PFAS Basics - Why wastewater professionals should learn more.
How to Participate Today

Submit your question using the chat feature. We will answer questions after each section. If we do not get to your question after a section, we will answer at the end of the webinar.

A recording will be made of this webinar. It will be available for replay shortly after the webcast, if you are a member.
Questions & Membership

Please email
Marykay Steinman
CPWQA Administrative Assistant
info@cpwqa.org

Upcoming Events

Hanover Wastewater Treatment Facility Plant Tour – April 12, 2019
Swatara Township Authority Plant Tour – May 10, 2019
Annual Awards Meeting and Golf Tournament – June 28, 2019

www.cpwqa.org
PFAS & Wastewater & Biosolids

Ned Beecher • NEBRA

April 3, 2019

A CPWQA Webinar
FLUOROTECHNOLOGY MAKES IMPORTANT PRODUCTS FOR VITAL INDUSTRIES POSSIBLE

FluoroCouncil member companies voluntarily committed to a global phase-out of long-chain fluorocarbons by the end of 2015, resulting in the transition to alternatives, such as short-chain fluorocarbons that offer the same high-performance benefits, but with improved environmental and health profiles.

**ELECTRONICS**
- Improves insulation, weatherability, transparency and water resistance.
- Provides smooth and smudge-resistant touch screens.

**FIRST RESPONDERS**
- Offers life-saving protection in safety gear and firefighting foams used to fight flammable liquid fires.

**OIL AND GAS**
- Provides reliable equipment to help improve the safety and affordability of oil-field and pipeline operations.
- Improves the reliability and safety of fuel system seals and hoses, O-rings and downhole and field equipment gaskets.

**AUTOMOTIVE**
- Provides every automotive system with durability, heat and chemical resistance and vapor barriers.
- Increases reliability of engine compartment wiring and gauges.
- Improves auto safety by reducing engine compartment fires.
- Protects carpets and seats against stains, soil, oil and water.

**Military**
- Enables apparel and equipment to provide high-barrier skin protection in extreme environments and against chemical warfare agents.

**CHEMICAL/PHARMACEUTICAL MANUFACTURING**
- Provides sterile, corrosion-resistant coatings, linings and equipment.

**AEROSPACE/DEFENSE**
- Enables chemical-resistant tubes, hoses and fluid seals.
- High and low-temperature brakes and hydraulic fluids used in aircraft control systems and brakes.
- Ultra-high frequency wire and cable insulation necessary for navigation, fly-by-wire control and aircraft communications.

**HEALTHCARE**
- Serves as high dielectric insulators in medical equipment that relies on high-frequency signals, like defibrillators, pacemakers and CAT, PET and MRI imaging devices.
- Used to treat medical garments, drapes, and divider curtains to protect against the transmission of diseases and infections.

**SEMICONDUCTORS**
- Creates the ultra-pure manufacturing environments necessary for microelectronics.
- Used for plasma machinery etching, materials, cleaning fluids and wetting surfactants for chemical etchants.

**ALTERNATIVE ENERGY**
- Enables lithium-ion batteries, fuel cells and solar panels, which contribute to reduced emissions and energy costs.

**BUILDING/CONSTRUCTION**
- Enhances durability, UV resistance and anti-corrosion properties to strengthen the lifetime of infrastructure and surfaces.

**OUTDOOR APPAREL/EQUIPMENT**
- Creates breathable membranes and long-lasting finishes that provide water repellency, oil repellency, stain resistance and soil release with abrasion-resistant finishes for apparel and equipment.

