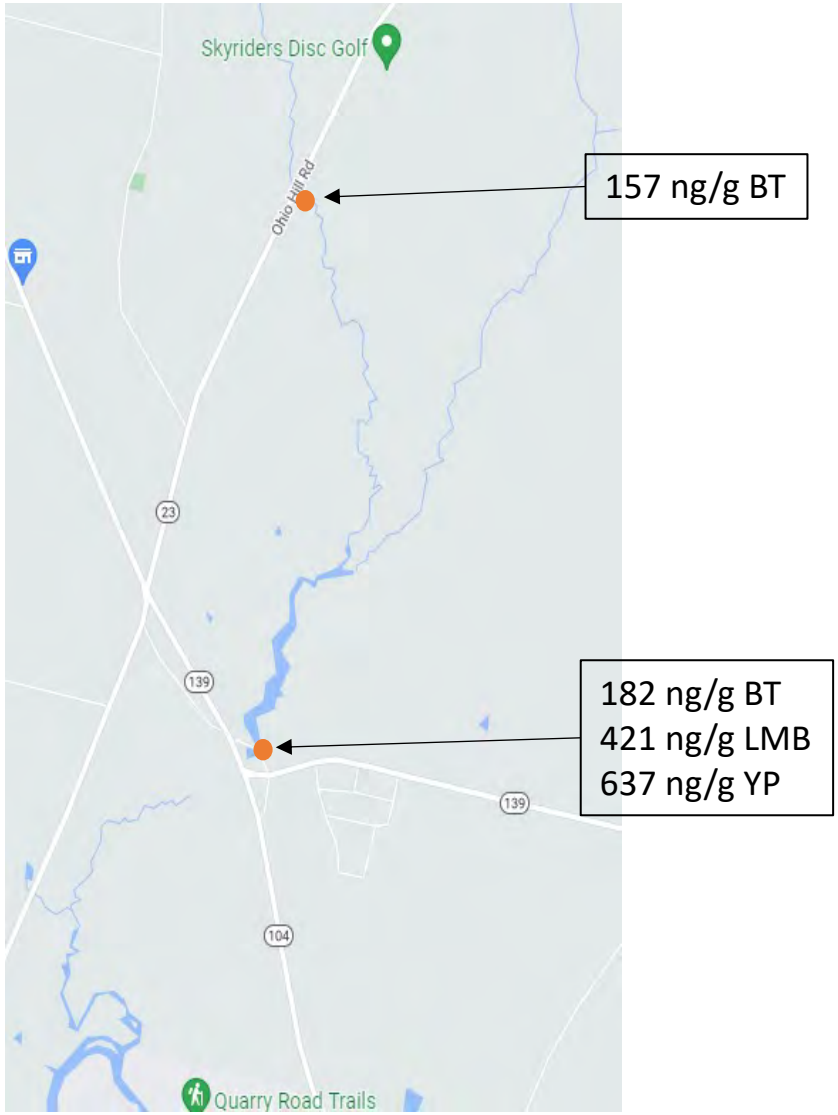


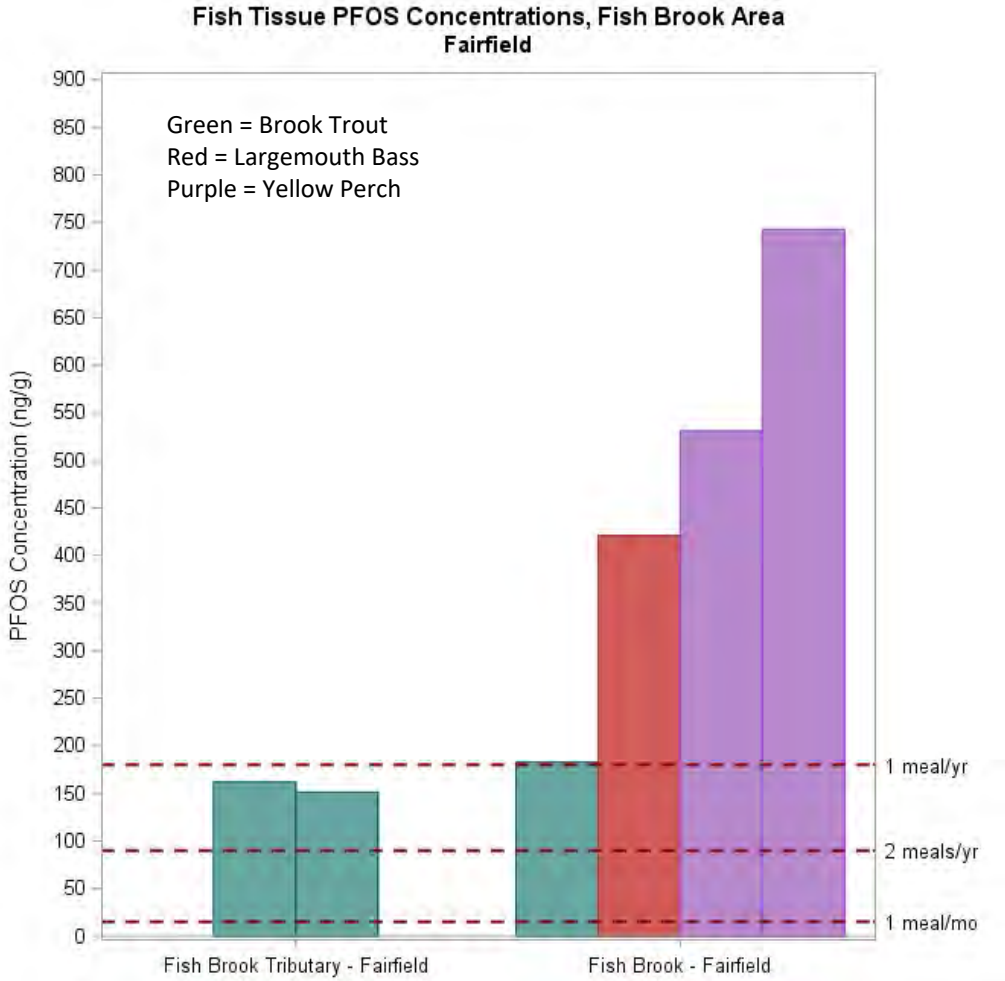
Fairfield PFOS in Deer Tissue Study



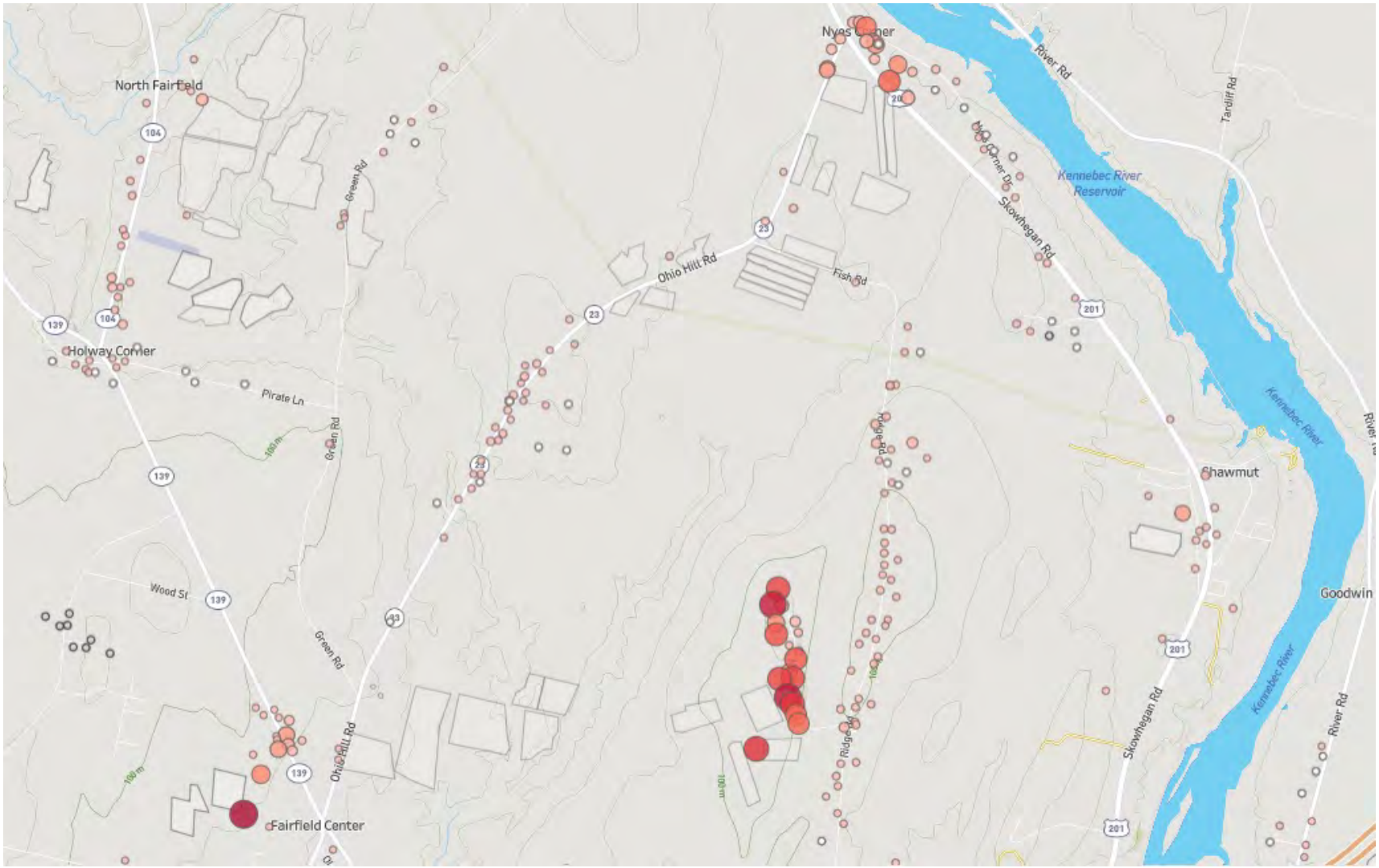


Fish Brook Area in Fairfield

