Biosolids: What to do in an Uncertain Regulatory Climate

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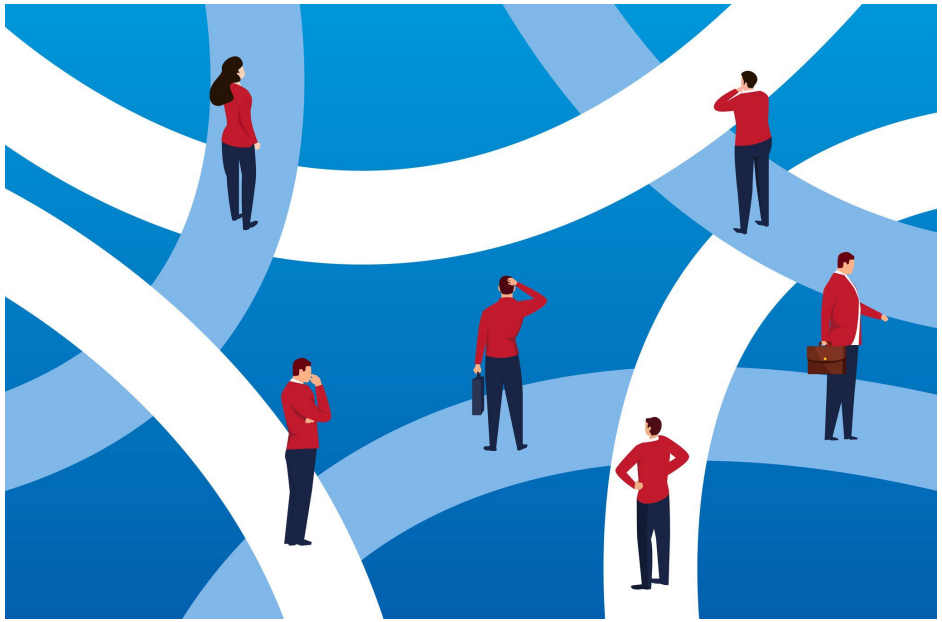
Clean Water SoCal

Biosolids Meeting

May 15, 2025

What's on the agenda today?

- Current biosolids management in the US
- Threats to the status quo (incl. the Draft Risk Assessment)
- How biosolids master planning can help
- What can utilities do now relative to PFAS?



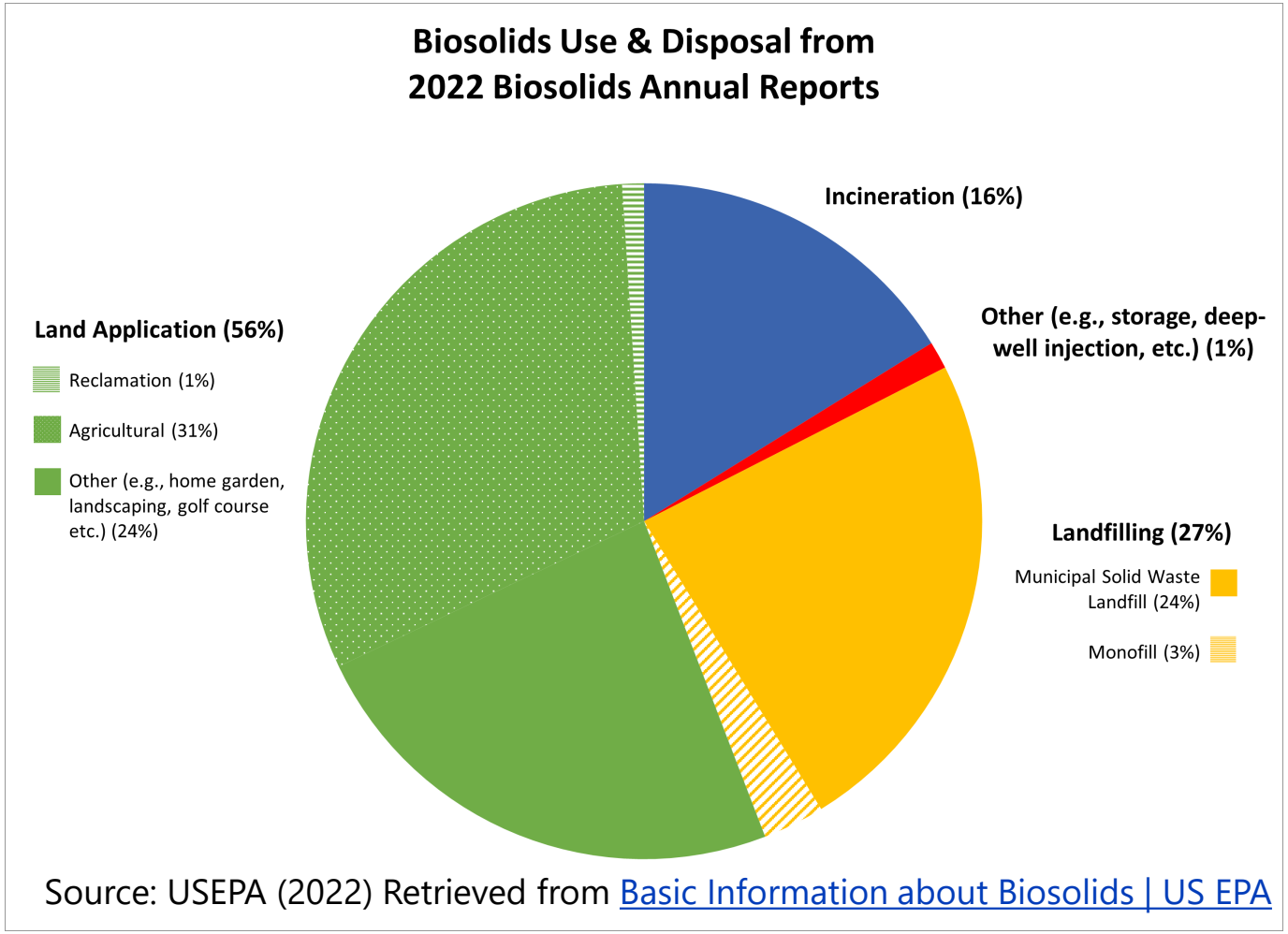
01

Current Biosolids Management in the US

Land application, incineration, and landfilling comprise 99% of recent biosolids management in US

Land Application Benefits:

- Soil health (available nutrients, available carbon)
- Reduced fertilizer and pesticide use
- Low-cost fertilizer for farmers
- Carbon sequestration
- Water retention
- Revitalize degraded lands



Source: USEPA (2022) Retrieved from [Basic Information about Biosolids | US EPA]

