



EPA's Draft Risk Assessment for Biosolids and other Municipal Wastewater PFAS Challenges

REGFORM Hazardous Waste Seminar

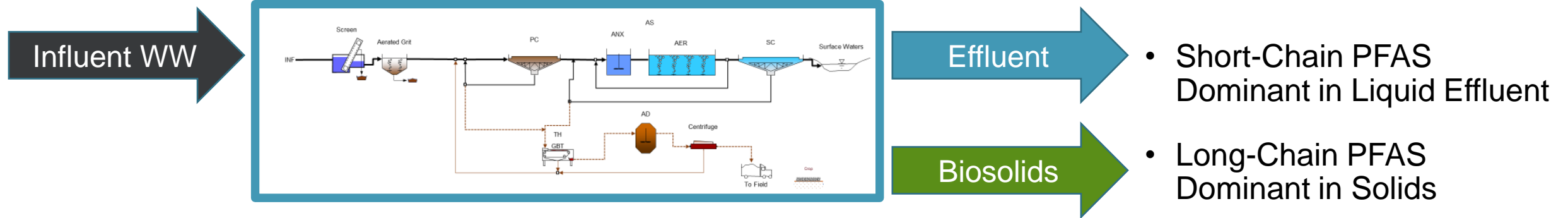
David Carani



4/2/2025

Wastewater Treatment PFAS Fate and Transport

Water Reclamation Facility (WRF)



- Industrial Pretreatment Program (IPP)
- Chemical Action Plans
 - Commercial Products
 - Product Stewardship

- Monitoring
- Source Control

- Effluent
 - Surface Water Discharge
 - Groundwater Recharge
 - Reuse
 - IPR/DPR

- Monitoring
- Reduced Loadings

- Biosolids
 - Land Application
 - Incineration
 - Landfill

- Monitoring
- Reduced Loadings

Example Idaho Wastewater Influent and Effluent PFAS

- Predominantly Residential and Commercial Service Area
- Method 1633 Analysis

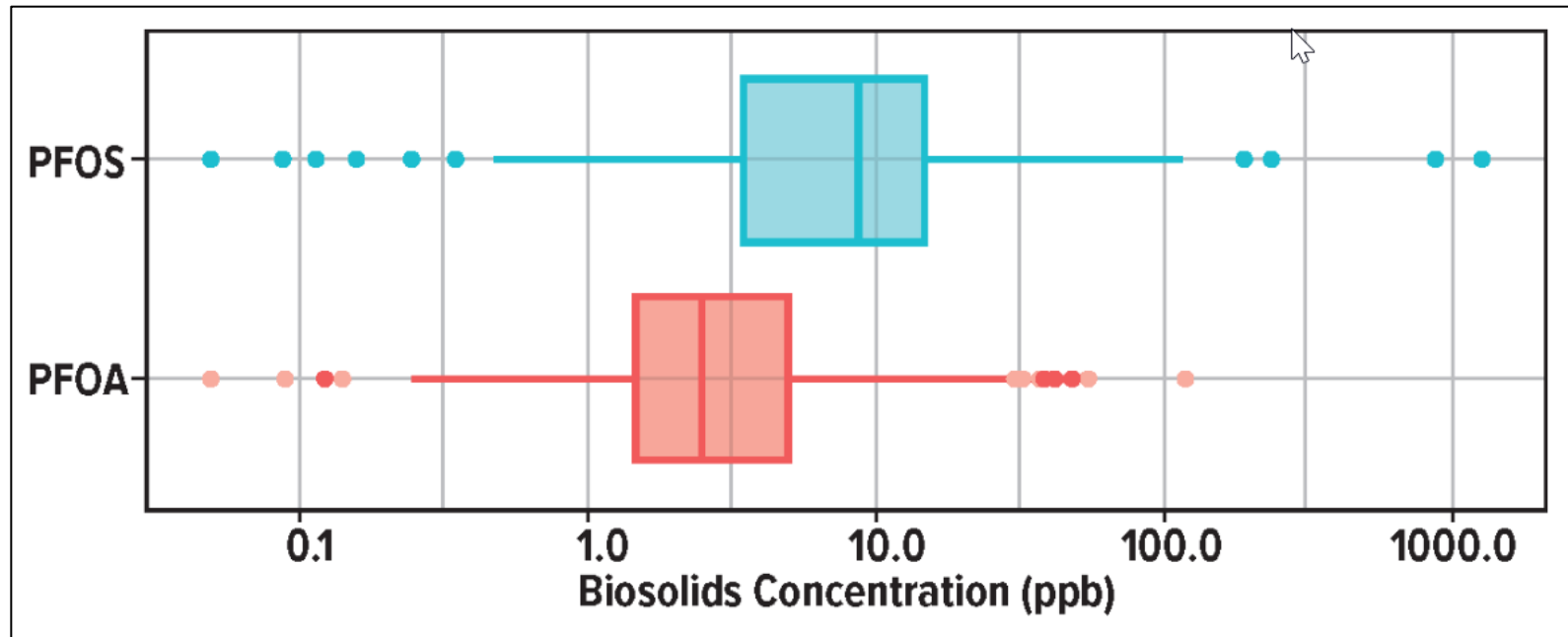
**Draft Surface Water Human Health
Criteria (Water + Organism)**