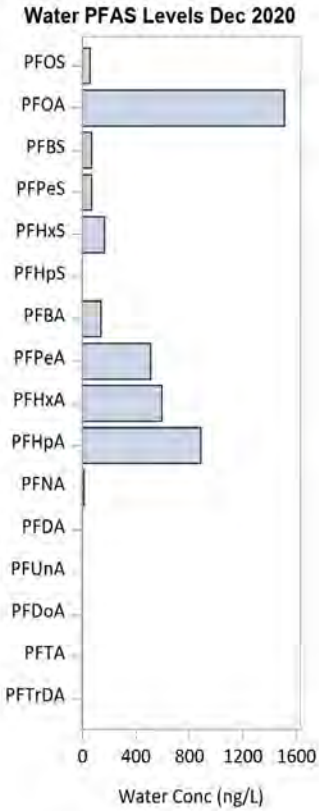


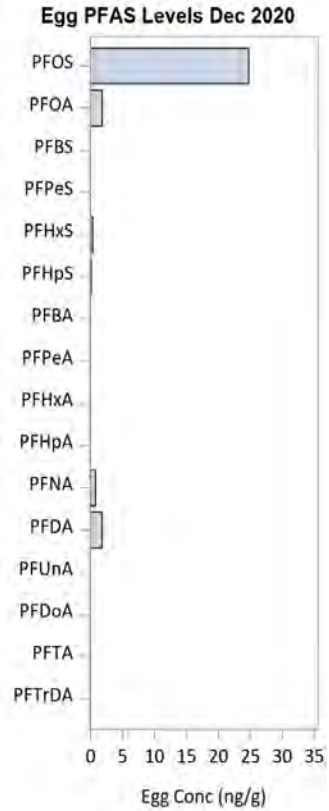


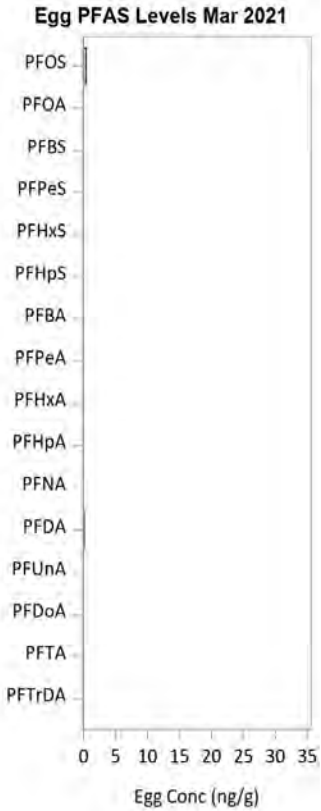
PFAS from Soil to Ground Water