02

Threats to the status quo

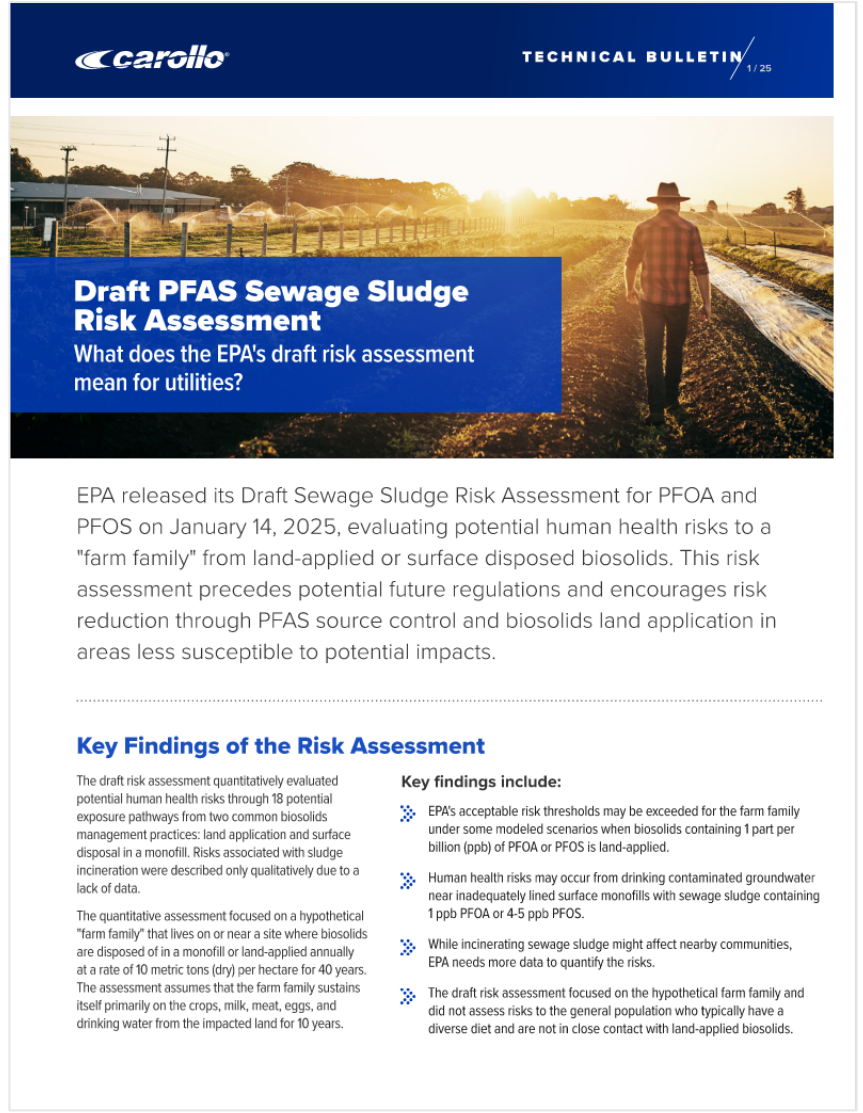
A confluence of factors are creating uncertainty about management options

- Concerns about contaminants (PFAS, etc)
- Concerns about liability
- Potential regulatory changes, restrictions
- Increasing costs
- Fewer, reliable management providers
- Perception

You may have heard about a little document issued by the EPA…

- A few initial points:
  - » NOT a regulation
  - » DOES NOT reflect risks for the average person or general population
  - » NOT Final
  - » Found risks from ALL management practices considered
  - » DOES NOT recommend best disposal/management option
  - » Did not include risk management

No timeline given for next steps in the regulatory process



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TECHNICAL BULLETIN 1/25

Draft PFAS Sewage Sludge Risk Assessment

What does the EPA's draft risk assessment mean for utilities?

EPA released its Draft Sewage Sludge Risk Assessment for PFOA and PFOS on January 14, 2025, evaluating potential human health risks to a "farm family" from land-applied or surface disposed biosolids. This risk assessment precedes potential future regulations and encourages risk reduction through PFAS source control and biosolids land application in areas less susceptible to potential impacts.

Key Findings of the Risk Assessment

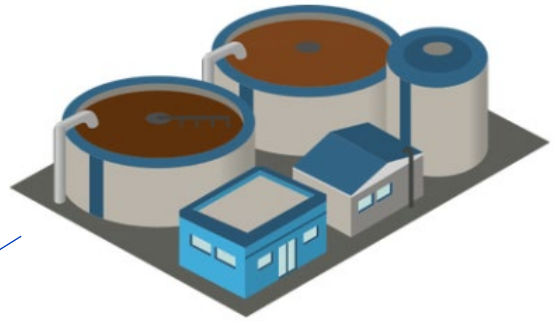
The draft risk assessment quantitatively evaluated potential human health risks through 18 potential exposure pathways from two common biosolids management practices: land application and surface disposal in a monofill. Risks associated with sludge incineration were described only qualitatively due to a lack of data.

The quantitative assessment focused on a hypothetical "farm family" that lives on or near a site where biosolids are disposed of in a monofill or land-applied annually at a rate of 10 metric tons (dry) per hectare for 40 years. The assessment assumes that the farm family sustains itself primarily on the crops, milk, meat, eggs, and drinking water from the impacted land for 10 years.

Key findings include:

- EPA's acceptable risk thresholds may be exceeded for the farm family under some modeled scenarios when biosolids containing 1 part per billion (ppb) of PFOA or PFOS is land-applied.
- Human health risks may occur from drinking contaminated groundwater near inadequately lined surface monofills with sewage sludge containing 1 ppb PFOA or 4-5 ppb PFOS.
- While incinerating sewage sludge might affect nearby communities, EPA needs more data to quantify the risks.
- The draft risk assessment focused on the hypothetical farm family and did not assess risks to the general population who typically have a diverse diet and are not in close contact with land-applied biosolids.

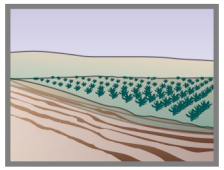
Quantitatively considered only land application and monofills (surface disposal)



