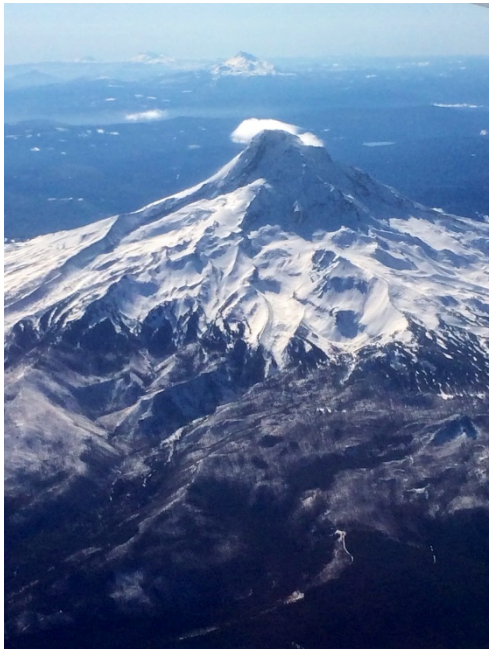
Proactive Positions on Mo & PFAS*



Biofest 2017 (so happy to be here… thanks!)

October 15, 2017

Ned Beecher, Executive Director
NEBRA
Tamworth, NH
ned.beecher@nebiosolids.org

* Per- and Polyfluoroalkyl substances, aka per- and polyfluorinated alkyl substances, aka perfluorinated compounds (PFCs), including PFOA & PFOS

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Acknowledgments "Standing on the shoulders of giants."

- Linda Lee, Ph.D., Purdue University
- Ed Topp, Ph.D., Agri-Food Canada
- Mark Russell, Chemours (retired)
- Harrison Roakes & Stephen Zemba, Ph. D., Sanborn Head Associates
- NEBRA's PFAS Advisory Group
- NH DES
- George O'Connor, Ph.D., Univ. of Florida
- Rufus Chaney, Ph.D., USDA ARS (retired)
- Gary Van Riper
- WE&RF
- Maile Lono Batura & NW Biosolids (thanks for the invite!)

AND CONGRATULATIONS, NW BIOSOLIDS,

FOR YOUR 30-YEAR MOVEMENT!

