



PFAS Research Updates (mostly specific to biosolids/soils)



Ned Beecher • NEBRA

June 24, 2019

W3170/4170 Research Meeting
Beltsville, MD

Summary

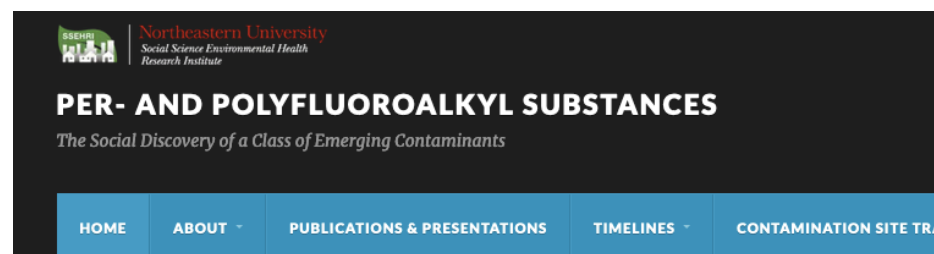
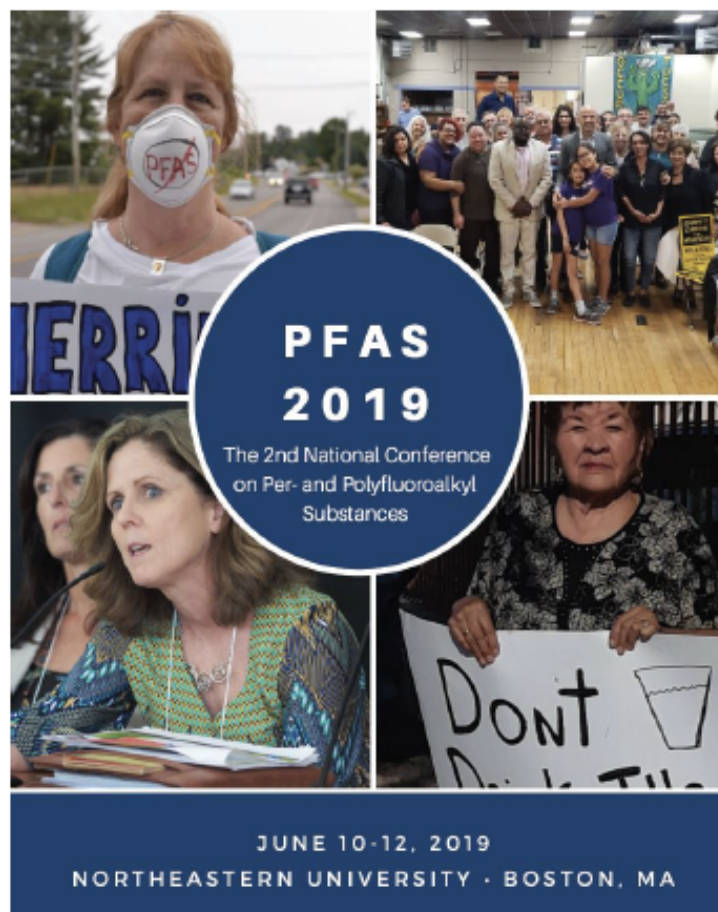
- Lots of research on PFAS. Lots of speculation on biosolids' role.
- Drinking water is the health concern (now). (Food contamination concern is current fad.)
- Key published research (NEBRA has lit. review)
- Data summaries:
 - Biosolids
 - Land-applied soils
 - Associated groundwater (& surface water)
 - Associated milk

Tomorrow: research needs will be covered

Lots of research on PFAS.

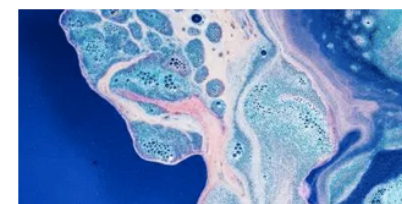
PFAS Health
Research (& advocacy)

[https://
pfasproject.com/](https://pfasproject.com/)



NEWS

Bipartisan Senate Efforts to Mandate Agencies Address Growing PFAS Crisis



NEWS

Exempt 'essential uses' to accelerate PFAS phaseout, experts say

Screenshot

PFAS Health Effects Summary



Animal toxicity

- Causes liver, immune system, developmental, endocrine, metabolic, and neurobehavioral toxicity.
- PFOA and PFOS caused tumors in chronic rat studies.



