Proactive Positions on Mo & PFAS*

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

October 15, 2017

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* Per- and Polyfluoroalkyl substances, aka per- and polyfluorinated alkyl substances, aka perfluorinated compounds (PFCs), including PFOA & PFOS
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!
When getting involved in reviewing & helping develop regulations,...

...sometimes the goal is a bit hard to see.

Sometimes the goal is clear.
Mt. Hood, July 2017
Sometimes we’re wandering in the dark.
When you **can** see, it might be daunting.
Steep learning curve...
Sometimes you feel accomplishment.
Sometimes you feel accomplishment.
At other times, there are only a few bumps along the way.

Sometimes you hit a wall and have to catch your breath.
Wandering in the dark...

PFAS

[Chemical structure image]
...sometimes the goal is a bit hard to see.

U. S. EPA Guidance: PFOA + PFOS = \( \leq 70 \) ppt* in drinking water

*1 ppt = 1 sec. in 32,000 years
U. S. EPA Guidance: PFOA + PFOS = \( \leq 70 \) 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.
Current attention on PFAS

*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.*

*Scientific American, Apr. 2017, based on Hu et al., *ES&T Letters*, August 2016*
We’re at the stage when regulatory responses vary a lot.

<table>
<thead>
<tr>
<th>Soils – Screening Standards</th>
<th>PFOA (ppb)</th>
<th>PFOS (ppb)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnesota soil reference value, 2012</td>
<td>2100</td>
<td>2100</td>
<td></td>
</tr>
<tr>
<td>Maine DEP Remedial Action Guidelines</td>
<td>800</td>
<td>11,000</td>
<td>Based on risk from dermal exposure and ingestion, for residential soil.</td>
</tr>
<tr>
<td>Vermont DEC Soil Screening Level</td>
<td>300</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Regulatory standards</th>
<th>PFOA (ppb)</th>
<th>PFOS (ppb)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>U. S. biosolids, 2001 (Venkatasen and Halden, 2013)</td>
<td>34</td>
<td>403</td>
<td></td>
</tr>
<tr>
<td>NH land applied solids, 2017 (n=20)</td>
<td>2.3 (mean)</td>
<td>5.3 (mean)</td>
<td>Means using detection limit for reported non-detects.</td>
</tr>
<tr>
<td>Heat dried biosolids (n = 5) preliminary data, Mashtare, Lee, et al.</td>
<td>~2 (mean) ND to ~10 (range)</td>
<td>~46 (mean) 3 – 160 (range)</td>
<td>(Strynar and Lindstrom, 2008)</td>
</tr>
<tr>
<td>Other media: Dust</td>
<td>142 (mean)</td>
<td>201 (mean)</td>
<td></td>
</tr>
<tr>
<td>Human blood, U. S. 2012</td>
<td>2 (mean)</td>
<td>6 (mean)</td>
<td>CDC NHANES</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>GW flow</th>
<th>PFOA + PFOS (PPT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8 ND</td>
<td>ng/L PFOA + PFOS</td>
</tr>
<tr>
<td>25.6</td>
<td></td>
</tr>
<tr>
<td>363</td>
<td></td>
</tr>
<tr>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>884</td>
<td></td>
</tr>
<tr>
<td>315</td>
<td></td>
</tr>
<tr>
<td>46.5</td>
<td></td>
</tr>
<tr>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>
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.
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)?
When you can see, it might be daunting.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Typical</th>
<th>High</th>
<th>Worst case</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI-GROW</td>
<td>0.009 ug/L</td>
<td>0.046 ug/L</td>
<td>0.23 ug/L</td>
</tr>
<tr>
<td>PEARL</td>
<td>0.13 – 0.42 ug/L</td>
<td>0.66 – 2.1 ug/L</td>
<td>3.2 – 10.4 ug/L</td>
</tr>
<tr>
<td>German</td>
<td>0.3 – 0.8 ug/L</td>
<td>1.2 – 4.2 ug/L</td>
<td></td>
</tr>
</tbody>
</table>

Compare:
VT groundwater standard: 0.020 ug/L

Does not take into account dilution / attenuation before withdrawal of drinking water (typical for modeling chemical impacts to groundwater).
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollutant concentration in material applied</td>
<td>10.00 μg/kg (dry weight)</td>
</tr>
<tr>
<td>Application rate</td>
<td>10.00 US tons/acre (dry weight)</td>
</tr>
<tr>
<td>Aquifer area</td>
<td>1.00 acres</td>
</tr>
<tr>
<td>Aquifer thickness</td>
<td>10.00 feet</td>
</tr>
<tr>
<td>Aquifer porosity</td>
<td>30.00 %</td>
</tr>
<tr>
<td>Background pollutant concentration in aquifer</td>
<td>0.00 μg/L</td>
</tr>
</tbody>
</table>

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.
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 uncertainty about health impacts, analysis, etc.!
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.)
Sometimes you feel accomplishment.

Not yet re PFAS.
Sometimes the goal is clear.

Mo in MA

Reasonable Mo standard = 40 mg/kg.
Steep learning curve...
...for us and regulatory agency.
Sometimes there are only a few bumps along the way.

- Long discussions with the risk assessment staff.
- Providing documents, putting on workshop.
- Helped to have the major utility – MA Water Resources Authority (MWRA) pulling in the same direction (like gravity).
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.
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:
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 Comment

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 - effective 9/23/2016

[Subscribe: Regulations Updates] • [All Proposed and Recently Promulgated Regulations]
310 CMR 32.00: LAND APPLICATION OF SLUDGE AND SEPTAGE

Section

32.01: Authority
32.02: Purpose
32.03: Severability
32.04: Reserved
32.05: Definitions
32.06: Computation of Time
32.07: Accurate and Timely Submittals
32.08: Accurate and Complete Record Keeping
32.09: General Restrictions on Land Application and Storage of Sludge and Septage
32.10: Classification of Sludge and Septage
32.11: Department Approval of Sludge or Septage for Beneficial Purposes
32.12: Criteria for Approval of Suitability
32.13: Obtaining and Keeping an Approval of Suitability
32.14: Additional Requirements for Approval of Suitability for Type I Sludge
32.15: General Requirements for Land Application
32.21: Site Requirements for Land Application of Type I or Type III Sludge or Septage
32.22: Water Pollution Prevention Requirements for Land Application of Type II or Type III Sludge or Septage
32.23: Application Management Requirements for Type I or Type III Sludge or Septage
32.24: Soil Sampling Requirements for Land Application of Type II or Type III Sludge or Septage
32.25: Approval of Site for Land Application of Type II or Type III Sludge or Septage
32.26: Providing Notice of Land Application of Type III Sludge or Septage
Thank you, MassDEP and the scientists who provided data

<table>
<thead>
<tr>
<th>Heavy Metals or Chemicals</th>
<th>Maximum Allowable Concentration in Parts Per Million Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium</td>
<td>14</td>
</tr>
<tr>
<td>Lead</td>
<td>300</td>
</tr>
<tr>
<td>Nickel</td>
<td>200</td>
</tr>
<tr>
<td>Zinc</td>
<td>2500</td>
</tr>
<tr>
<td>Copper</td>
<td>1000</td>
</tr>
<tr>
<td>Chromium (Total)</td>
<td>1000</td>
</tr>
<tr>
<td>Mercury</td>
<td>10</td>
</tr>
<tr>
<td>Boron (water soluble)</td>
<td>300</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>40</td>
</tr>
</tbody>
</table>

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)!
Thank you.

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