Governed under RCRA not CWA

Insufficient data

Land Application



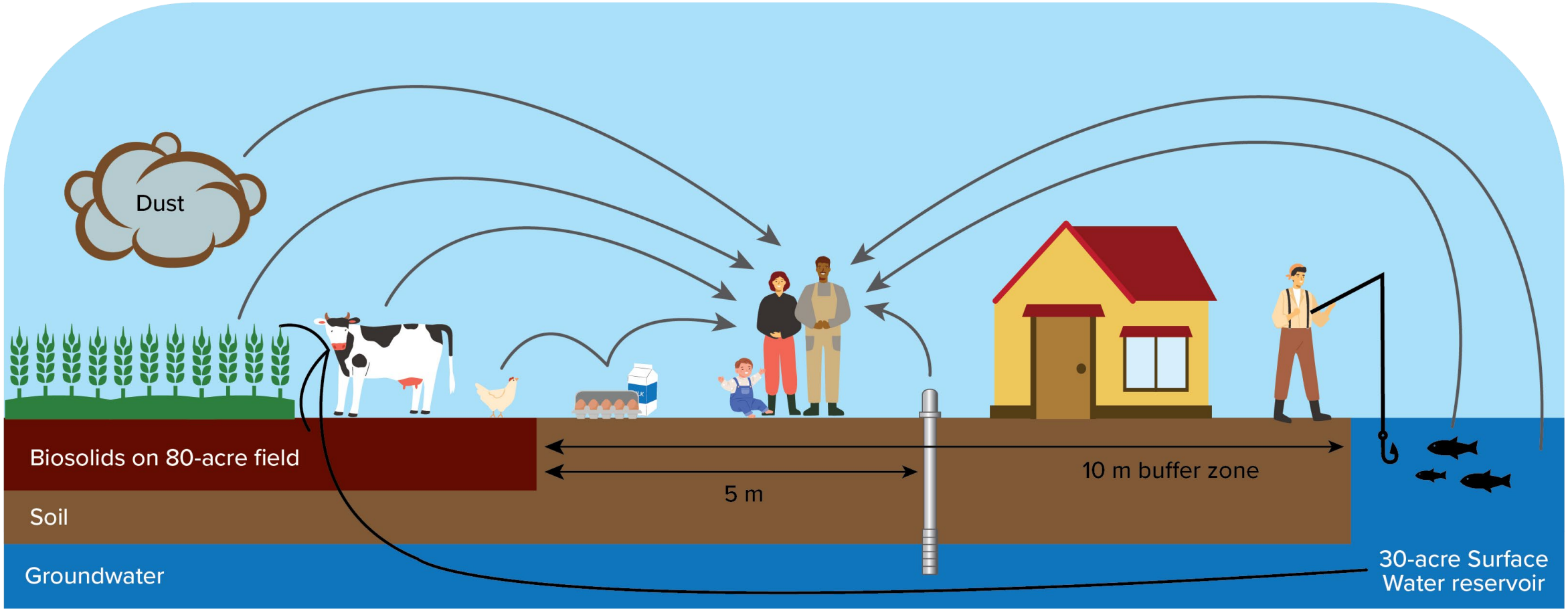
Surface Disposal

Incineration

Landfill

Assessment intended to model a farm family subsisting on their land/products – not the general population

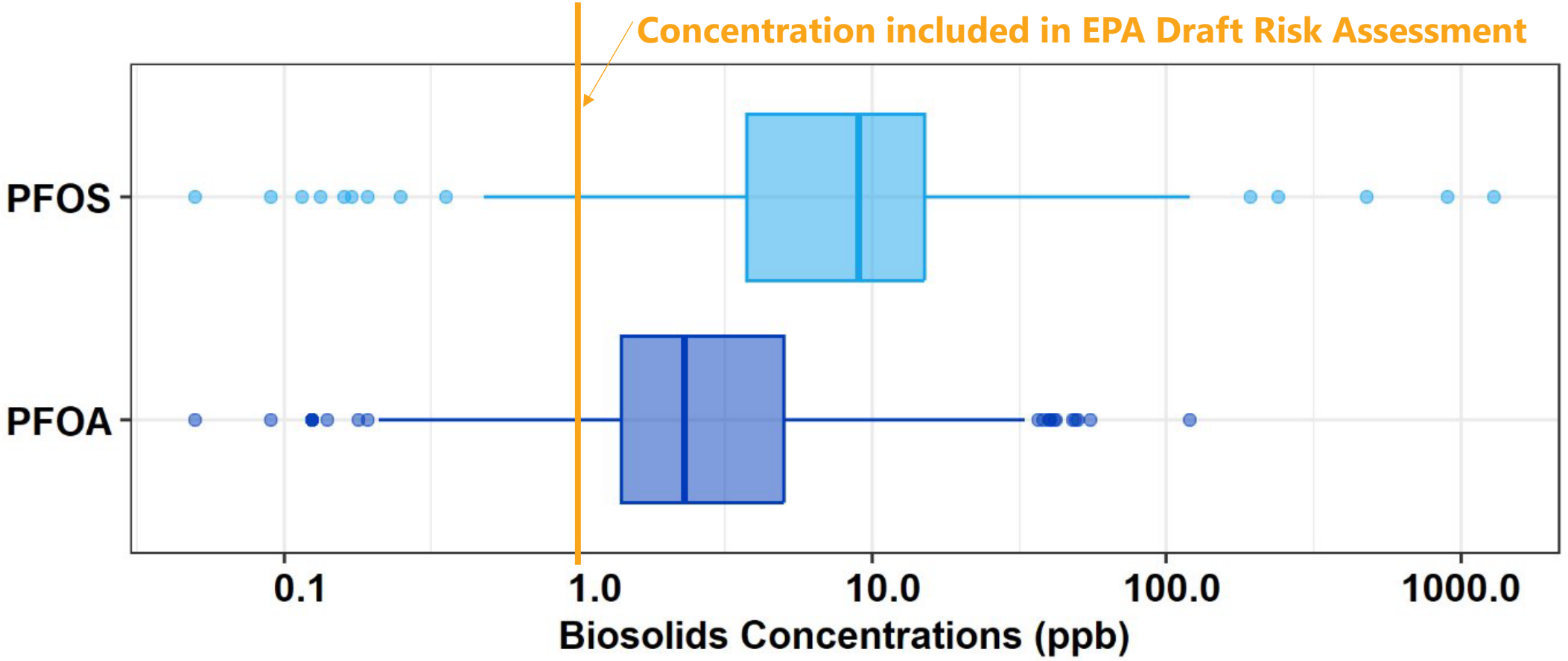
- **Land Application: Pasture or Crop Farm Scenario**



