PFAS and Residuals Technology and Management Study, Parts 1 & 2

January 31, 2025
Stakeholder Meeting

Tighe&Bond

Brown AND Caldwell

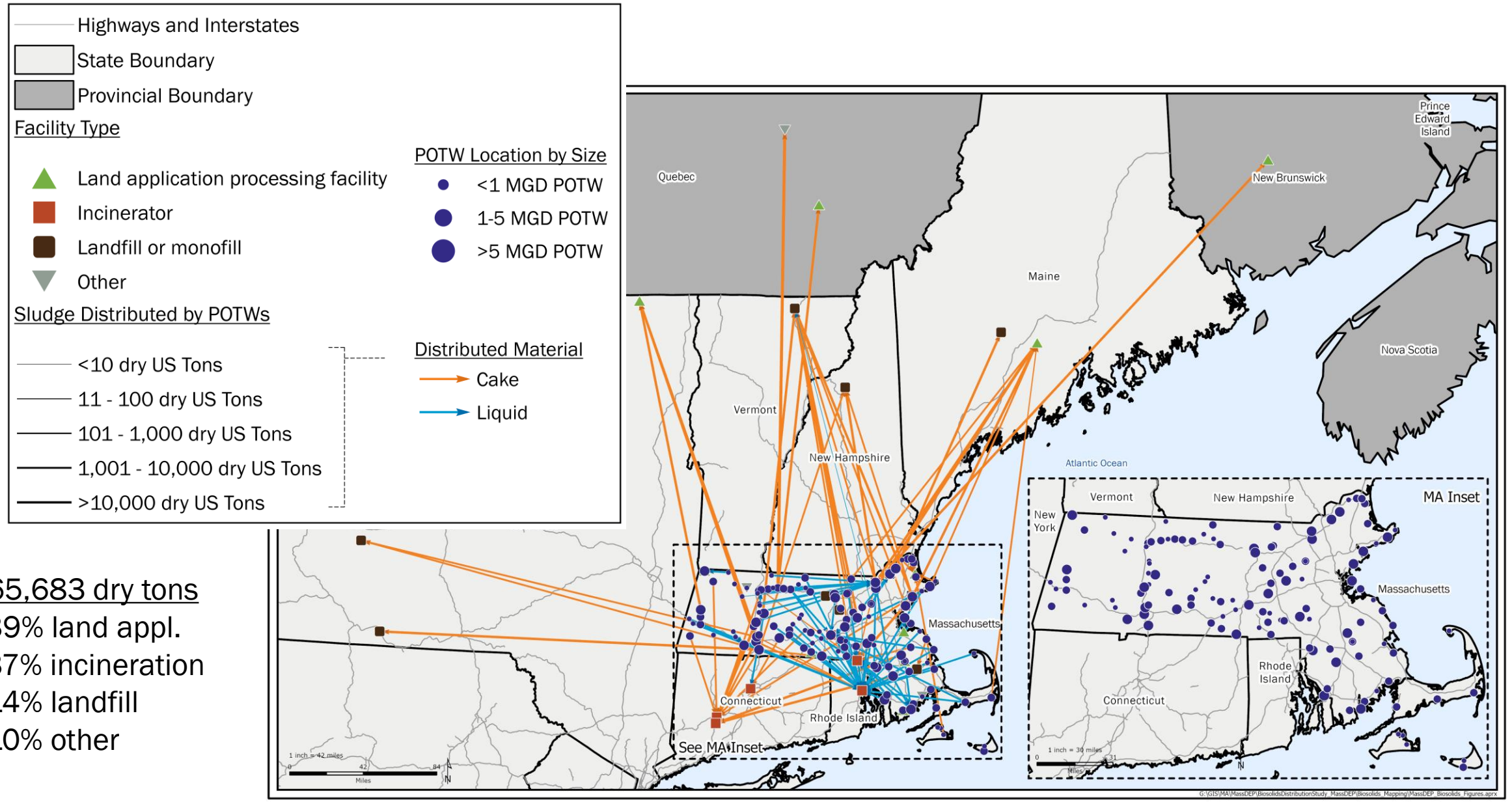
Zoom Meeting Logistics

- Presentation will be recorded
- Slides will be posted on MassDEP's website following the presentation and attendees will be notified
- To minimize background noise, attendees are on mute
- Please enter questions in the Q&A
  - Include your full name and affiliation if you ask a question