FluoroTechnology is the use of fluorine chemistry to create any fluorinated product. When fluorine and carbon atoms join together, a chemical bond is formed. The use and manipulation of this bond in its distinct properties of strength, durability, and flexibility. These properties are critical to the reliable and enduring products that industry and consumer rely on every day.
PFAS – The Basics

- Water soluble, hydrophobic, lipophobic, bind to proteins
- Persistent – C8 and lower versions do not degrade
- Not volatile, resists photolysis & hydrolysis
- Transport pathways: air deposition, leaching & groundwater, surface water
- Human exposure through drinking water (the current focus), food & food packaging, indoor dust & product exposure, use of consumer products
- Sorption & solubility differences among different PFAS
- 4000+ varieties, co-contaminants
- Destroyed at ~1000° C
- No natural counterparts
PFAS = Per- and Poly- Fluorinated Alkylated (Fluoroalkyl) Substances
includes the subset of PFCs – Perfluorinated Compounds (but PFAS is a better term)

Fluorocarbon tail
• Strong bonds
• Hydrophobic
• Oleophobic
• Varying length

Also Note:

More than 4,000 PFAS compounds identified

Slide courtesy Steve Zemba, Sanborn Head
PFAS vs PFAAs

- PFAS chain lengths from ~4 to C16 – not just the infamous C8 PFOA and PFOS

- PFOS C8
  - Perfluorooctane sulfonic acid

- PFOA C8
  - Perfluorooctanoic acid

- MeFOSA
  - Perfluorooctanoic acid (PFOA) precursor

- Perfluoroalkyl acids (PFAAs): terminal microbial metabolites

- Persistent like PCBs BUT much more mobile (low pKₐs; ~anionic)
- Level of concern are at the ppt (ng/L) level (no other common contaminant is regulated in ppts)
- Our challenge for the next decade or two.
Major sources of PFAS in the environment:

- Cottage Grove, MN
- Parkersburg, WV

EPA reaches new C8 deal with DuPont

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

https://www.youtube.com/watch?v=8W_zJfJGhSI&feature=youtu.be
A diffuse PFAS release: wastewater & biosolids mirror modern life.

If they contain any feedstocks from society, they contain PFAS from our modern environments. We know this now, because of advances in analytical chemistry.
Interstate Technology Regulatory Council’s (ITRC) fact sheets

Helpful resources
http://pfas-1.itrcweb.org/
PFAS and Recycling: Putting Them in Perspective
A NEBRA Fact Sheet • March 22, 2018
Find out more: https://www.nebiosolids.org or call 603-323-7654

Recycling organic “wastes” benefits society and the environment. Throughout the U. S. and Canada, biosolids1 (treated wastewater solids), paper mill residuals, composites, and other organic residuals are commonly recycled to soils. This recycling does amazing things. It enhances soil health, recycles nutrients, sequesters carbon, reduces fertilizer & pesticide use, strengthens farm economies, restores vitality to degraded lands, and puts to productive use residuals that every community has to manage. (Wastewater treatment is a vital public health service, and it creates residual solids that have to be managed!) Sustainability & healthy soils require recycling organic residuals. Properly treated and tested, they are not “wastes.”

Trace PFAS are in biosolids, paper mill residuals, organic wastes. Of course they are, because these materials reflect the chemistry of our daily lives, which includes PFAS and many other chemicals that make up in trace amounts (parts per billion or less) the complex mixture of our bodies and our environment. PFAS are mostly in manufacturing and use in products like AFFF. They are also somewhat in atmosphere (as well as in other organic residuals). The two most prominent PFAS, PFOA and PFOS, have recently gained attention due to presence in drinking water across the U. S. and in the most remote environments. However, their extensive use and persistence in the environment has resulted from the use of PFAS-containing aqueous film-forming foams (AFFF) used in firefighting, especially at military sites and airports. Because of their extensive use and persistence in the environment, PFAS are found in drinking water by industries, including at two military bases in New Hampshire: Fort drain, Merrimack and Pease Tradeport, NH. Other drinking water contamination has resulted from the use of PFAS-containing aqueous film-forming foams (AFFF) used in firefighting, especially at military sites and airports. Because of the widespread occurrence of PFAS in the environment, biosolids and other residuals are not sources of PFAS; they convey them. In the 2000s, PFAS were found in typical biosolids (not industrially-impacted) in concentrations of tens to hundreds of parts per billion (ppb). Recent testing of biosolids show significantly lower levels (Figure 1), likely due to the phase-out of PFOA and PFOS over the past decade. Data show no evidence that routine recycling of modern biosolids and residuals leads to groundwater impacts at levels greater than the U. S. EPA health advisory level2.