Human health effects associated with PFC(s) in the general population and/or communities with contaminated drinking water include:

- ↑ cholesterol
- ↑ uric acid
- ↑ liver enzymes
- ↓ birth weight
- ↓ vaccine response
- Thyroid disease
- Osteoarthritis
- Diabetes
- Testicular and kidney cancer
- Pregnancy-induced hypertension
- Ulcerative colitis
- Effects in young adulthood from prenatal exposures
 - *Obesity in young women.*
 - *↓ sperm count in young men.*



U. S. Centers for Disease Control: Draft Toxicological Profiles for PFOA & PFOS – June 2018

- Interpreted to mean EPA drinking water level should be ~10x lower: 7 – 12 ppt range
- October 31, 2018: ATSDR posts drinking water advisory values based on their draft MRLs (https://www.atsdr.cdc.gov/pfas/mrl_pfas.html)
 - PFOA: 78 ppt (adult) and 21 ppt (child)
 - PFOS: 52 ppt (adult) and 14 ppt (child)
 - PFHxS: 517 ppt (adult) and 140 ppt (child)
 - PFNA: 78 ppt (adult) and 21 ppt (child)

“These concentrations are compared to concentrations in drinking water to determine if further evaluation is needed.... If an exposure is above an MRL, ATSDR conducts further evaluation to determine if the exposure might harm human health..... ATSDR sets each MRL well below a value that is likely to cause a health effect.... ATSDR’s MRLs are screening values and are not designed or intended to be used as public water standards, but they do provide valuable information about PFAS exposures and potential public health impacts.”

Lots of speculation about biosolids' role.

The curious case of tainted milk from a Maine dairy farm

Richard Valdmantis, Joshua Schneyer

6 MIN READ



ARUNDEL, Maine (Reuters) - For Maine dairy farmer Fred Stone, the discovery in 2016 that his cows were producing tainted milk has since brought financial ruin and threatened to shut down a century-old family business.



- Maine farm: likely PFOS problem not from municipal biosolids (but the media has yet to cover that.)
- Maine moratorium on biosolids March 22nd.
- Extensive biosolids & soil testing
- Dept. of Ag & NEBRA – milk testing: ND
- WRRFs still reeling. Biosolids compost is being sold, but land application has stopped.

Why are PFAS a hot topic for biosolids?

- May 2016 → EPA drinking water public health advisory (PHA) -
- 70 ng/L (ppt) for PFOA & PFOS combined. Rare ppt PHA.
- Agencies look for sources. → Biosolids convey PFAS.
- Today's wastewater, biosolids, & other residuals (e.g. from recycle paper mills) contain 1s to 10s *ug/kg* (ppb) of PFAS.
- Scant literature shows some leaching to groundwater at levels approaching the EPA's 70 ppt. → Regulators concerned.
- 2016 - 2019: Public & legislative pressure → lower benchmarks below EPA's 70 ppt, impacting biosolids & residuals management (and many other activities!). VT groundwater standard = 20 ppt for the sum of 5 PFAS!
- Pressure mounts to set soil & biosolids screening levels.

Major sources of PFAS in the environment:

e.g.: Cottage Grove, MN; Parkersburg, WV

EPA reaches new C8 deal with DuPont

on January 16, 2017 at 4:54 pm



The Washington Works DuPont plant in Parkersburg, West Virginia, on Wednesday, August 5, 2015. Photo: Maddie McGarvey for The Intercept/Investigative Fund

PARKERSBURG, WV — “Less than two weeks before the Obama administration leaves office, the U.S. Environmental Protection Agency on Monday said it had reached a new agreement with DuPont Co. regarding pollution of drinking water in the Mid-Ohio Valley with the toxic chemical C8 from the company’s manufacturing plant near Parkersburg.