Agenda

- Part 1: Summarize takeaways
  - "Current and Near-Term Management of Massachusetts Wastewater Sludge"
- Part 2: Takeaways and recommendations
  - "Future Options and Associated Costs for Management of Massachusetts Wastewater Sludge"

Overview of Massachusetts Sludge Management 2023 (Part 1)



165,683 dry tons

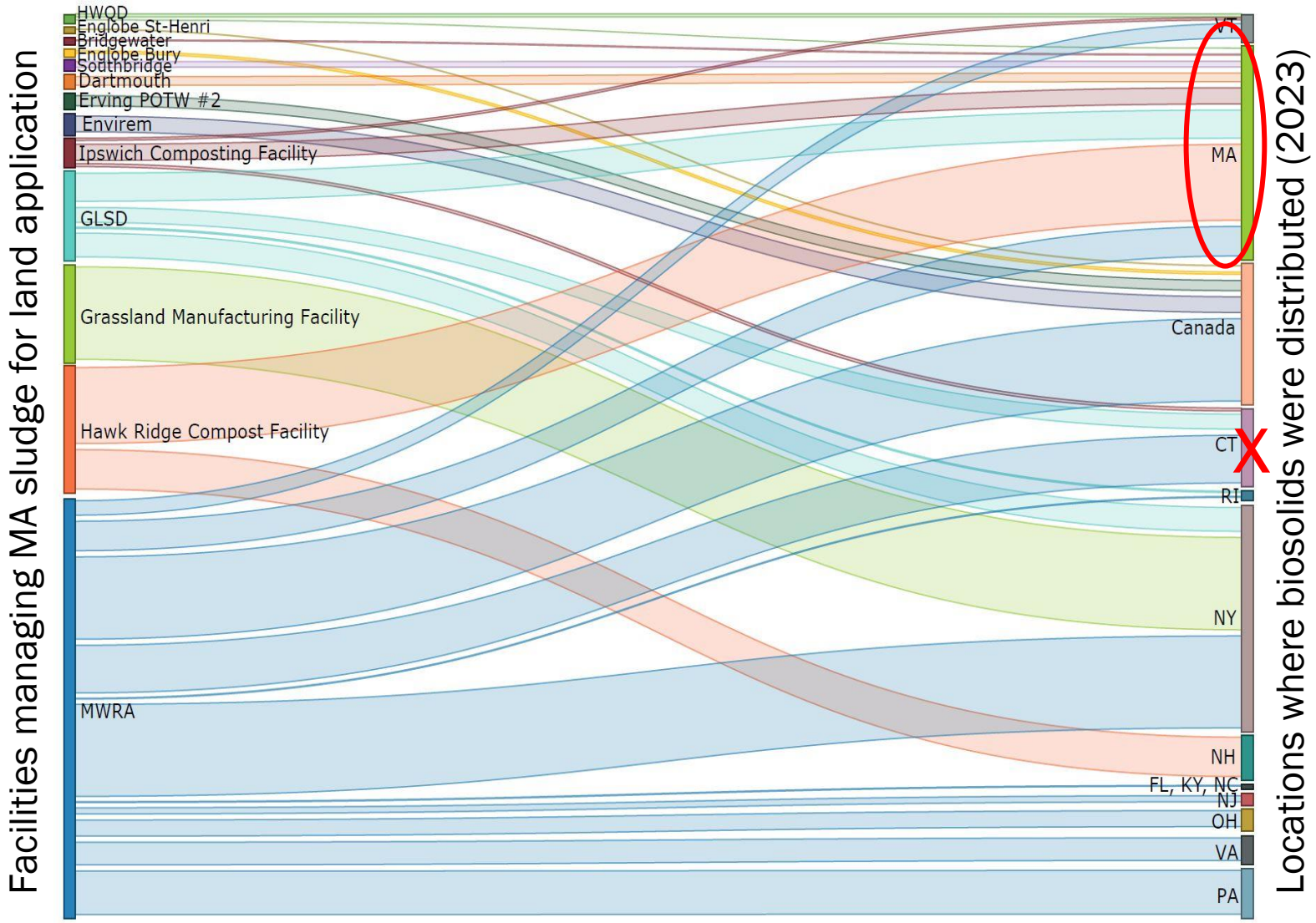
39% land appl.