1 About biosolids
Biosolids have been widely used on farms and other lands across North America for decades. Sixty percent (60%) of U. S. wastewater solids are applied to soils. Seattle, San Francisco, Los Angeles, Denver, Chicago, Boston, Concord, Augusta, Burlington, and hundreds of other communities recycle their biosolids. Many major land grant universities have studied biosolids use on soils and accept the practice, finding little risk when used according to regulations. Every U. S. state and Canadian province regulates and allows biosolids use on soils. U. S. EPA, USDA, and U. S. FDA all support biosolids recycling. Thousands of research publications over 45+ years and two major reviews by the National Academy of Sciences have found biosolids use on soils presents “negligible risk” and that “there is no documented scientific evidence that the Part 503 rule [federal regulation] has failed to protect public health.”

Download at: https://www.nebiosolids.org/pfas-biosolids
questions?
There is debate. That is not ours to figure out. But we comment to ensure no rush to judgment without good science. Drinking water maximum contaminant limits are being set now in NH, MA, NJ, NY, VT…. Wastewater & biosolids may have to demonstrate they don’t affect drinking water at those low MCL levels….
Sources of PFAS Exposure for Humans

- Best documented source is contaminated drinking water near industrial production facilities or waste disposal e.g., Cottage Grove, Minnesota; Parkersburg, West Virginia; Dalton, Georgia; Decatur, Alabama; Arnsberg, Germany; Osaka, Japan (Lindstrom et al. 2011, Environ. Sci. & Technol. (45) 8015 – 8021).

- Food is also implicated in many studies, especially fish from contaminated waters, items contaminated by food packaging and breast milk (Fromme et al. 2009, Inter. J. Hyg. & Envr. Heath (212) 239-270; Mogensen et al. 2015, Environ. Sci. & Technol. (49) 10466 - 10473).

- House dust may also be an important route of exposure – especially for children who ingest relatively higher levels of dust via hand-to-mouth activity (Shoeib et al. 2011, Environ. Sci. & Technol. (45) 7999 - 8005).

Toxicity of PFOA & PFOS is not certain
- Epidemiological studies and laboratory animal studies have not shown consistent and conclusive findings
- Cancer incidence studies in NY, NH, and MN not indicative of PFAS effects
- If PFAS is causing health effects, the effects appear to be subtle
- Current risk-based standards/guidelines for PFOA and PFOS are protective (e.g. EPA’s public health advisory, Health Canada’s numbers)

Reasons for concern
- PFAS in drinking water elevates PFAS in blood.
- Little data for PFAS other than PFOA and PFOS
- Uncertainty = unease = extra conservative protections

Slide courtesy Steve Zemba, Sanborn Head
The major health concern now is drinking water.

- EPA initial health advisory pre-2016:
  \[ \text{PFOA + PFOS} = 600 \text{ ng/L (ppt)} \text{ screening level} \]

- EPA long-term public health advisory May 2016
  \[ \text{PFOA + PFOS} = 70 \text{ ng/L (ppt)} \text{ screening level} \]

- Driven by research like the C8 study around Parkersburg, WV – a PFAS factory town

- Many water utilities & well owners suddenly had to act

- June 2018 – ATSDR Tox. Profiles are wrongly interpreted to say drinking water standard should be 7 – 10 times lower; careful reading shows that a lot of uncertainty remains about health impacts.

<table>
<thead>
<tr>
<th>Half-lives in the human body (geometric means)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFHxS</td>
</tr>
<tr>
<td>PFOS</td>
</tr>
<tr>
<td>PFOA</td>
</tr>
<tr>
<td>PFHxA</td>
</tr>
<tr>
<td>PFBS</td>
</tr>
<tr>
<td>BPA</td>
</tr>
</tbody>
</table>
NRDC applied a total of 1000x to get to their recommended 4 – 7 ppt drinking water numbers for PFOA + PFOS.