Select takeaways from the Draft Risk Assessment for land app… and a few concerns

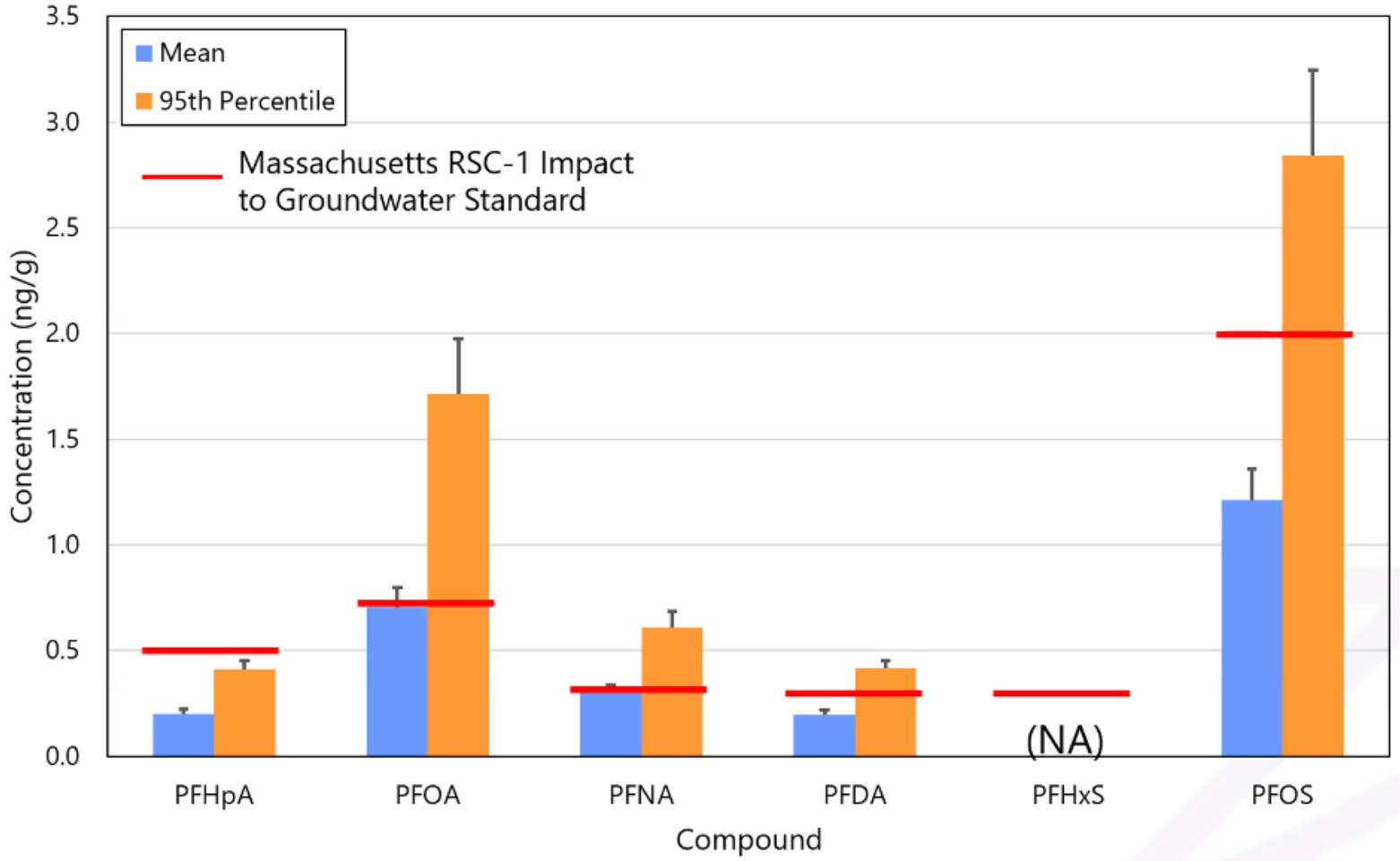
- **Key Takeaways**
  - 18 exposure pathways considered
  - 1 ppb PFOS and 1 ppb PFOA (separately) assumed
  - Cancer and/or non-cancer risks exceeded EPA targets under some modeled scenarios
  - Comment period ends August 14, 2025
- **Concerns**
  - Research/cases used to formulate basis for risks
  - Lack on inclusion of recent/ongoing work regarding fate/transport, plant uptake, etc.
  - Issuance without risk management element
  - **Perception and potential reactions**

1 ppb PFOS and/or PFOS would likely be lower than values found in most biosolids



Source: California Geotracker, 2024
Values < MDL assumed MDL/2

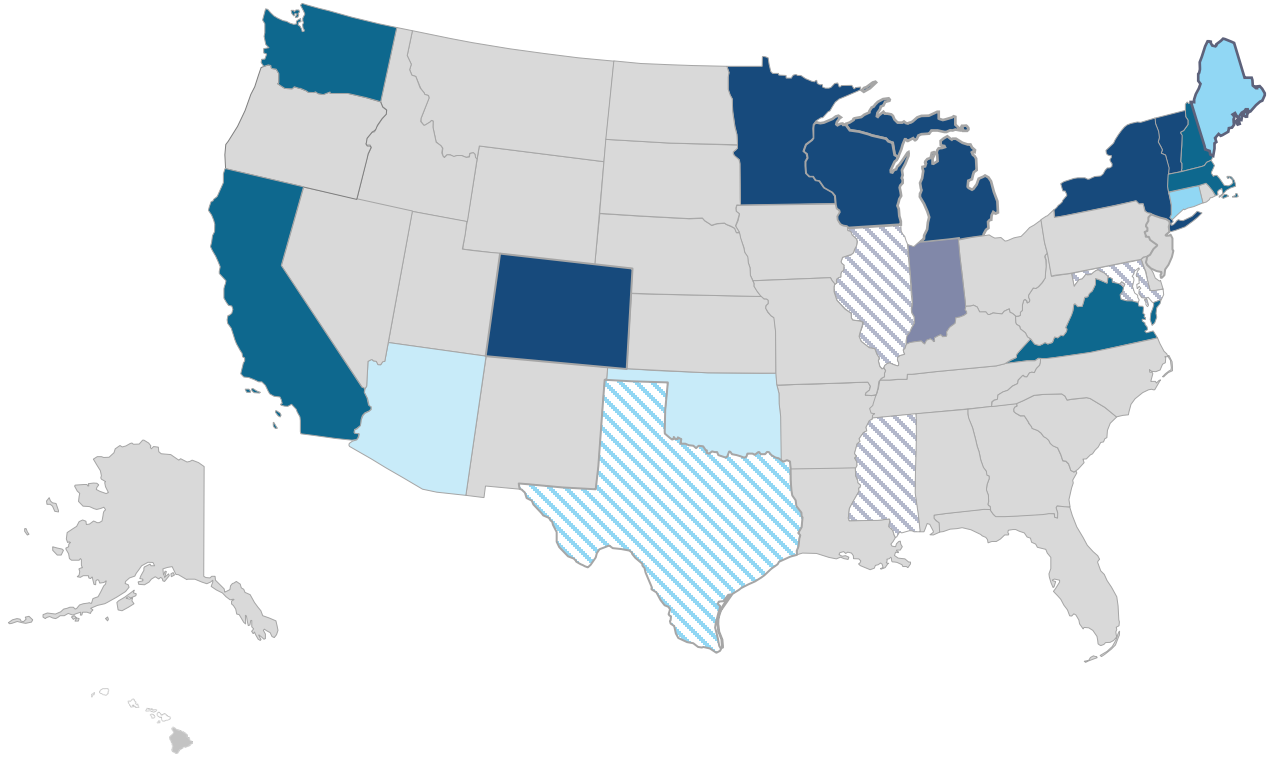
Meanwhile… >1 ppb PFOS found in soil without biosolids applied



Source: PFAS Concentrations in Surface Soil in Northern New England: Regional and Global Source Patterns and Regulatory Relevance (Woodard Curran)

States Are Taking Actions to Regulate PFAS in Biosolids

- Sampling and reporting guidance
- Sampling and reporting requirements
- Source control screening level(s)
- Proposed land application limits
- Land application bans
- Proposed land application bans



Updated March 2025.
Not intended to be comprehensive due to ongoing changes.
**Anything hashed was proposed and did not pass.*

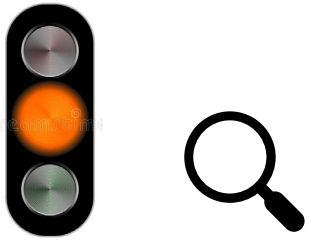
Michigan's tiered strategy for addressing PFAS in biosolids:

PFOS + PFOA < 20 ppb

Eligible for Exceptional Quality Designation

PFOS & PFOA < 20 ppb

No further requirements to land apply



PFOS or PFOA 20-100 ppb

Reduce rate to 1.5 dt/acre
Source investigation/ reduction plan required

PFOS or PFOA ≥ 100 ppb

No land application
Source investigation/ reduction plan required

Other states and countries have emulated Michigan's approach.