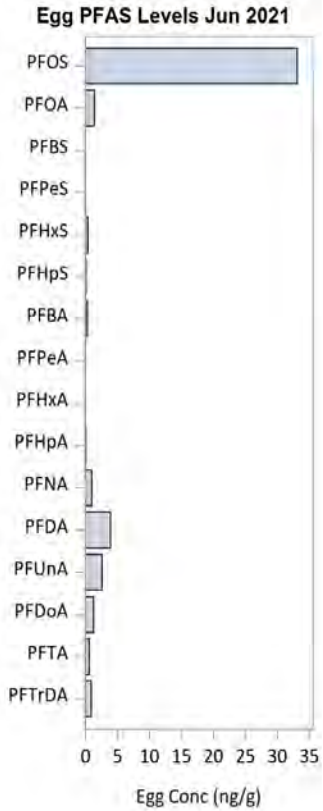


PFAS from Water to Chickens to Eggs

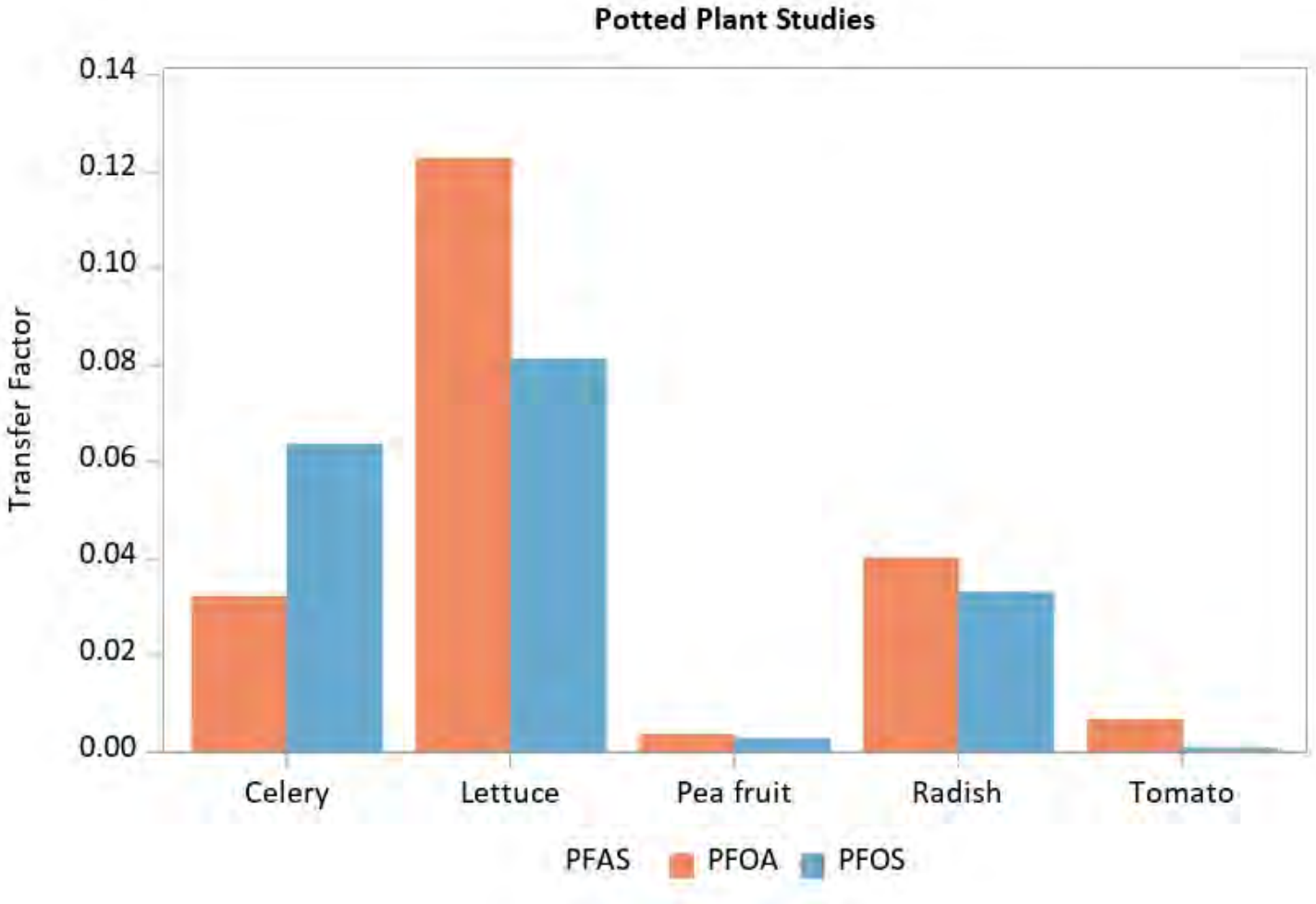








PFAS move differently within plants



Source: Blaine et al. 2013 - https://pubs.acs.org/doi/abs/10.1021/es403094q and Blaine et al. 2014 - https://pubs.acs.org/doi/abs/10.1021/es500016s

For more information

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