TETRA TECH

Exploring Emerging Contaminants in Organics Processing

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April 2022

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Emerging Contaminants In Organics
Overview

- Importance of Organics Management
- Focus On: PFAS & 1,4-Dioxane
- Brief Regulatory Update
- Lifecycle
- Impact
- Treatment Options
- Proactive Measures & Future Outlook

Organics Management

Organics management includes:

Collection processing, treatment and reuse of organic material such as…

Green & food waste

Biosolids, farm and dairy waste

Forestry materials + other materials.

Organics Management is Important!

- Reduces greenhouse gases
- Reduces disposal needs & costs (saves landfill space)
- Reduces leachate generation
- Improves soil health
- Stimulates the economy

Emerging Contaminants

- Chemicals not previously detected (or detected in far lesser concentrations) now discovered in water supply

- May pose a risk to human health and environment *(risk not yet fully understood.)*

Per and Polyfluorinated Alkyl Substances *(PFAS): What they are…*

- Compounds resistant to heat, oil, stains, grease, and water
- Released through industrial processes and disposal of PFAS containing products
- Precursors, short chain and long chain
- Persistent in environment and resistant to environmental degradation processes
- Potential for **bioaccumulation**

Per and Polyfluorinated Alkyl Substances
(PFAS) Found in…

Fire-fighting foam

Food packaging,
Non-stick cookware

Adhesives
Paints and varnishes

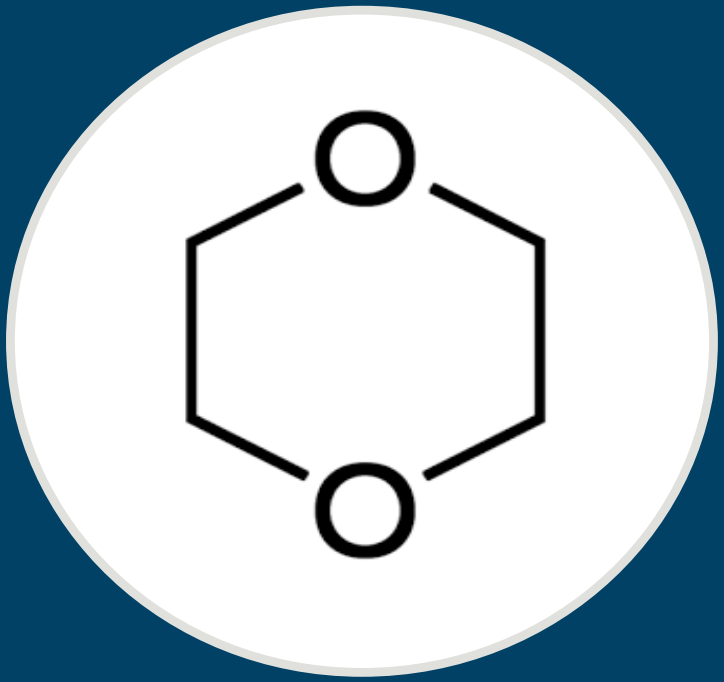
Water repellent clothing,
Personal care products,
Sunscreen

Carpeting & Furniture

Cleaning products

1,4-Dioxane
What it is…

- Synthetic industrial chemical completely miscible in water
- Historically used as a stabilizer for chlorinated solvents, paints, strippers and waxes
- Relatively resistant to biodegradation
- Rapid migration in groundwater
- High likelihood of being in leachate
- By-product of Polyethylene terephthalate (PET) manufacturing and recycling



1,4-Dioxane

1,4-Dioxane
Found in…

Pesticides

Dyes

Greases

Antifreeze

Deodorants & Shampoos

Cosmetics

Emerging Contaminants Regulations
PFAS

EPA

- No MCL for drinking water
- Drinking water health advisories of 70 ppt
- PFOS & PFOA are included on the Contaminant Candidate List (CCL 4)
- EPA PFAS Roadmap Issued in 2021
  - Risk Assessment for PFAS in biosolids expected in 2024

State Regulations

- New York: MCLS of 10 ppt PFOA and PFOS were adopted in July 2020
- New Jersey: 14 ppt PFOA, 13 ppt PFOS, and 13 ppt PFNA MCL
- New Hampshire: 14 ppt PFOA, 15 ppt FOS, 11 ppt PFNA, 18 ppt PFHxS
- Maine: 20 ppt for a combination of 6 compounds
- Maine: Soil screening level of 2.5 ug/kg for PFOA and 5.2 ug/kg for PFOS
- Maine: Soil Remediation Action Guidelines, Water Remedial Action Guidelines, fish tissue and crop specific guidelines