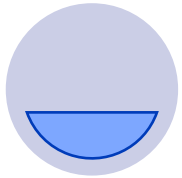
	Michigan	Wisconsin	Colorado	New York	Canada
Year Enacted	2021 (2024 Update)	2021	2023	2023	Proposed 2023
PFAS	PFOS or PFOA	PFOS+PFOA	PFOS	PFOS or PFOA	PFOS
Land application not allowed					
	>100	>150	NA	>50	>50
Source investigation required and limit on application rate					
	20-100	50-150	NA	NA	NA
Source investigation required					
	NA	20-50	>50	20-50	NA
No change to biosolids applications practices					
	<20	<20	<50	<20	NA

Adapted from: Thompson, K., Young, M., Gupta, R., Steinle-Darling, E., 2023. Complying with New York's Draft Policy for PFAS in Biosolids. Clear Waters 31–37.

03

How Biosolids Master Planning Can Help

Biosolids master plans help utilities lay out how to get “there” from here



Biosolids Master Planning

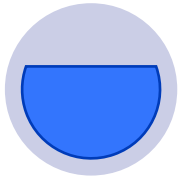
Evaluate options

Define projects, triggers, risks

Estimate capital investments and operating costs

Develop schedules and roadmaps

Document in dynamic CIP



Financing and Partnering

Rate studies

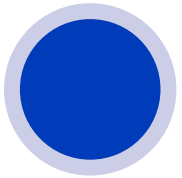
Loan/grant applications

Bonds

Public/private partnerships

Regional partnerships

Other financing mechanisms



Project Implementation

Design

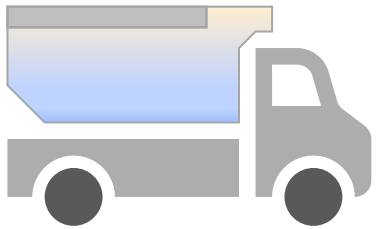
Construct

Operate

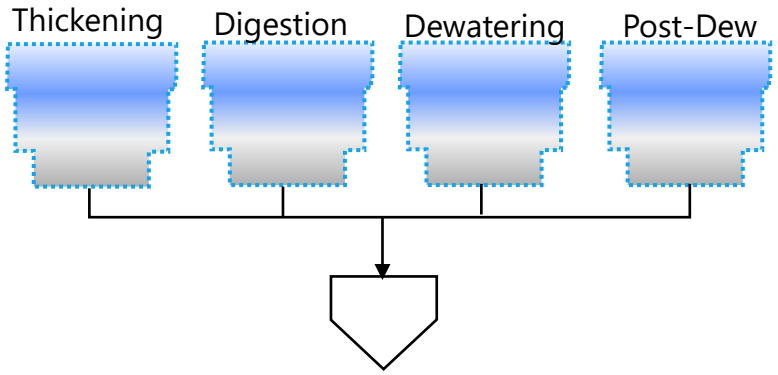
Utilities seek vision-aligned solutions that address multiple needs within their constraints

- Near-term
  Mid-term
  Long-term
- Financially responsible (capital and operating costs)
- Fit on site/in community
- Proven operability, reliability, and safety
- Meet current and potential regulations
- Environmentally responsible

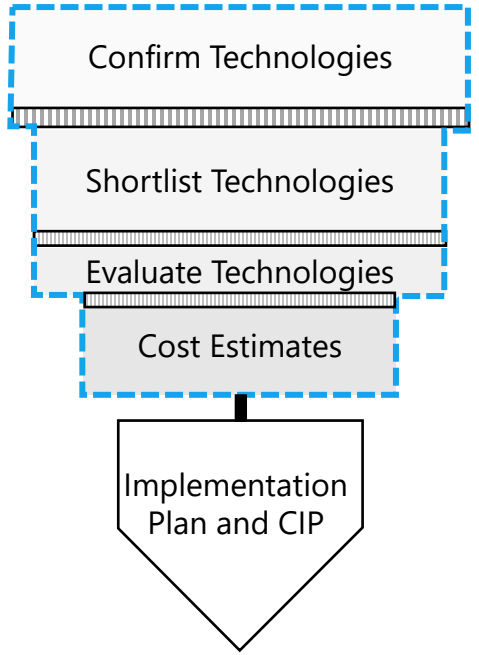
Assess end uses and current processes, identify technologies and evaluation criteria/weights, and then evaluate to select best options



End Use Market Assessment



Process Assessment and Technology Identification



Stepwise Evaluation and Technology Selection

For example, post-dewatering technologies being considered for risk mitigation relative to PFAS

Incineration (700-900°C)

Courtesy of Suez

Gasification (700-1000 °C+)

Courtesy of Aries

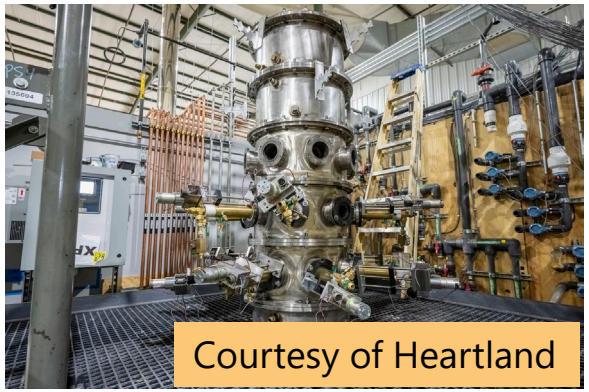
Pyrolysis (300-950 °C)

Courtesy of Bioforcetech

Supercritical Water Oxidation (374 °C; 221.1 bar)

Courtesy of 374Water

Ultra-high Temp Ionic Gasification (3,000-10,000 °C)