EPA said in a [news release](#) that it had amended its 2009 agreement with DuPont to reflect a lower level of C8 exposure recommended in an EPA health advisory issued last year. While more protective than the previous agreement with DuPont, the new number would allow larger

LAWSUITS CHARGE THAT 3M KNEW ABOUT THE DANGERS OF ITS CHEMICALS



Sharon Lerner

April 11 2016, 9:42 a.m.

FOR DECADES, 3M was the primary producer of C8, or [PFOA](#), and was the sole producer of a related chemical known as PFOS. But while DuPont was caught up in a [massive class-action suit](#) over C8, 3M has largely avoided public scrutiny and serious legal or financial consequences for its role in developing and selling these industrial pollutants.

In February, however, a state court in Minnesota, where the company is headquartered, allowed a lawsuit against 3M to move forward. And late last year, lawyers filed a class-action suit in Decatur, Alabama, home to one of 3M’s biggest plants. Both lawsuits charge that 3M knew about the health hazards posed by the perfluorinated chemicals it was manufacturing and using to make carpet coating, Scotchgard, [firefighting foam](#), and other products — and that the company knew the chemicals were spreading beyond its sites. With PFCs cropping up in drinking water around the country and all over the [world](#), the two lawsuits raise the possibility that 3M may finally be held accountable in a court of law.

State Attorney General Lori Swanson first filed the lawsuit against 3M on behalf of the people of Minnesota in 2010, claiming that the company polluted more than 100 square miles of groundwater near its plant in Cottage Grove, Minnesota, as well as four aquifers serving as drinking water for some 125,000 people in the Twin Cities. The suit charges that the company piped PFC-polluted wastewater into a stream that flows into the Mississippi River and disposed of it on land near the river, which allowed it to leach into the river.



Based on the company’s own research, the complaint argues, 3M “knew or should have known” that PFCs harm human health and the environment. [Flip Photo](#) that the chemicals would leach from their disposal site.

Major source of PFAS in the environment: AFFF, Pease AFB, NH

All the white is AFFF
(PFAS-containing foam)



https://www.youtube.com/watch?v=8W_zJfJGhSI&feature=youtu.be

Typical' wastewater & biosolids are part of "ambient background" levels of PFAS.

There are a few cases of large industrial inputs to WWTFs & biosolids; those are industry point sources - not typical.



Source: Dr. Bradley Clarke, RMIT, Per- and polyfluoroalkyl substances (PFAS) in Australia, Dec. 2017 slide presentation to Water Research Australia

Drinking water is the health concern now.
(Food contamination concern is current fad.)