37% incineration

14% landfill

10% other

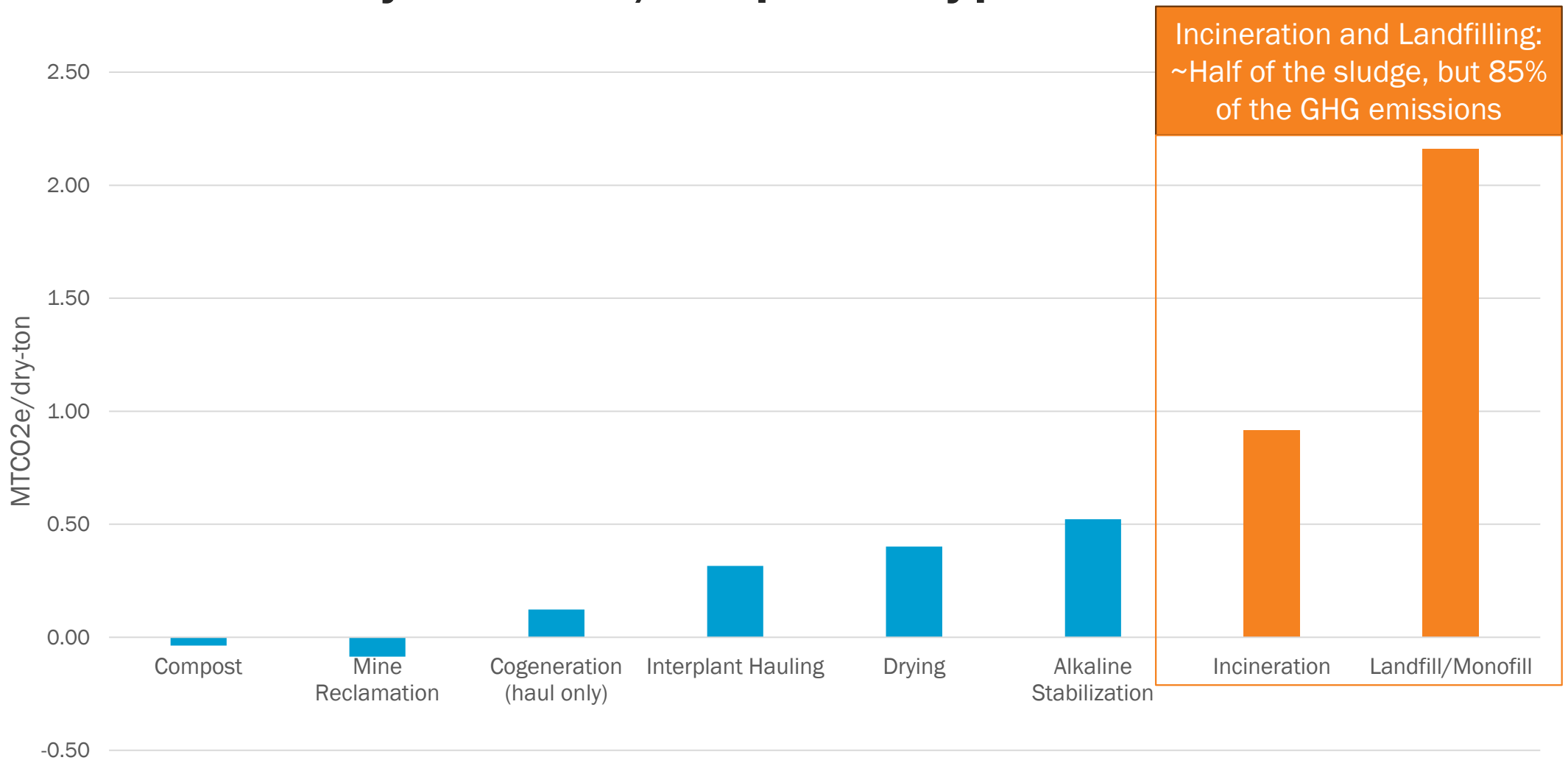
Land Application of Massachusetts Biosolids in 2023



Key Take-Aways

- MWRA and GLSD distribute pellet product widely
- MA composters rely on MA land application sites
- 95% of sludge to Hawk Ridge (ME) is from MA, and 64% of compost is land applied back in MA

Net Greenhouse Gas Impact per Dry-Ton of Sludge Generated in Massachusetts by End-Use/Disposal Type