➤ **PFOA 0.0009 ng/L**

➤ **PFOS 0.06 ng/L**

California Biosolids PFAS

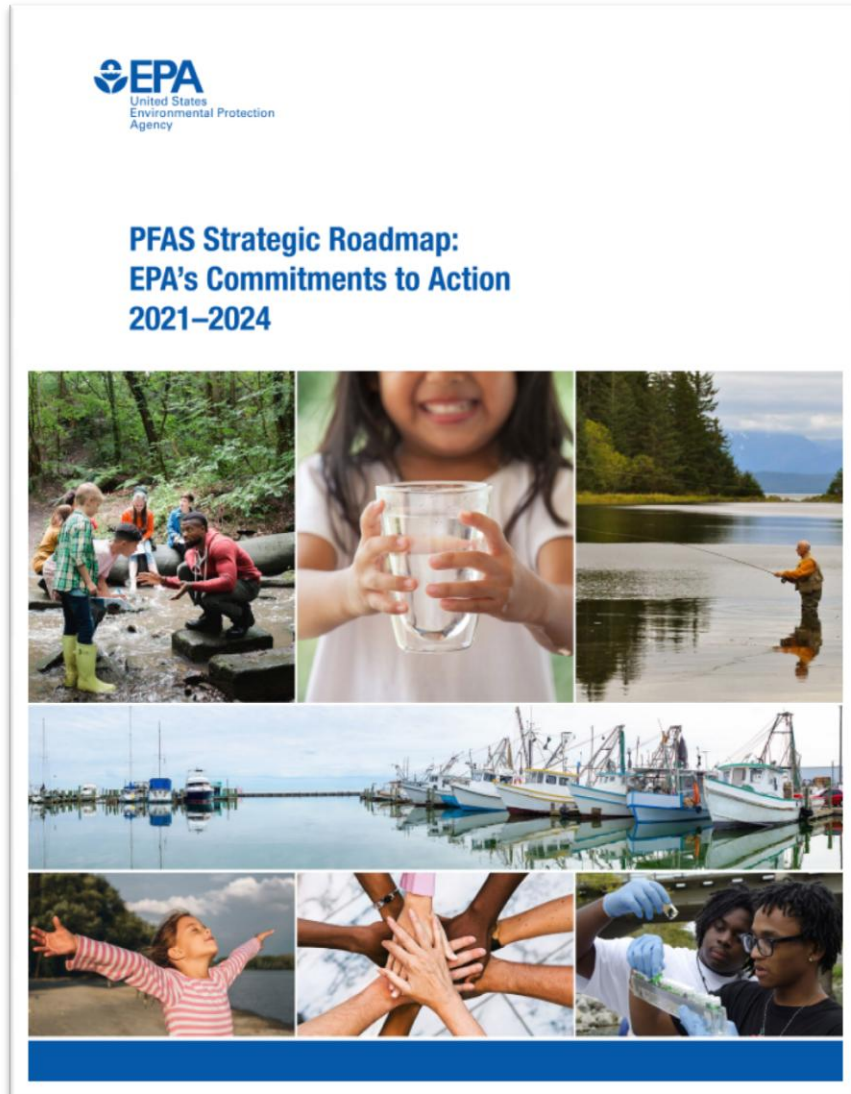
- CWEA: PFAS and Biosolids: What Wastewater Pros Need to Know
 - A State-of-the-Science Review of PFAS in Biosolids



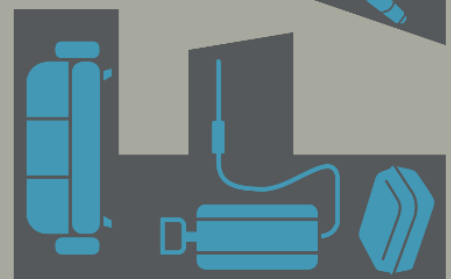
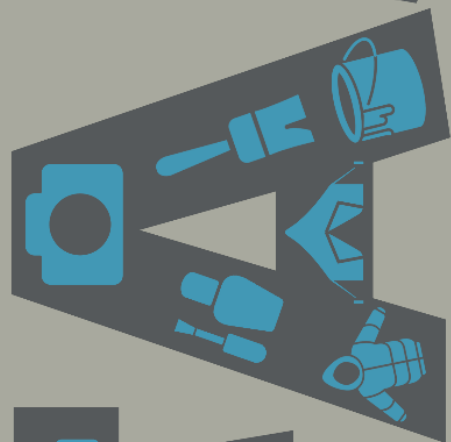
Boxplot of California biosolids PFAS monitoring results for PFOA and PFOS. Values below their detection limit were assumed to be half their detection limit.

<https://www.cwea.org/news/pfas-biosolids-what-you-need-to-know/>

EPA PFAS Strategic Roadmap



- Drinking water monitoring rule
 - Fall 2021
- National primary drinking water rule for PFOA & PFOS
 - Proposed Fall 2022
 - Final Fall 2023
- Toxicity assessment for GenX + 5 PFAS
 - Fall 2021
- Health advisories for GenX and PFBS
 - Spring 2022
- PFAS ELGs
 - Fall 2022
- NPDES permitting & guidance
 - Winter 2022
- PFAS analytical methods
 - Fall 2022-2024
- Recommended ambient water quality criteria
 - Aquatic Life - Winter 2022
 - Human Health - Fall 2024
- PFAS fish advisory programs
 - Spring 2023
- Designate PFOA/PFOS as CERCLA hazardous substances
 - Summer 2023
- Biosolids risk assessments
 - Winter 2024