Grist / Samere Fahim Photography

CAKE OR DEATH

That chocolate cake won't last forever, but the chemicals in it might

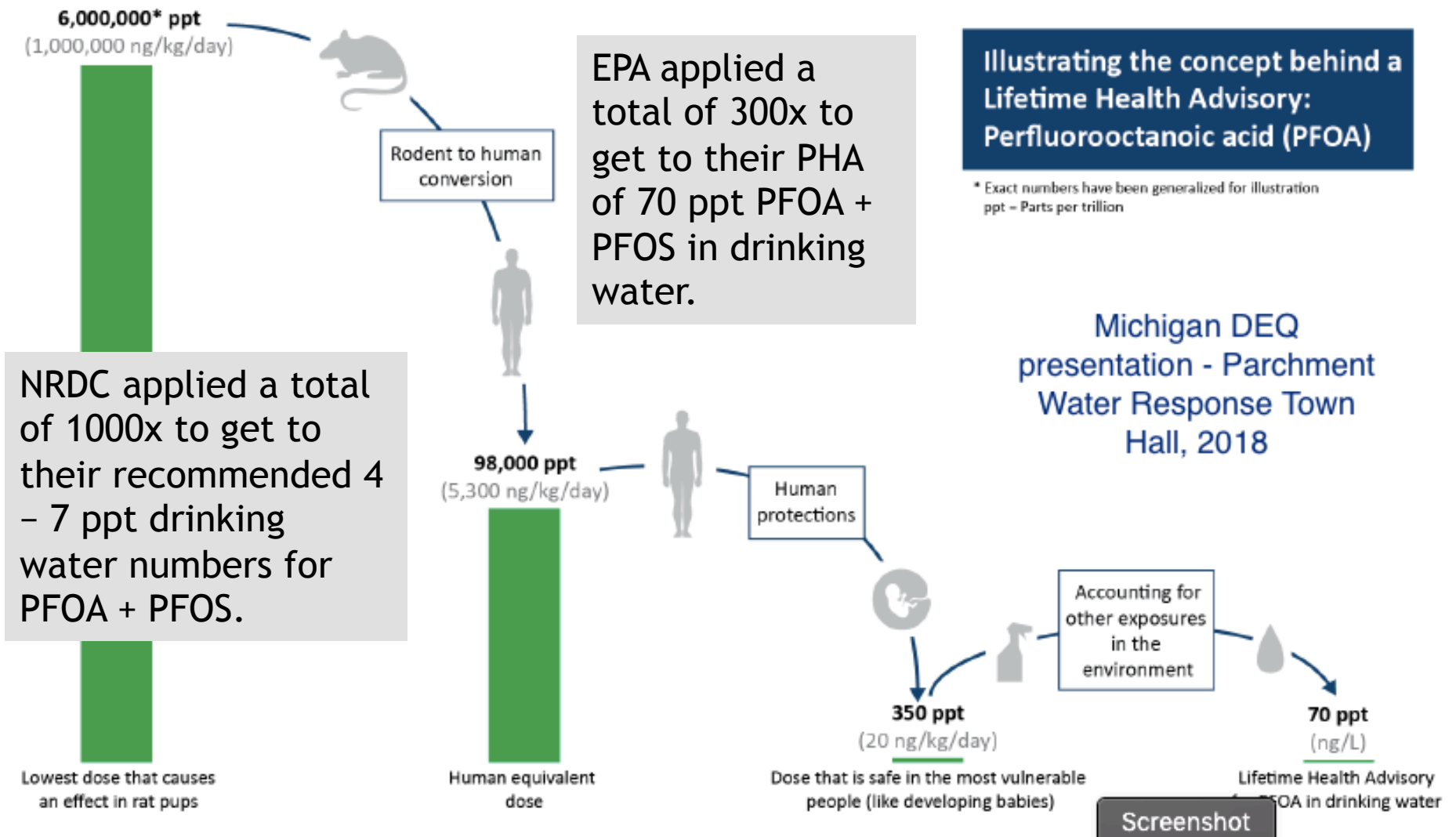
Where they set drinking & groundwater limits impacts biosolids programs:

		Soil Screening Levels for Groundwater Protection (mg/kg)							
		U.S.	U.S States						
Agency		USEPA	Alaska	Maine	Michigan	North Carolina	Texas	Texas	
Department	Regions		DEC	DEP	DEQ	DEQ	CEQ	CEQ	
Year		2018	2017	2018	2016	2018	2017	2017	
Standard		RSL ^a	CL	RAG	GSIPC	PSRG	PCL	PCL	
PFAS	CAS RN				Drinking Surface Water ^b	Non-drinking Surface Water ^c		0.5 acre source	30 acre source
PFNA	375-95-1	--	--	--	--	--	--	0.003	0.0015
PFOA	335-67-1	0.000172	0.0017	0.0095	0.35	10	0.017	0.003	0.0015
PFOS	1763-23-1	0.000378	0.003	0.021	0.00022	0.00024	--	0.05	0.025