EPA applied a total of 300x to get to their PHA of 70 ppt PFOA + PFOS in drinking water.
Findings of the Australian Health Expert Panel – quite a contrast to current level of high concern in some of U. S.

- Associations with several health outcomes, in particular: increased cholesterol, increased uric acid, reduced kidney function, altered markers of immunological response, levels of thyroid and sex hormone levels, later menarche and earlier menopause, and lower birth weight.
- Differences between those with the highest and lowest exposures are generally small, with the highest groups generally still being within the normal ranges for the whole population.
- There is no current evidence that supports a large impact on an individual’s health. In particular, there is no current evidence that suggests an increase in overall cancer risk.
- Possible association with an increased risk of two uncommon cancers (testicular and kidney)… evidence is very weak, inconsistent
- The evidence does not support any specific biochemical or disease screening, or health interventions, for highly exposed groups (except for research purposes).
PFAS behavior in soils (Mobility/Leaching)

- Direct exposure to PFAS in soil is not generally a significant health risk pathway.
- But soil can be a reservoir, releasing a little PFAS to leaching over time. Leaching is the only potential concern.
- Sorption in the soil does occur and may best be described as a sorption equilibrium reaction.
- PFAS sorption equilibria are influenced by:
  - PFAS carbon chain length
  - Organic carbon content
  - pH
  - \([\text{Ca}^{2+}]\)
  - Clay content
  - Specific surface area
- More research needed.
PFAS Risk and Biosolids (PFAS in Soil)

Limited research shows:

• PFAS soil concentrations can be correlated to biosolids loading rate

• Correlation is especially strong for longer chain (>C8) PFCA.

• For short chain PFCA, soil concentration may correlate better with time from last application.

• PFAS concentrations in well water and surface water seem to be correlated to loading rate of short chain PFAS.

• Soil PFAS concentrations at depth may increase over time (slow leaching? degradation of precursors?)

• Soil PFAS concentration can change as a result of precursor degradation.
PFAS Risk and Biosolids (Mobility/Leaching)

• Little evidence that biosolids without obvious industrial PFAS contributions are a risk to public health via groundwater contamination following typical land application

• A determination of public health risk is influenced by several factors:
  • Type and quality of biosolids,
  • PFAS compounds to be considered,
  • Field conditions (climate, soil type, depth to groundwater, etc.), and
  • Regulatory requirements (loading limits, land application restriction, drinking water standards, required setback, application rates).

• Differences in these factors from state to state can lead to different conclusions regarding public health risk
PFAS Risk and Biosolids (Mobility/Leaching)

- Sorption in the soil does occur and is best described as a sorption equilibrium reaction
- PFAS sorption equilibria are influenced by:
  - PFAS carbon chain length
  - Organic carbon content
  - pH
  - $[\text{Ca}^{+2}]$
  - Clay content
  - Specific surface area
- More research needed.
What regulatory numbers there are…

Drinking water:
- 200 ppt PFOA, 600 ppt PFOS - Canadian health drinking water standard
- 70 ppt PFOA + PFOS – U. S. EPA public health advisory (screening level)
- 20 ppt for the sum of PFNA, PFOA, PFOS, PFHpA, PFHxS – Vermont

Soil:
- 300 ppb PFOA – the lowest state (VT) residential clean-up standard based on dermal contact & ingestion – not leaching.
- 0.29 ppb for PFOA and 0.53 ppb for PFOS - Alaska proposed soil cleanup levels based on migration to groundwater (leaching)
- 3 ppb each for PFOA and PFOS - Literature soil screening value (Xiao et al., 2015)
- 72 ppb - NY state screening value in use for residuals under one permit

Non-ag residual: 2.5 ppb for PFOA and 5.2 ppb for PFOS - ME screening value

Typical modern biosolids & paper mill residuals: 1’s to low 10’s ppb – no issue, except maybe for leaching.