CHALLENGES FOR WASTEWATER SYSTEMS

TECHNOLOGICAL
PUBLIC PERCEPTION
LEGAL

PFAS TREATMENT TECHNOLOGY



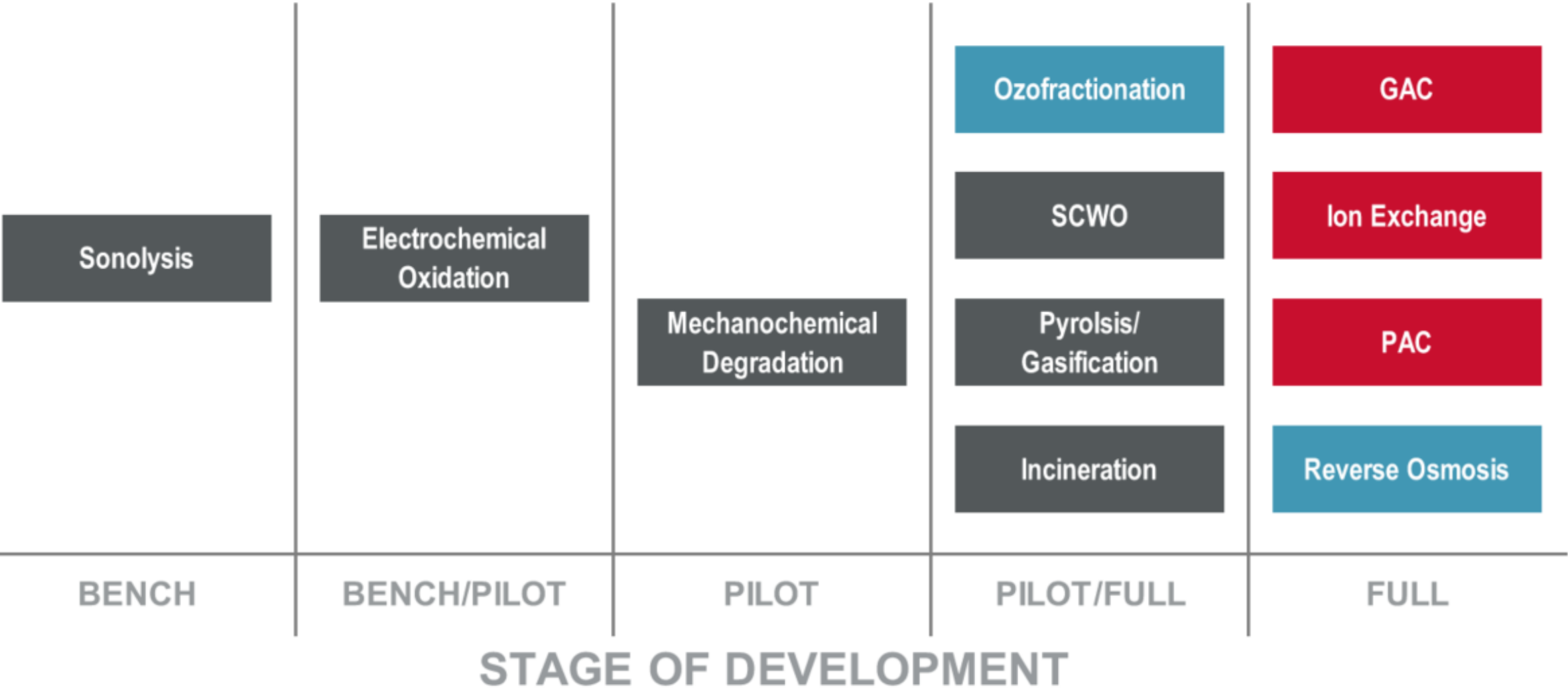
Adsorption



Separation



Destruction



Biosolids Management Challenges

State of Maine Ban on Land Application and Products

Maine, Biosolids and PFAS...

- *LD1911 An Act to Prevent the Further Contamination of the Soils and Waters of the State with So-called Forever Chemicals*
 - Bans the land application or distribution of wastewater sludge derived products
 - Requires testing of treatment plant effluent
 - Rescinded \$10/ton PFAS impact fee
- Signed into Law and will take effect this summer (Aug 8, 2022)
- Concerns over limited disposal outlets and impact on landfills.
- Loss of beneficial residuals

https://legislature.maine.gov/legis/bills/display_ps.asp?PID=1456&snum=130&paper=&paperId=1&ld=1911

In a First, the EPA Warns of ‘Forever Chemicals’ in Sludge Fertilizer – The New York Times

- New York Times Article, January 14, 2025
 - ‘Forever Chemicals’ Found in Some Milk, Including Organic - Consumer Reports
 - “The highest levels of PFAS were 84 parts per trillion PFOA in a sample of Kirkland Signature milk and 60 ppt PFOA in a sample of 365 Whole Foods milk, both bought in California. The PFOA or PFOS found in the other four samples fell under the level at which we could put an exact number to them because of the sensitivity of the tests we used, but we can estimate that the levels were between 20 and 50 ppt.”

[In a First, the E.P.A. Warns of ‘Forever Chemicals’ in Sludge Fertilizer - The New York Times](#)


[‘Forever Chemicals’ Found in Some Milk, Including Organic - Consumer Reports](#)

The New York Times


In a First, the E.P.A. Warns of ‘Forever Chemicals’ in Sludge Fertilizer

Levels of PFAS in sewage sludge used as fertilizer can pose risks that sometimes exceed safety thresholds “by several orders of magnitude,” the agency said.

Listen to this article · 9:54 min [Learn more](#) [Share full article](#) [133](#)



A wastewater treatment plant in Fort Worth, Texas, last year. Jordan Vonderhaar for The New York Times

 By Hiroko Tabuchi

Jan. 14, 2025

For the first time, the Environmental Protection Agency on Tuesday warned that “forever chemicals” present in sewage sludge that is used as fertilizer can pose human health risks.

Something's Poisoning America's Land. Farmers Fear 'Forever' Chemicals. New York Times, Aug 31, 2024

- Fertilizer made from city sewage has been spread on millions of acres of farmland for decades. Scientists say it can contain high levels of the toxic substance.



Something's Poisoning America's Land. Farmers Fear 'Forever' Chemicals.

Fertilizer made from city sewage has been spread on millions of acres of farmland for decades. Scientists say it can contain high levels of the toxic substance.

<https://www.nytimes.com/2024/08/31/climate/pfas-fertilizer-sludge-farm.html>

City finds 'forever chemicals' in fertilizer sludge, continues to apply to crops



The city of Columbia dumps wastewater sludge April 25 at a farm in Columbia. The city transports and applies the material for free.

Columbia wastewater sludge spread on farm fields in four counties

The Columbia Wastewater Treatment Plant separates liquids from solids before processing the leftovers and shipping them off to farms to use as fertilizer. The material contains nutrients to help crops grow, but it also contains some contaminants, such as PFAS, or "forever chemicals." Corn, the most common crop on these farms, is considered to be at a lower risk for taking up PFAS into edible parts of the plant.

The map below shows only the fields that received waste in 2023. About 120 fields total are part of a multi-year rotation.