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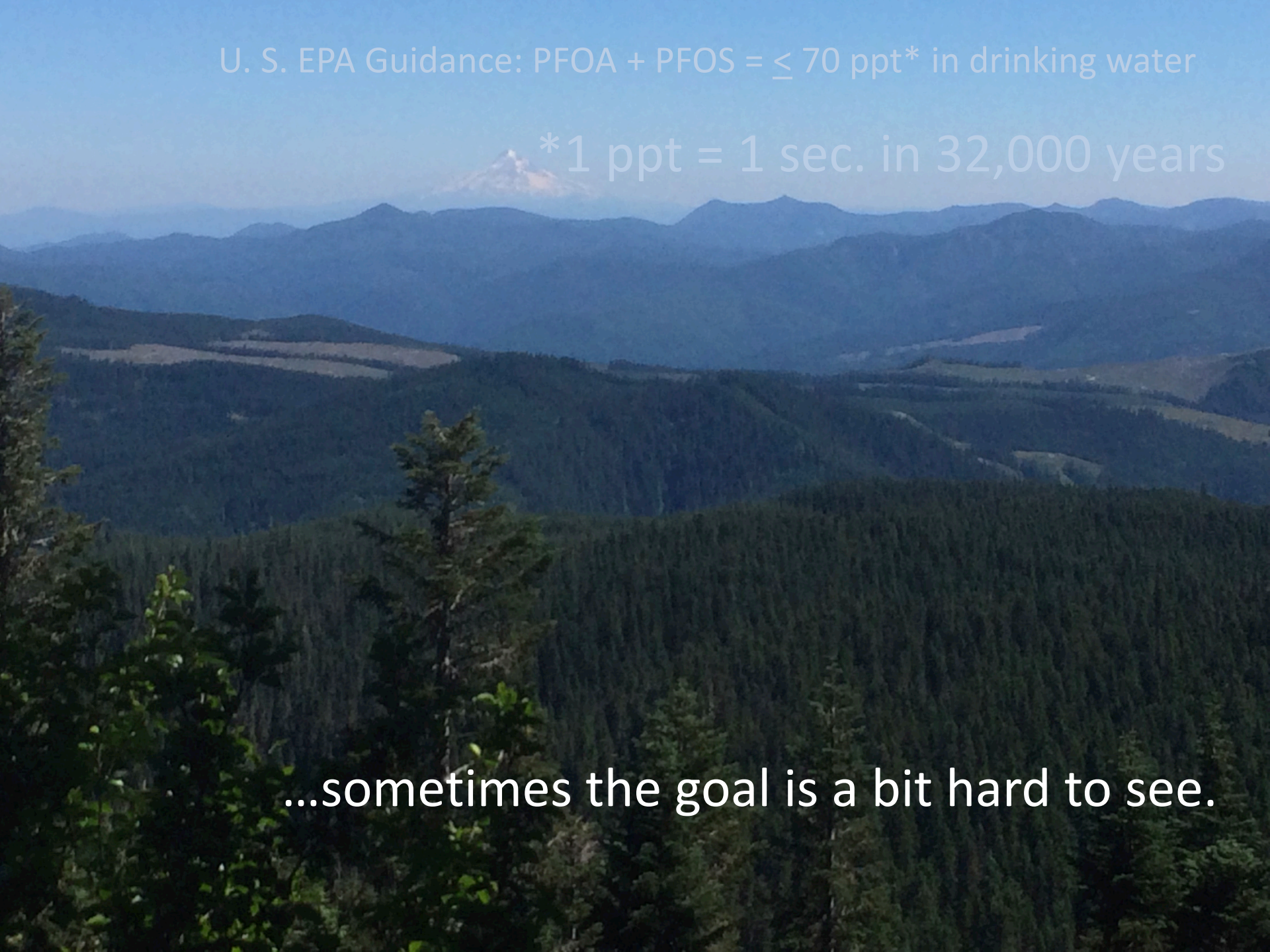
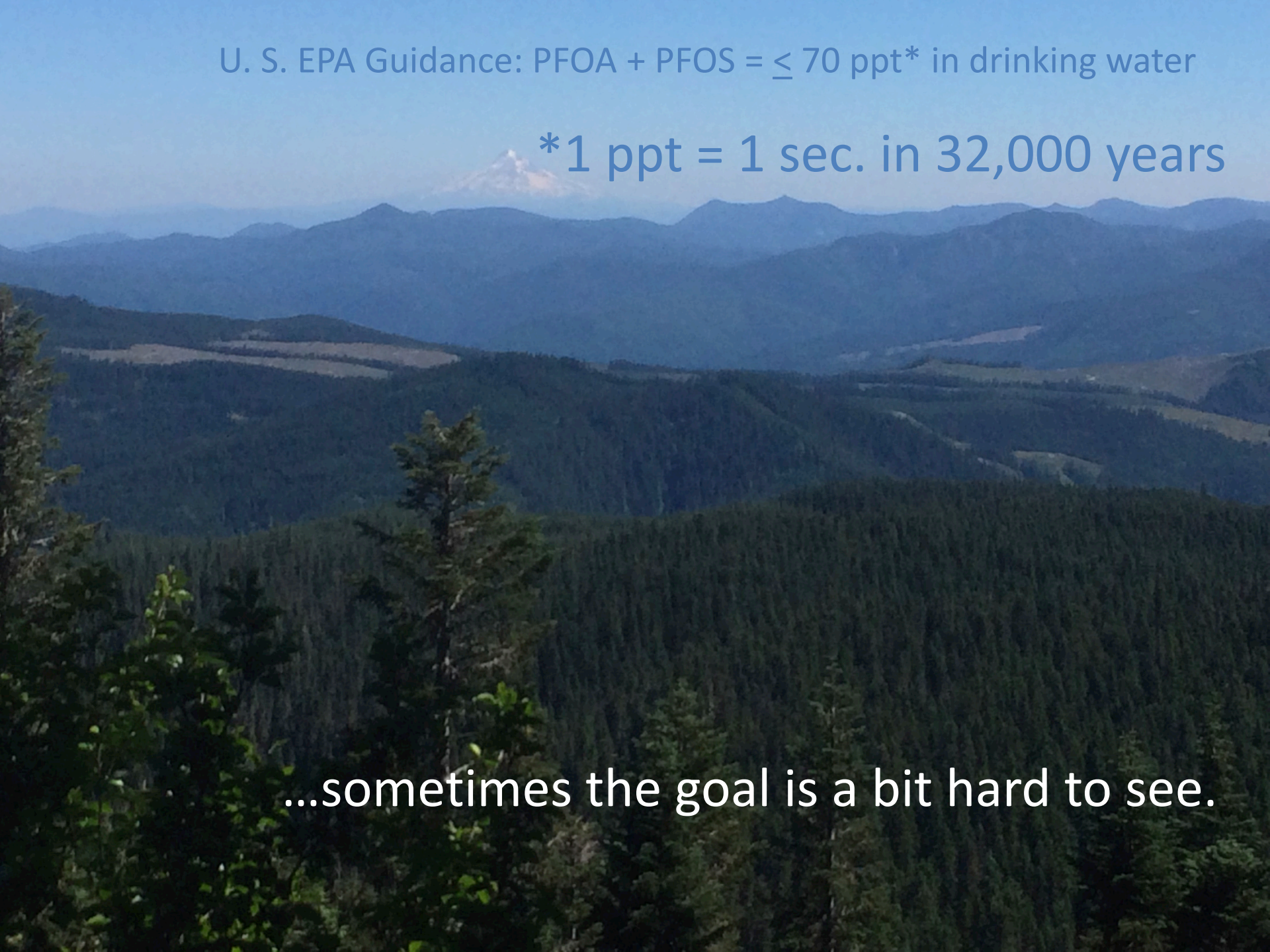

U. S. EPA Guidance: PFOA + PFOS = ≤ 70 ppt* in drinking water
*1 ppt = 1 sec. in 32,000 years
…sometimes the goal is a bit hard to see.


U. S. EPA Guidance: PFOA + PFOS = ≤ 70 ppt* in drinking water
*1 ppt = 1 sec. in 32,000 years
…sometimes the goal is a bit hard to see.