Courtesy of Heartland

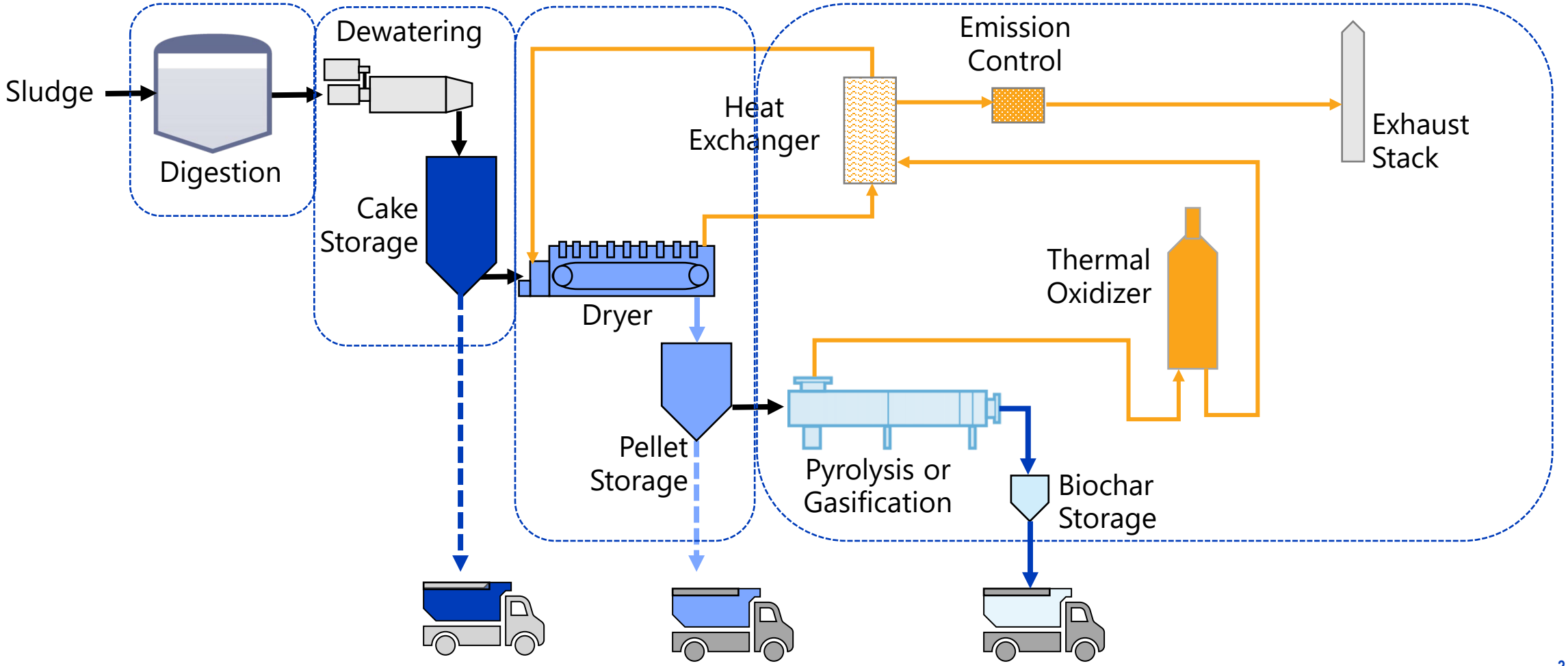
Cheat Sheet:

- *300 deg C ~ 570 deg F*
- *374 deg C ~ 705 deg F*
- *700 deg C ~ 1,300 deg F*
- *1,000 deg C ~ 1,800 deg F*
- *3,000 deg C ~ 5,400 deg F*
- *10,000 deg C ~ 18,000 deg F*
- *221 bar ~ 3207 psi*

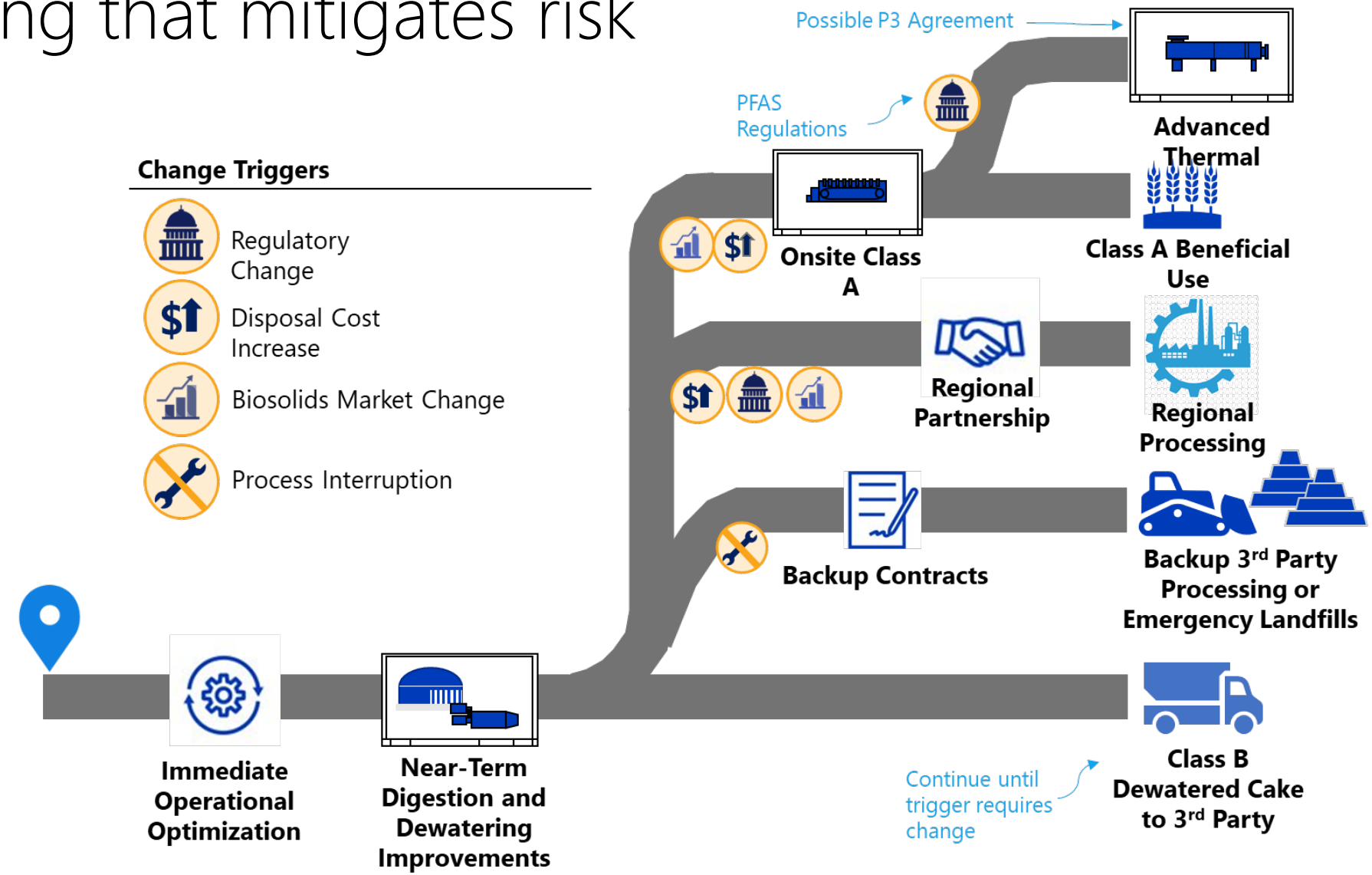
Considerations beyond PFAS destruction…

- Scalability
- Safety/Reliability/ Longevity
- Capital and Operating Costs
- Permitting
- Broader Environmental Impacts
- Long-term Impacts of Source Control/Bans

Phasing can address near-term needs and reduce quantities while setting utilities up for the future