Source: Columbia Wastewater Treatment Plant

EMMET JAMIESON/Missourian

Farmers v. Synagro Lawsuit

- City of Fort Worth Biosolids
- Texas Ranches Filed Federal Lawsuit Against Synagro
 - Farmers Allege Sludge Sickened Farmers, Killed Livestock, Polluted Drinking Water, Contaminated Beef, and Left Properties Worthless
- First-of-its-kind Criminal Investigation
 - Dana Ames, Environmental Crimes Investigator, Johnson County Constable's Office

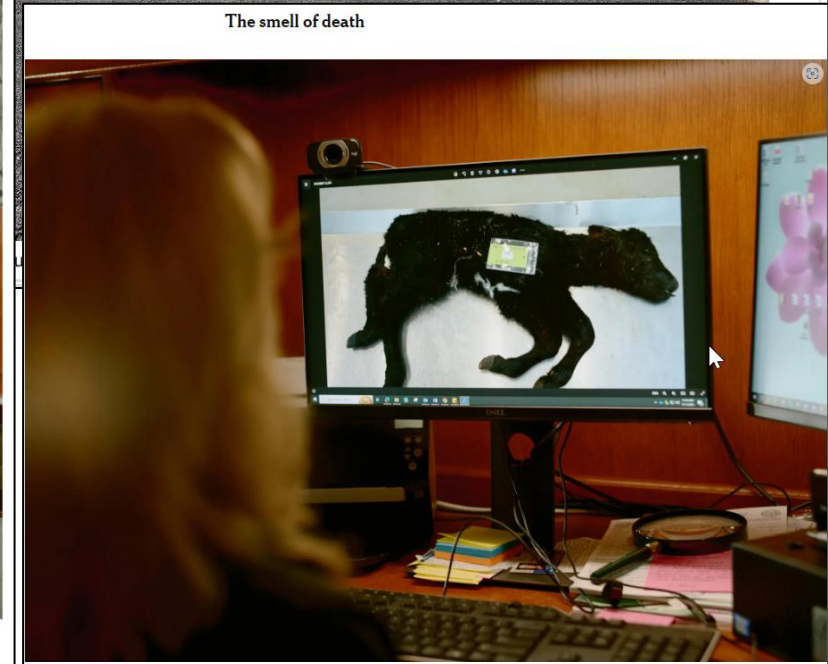
PFAS

Texas farmers claim company sold them PFAS-contaminated sludge that killed livestock

Two ranches also allege biosolids with 'forever chemicals' ruined crops, polluted drinking water and left their properties worthless



A smell "worse than death," Ms. Ames said. Jordan Vonderhaar for The New York Times

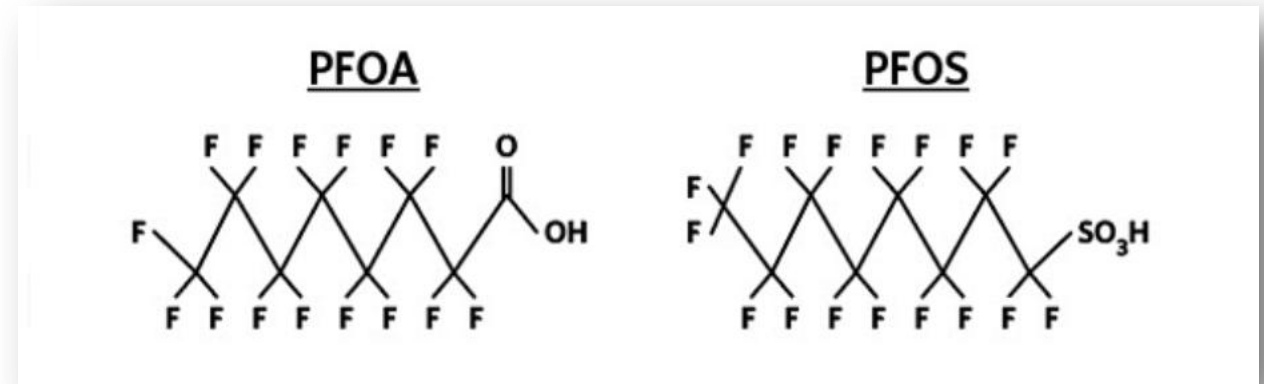


A stillborn calf found contaminated with PFAS. Jordan Vonderhaar for The New York Times

<https://www.nytimes.com/2024/08/31/climate/pfas-fertilizer-sludge-farm.html>

EPA Finalized PFOA and PFOS as “Hazardous Substances” under CERCLA on July 8, 2024

1. PFOA and PFOS manufacturers
2. PFOA and PFOS processors
3. Manufacturers of products containing PFOA and PFOS
4. Downstream product manufacturers and users
5. **Waste management and wastewater treatment facilities**
6. **Land applied biosolids**
7. Municipal Airports



If PFOA or PFOS contamination is identified at a site, responsible parties, including municipal wastewater facilities, are held liable for cleanup costs under CERCLA (Superfund Law).

H.R. 1267 – Water Systems PFAS Liability Protection Act

- Proposed Bipartisan legislation that exempts passive receivers from CERCLA liability related to PFAS contamination (119th Congress)
- Committees the bill has been referred to:
 - House Energy and Commerce
 - House Transportation and Infrastructure



Representative Sam Graves, Chair



Representative Bob Onder



Representative Eric Burlison

Michigan EGLE modified Residuals Management Program (RMP) to incorporate conditions of the Land Application of Biosolids Containing PFAS Interim Strategy (2021)

Michigan January 2024 Updated Interim Strategy Requirements

- **PFOS or PFOA at or above 100 µg/kg**
 - Cannot land apply
 - Implement a source reduction plan
- **PFOS or PFOA at or above 20 but below 100 ug/kg**
 - Considered elevated
 - Reduced land application rate of 1.5 dry tons per acre (dt/acre)
 - Implement a source reduction plan
- **PFOS or PFOA below 20 µg/kg**
 - May be land applied with no additional requirements