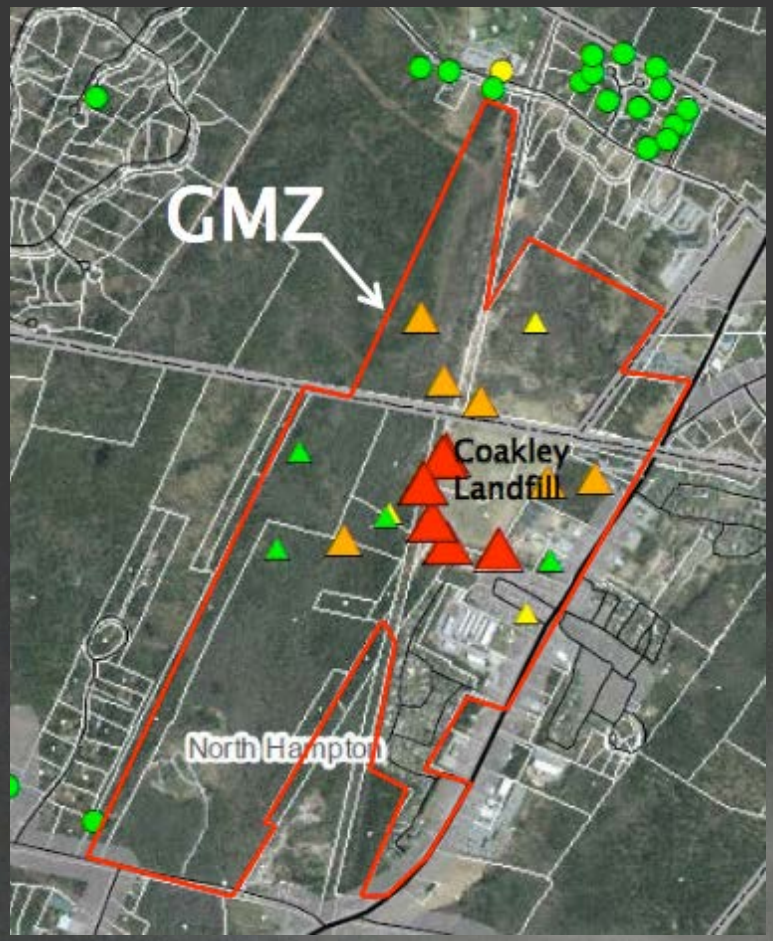
Wandering in the dark…

Rational Regulatory Thinking:

- U. S. EPA guidance: PFOA + PFOS = $\leq$ 70 ppt* in drinking water
- Research finds these everywhere (polar bears, rain).
- Industrial & military sites are clearly impacted. Once we address them, where else to look?
- Literature: PFAS in biosolids & at land application sites.
- Can biosolids & residuals application to soil lead to shallow groundwater levels approaching the EPA guidance value?

NY, NH, & VT industrial site impacts

- Current public attention in the Northeast is due to impacted ground- & drinking water near factories using PFAS, past firefighting sites, and landfills leaching PFAS.



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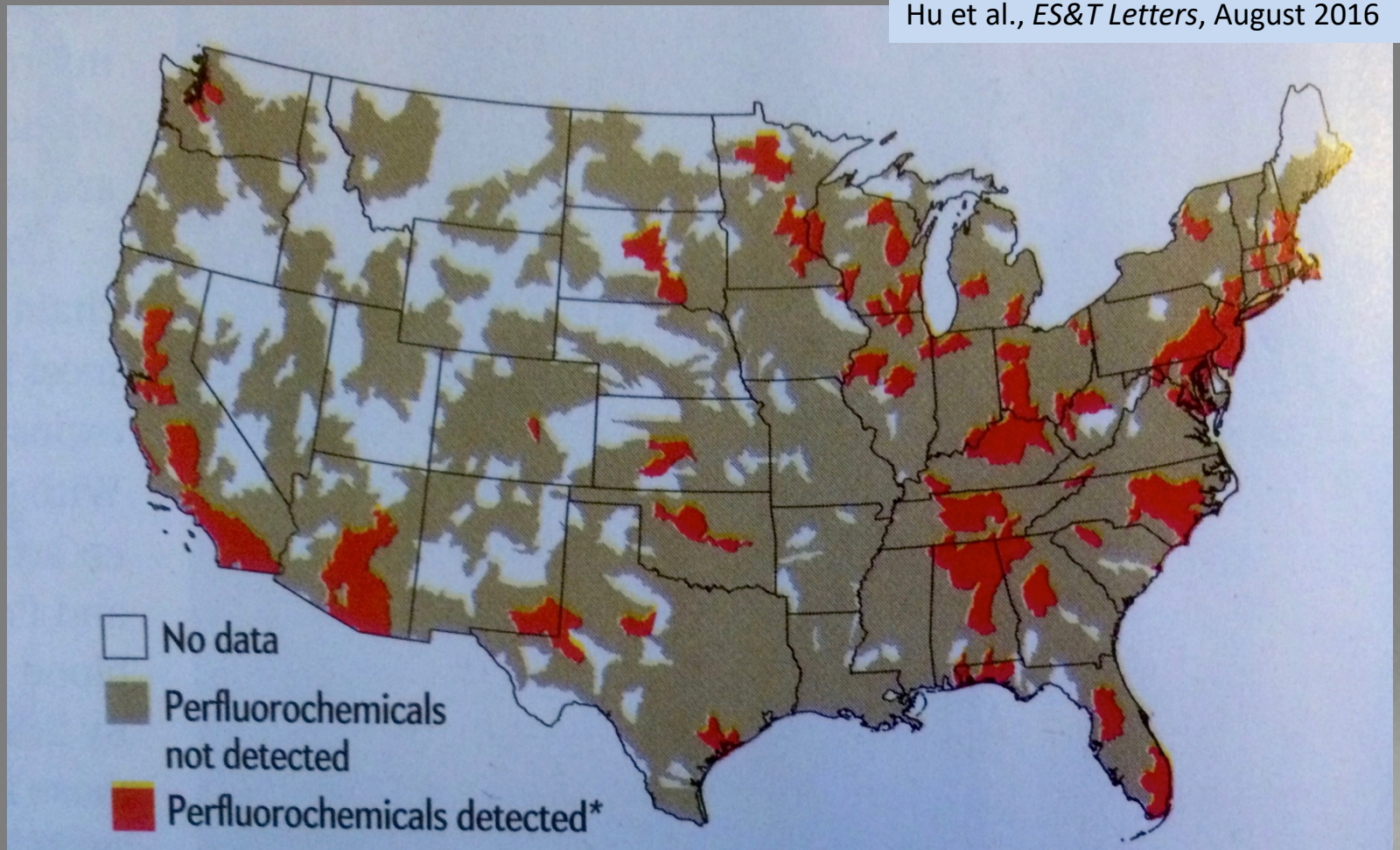
Current attention on PFAS