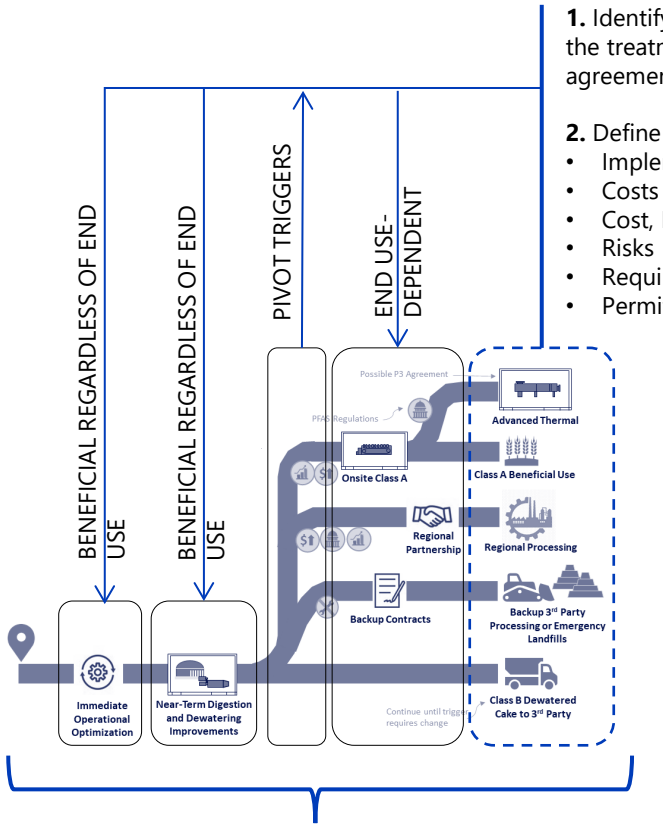


Develop flexible roadmap with phasing that mitigates risk



Develop dynamic capital improvement plan (CIP)

1. Complete process and technology evaluation
2. Define projects, triggers, costs, schedule, partnerships, and permits
3. Develop implementation plan
4. Document in dynamic CIP with cost allocation by year, sensitivity parameters, toggle switches



1. Identify and evaluate end products and the treatment trains, technologies, and/or agreements required to produce them

2. Define precursor projects:
- Implementation Schedule and Phasing
- Costs and Funding Opportunities
- Cost, Regulatory, Operational Triggers
- Risks
- Required Partners
- Permitting Agencies