Remember:
- 1 ppb = 1 second in 31.7 years
- 1 ppt = 1 second in 31,700 years
At the state level, PFAS investigations start with...

1. ... the drinking water people, and
2... quickly involve groundwater and the site clean-up programs.
3. The wastewater & biosolids programs are surprised by sudden PFAS focus on them.
Sampling & Analyzing PFAS

• EPA Method 537, v. 1.1 is for drinking water only.
• Still no validated EPA method for non-potable waters, soils, sediments, composts and other residuals.
• Labs use their own “Modified Method 537.”
• Different labs = different methods = different interpretation = different results
• Past and current data should be used for “screening purposes” only
• Sampling protocol requires field blanks, specialized containers and equipment, and minimizing possible contamination (e.g. wear washed cotton clothing, no waterproof notebooks, no aluminum foil, etc.)
Water Well Testing in NH
~2,900 water samples
~2,300 sample locations

How a state PFAS investigation progresses...

http://nhdes.maps.arcgis.com/apps/View/index.html?
appid=66770bef141c43a98a445c54a17720e2&extent=-73.5743,42.5413,-69.6852,45.4489
How a state PFAS investigation progresses…
How a state PFAS investigation progresses...

Human Blood Testing in NH

95th Percentile PFC Levels by Community (As of 7/31/17)

- Pease 2015
- Pease 2016-2017
- Southern NH 2016-2017
- MVD 2016-2017
- U.S. Pop 2011-2012
- U.S. Pop 2013-2014

(miocgrams/liter)

PFOS

<table>
<thead>
<tr>
<th>Community</th>
<th>2015</th>
<th>2016-2017</th>
<th>Southern NH</th>
<th>MVD</th>
<th>U.S. Pop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pease</td>
<td>27.4</td>
<td>31.7</td>
<td>21.7</td>
<td>8.6</td>
<td>19.8</td>
</tr>
<tr>
<td>Southern NH</td>
<td>16.4</td>
<td>15.2</td>
<td>18.5</td>
<td>6.5</td>
<td>3.4</td>
</tr>
<tr>
<td>MVD</td>
<td>21.7</td>
<td>26.6</td>
<td>10.1</td>
<td>5.7</td>
<td>5.4</td>
</tr>
<tr>
<td>U.S. Pop 2011-2012</td>
<td>8.6</td>
<td>6.5</td>
<td>5.6</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>U.S. Pop 2013-2014</td>
<td>19.8</td>
<td>3.4</td>
<td>5.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

https://www.dhhs.nh.gov/media/pr/2017/10102017-pfc-findings.htm
## PFAS in Wastewater

### 2017 data

<table>
<thead>
<tr>
<th></th>
<th>PFBA</th>
<th>PFHXA</th>
<th>PFHXS</th>
<th>PFHXA</th>
<th>PFNA</th>
<th>PFOA</th>
<th>PFOS</th>
<th>PFPEA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C4</td>
<td>C7</td>
<td>C6-S</td>
<td>C6</td>
<td>C9</td>
<td>C8</td>
<td>C8</td>
<td>C5</td>
</tr>
<tr>
<td>Small City Influent</td>
<td>13</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>7</td>
<td>&lt;4</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Small City Effluent</td>
<td>7</td>
<td>&lt;4</td>
<td>&lt;4</td>
<td>46</td>
<td>&lt;4</td>
<td>6</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>Mid-size City Influent</td>
<td>&lt;9.6</td>
<td>7</td>
<td>7</td>
<td>10</td>
<td>&lt;4.8</td>
<td>15</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>Mid-size City Effluent</td>
<td>&lt;9.6</td>
<td>5</td>
<td>8</td>
<td>20</td>
<td>&lt;4.8</td>
<td>15</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Municipality with industrial impacts Influent</td>
<td>56</td>
<td>8</td>
<td>&lt;4</td>
<td>49</td>
<td>&lt;4</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipality with industrial impacts Effluent</td>
<td>73</td>
<td>19</td>
<td>&lt;4</td>
<td></td>
<td></td>
<td>49</td>
<td>&lt;4</td>
<td>101</td>
</tr>
</tbody>
</table>