Scientific American, Apr. 2017, based on Hu et al., *ES&T Letters*, August 2016



*Zip codes where the chemicals were detected in one or more water samples that were at or above the minimum reporting levels required by the EPA (2013–2015). Not all drinking-water sources within a zip code necessarily have high levels.

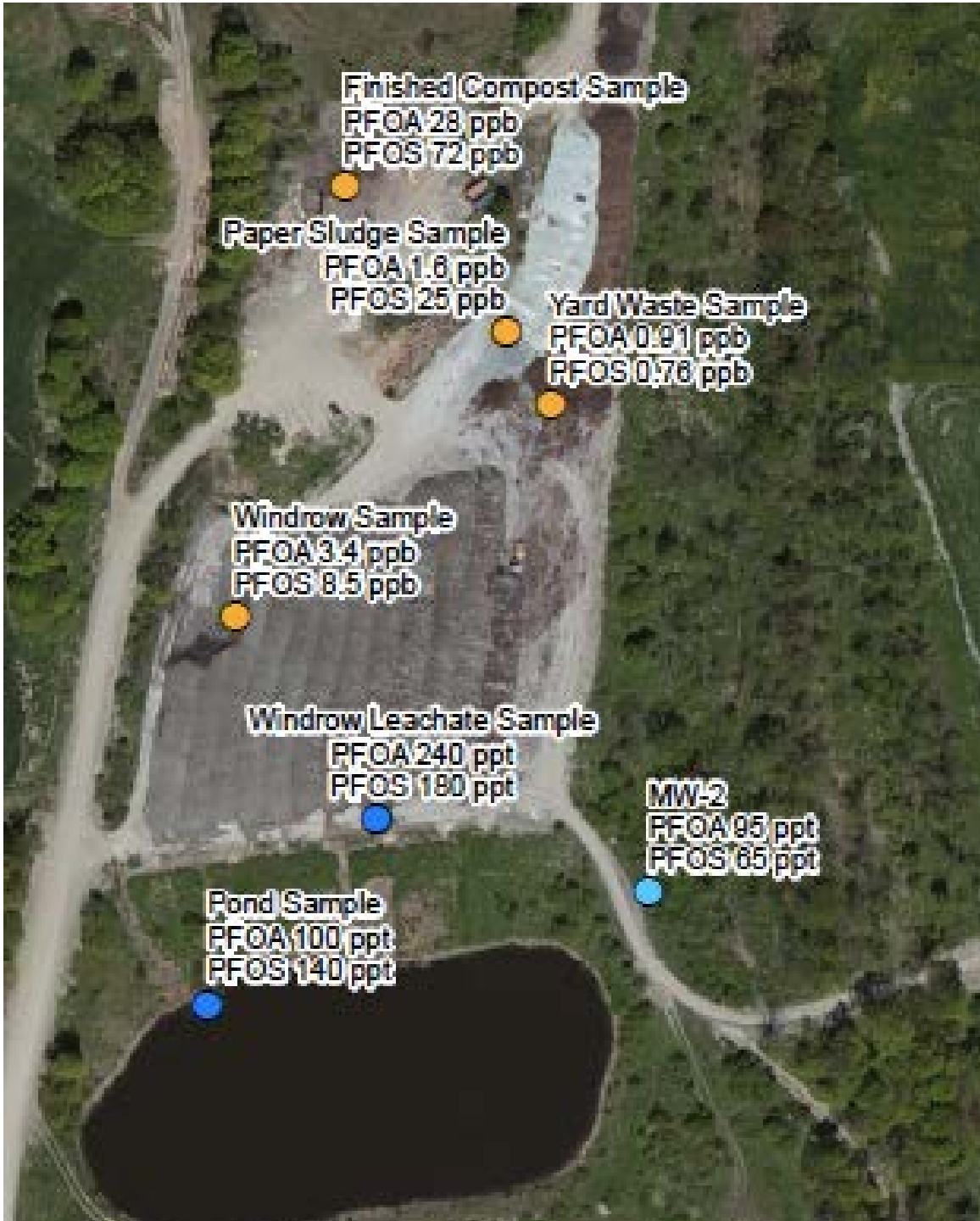
We're at the stage when regulatory responses vary a lot.