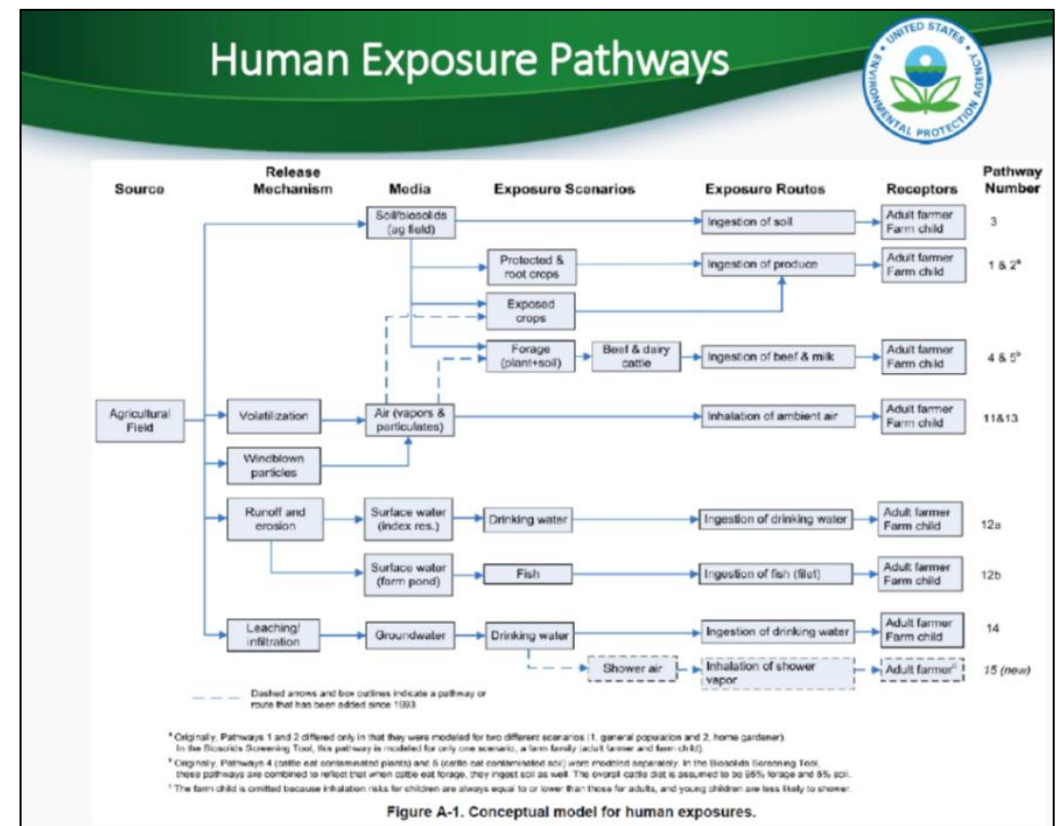
EPA Biosolids Risk Assessment

- 15 Human Exposure Pathways
- 61 Years on Family Farm
- Food from Biosolids Amended Crops, Beef and Dairy from Forage Crops, Fish from Farm Pond, Drinking Water from Farm Well, etc.

U.S. Environmental Protection Agency
Biosolids Program
Screening and Refined Risk Assessment
of Chemicals in Sewage Sludge

Dr. David Tobias, Lead Risk Assessor
 Office of Water, Office of Science and Technology (OST)
 Health and Ecological Criteria Division
tobias.david@epa.gov

SAB Meeting



Draft Sewage Sludge Risk Assessment for PFOA and PFOS: Information for Wastewater Treatment Plants, January 2025

- Farm Scenarios
 - 40 Years @ Typical Land Application Rates 10 DMT/ha
 - Low 1 ppb PFOA or PFOS Concentration
- Land Reclamation
 - Once @ 50 DMT/ha
 - Low 1 ppb PFOA or PFOS Concentration

Application Rates for Exposure Scenarios

Scenario	Concentration of PFOA or PFOS	Application Rate	Number of Applications	Human Exposure Duration
Farm – pasture-raised livestock	1 part per billion (ppb)	10 dry metric tons (DMT) per hectare (ha)	Once annually for 40 years	10 years – cancer 1 year – noncancer
Farm – food crops (fruits and vegetables)	1 ppb	10 DMT/ha	Once annually for 40 years	10 years – cancer 1 year – noncancer
Land reclamation sites	1 ppb	50 DMT/ha	One application only	10 years – cancer 1 year – noncancer
Sewage sludge surface disposal sites (sewage monofills)	1 ppb	Flow rate 4×10^{-6} m ³ /sec	Disposal site operating for 50 years	10 years – cancer 1 year – noncancer

Estimated risks scale linearly with the starting concentration of PFOA or PFOS in sewage sludge, assuming all other factors are held constant. As such, sewage sludge containing ten times more PFOA or PFOS (i.e., 10 ppb) would yield risk estimates that are ten times greater than those presented in the draft risk assessment.

Draft Biosolids Risk Assessment

Disposal of sludge to monofils and land applying biosolids pose quantifiable human health risks to nearby populations from legacy PFAS.

PFAS	Concentration Exceeding Human Health Risk Thresholds
PFOA	1 ppb (land applied sludge)
PFOS	1 ppb (land applied sludge)
PFOA	1 ppb (unlined or clay-lined surface monofil)
PFOS	4-5 ppb (unlined or clay-lined surface monofil)

Comments due April 16, 2025

EPA acknowledged that the assessment “does not model risks for the general public”

Draft Sewage Sludge Risk Assessment for PFOA and PFOS: Information for Wastewater Treatment Plants, January 2025

- EPA's Approach Minimizes Portrayal of Potential Risks
 - Combining Exposure Pathways, Other Sources of Exposure, and Combinations of PFOA, PFOS, and Other PFAS Would All Increase Risks

Draft Risk Assessment: Central Tendency Assumptions

- Assume median (50th percentile) exposure conditions rather than high-end (*e.g.*, 90th percentile) exposures.
- Does not add together exposures from multiple pathways (*e.g.*, egg consumption plus drinking water).
- Does not consider non-sewage sludge exposures to PFOA or PFOS (*e.g.*, consumer products, other dietary sources).
- Does not account for the combined risk of PFOA and PFOS together or PFAS of other chain lengths (*e.g.*, PFDA, PFNA, PFBS).
- Does not account for exposures from the transformation of PFOA or PFOS precursors.

