EMERGING CONTAMINANTS: *1,4-DIOXANE & PFAS*

Environmental and regulatory issues

Midwest Environmental Compliance Conference – Kansas City

April 11, 2018

What is an Emerging Contaminant?

- Many different definitions depending on regulatory program:

  An emerging contaminant (EC) is a chemical or material characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards. A contaminant also may be "emerging" because of the discovery of a new source or a new pathway to humans. **(EPA)**

- Today we will be discussing the following emergent contaminants *du jour*
  - ***1,4-Dioxane; and***
  - ***Per- and Polyfluoroalkyl Substances (PFAS)***

Stay tuned there are many more emergent contaminants to come

Why Focus on 1,4-Dioxane and PFAS ?

1,4-Dioxane and the most common PFAS:

- Highly persistent and resist degradation in the environment
- Mobile within the environment, highly soluble in water
- Have only recently been sampled/analyzed at most known contaminated sites
- Difficult to treat by existing in-situ remediation methods
- Can occur as a diffuse anthropogenic pollutants (DAP) in ground water
- Have health based drinking guidelines/standards in the parts per trillion (ppt) range
- **HAVE BEEN FOUND IN MANY DRINKING WATER SUPPLY SYSTEMS**

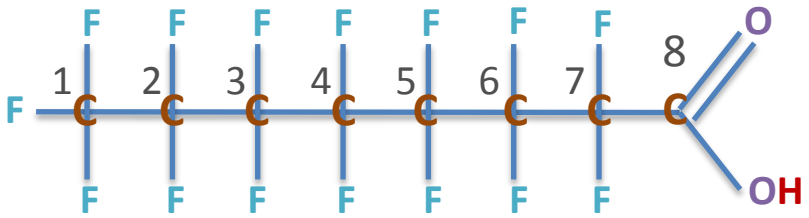
1,4-Dioxane Use and Potential Sources

Processes	Product Uses/Sources
• **Stabilizer in chlorinated solvents** (*e.g.,* with TCA at 1-4% by weight as acid scavenger/metal inhibitor) • Solvent for specific applications in biological procedures (histology) • Solvent used in impregnating cellulose acetate membranes used as filters • By-product during esterification of polyester • Wetting/dispersing agent in textile processes	• Solvent in paints, lacquer & varnish remover • Solvent in stain and printing compositions • Solvent in liquid scintillation counters • Impurity in antifreeze, including aircraft de-icing fluid formulations • "Inert" ingredient in pesticides & fumigants • Purifying agent in pharmaceuticals • Solvent in resins, oils, rubber chemicals, sealants, adhesives, waxes, and cements

Acronyms - PFAS

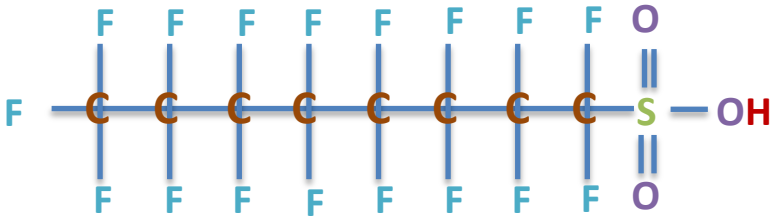
- PFAS = Per- and Poly-fluoroalkyl substances
- Per-fluoroalkyl substances:

(PFOA)



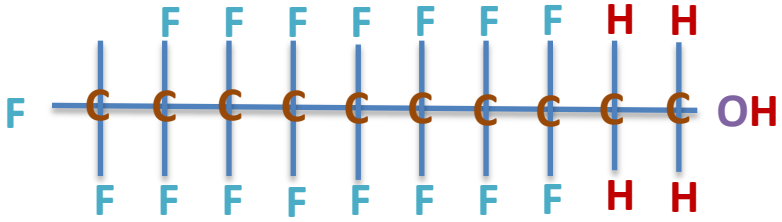
Perfluorooctanoic acid

(PFOS)



Perfluorooctane sulfonic acid

- Poly-fluoroalkyl substances:



Fluorotelomer (8:2 FTOH)

PFAS Use and Potential Sources

Processes	Product Uses/Sources
• PFOA – used in manufacturing of fluoropolymers and substances with special properties since 1940s. In 2006, agreement with EPA to stop producing/using PFOA • PFOS – Aqueous film forming foam produced since mid-60's by 7 manufacturers (3M, Ansul, National Foam, Angus, Chemguard, Buckeye, and Fire Service Plus, Inc.). AFFF not produced in US since 2002.	PFOA • Teflon® • Gore-Tex® textiles • Scotch Guard® • Stainmaster® Carpets • Food containers • Cleaning and personal care products PFOS • AFFF – firefighting at military bases, airports, oil refineries and firefighting training facilities