Emerging Contaminants Regulations
PFAS

Location	Year Last Updated	Type	PFOA ppt	PFOS ppt	PFNA ppt
USEPA	2016	DW	0.070	0.070	
	2021	DW/GW	0.400	0.400	
	2019	GW	0.040	0.040	
Connecticut (CT)	2016	DW/GW	0.070	0.070	0.070
	2018	GW	0.070	0.070	0.070
Delaware (DE)	2016	GW	0.070	0.070	
	2016	GW	0.070	0.070	
Maine (ME)	2021	GW	0.070	0.070	0.070
	2021	DW	0.020	0.020	0.020
Massachusetts (MA)	2019	GW	40,000	500	40,000
New Hampshire (NH)	2019	GW	0.012	0.015	0.011
	2020	DW	0.012	0.015	0.011
New Jersey (NJ)	2020	GW	0.014	0.013	0.013
	2020	DW	0.014	0.013	0.013
New York (NY)	2020	DW	0.010	0.010	
	2017	DW			
Vermont (VT)	2020	DW/GW	0.020	0.020	0.020
	2019	GW	0.002	0.002	0.002

Emerging Contaminants Regulations
PFAS

ITRC Fact Sheets https://pfas-1.itrcweb.org/fact-sheets/

Soil Screening Levels and/or Standards for Groundwater and Surface Water Protection (mg/kg)

	Agency	USEPA	Connecticut	Maine	Massachusetts			New York
	Department	Regions	DEEP	DEP	DEP			DEC
	Year Last Updated	2021	2018	2021	2019			2020
PFAS	CAS RN		Protection of GA/GB GW	Leaching to Groundwater	Protection of Drinking Water	Non-Drinking Water/Surface Water Protection		Drinking Water
PFNA	375-95-1	--	0.0014	--	0.00032	0.3	0.4	--
PFOA	335-67-1	0.006100	0.0014	0.0017	0.00072	0.3	0.4	0.00110
PFOS	1763-23-1	0.000378	0.0014	0.0036	0.002	0.3	0.4	0.00370
PFBS	375-73-5	0.00194	--	7.1	--	--	--	--
PFHxS	355-46-4	--	0.0014	--	0.0003	0.3	0.4	--
PFHpA	375-85-9	--	0.0014	--	0.0005	0.3	0.4	--

Emerging Contaminants Regulations
1,4-Dioxane

EPA

- No MCL for drinking water
- Drinking water equivalent level is 1 mg/L
- Industrial Soil Screening Level of 17 mg/kg
- Industry Air Screening Level of 2.5 ug/m^3
- EPA Final Risk Assessment completed in December 2020