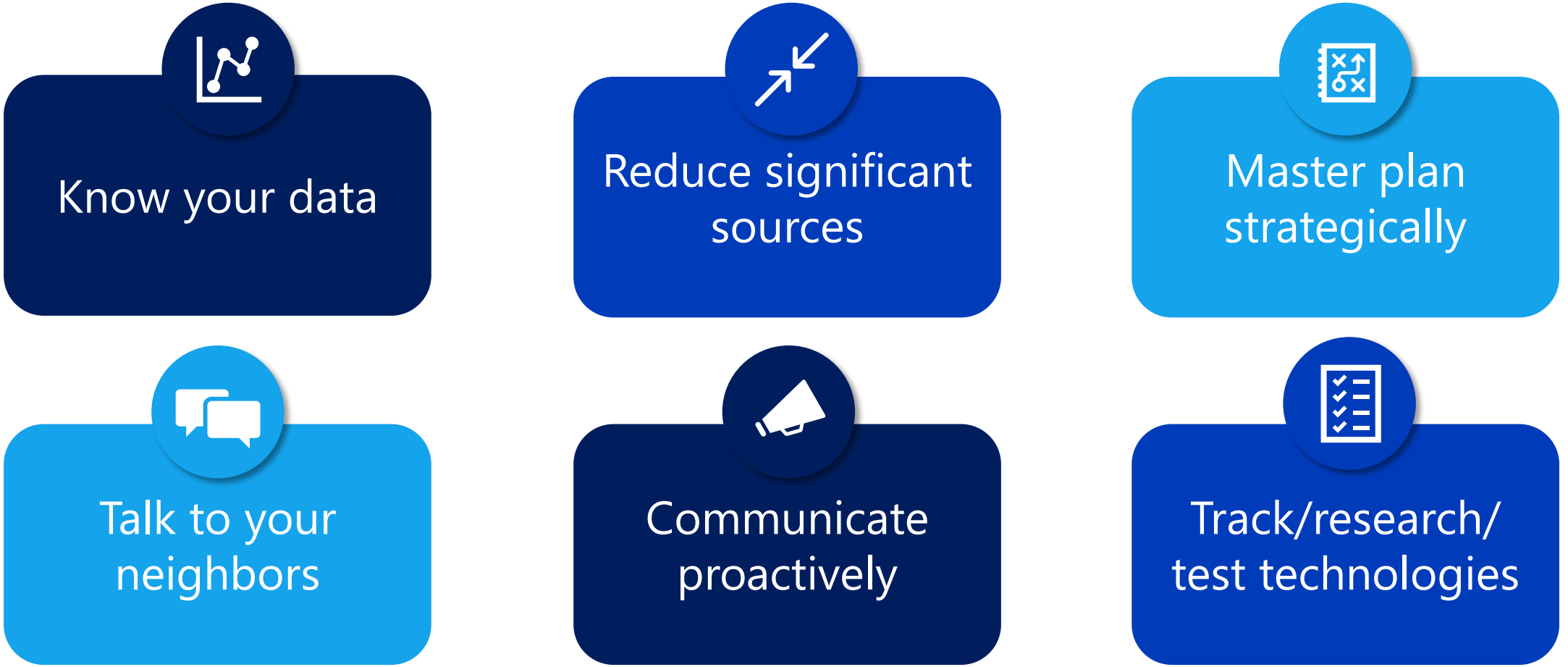
3. Develop the implementation roadmap

4. Document CIP with cost allocation by year

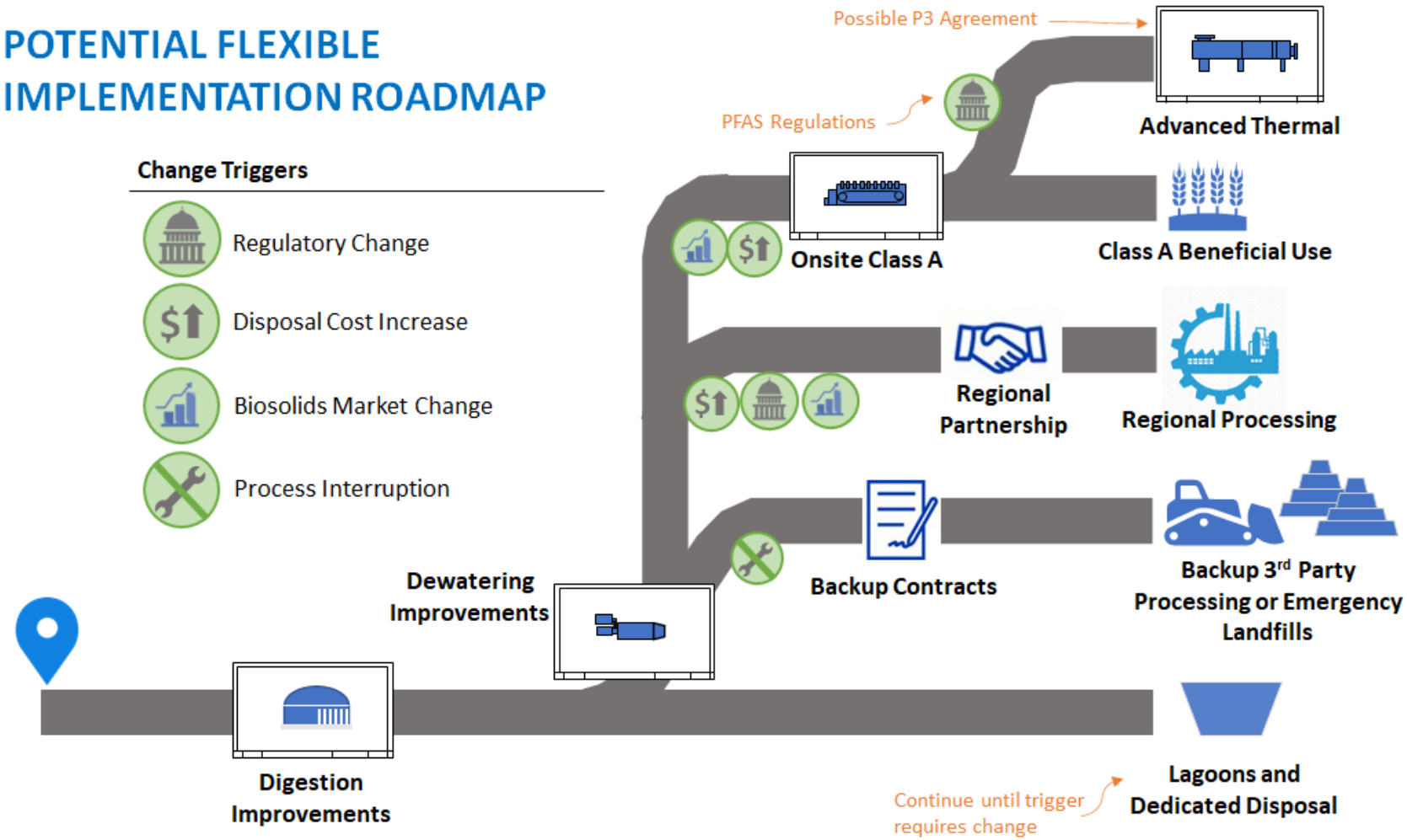
04

What can utilities do now relative to PFAS?

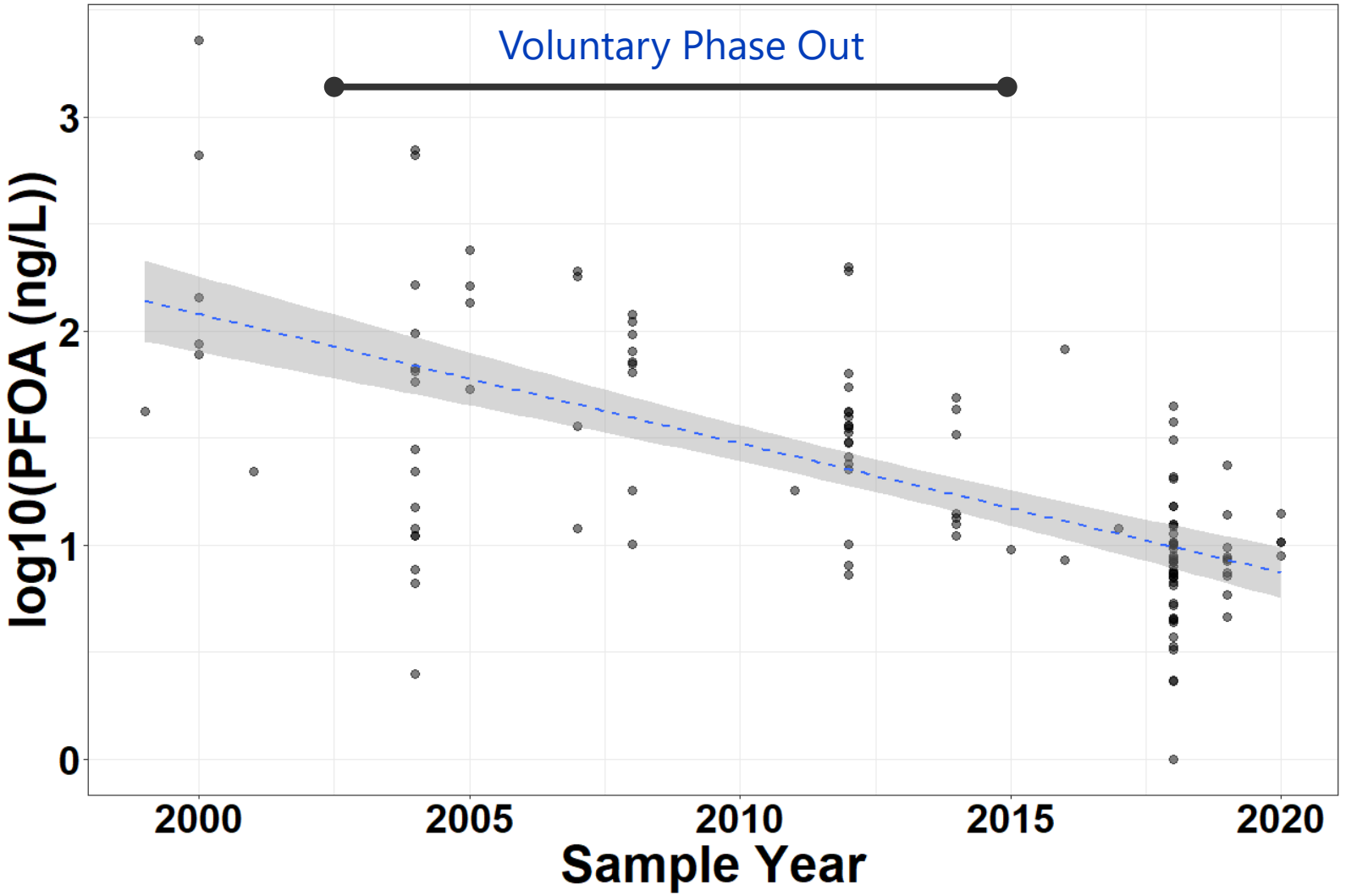
Utilities can take proactive steps while awaiting regulatory guidance on biosolids.



Plan for flexibility with offramps for different trigger points – invest in improvements along the path



Source control and phase outs have led to decreased PFAS concentration in effluent and biosolids



Source: Thompson, K. A. et al. 2022. ACS ES&T Water, 2(5), 690–700.

Source control and phase outs have led to decreased PFAS concentration in effluent and biosolids

Mean and Median Values of Biosolids/Sludge Concentrations Since 2018

Year	PFOS (ppb)		PFOA (ppb)	
	Mean	Median	Mean	Median
2018*	184	13	25	7
2021	21	9	8	4
2022	16	10	7	3
2023	11	7	6	3
2024**	8	5	5	2

*Includes data from industrially impacted facilities as part of a statewide study

**Calculations based on 170 results received as of 12/05/2024

All values listed are in parts per billion (ppb[µg/kg])

Source: EGLE, "Michigan's Interim Strategy for Land Application of Biosolids Containing PFAS", Conference Presentation 2024.

Thank you!

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