- ITRC fact sheets, Table 4.1, May 2019

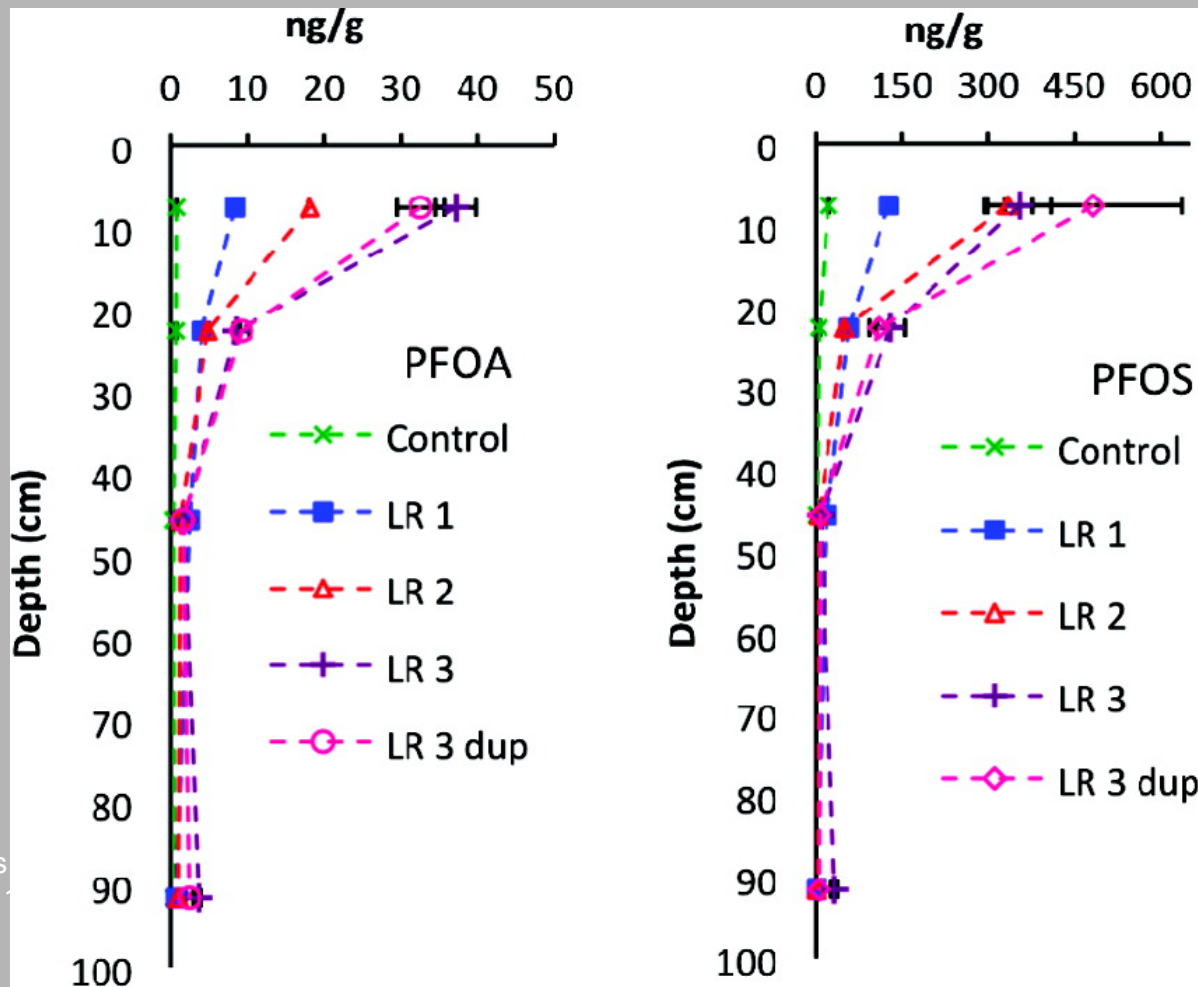
Uncertainty factors applied

when calculating risk levels for drinking water



Some PFAS leach in soil

Sepulvado et al; *Environ. Sci. Technol.* 2011, 45, 8106-8112



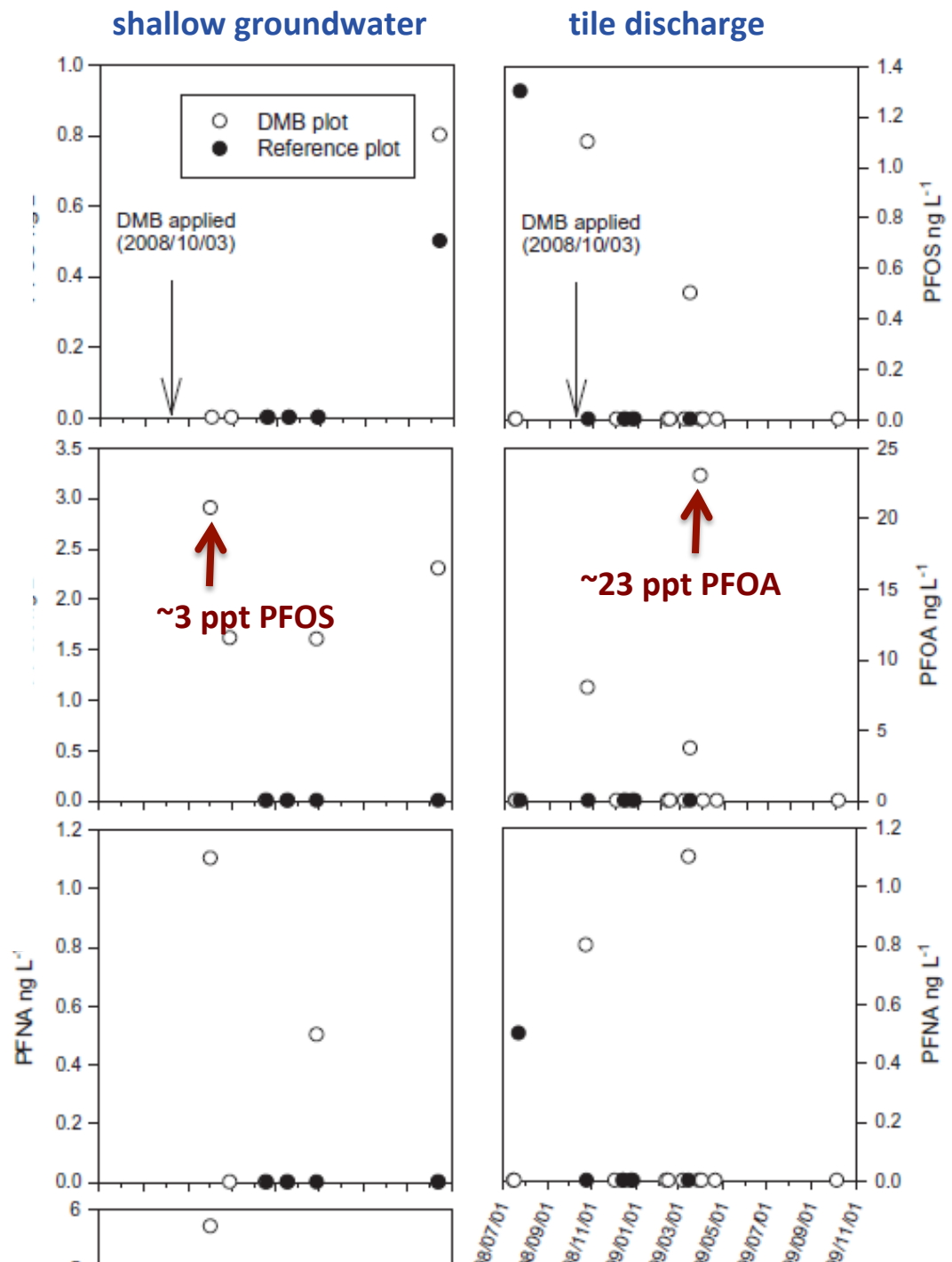
Concentrations
Mg/ha, LR 2 = 1

g/ha, LR 1 = 553

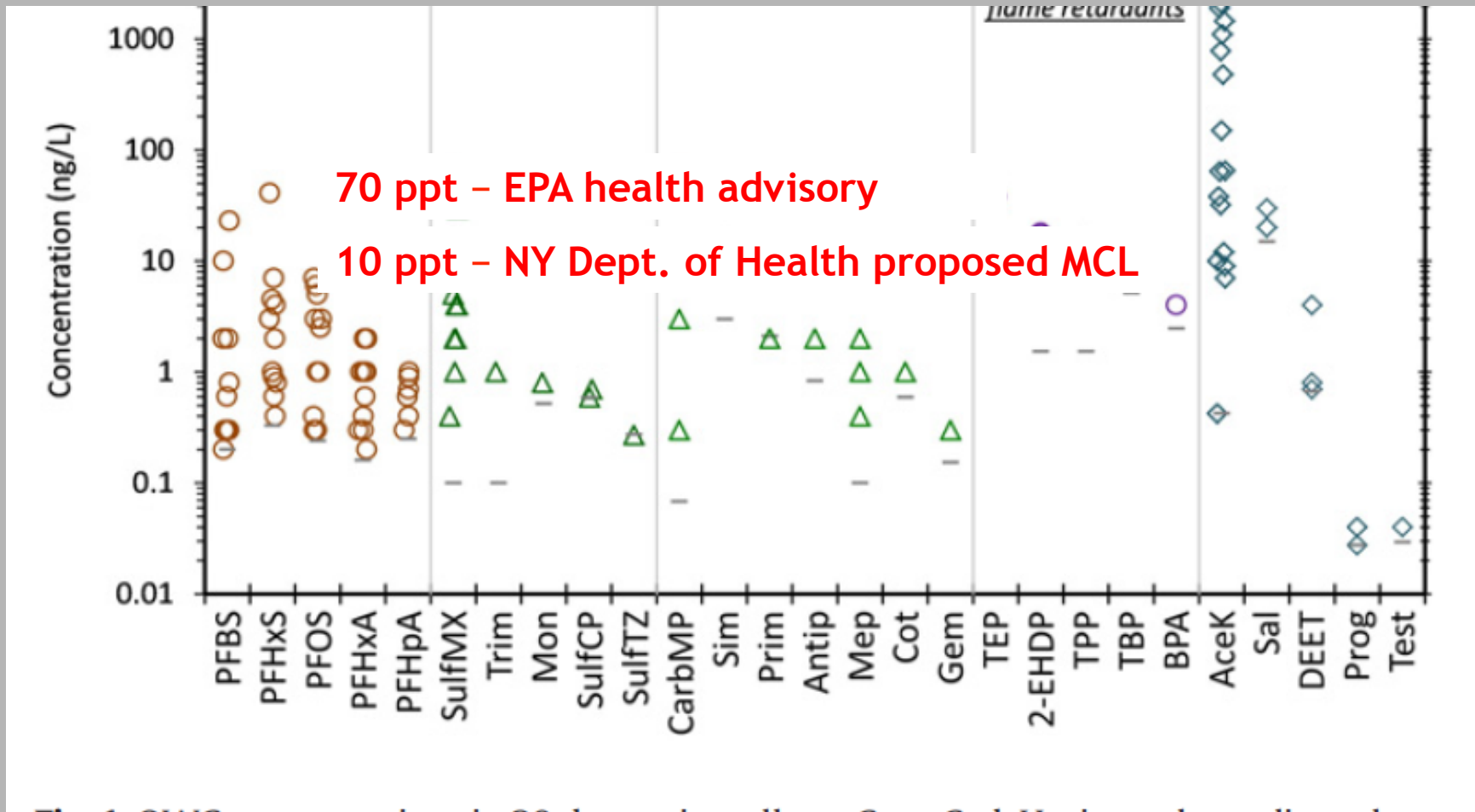
Application of typical biosolids finds:

- Perfluorinated chemicals detected in both groundwater and tile discharge after a single large biosolids application.
- Chemicals detected for months after the application.
- The contributions of leaching through the soil matrix and preferential flow through macropores are unknown.

Gottschall et. al.
2017. *Sci. Total Environ.* 574:
1345 – 1359



Cape Cod Groundwater impacted by septic systems



* Schaider et al., 2016. Septic systems as sources of organic wastewater compounds in domestic drinking water wells in a shallow sand and gravel aquifer. *Sci. Total Environ.*

What's stopping biosolids:

- Regulatory programs setting very low drinking water MCLs & groundwater (& surface water) standards.
- Typical public & media focus on biosolids as part of the problem.

NEBRA's public facing page:

- <https://www.nebiosolids.org/pfas-biosolids>

Includes “Information Update” on Maine farm situation

Lots more detail (password member2017):

- <https://www.nebiosolids.org/pfas-residuals>



Biosolids compost for my raspberries... still using it, even though I know it has PFAS in it. The benefits far outweigh the risks :)



Thank you.

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You're invited:

**MEWEA/NEBRA PFAS Summit
Friday, Sept. 13
Northport, ME**

Presenters include Maine DEP Commissioner, farmer and land applicators impacted by PFAS regulatory response, Maine risk assessor, PFOA & PFOS soil leaching modeler, commercial lab, etc.