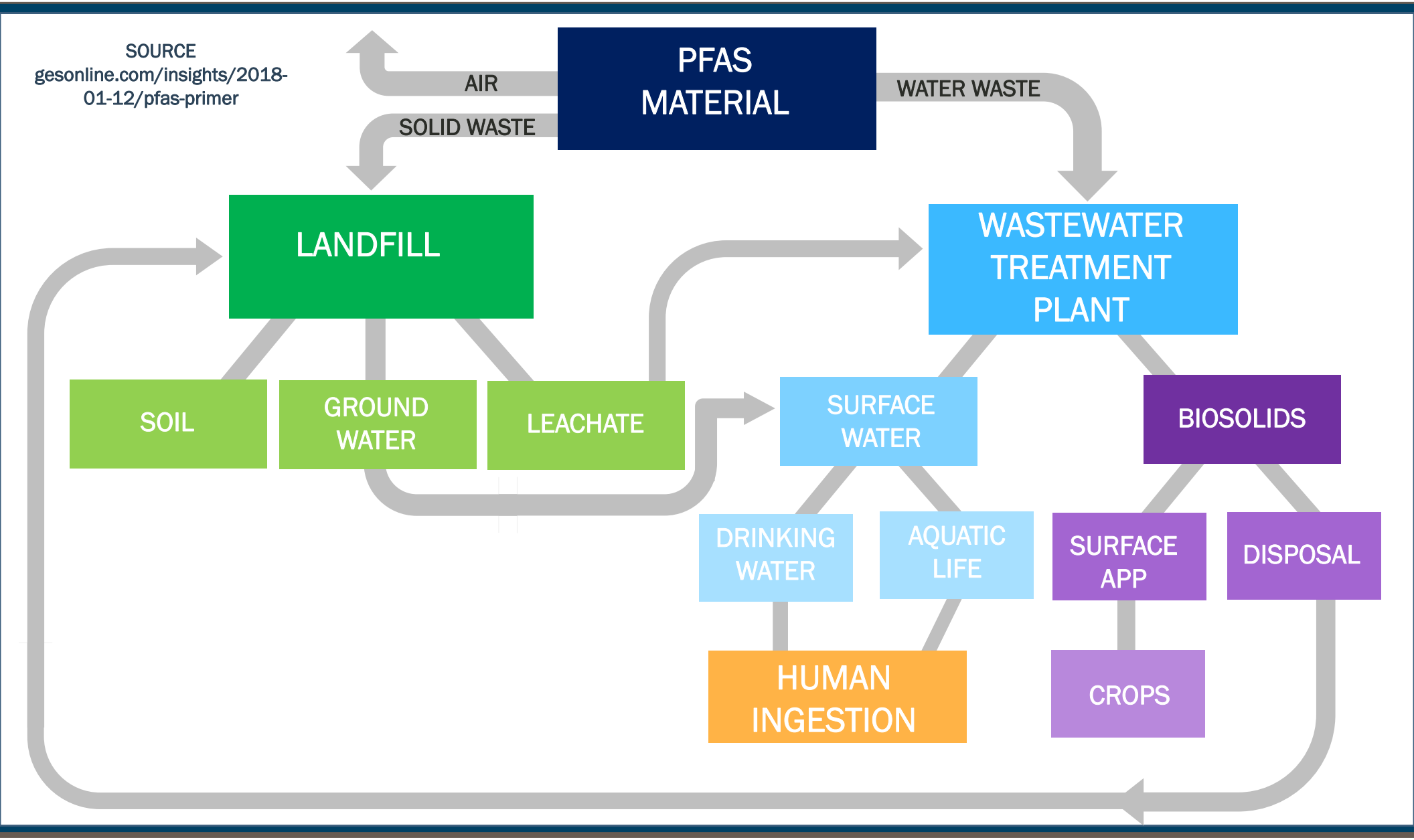
State Regulations

- New York: First state to adopt drinking water standard of 1 ppb
- California: Drinking water notification level of 1 ppb
- New Hampshire: Reporting limit of 0.25 ug/L (public water supply)
- Massachusetts: Drinking water guidance level of 0.3 ug/L
- Other states have guidance levels, or drinking water notification level