	PFOA (ppb)	**PFOS** (ppb)	**Notes**
Soils – Screening Standards			
Minnesota soil reference value, 2012	**2100**	**2100**	
Maine DEP Remedial Action Guidelines	**800**	**11,000**	Based on risk from dermal exposure and ingestion, for residential soil.
Vermont DEC Soil Screening Level	**300**		sure and
Soil Measured Concentrations			
Vermont soils near plastics manufacturing facility in No. Bennington (VT ANR, 2016)	**Non-detect (ND) to 45**		
Garden control soils (MN Dept. of Health), 2005 (n=6)	**0.29 – 0.54** (range)	**0.93 – 2.1** (range)	
Biosolids & Residuals			
Regulatory standards	**none**	**none**	
U. S. biosolids, 2001 (Venkatasen and Halden, 2013)	**34**	**403**	
NH land applied solids, 2017 (n=20)	**2.3** (mean)	**5.3** (mean)	Means using detection limit for reported non-detects.
Heat dried biosolids (n = 5) preliminary data, Mashtare, Lee, et al.	**~2** (mean) **ND to ~10** (range)	**~46** (mean) **3 – 160** (range)	(Strynar and Lindstrom, 2008)
Other media: Dust	**142** (mean)	**201** (mean)	
Human blood, U. S. 2012	**2** (mean)	**6** (mean)	CDC NHANES

Maine now has a draft RAG for PFOA based on leaching potential of 300, 1st of its kind. NY is developing "a number" for paper mill residuals.

Residuals management is being negatively impacted right now.

Regulatory response in March 2017 drives recycle paper mill residuals to landfill and composting business to laying off workers.



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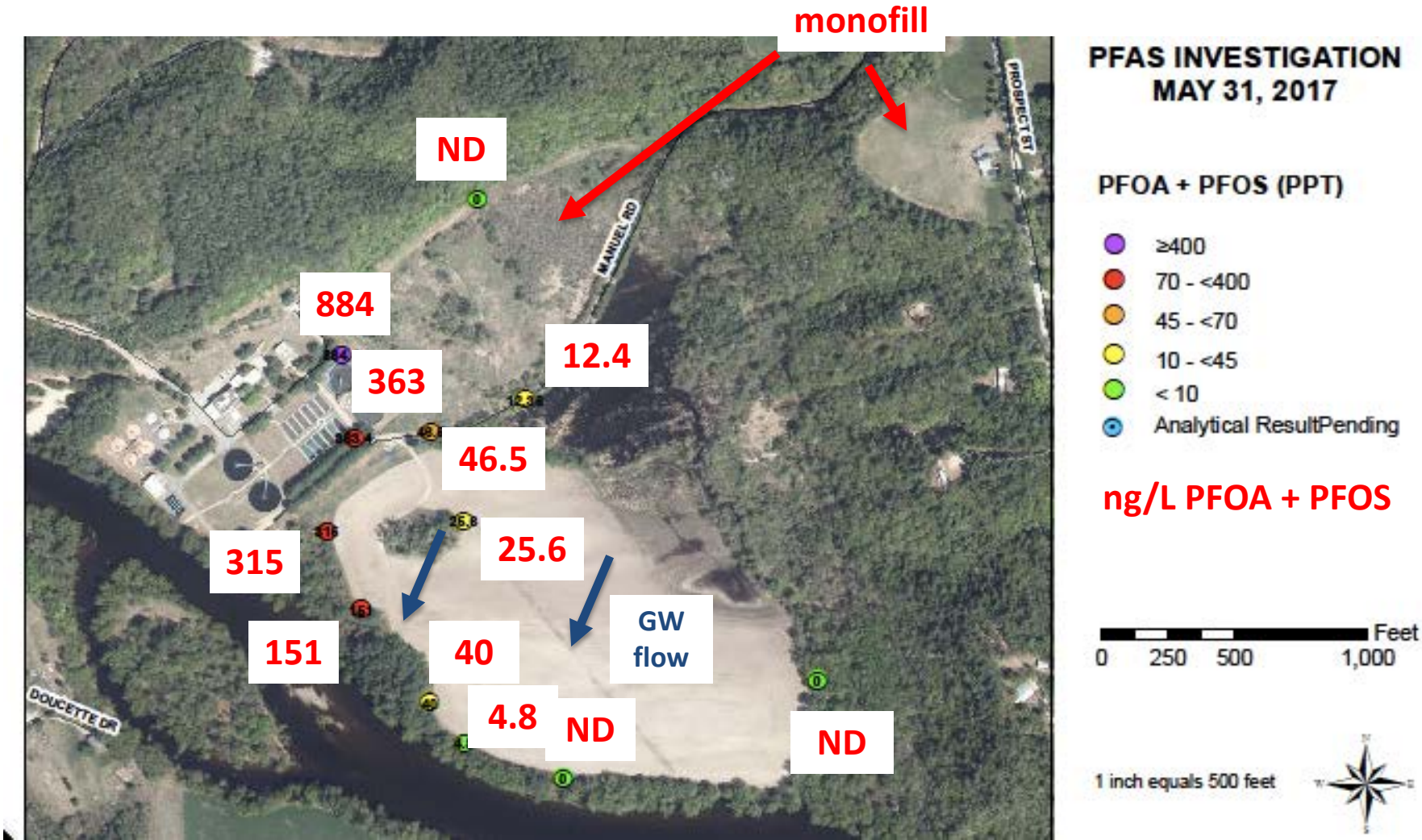
Monitoring well testing at biosolids monofill

- Monofill used in 1980s. Since ~1996, all biosolids from WWTP (11.5 MGD) have been land applied, some on farm field shown.
- Likely a worst-case scenario?



Sampling Class A biosolids home use

- 3 sites / wells
- May 2017 sampling
- 10+ years annual use of Class A compost, pellets, soil blend
- Lawn care, gardens (flower, vegetable), fruit trees, land restoration with topsoil mix
- Wells: 1 surface & 2 drilled (~100’ and 200+’)

Results: ND, except surface well site had hit of 9 ng/L PFOS, which could be from house fire next door, fire department across the street, etc.