Draft Sewage Sludge Risk Assessment for PFOA and PFOS: Information for Wastewater Treatment Plants, January 2025

- EPA Highlights Risks at **Low 1 ppb (ug/kg) Biosolids Concentration for PFOA or PFOS**
 - “Based on the modeling in the draft sewage sludge risk assessment, the EPA finds that there may be human health risks exceeding the EPA’s acceptable thresholds for some modeled scenarios when land-applying sewage sludge that contains **1 part per billion (ppb) of PFOA or PFOS.**”
- EPA suggests avoiding biosolids land application to fields used for grazing and growing livestock feed, especially for dairy cows:
 - “To reduce potential risk associated with land application, consider land-applying in areas that may be less sensitive to PFOA and PFOS pollution, like areas far from fishable waters or with deep protected drinking water aquifers. **Consider avoiding land application in fields used to graze livestock or grow feed, especially for dairy cows.** Fields used to grow fruits and grain may be better alternatives to those growing hay or leafy greens like spinach or kale.”

Comparisons with Michigan 2024 Land Application Interim Strategy

Example Biosolids and Compost Products

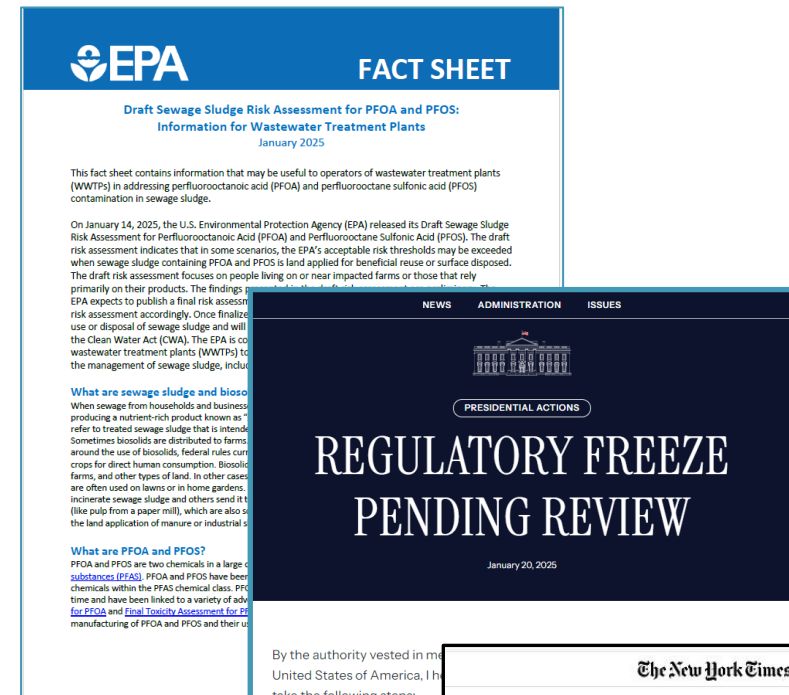
- **PFOS or PFOA at or above 100 µg/kg**
 - Cannot land apply, Implement a source reduction plan
- **PFOS or PFOA at or above 20 ug/kg but below 100 ug/kg**
 - Considered elevated, Reduced land application rate of 1.5 dry tons per acre (dt/acre). Implement a source reduction plan
- **PFOS or PFOA below 20 µg/kg**
 - May be land applied with no additional requirements

Example Biosolids and Compost Products

- **Missoula Garden City Compost 59 ug/kg**
- **Glacier Gold Compost 51 ug/kg**
- **Colorado Biosolids PFOS <1.9 to 33 ug/kg**
- **California Median PFOS 6.7 ug/kg**
- **California Median PFOA 1.7 ug/kg**
- **Draft Sewage Sludge Risk Assessment for PFOA or PFOS 1 ug/kg**

Next Steps

- EPA's Next Steps
 - Public Comment Closes April 16, 2025
 - EPA Considerations, Revisions, Final Risk Assessment
 - Informs Potential Regulatory Future
 - *If Risks Exceed Acceptable Thresholds EPA Expects to Propose Regulation to Manage PFOA and/or PFOS in Sewage Sludge to Protect public health and Environment*
- Federal **Regulatory Freeze Pending Review**
 - January 20, 2025 Executive Order
 - (1) *"Do not propose or issue any rule in any manner,...*
 - (2) *"Immediately withdraw any rules that have been sent to the OFR but not published in the Federal Register...*
 - (3) *"...consider postponing for 60 days...any rules that have been published in the Federal Register,..."*
- Public Perception
 - Complex Subject, Potential Misinformation



Trump EPA Appears Uncertain On Regulating PFAS

- EPA is waiting on their new “*PFAS Lead*” prior to making decisions that impact PFAS regulations
- Withdrew effluent limit guidelines (ELG)
- Extended public comment period on Human Health Criteria and Biosolids Risk Assessment
- EPA has 60 days from February 19 to review Biden-Era regulations and submit a list targeted for repeal
- PFAS were notably missing from Administrator Zeldin’s March 12 Deregulation Memo

PFAS Workgroups

End of Year Recap on December 6, 2023

Drinking Water

- Expecting final MCL rule in 2024
- Developed briefing memo focused on potential program for fire department AFFF takeback

Water Quality Standards

- Consider adoption of 304(a) criteria when available
- Delay criteria development for GRW and DWS
- Consider treatment efficiencies
- Clarify carcinogen definition
- **Prepare state roadmap**
- Financial assistance for research and sampling

Permitting and Pretreatment

- POTWs concerned about future biosolids disposal limitations
- **POTW (w/IPP) operating permit special condition language**
- Reassess need for industrial direct discharger permit condition language

Removal and Destruction Technologies

- Relative costs for technologies – complicated
- Waste management for removal/sequestering processes is an issue
- Developed fact sheets on GAC, ion exchange, and RO

Biosolids, CERCLA, and RCRA

- Missouri has limited ability to develop PFAS management approaches do to the “no stricter than federal” provisions of state law and regulations
- Many EPA PFAS-related initiatives currently underway

Sampling

- Developed document on “PFAS Sampling Guidance for Public Water Supplies”
- Recommend creating similar guidance for other media as methods are finalized