**How a state PFAS investigation progresses…**
Regulatory over-reaction in March 2017 drove recycle paper mill residuals to landfill and composting business to lay off workers, due to non-drinking, surface water levels up to combined 240 ng/L (ppt) for PFOA & PFOS. (Not drinking water. Do we need to have all surface water meet drinking water screening?)

How a state PFAS investigation progresses...
Monitoring well testing at mine reclamation site reclaimed with biosolids


How a state PFAS investigation progresses…
Look to the literature: PFAS in soil land application, other sites

<table>
<thead>
<tr>
<th>Source</th>
<th>Type of loading</th>
<th>PFOA (ug/kg)</th>
<th>PFOS (ug/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington et al., 2009, Decatur, AL biosolids</td>
<td>Industrially-impacted, high-PFAS biosolids</td>
<td>50 – 320</td>
<td>30 – 410</td>
</tr>
<tr>
<td>Sepulvado et al., 2011 Chicago, IL biosolids</td>
<td>Short-term Long-term</td>
<td>no data</td>
<td>2 – 11 5.5 – 483</td>
</tr>
<tr>
<td>Gottschall et al., 2017, Ottawa, ON biosolids</td>
<td>One-time</td>
<td>0.1 – 0.8</td>
<td>0.2 – 0.4</td>
</tr>
<tr>
<td>Garden control soils, MN (=6)</td>
<td>No significant PFAS source</td>
<td>0.29 – 0.54</td>
<td>0.93 – 2.1</td>
</tr>
<tr>
<td>VT Dept. Health testing (n=100), for comparison</td>
<td>Aerial deposition from nearby industry use</td>
<td>ND – 45 most &lt; 10</td>
<td></td>
</tr>
<tr>
<td>NH DES soil testing 2016 (n=160)</td>
<td>Aerial deposition from nearby industry use</td>
<td>ND – 33</td>
<td></td>
</tr>
</tbody>
</table>

For comparison: 300 ppb PFOA is lowest standard (based on dermal contact & ingestion) ...
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.  
Concerns about short-chain PFASs

Similar biological activity in lab testing


Varying patterns of accumulation in animal organs


Poorer removal during GAC drinking water treatment


More accumulation in plant shoots and fruits

questions?
summary & interim recommendations for wastewater & biosolids management
Summary: Wastewater & biosolids convey PFAS, but...

- **PFAS are ubiquitous.** Even wastewater & biosolids with no industrial inputs can have 1’s to 10’s parts per billion (ppb*). Wastewater & biosolids are not sources, but transfer routes for PFAS. Source control & phase-outs are the best option for reductions. But we will not get to zero PFAS in wastewater and biosolids and the environment anytime soon.

- **Presence does not necessarily mean risk.** For wastewater & biosolids, there is no dermal, inhalation, or ingestion risk. The indirect pathway of leaching to waters is the only possible human health concern, and that will depend on the endpoint screening levels set for ground- and surface waters.

- **Recent data from biosolids sites** show groundwater impacts directly under several worst-case-scenario legacy biosolids sites, but no significant impacts on neighboring drinking water wells. Biosolids & soils bind longer-chain PFAS (e.g. PFOA & PFOS).

- **PFOA & PFOS are at lower levels in modern wastewater & biosolids than in the past,** due to phase-outs. Wastewater & biosolids returning to the environment today are conveying significantly less PFOA & PFOS (~1/10th).