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Wandering in the dark…

Legislatures get involved…

- NH 2017
  - Bill dictating MCL calculation like VT's, to create 20 ppt drinking water standard

VT 2017

- Bill establishing liability for costs for water hook-ups to be charged to an identified responsible party (e.g. St. Gobain); BUT, could a responsible party could be a municipal land application program (VT groundwater standard is 20 ng/L)?

Modeling by Mark Russell, formerly w/ Chemours

Results of PFO(A) simulation

SCI-GROW (1 scenario, 1 application)

Typical:	0.009 ug/L
High:	0.046 ug/L
Worst case:	0.23 ug/L

Compare:
VT groundwater standard:
0.020 ug/L

PEARL (5 crops, 9 scenarios, 20 annual applications)

Typical:	0.13 – 0.42 ug/L
High:	0.66 – 2.1 ug/L
Worst case:	3.2 – 10.4 ug/L

Does not take into account dilution / attenuation before withdrawal of drinking water (typical for modeling chemical impacts to groundwater).

German scenario (100 ug/kg max conc, assume 100% PFO)

Typical:	0.3 – 0.8 ug/L
Worst case:	1.2 – 4.2 ug/L

Draft – not reviewed or approved by DuPont management

When you can see, it might be daunting.

Modeling by VT DEC

Compare:
VT groundwater standard:
0.020 ug/L

pollutant concentration in material applied	10.00	µg/kg (dry weight)
application rate	10.00	US tons/acre (dry weight)
aquifer area	1.00	acres
aquifer thickness	10.00	feet
aquifer porosity	30.00	%
background pollutant concentration in aquifer	0.00	µg/L

Increase in groundwater concentration from biosolids application: **~25 ng/L**

When you can see, it might be daunting.

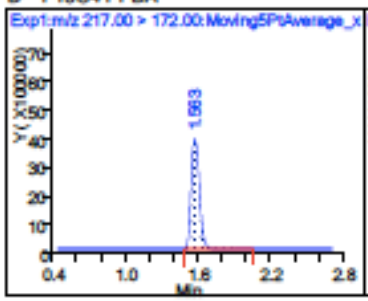
Even analyses are a bit uncertain:

- **There is no EPA-approved method for matrices other than drinking water.**
- **Labs use different "modified Method 537", so data are rough and might not be defensible in court.**

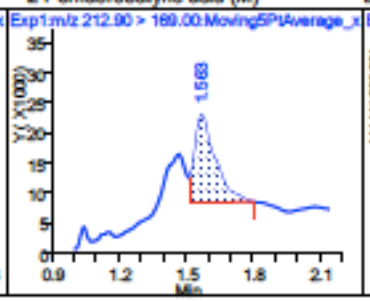
Steep learning curve…

Injection Date:	12-Sep-2017 11:47:16	Instrument ID:	A8_N		
Lims ID:	MB 320-183462/1-A				
Client ID:					
Operator ID:	SYACINSTLCMS01	ALS Bottle#:	4	Worklist Smp#:	2
Injection Vol:	2.0 ul	Dil. Factor:	1.0000		
Method:	A8_N	Limit Group:	LC PFC ICAL		

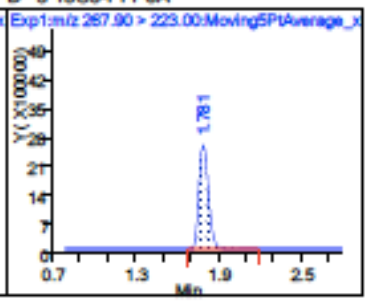
D 1 13C4 PFBA



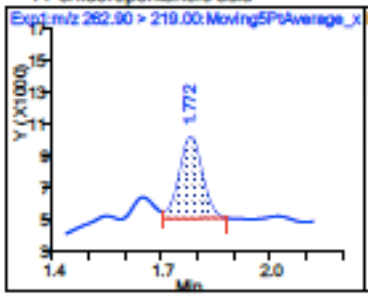
2 Perfluorobutyric acid (M)



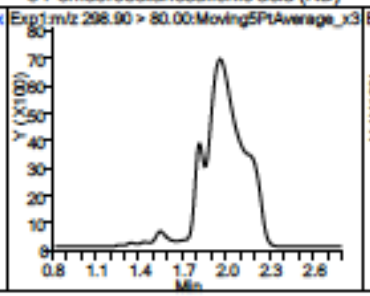
D 3 13C5-PFPeA



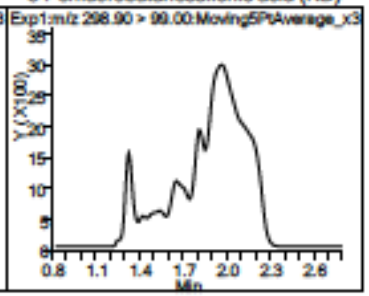
4 Perfluoropentanoic acid



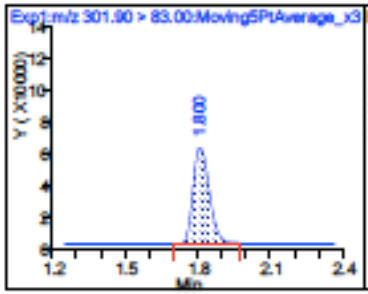
5 Perfluorobutanesulfonic acid (ND)