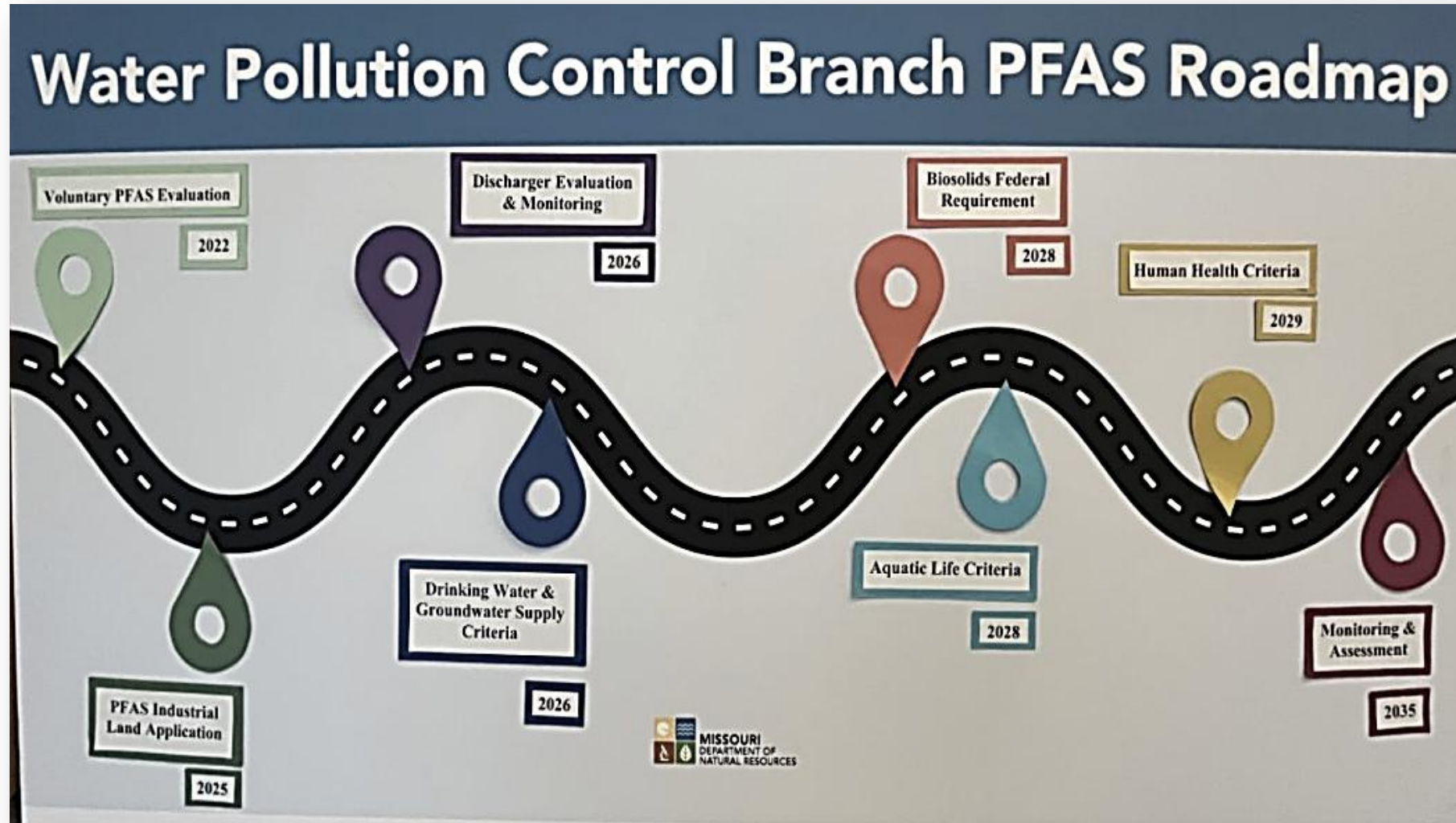
Funding Opportunities

- **Recommend funding to support comprehensive sampling (drinking water, wastewater, stormwater, soils)**
- Recommend funding to support a PFAS technology validation program

Public Policy and Communication

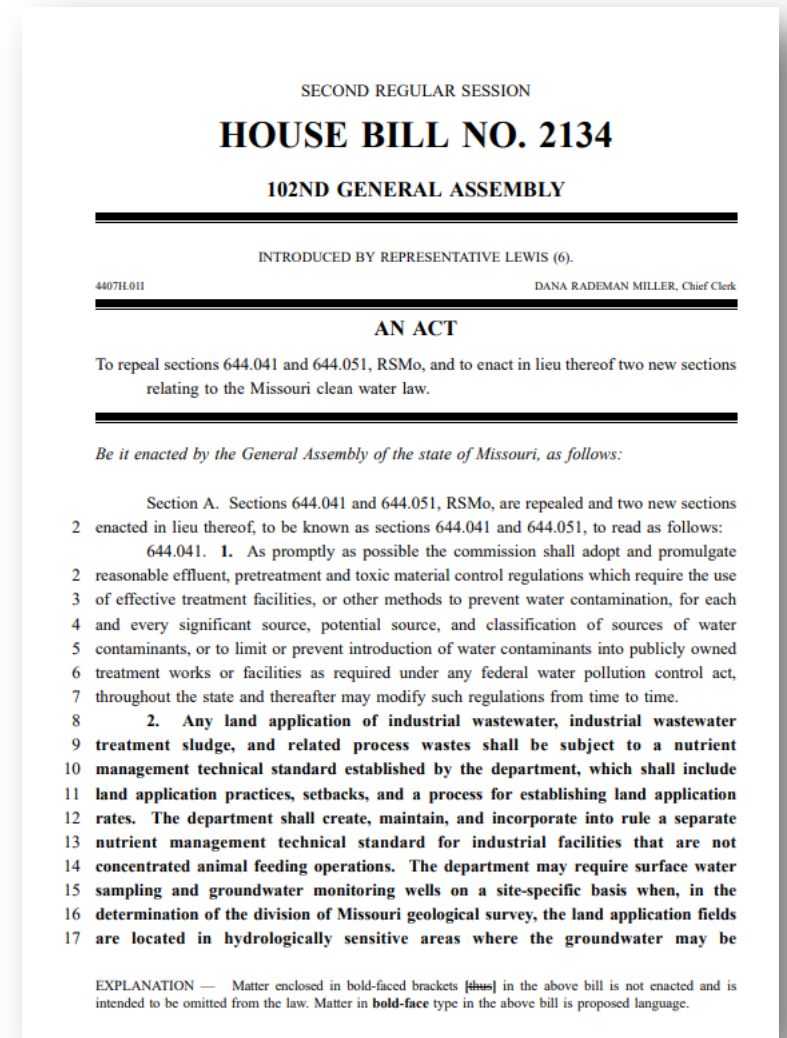
- Drinking water monitoring results letters
- Mostly sending on non-detect letters
- Group will consolidate reports from other subgroups into a final comprehensive report