*1 ppb = 1 sec. in 31.7 years / 1 ppt = 1 sec. in 31,700 years*
Summary: Wastewater & biosolids convey PFAS, but... (2)

- **Data are inadequate for robust modeling of leaching potential from biosolids applied to soils.** Most states recognize this. There are no approved EPA analytical methods for solids/biosolids. Need regional / national studies to address data gaps.

- **Environmental impacts:** Wastewater & biosolids have contained PFAS for 50+ years – including PFOA & PFOS at higher levels than today. Bioassays of uses of effluent & biosolids have not found significant negative impacts, only benefits.

- **How much will society – your municipality & state – spend chasing trace PFAS in waste streams & the environment?** And what is the public health benefit compared to use of those resources elsewhere? Prioritize – as DES has done – the obvious, highly-impacted industrial & military sites. Careful thinking is needed as screening levels & standards are set.

- **Best practical option:** Phase out any PFAS that are particularly toxic, persistent, &/or bioaccumulative.

*1 ppb = 1 sec. in 31.7 years / 1 ppt = 1 sec. in 31,700 years*
Interim guidance – wastewater & biosolids

- Evaluate potential sources of PFAS in wastewater. Look upstream for industries that use any of these chemicals. Look at landfill leachate. Apply industrial pretreatment & source control strategies to reduce PFAS in influent.

- Consider testing for PFOA and PFOS and other PFAS. Be careful, because these chemicals are everywhere and the analytical levels (ppt) are challenging. There is still no EPA-approved analytical method for PFAS in non-potable waters; one is expected in late 2019. Plan you sampling & analysis carefully. Know in advance what you will do with these data and what they will mean. Guidance is available.

- Honestly communicate with your regulators, ratepayers, employees, and customers (farmers, landowners) about traces of chemicals – including PFAS – in various media, including wastewater, biosolids, other residuals, composts, digestates, animal manures, and soils. Honor their questions and address them as you can. Offer to provide further information.
Interim guidance - biosolids

» Continue to manage biosolids sites to manage for nitrate and other leachable compounds. Those best practices work for leachable PFAS too.

» Continue to apply biosolids in accordance with the agronomic rate. This controls the amount of any traces of chemicals thus conveyed to the environment, including PFAS. Healthy soils break down and sequester most trace chemicals. Limited research shows that longer-chain PFAS, such as PFOA and PFOS, are bound in the soil; shorter chain PFAS leach somewhat more easily.

» Maintain setbacks and buffers from water bodies. Setbacks protect against nutrient pollution of waters and also reduce the risk of trace PFAS migration to surface water.
Interim guidance – wastewater & biosolids

- Communicate with regulatory agencies and monitor research and the development of legislation and regulation. Discourage the setting of low regulatory standards for drinking water, groundwater, surface waters, and soils without careful consideration of the implications for management of wastewater, residuals, digestates, and biosolids.

- Support targeted field research on PFAS in wastewater, biosolids, and soils.

- Support societal efforts to reduce the use of PFAS – at least any persistent, bioaccumulative (e.g. longer-chain) versions. Support source reduction and pollution prevention.
PFAS in Biosolids and Residuals

Recycling organic “wastes” benefits society and the environment. Throughout the U. S. and Canada, biosolids, paper mill residuals, composts, and other organic residuals are commonly recycled to soils. This recycling does amazing things:

- enhances soil health

NEW! Maine Farm PFAS Concern - Information Update - March 26, 2019
Thank you.

Ned Beecher, Executive Director
NEBRA
Tamworth, NH
ned.beecher@nebiosolids.org
603-323-7654

Biosolids compost for my raspberries... still using it, even though I know it has PFAS in it. The benefits far outweigh any risks.
questions?
CPWQA Membership

Please email
Marykay Steinman
CPWQA Administrative Assistant
info@cpwqa.org

Upcoming Events

Hanover Wastewater Treatment Facility Plant Tour – April 12, 2019
Swatara Township Authority Plant Tour – May 10, 2019
Annual Awards Meeting and Golf Tournament – June 28, 2019

www.cpwqa.org