Part 1 Summary

2023 Conditions

- **Landfills**: Decreasing capacity for sludge acceptance over next 10 years
- **Land Application**: Northeast processing facilities essentially at capacity
- **Incineration**: Northeast incineration facilities aging and essentially at capacity
  - Woonsocket will no longer accept liquid sludge. Significantly affects MA sludge

Projected 2028 Conditions

- At least ~12,000 dry US tons projected to have no clear outlet (given current management options)

Part 2 - Project Goals

- How does PFAS impact wastewater sludge management now and in the future?
  - Regulatory landscape in Massachusetts and beyond for PFAS in wastewater sludge
  - Potential for reduction of PFAS levels in sludge with source control (upstream of POTW)
  - PFAS reduction technologies for sludge, wastewater and leachate treatment
  - Sludge volume reduction technologies
  - Considerations for POTWs and regulators/legislators

- This study does NOT include health impacts or quantitative risk assessment
- Qualitatively: lower PFAS concentrations = lower health risk and more sludge management options

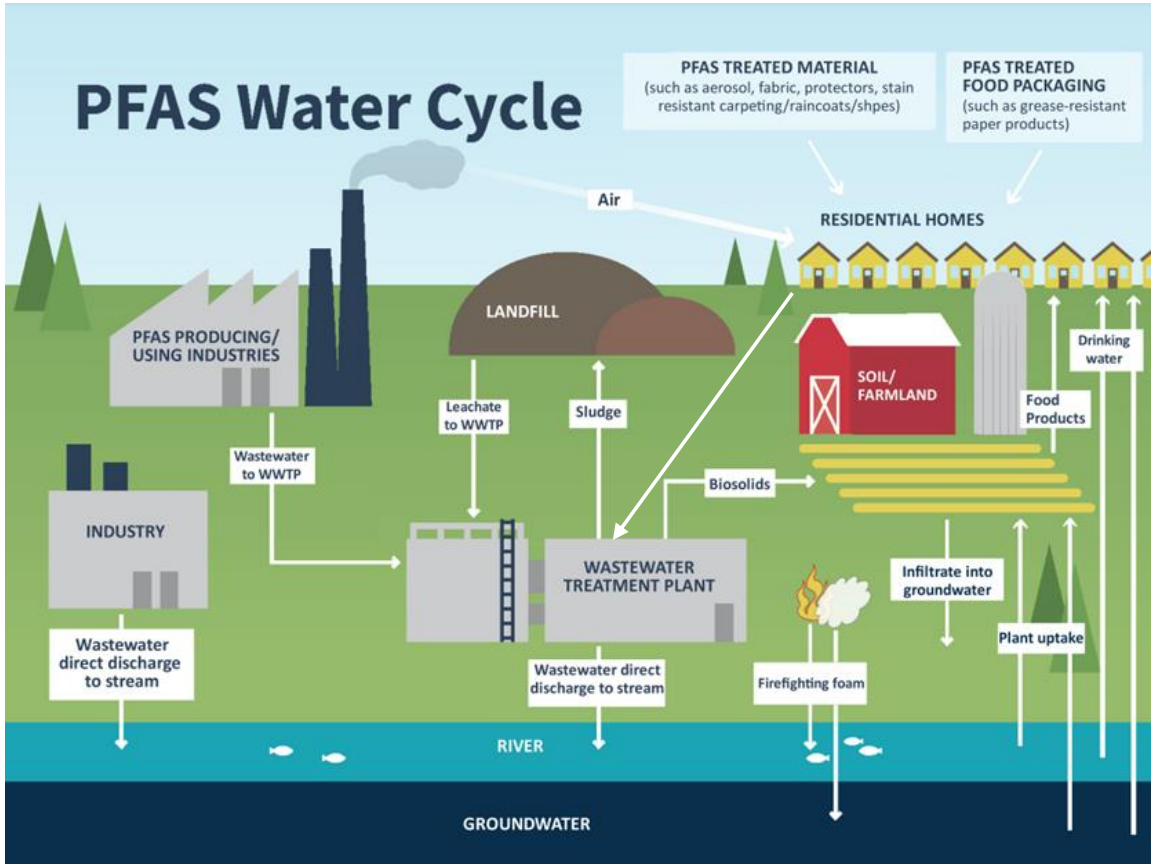
Potential PFAS Impacts on Sludge & Biosolids Management

Landfill Disposal

- Leachate Contamination
- Soil and Water Contamination
- PFAS Persistence and Mobility