Missouri PFAS Roadmap is on hold until EPA provides direction



2024 House Bill 2134

- Set restrictions for Industrial Land Application
- Definitions -10 CSR 20-2.010
- Land Application Requirements - Industrial Nutrient Management Technical Standard (INMTS)
 - Sampling
 - Pollutant Limits - **including PFOA and PFOS**
 - Nutrient Land Application Rates
 - Soil Sampling or P-Index
- Land Application Management Plans (LAMPs)



*****Not intended for domestic wastewater, domestic biosolids, or stormwater systems*****

Industrial Nutrient Management Technical Standard (INMTS) Soil Concentration Limits

	Mg/kg	µg/kg	ppt
PFOS	3.0 E-5	0.03	30
PFOA	6.1 E-5	0.061	61
PFH _x S	4.2 E-6	0.0042	4.2
PFNA	4.2 E-5	0.042	42
Select 4 PFAS Compounds	1.372 E-4	0.1372	137.2

EPA Draft Biosolids Risk Assessment = 1 ug/kg

Background Levels of PFAS and PFOA Compared to Draft INMITS Limits

Author	Location	Value Type	PFOS (ug/kg or ppb)	PFOA (ug/kg or ppb)
Zhu et al. 2019	Vermont (n=66)	UTL ¹	3.4	1.6
Maine DEP Study 2022	Maine (n=63)	UTL ¹	3.04 (urban) 0.55 (non-urban)	2.2
Santangelo et al. 2022	New Hampshire (n=112)	95 th PCTL ²	2.6	2.2
Rankin et al. 2016	Minnesota (n=2)	95 th PCTL ²	0.29	0.16
Rankin et al. 2016	North America sites (n=33)	95 th PCTL ²	1.4	1.5
Strynar et al. 2018	U.S. sites (n=8)	95 th PCTL ²	2.4	6.4
Scher et al. 2018	Minnesota (n=6)	95 th PCTL ²	2.1	0.54
Sim et al. 2018	South Korea (n=16)	Mean	0.22	0.30
Kikuchi et al. 2018	Sweden (n=31)	95 th PCTL ²	1.3	0.22
MDNR 2024	Missouri	Draft INMITS Limits	0.03	0.061

Updated Rule Language and RIR

- Published this Spring 2025
- Will no longer contain PFAS
- Will only address the intent of the Revised Missouri Statute §644.041.



10 CSR 20-2.010 – Definitions

Title 10—DEPARTMENT OF
NATURAL RESOURCES
Division 20—Clean Water Commission
Chapter 2—Definitions

10 CSR 20-2.010 Definitions

PURPOSE: This rule sets forth the definitions of terms used in the Missouri Clean Water Law and Missouri Concentrated Animal Feeding Operation (Hog Bill) Law and all regulations passed pursuant to it, specifically Title 10, Division 20.

PUBLISHER'S NOTE: The secretary of state has determined that the publication of the entire text of the material which is incorporated by reference as a portion of this rule would be unduly cumbersome or expensive. This material as incorporated by reference in this rule shall be maintained by the agency at its headquarters and shall be made available to the public for inspection and copying at no more than the actual cost of reproduction. This note applies only to the reference material. The entire text of the rule is printed here.

(1) "Abandoned well," as defined in section 256.603, RSMo.

(2) "Aerichemical," any [pesticide or] fertilizer licensed by the Missouri Fertilizer Control Program or any pesticide but does not include anhydrous ammonia fertilizer material.

(3) "Aerichemical facility," any site, with the exception of chemical production facilities, where bulk pesticides or fertilizers, excluding anhydrous ammonia fertilizer, are:

~~[(26)](32)~~ "Domestic wastewater," wastewater (i.e., human sewage) originating primarily from the sanitary conveniences of residences, commercial buildings, factories, and institutions, including any water which may have infiltrated the sewers. Domestic wastewater excludes stormwater, animal waste, industrial process wastewater, industrial process wastewater treatment residuals, and other similar [waste] industrial residuals.

U.S.C. Section 1251, et seq.

(7) "Aquifer," [a subsurface water-bearing bed or stratum which stores or transmits water in recoverable quantities that is presently being utilized or could be utilized as a water source for private or public use. It does not include water in the vadose zone. For purpose of the effluent regulation, sandy or gravelly alluvial soils in or on the floodplains of intermittent streams are not an aquifer] as defined by Section 640.403, RSMo. For the purposes of these rules, it does not include water in the vadose zone, or sandy or gravelly alluvial soils in or on the floodplains of intermittent streams.

(8) "Best management practices (BMPs)," schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent pollution and protect the environment. BMPs also include treatment requirements, operating procedures, and practices to control facility runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

(9) "Biosolids," the product derived from the separation of solids from liquids at a treatment works treating domestic sewage and then further treated physically, biologically, and/or chemically. This does not include solids at the initial influent or headworks. Biosolids are also known as sewage sludge.

~~[(8)](10)~~ "Blending," the practice of diverting wet-weather flows around any treatment unit and recombining those flows within the treatment facility, while providing primary and secondary or biological treatment up to the available capacity, consistent with all applicable effluent limits and conditions. See bypass, section (14) of this rule.

~~[(9)](11)~~ "Bulk fertilizer," any liquid or dry fertilizer which is transported or stored in undivided quantities of greater than five hundred (500) gallons measure or five thousand (5,000) pounds net dry weight respectively.

Thank You!



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