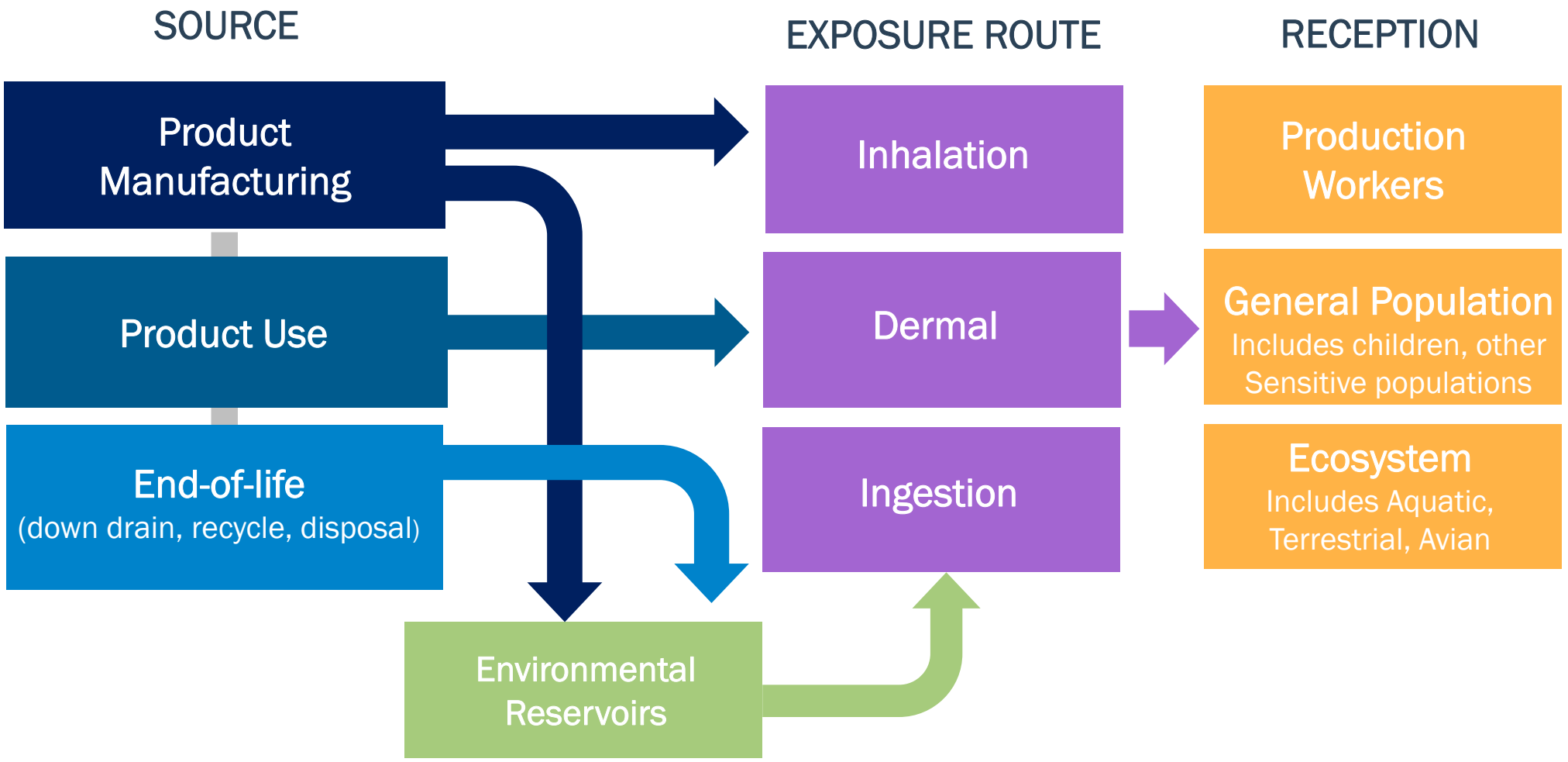
How Contaminants Enter the Organics Stream

- PFAS Lifecycle
- 1,4-Dioxane Lifecycle

PFAS Lifecycle



1,4-Dioxane Lifecycle



Emerging Contaminants in the News

In Maine, 'forever chemicals' are upending this family farm

February 08, 2022 | By Kevin Miller, Maine Public

'I don't know how we'll survive': the farmers facing ruin in Maine's 'forever chemicals' crisis

Maine faces a crisis from PFAS-contaminated produce, which is causing farms to close and farmers to face the loss of their livelihoods

by Tom Perkins with photographs by Tristan Spinski

Alabamians plead for tighter rules on spraying smelly biosolids as fertilizer

Updated: Mar. 17, 2022, 2:59 p.m. | Published: Mar. 17, 2022, 2:59 p.m.

Sewage Sludge Repackaged as Garden Fertilizer Tests Positive for Toxic Chemicals

By Frank Carini / ecoRI News staff | February 10, 2022 | Share

Toxic 'forever chemicals' found in Michigan farm's beef

Examples of Impact of Emerging Contaminants in Organics

- Paper mill residuals applied on farmland showed high levels of PFOS in:
  - Soil (878 ppb)
  - Surface water (476 ppt)
  - Drinking water (42 ppt)
  - Farm milk (938 ppt)
- Composting facility found high PFAS levels in:
  - Stormwater collection pond (240 ppt PFOA and PFOS)
  - At least one of GW monitoring wells (266 ppt PFOA and PFOS)
  - Leachate from windrows (420 ppt PFOA and PFOS)
- Research conducted in Minnesota indicated that every composting site in the study had at least one sample with PFAS over their over the health risk limit (HRL) or Health Based Value (HBV)

Examples of Impact of Emerging Contaminants in Organics

- Continued application of WWTP biosolids over many years resulted in levels of PFOA & PFOS (5 to 46 ppt) in the groundwater.
  - Sandy soil
  - Nearest drinking water wells had ND for PFOA & PFOS
- Research from Maine showed that all but one biosolids sample exceeded the soil screening levels for PFAS
- Sludge sampled from a plastic's manufacturing WWTP showed concentrations of 20,000 ppb and 138,000 ppb for 1,4-Dioxane
  - Manufacturer of PET resins

Potential Impact on Organics Business

- Potential cost impact for digestate treatment or pretreatment
- Potential limit on product usage if contaminated
- Potential impact on product value