Land Application

- Soil and Water Contamination
- Plant Uptake and Bioaccumulation

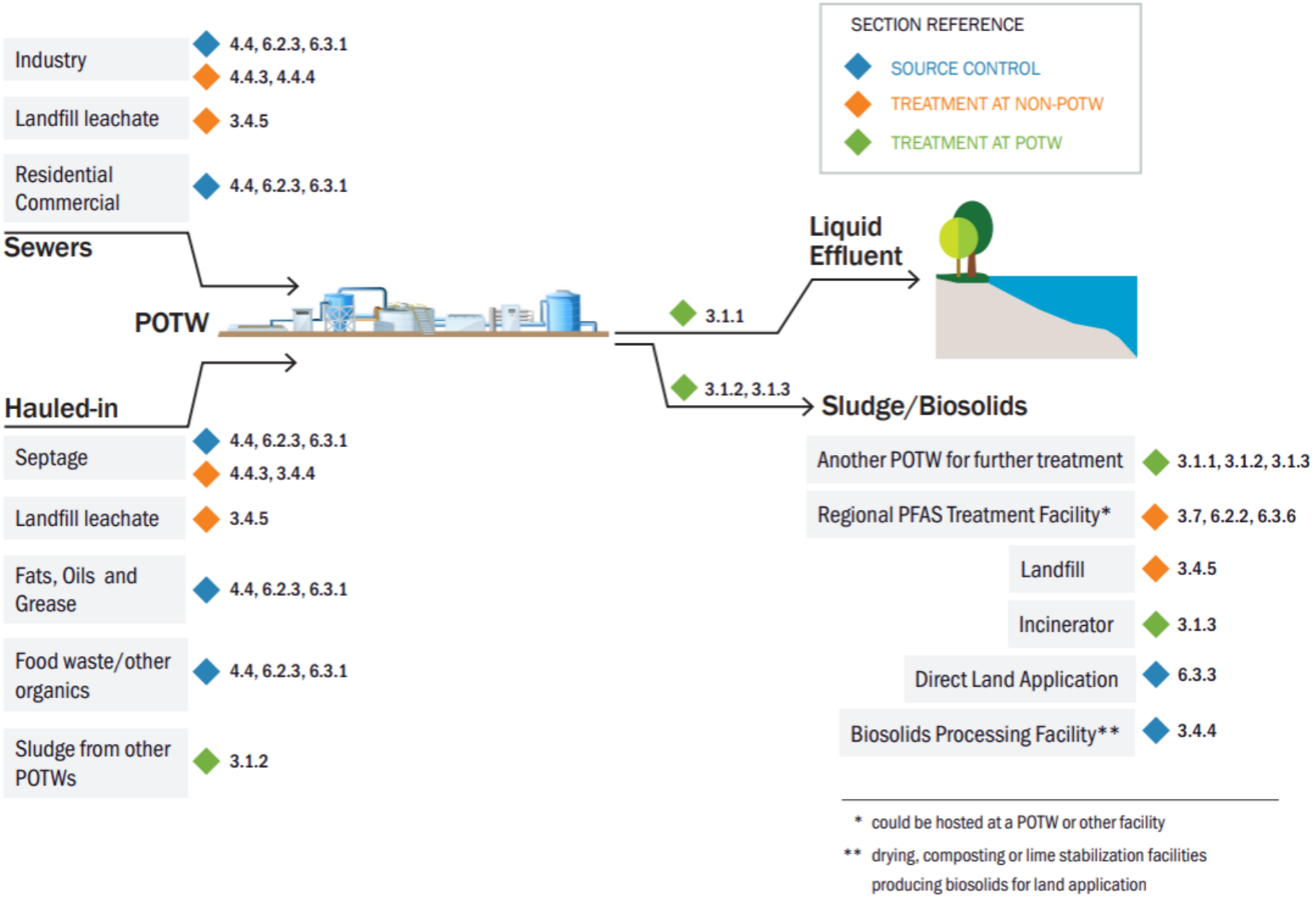


PFAS Water Cycle by US EPA, 2024
https://www.epa.gov/system/files/documents/2022-10/pfas-water-cycle-508-friendly_0.pdf

Incineration

- Formation of Hazardous Byproducts
- Air Emissions
- Ash Residue

POTW PFAS Flows: Potential Intervention Points



Contributions of PFAS into POTWs (Indirect Discharges)

Can We Control PFAS Upstream of POTWs?