Sources of PFAS Contamination

- ***Fire training facilities**
- ***Refineries**
- ***DoD sites/Military bases**
- ***Commercial and private airports**
- ***Landfills** (leaching from consumer products)
- ***Chemical facilities**
- ***Plating facilities**
- ***Semiconductor manufacturing**
- ***Textile/carpet manufacturers**

***Sites with high probability of risk-based criteria exceedance**

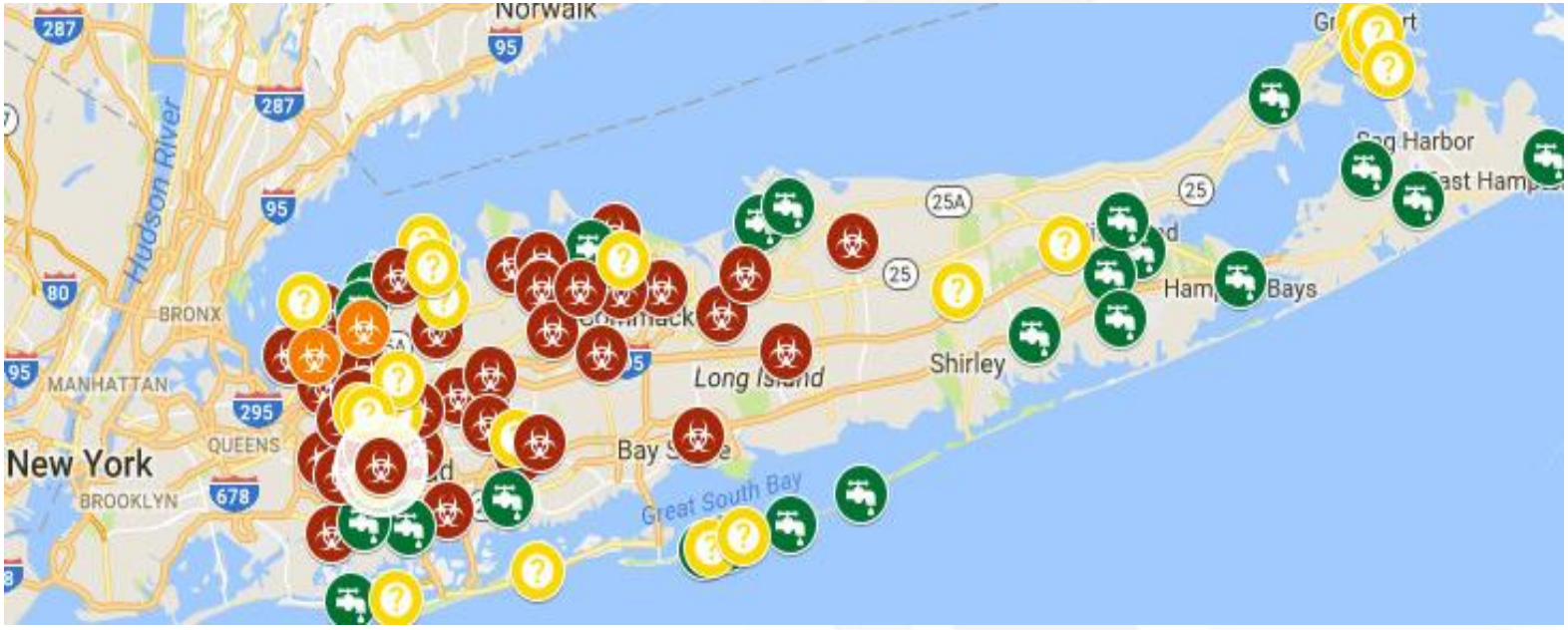
These Emerging Contaminants are Frequently in the News

Newsday

State renews calls for feds to regulate 1,4-dioxane in drinking water

February 24, 2017

71 percent of water suppliers tested on Long Island had concentrations of 1,4-dioxane that pose a 1-in-a-million cancer risk after prolonged exposure.