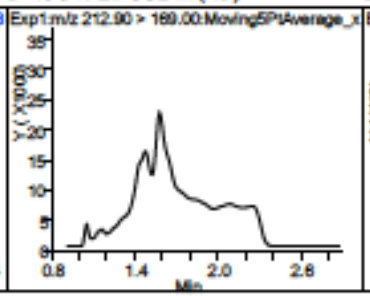
5 Perfluorobutanesulfonic acid (ND)



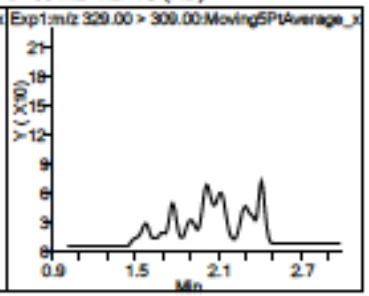
D 47 13C3-PFBS



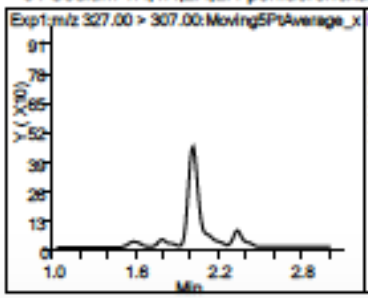
D 40 d-N-EtFOSE-M (ND)



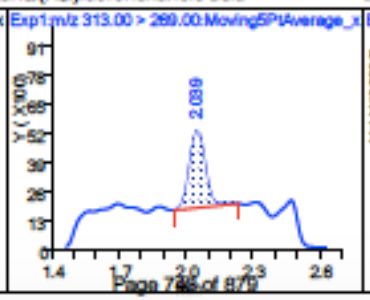
D 60 M2-4:2FTS (ND)



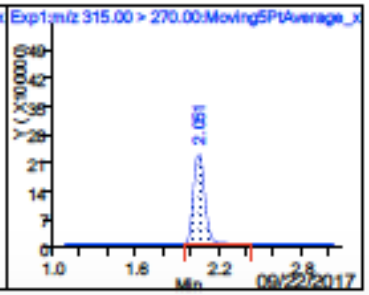
61 Sodium 1H,1H,2H,2H-perfluorohexane



6 Perfluorohexanoic acid



D 7 13C2 PFHxA



Wandering in the dark…

Challenges / Rabbit Holes:

- Public & media drive regulation – and the pressure is growing.
- Biosolids regulatory programs are surprised by this too; their agency drinking water programs are driving this.
- This is a BROAD topic. We have to keep focused just on the wastewater/biosolids/residuals angle (potential for leaching & runoff).
- PFOA & PFOS are phased out :) But there's GenX : (
- There's <u>uncertainty</u> about health impacts, analysis, etc.!

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Context is important

- Biosolids are not a significant source of human exposure.
- PFOA & PFOS in sampled New England biosolids are below 2001 national averages; source reduction has worked. (More data will be helpful, to confirm these findings.)
- Regulatory agencies that adopt low (≤70 ppt) PFAS standards for drinking water or groundwater are finding it hard to enforce and mitigate, because PFAS are everywhere!
  - EPA stresses that the 70 ppt is a public health advisory level for lifetime *drinking* water, protective of sensitive populations
  - With PFOA & PFOS levels already declining dramatically in humans, states need to assess what public health benefit is gained for considerable cost in chasing groundwater protection at lower levels and impacting biosolids programs, with all their other benefits!
- Biosolids managers can apply the same best management practices as for other microconstituents and nutrients (set-backs, depth to groundwater, etc.)

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Not yet re PFAS.
~~Sometimes you feel accomplishment.~~


Sometimes the goal is clear.
Mo in MA
Reasonable Mo standard = 40 mg/kg.


Steep learning curve…
…for us and regulatory agency.

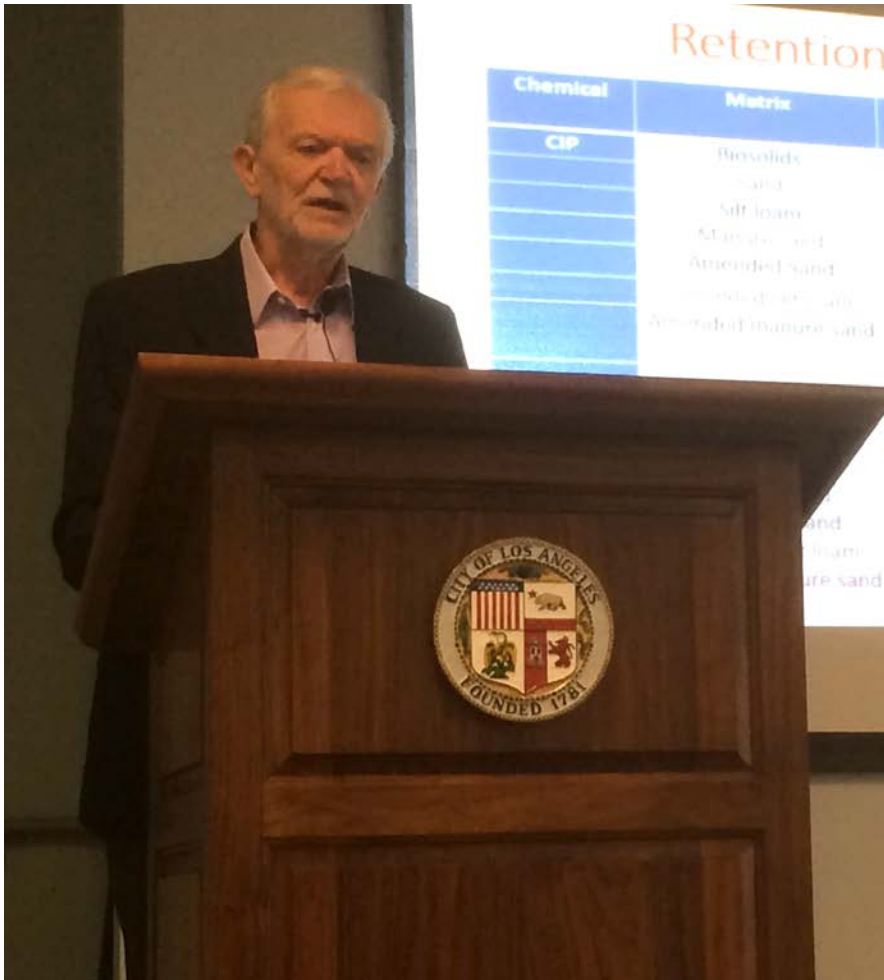
Bring in knowledge:

The MA Mo Workshop, June 17, 2015

- George O'Connor
- Rufus Chaney
- Gary Van Riper & others

Goal: Provide state staff enough data to feel assured that due diligence is done.

Changing a number upward is rare.



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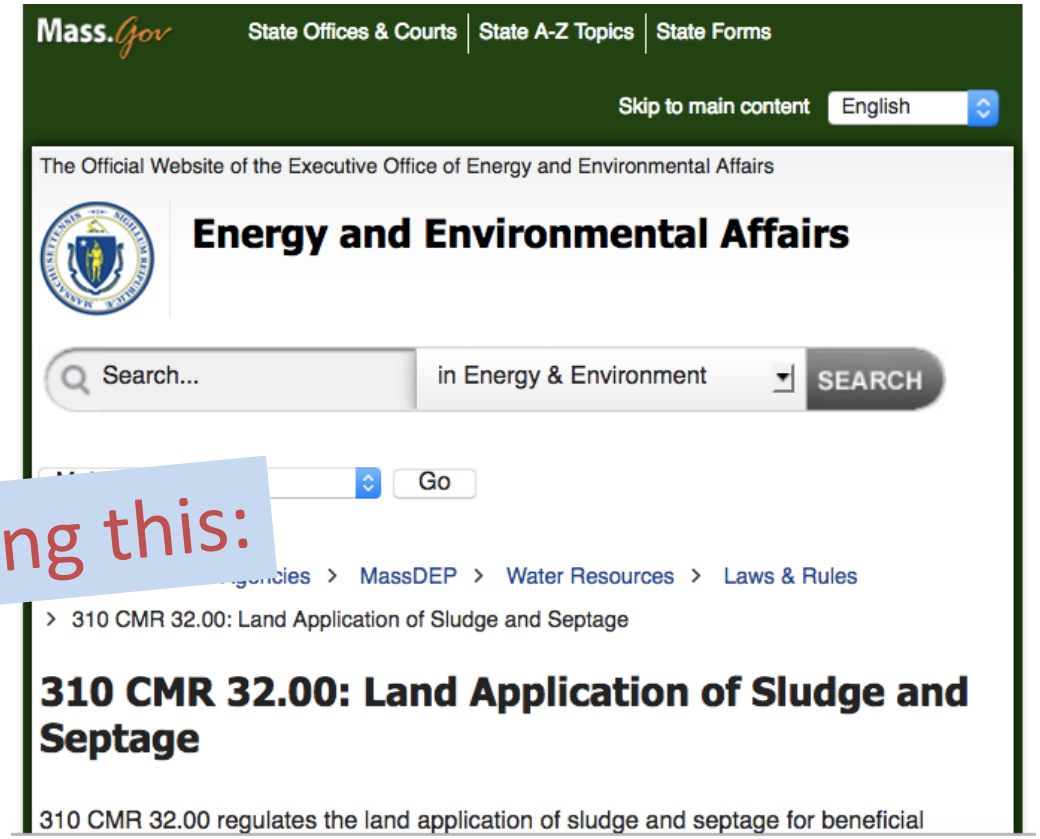
It took a while…

- Started late 2014….
- June 17, 2015 workshop…
- Further discussion…
- Draft regulation…
- September 2016: final regulation



So I now enjoy doing this:

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310 CMR 32.00: Land Application of Sludge and Septage

310 CMR 32.00 regulates the land application of sludge and septage for beneficial

310 CMR 32.00: Proposed Amendments & Public Commer

There are no proposed regulations out for public comment at this time.

310 CMR 32.00: Recently Promulgated Amendments

Amendment to 310 CMR 32: Land Application of Sludge and Septage - effecti

9/23/201

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310 CMR 32.00: Land Application

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Thank you, MassDEP

and the scientists who provided data

TABLE 32.12(2)(a)

Heavy Metals or Chemicals	Maximum Allowable Concentration in Parts Per Million Dry Weight
Cadmium	14
Lead	300
Nickel	200
Zinc	2500
Copper	1000
Chromium (Total)	1000
Mercury	10
Boron (water soluble)	300
Molybdenum	40
PCBs in Type I sludge which is a commercial fertilizer pursuant to 310 CMR 32.11(6)	2
PCBs in Type I sludge which is soil conditioner pursuant to 310 CMR 32.11(6)	1

The change has allowed a dramatic increase in use of Bay State Fertilizer in the Bay State (MA)!

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