- Unique or concentrated pollutants are more efficiently removed at their source
- 40 CFR 403 gives POTWs broad authority to regulate industrial sources
- Successfully implemented for PFOS & PFOA in other jurisdictions
  - Industry process changes
    - Product substitution
    - Contaminated equipment replacement
  - Industrial wastewater pretreatment
- Will it work in Massachusetts?

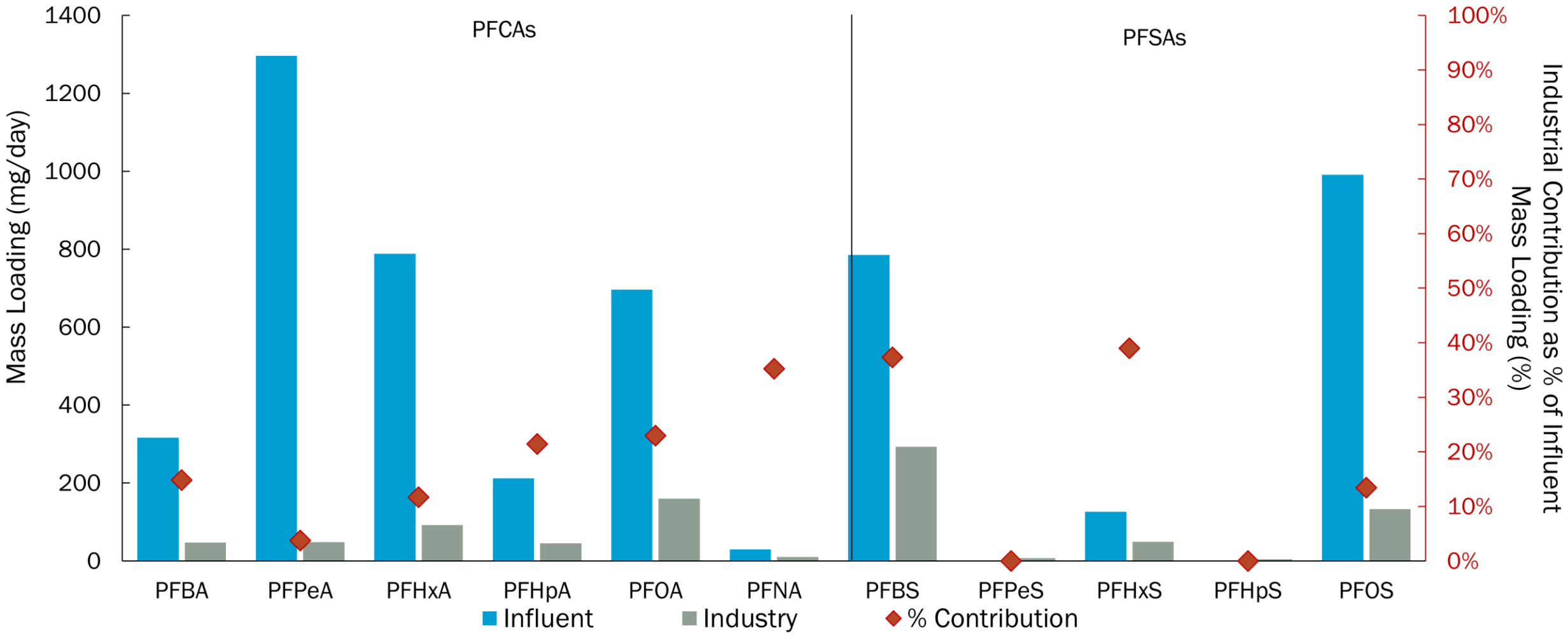
Takeaways from POTW PFAS Data Evaluation

- Detailed evaluation of PFAS database +
- Top 8 for influent and effluent the same – detected at >50% of plants
- Unique "spikes" raise questions for POTWs
  - Sampling/lab anomaly?
  - Unique discharger?
  - Slug discharge?
- Consistent detection of species implies "domestic" source
- Sludge has different species profile

Summary of PFAS Species Present in >50% of POTWs			
	Influent	Effluent	Sludge
PFBA	53%	71%	31%
PFPeA	78%	82%	38%
PFHxA	84%	84%	57%
PFHpA	75%	90%	38%
PFOA	90%	96%	62%
PFNA	47%	65%	52%
PFDA	25%	47%	79%
PFBS	76%	78%	29%
PFHxS	76%	76%	38%
PFOS	91%	96%	95%
NMeFOSAA	12%	24%	71%
NEtFOSAA	12%	18%	71%