Remediation / Treatment
PFAS

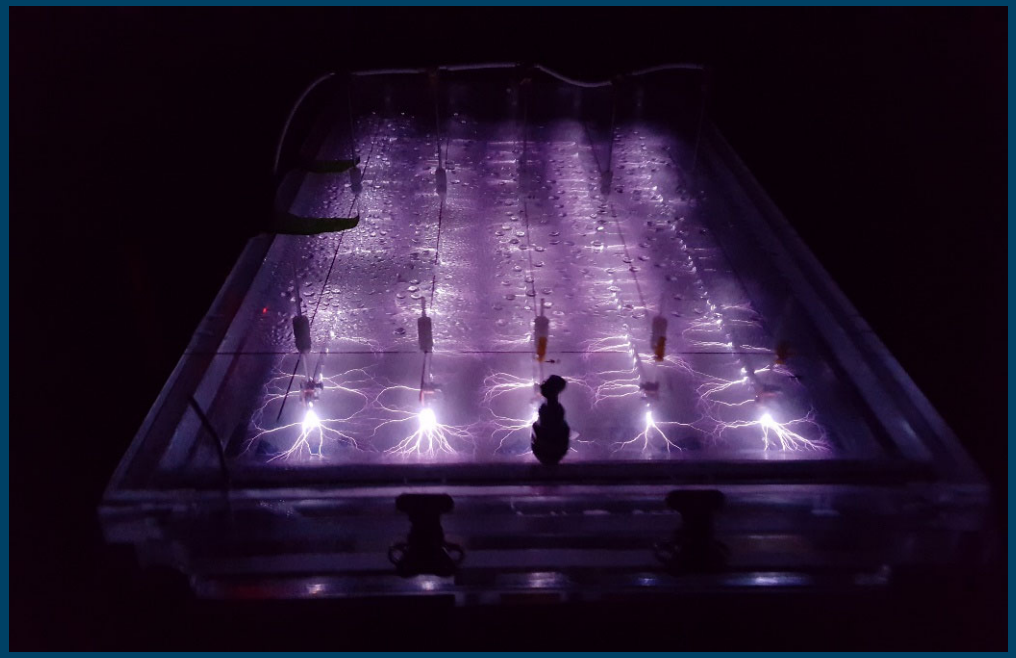
- PFAS is not destroyed through heat drying or composting
- Traditional Techniques for Groundwater and Drinking Water
  - Granular Activated Carbon (GAC)
  - Ion Exchange Resin (IX)
  - Oxidation technologies
  - In-situ containment technologies
- Continually evolving field
- Treatment of leachate and digestate is more difficult

Remediation / Treatment
PFAS – Destructive Technologies

- Destructive technologies break the bonds that hold PFAS compounds together
- Aim is to convert PFAS into CO_2, H_2O and F^- ions through the generation of oxidizing (OH-) or reducing species (e_{aq}^-) to treat and breakdown PFAS compounds
- They provide a treatment method that doesn't create an additional waste stream
- Can be utilized in complex waste streams

Remediation / Treatment
PFAS – Destructive Technologies

- Sonochemical Oxidation (Ultrasound)
- Electrochemical Oxidation
- Plasma Treatment
- High-Energy Electronic Beam (eBeam)



Graphic Source: Air Force Plasma Reactor Demonstration via Clarkson University

Remediation / Treatment
1,4-Dioxane

- Advanced oxidation treatment
- Bioremediation
- Synthetic Ion Exchange Media
- Currently treated for at many locations across the country
- Leachate and digestate treatment will require pretreatment

Minimizing Emerging Contaminants in Organics & Compost

- PFOA and PFOS have been largely phased out of use in both the US, Canada, and EU → replacement chemicals, imports
- Many plant-based products are replacing plastic service ware containing PFAS → can still be lined w/ PFAS products
- Reducing single-use plastic use can reduce the presence of 1,4-dioxane
- Minimizing contamination during compost feedstock acceptance → education of what items have higher PFAS levels

Proactive Measures

- Continue to operate facilities, compost, and apply biosolids
- Look upstream and evaluate sources of emerging contaminants
- Ban products containing fluorinated chemicals (i.e. Washington State)
- Get involved prior to regulations, stay involved
- Educate community and producers on issues and alternatives
- Talk to your consultant!

Projecting the Future

- Regulation of organics and other media
- Regulation/guidance on use of biosolids & land spreading of wastes
- Further studies & information on emerging contaminants in organics
- Pre-treatment or treatment
- Education & product information
- Source reduction

Questions

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