Ringwood Superfund Site

The Record PART OF THE USA TODAY NETWORK

Report: Contamination in Ringwood could threaten the Wanaque Reservoir

Scott Fallon, Staff Writer, @NewsFallon Published 5:30 a.m. ET June 19, 2017 | Updated 10:20 a.m. ET June 20, 2017

Residents who live next to the Ringwood Superfund site gather outside its gates in December 2015. *(Photo: northjersey.com file photo)*

High levels of a dangerous chemical at the Ringwood Superfund site are a potential threat to the nearby Wanaque Reservoir…

The pollution needs to be treated to ensure it doesn't migrate to the reservoir — just a mile away and contaminate the drinking water that serves as many as 3.5 million people, the report said.

The chemical known as 1,4-dioxane and considered a probable carcinogen, has not been detected in the reservoir. But high levels have been found over the past 18 months in groundwater and brooks that feed into the massive reservoir downstream of an area where an ocean of toxic paint sludge was dumped 50 years ago.

PFAS in the News

Judge Allows Another Lawsuit Over Hoosick Falls Contamination to Proceed

Josefa Velasquez, New York Law Journal

August 2, 2017

The New York Times

Upstate Village Tables Pollution Deal With Saint-Gobain and Honeywell

By JESSE McKINLEY FEB. 28, 2017

*Testing by New York State, has revealed that groundwater and **drinking water** in the Village of **Hoosick Falls** is contaminated with perfluorooctanoic acid (PFOA).*

Hoosick Falls residents at a town-hall meeting protested against a proposed $1 million settlement between the plastics companies Saint-Gobain and Honeywell and the village board over chemical contamination in the town's water. Credit Nathaniel Brooks for The New York Times.

Why do we care?

- We're finding these chemical in:
  - Public Water Supplies ---several ppb
  - Human Blood Serum
- We're learning about potential health effects:
  - Developmental delays
  - Immune system changes
  - Certain cancers
- Persistent and mobile in the environment
- Drinking water standards/guidance for them are in part per trillion range
- Potential to reopen cases previously closed by EPA and State Agencies
  - 5-year review
  - Order of magnitude
  - No standard or guidance years ago when many NFAs were issued
- Randomly found in low concentrations in groundwater:
  - Anthropogenic Pollutant in many historic urban areas
- Innocent Purchaser
- Toxic Tort and Diminution in Property Value Claims
- Current due diligence

Environmental Risks - 1,4-Dioxane

As an emerging contaminant:

- Uncertainty in human health risk data
  - ❖ "Likely to be carcinogenic to humans"
- Low toxicity in aquatic life
- Ongoing improvement of analytical protocols and detection limits
- May be regulated as hazardous waste when used as a solvent stabilizer
- Mainly a groundwater concern (often at chlorinated solvents sites)
- Minimal to no soil, sediment, surface water, and vapor intrusion impacts
- Challenging fate & transport properties
- Poses treatment & remediation challenges

Environmental Risks - PFAS

As an emerging contaminant:

- Uncertainty in human risk data
  - ❖ Easily absorbed after ingestion/inhalation
  - ❖ Bind to proteins in blood, liver and kidneys
  - ❖ Slowly excreted (half-life 2-9 years)
  - ❖ Estimated that >95% of US Population has measureable concentrations PFAS in blood serum
  - ❖ "Possible human carcinogen"
  - ❖ High concentration exposures linked to health effects in humans such as high cholesterol, immune system changes, kidney and testicular cancer, low birth weight

Environmental Risks – PFAS (cont'd)

As an emerging contaminant:

- Persistence – long-term stability, large half-life
  - ❖Not Biodegradable
  - ❖Biomagnifies in food chain
  - ❖Chemically and thermally non-reactive
- Mainly a groundwater concern – highly water soluble
- Ongoing improvement of analytical protocols and detection limits
- Challenging fate & transport properties
- Poses analytical, treatment & remediation challenges

Risk-Based Drinking Water Standards

1,4-Dioxane	PFAS
EPA – Tapwater screening level • No MCL • 0.46 ug/L (460 ppt) States DW/GW range: • 0.3 ug/L (300 ppt) (MA, WI) • 140 ug/L (140,000 ppt) (OH) International DW Standard: • WHO – 50 ug/L (50,000 ppt)	EPA – lifetime Health Advisory: • No MCL • 0.07 ug/L (70 ppt) PFOS + PFOA States – DW/GW Stds range: • 0.014 ug/L (14 ppt) (PFOA, NJ) • 2 ug/L (2000 ppt) (PFOA, NC) International DW Stds range: • 0.0053 ug/L (5.3 ppt) (PFOA, Netherlands) • 0.6 ug/L (600 ppt) (PFOS, Canada)