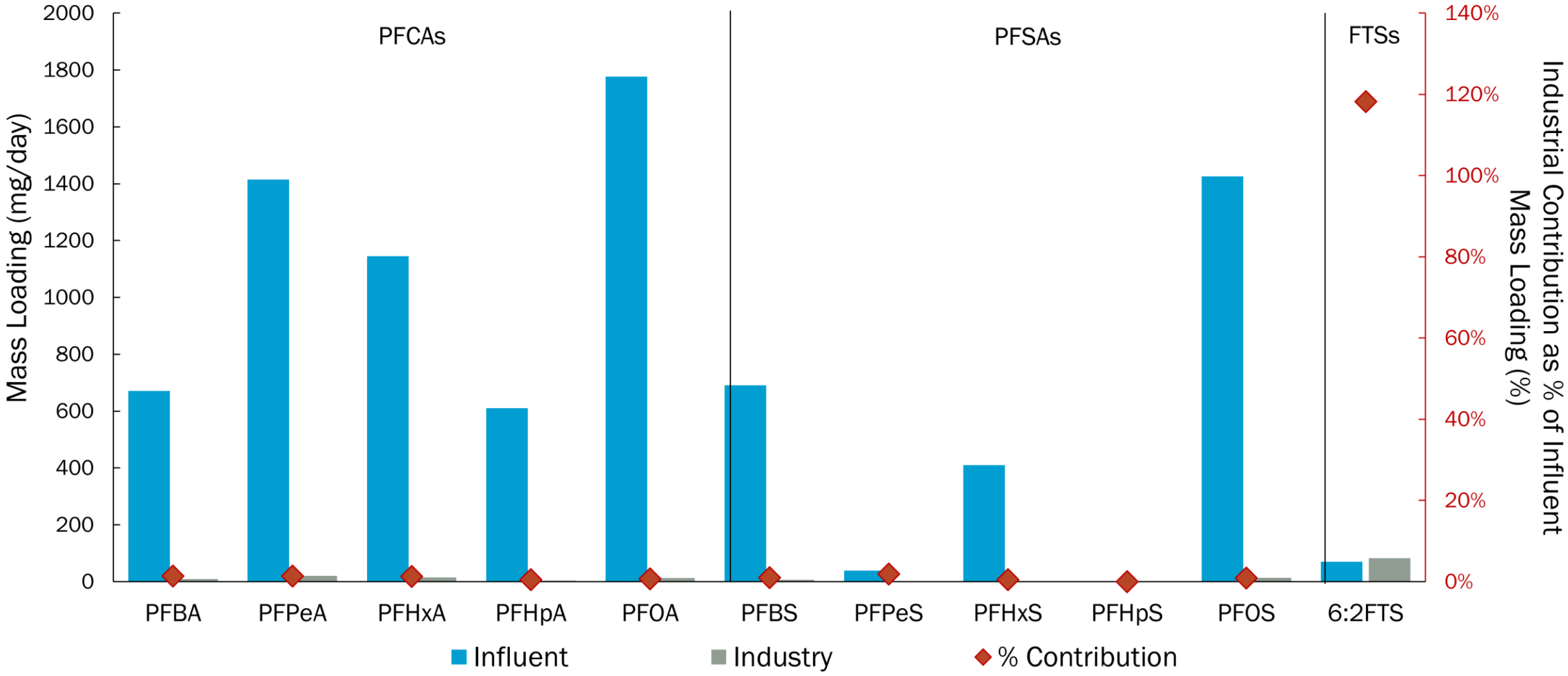
Source Reduction – POTW C

Industrial contributions
variable (1%-41%)



Source Reduction – POTW A

Industrial contributions
<1% except for specific compound (6:2FTS)



Treatment Technologies

Sludge, Wastewater, Leachate

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Treatment Technologies Evaluated

Sludge

- **Volume reduction technologies**
- **PFAS treatment**

Wastewater/Liquid Stream

- PFAS treatment

Leachate (not covered today)

- *PFAS treatment*

Sludge – Common Volume Reduction Technologies

Dewatering

- Centrifuge
- Screw Press
- Belt Filter Press
- Rotary Press

Anaerobic Digestion

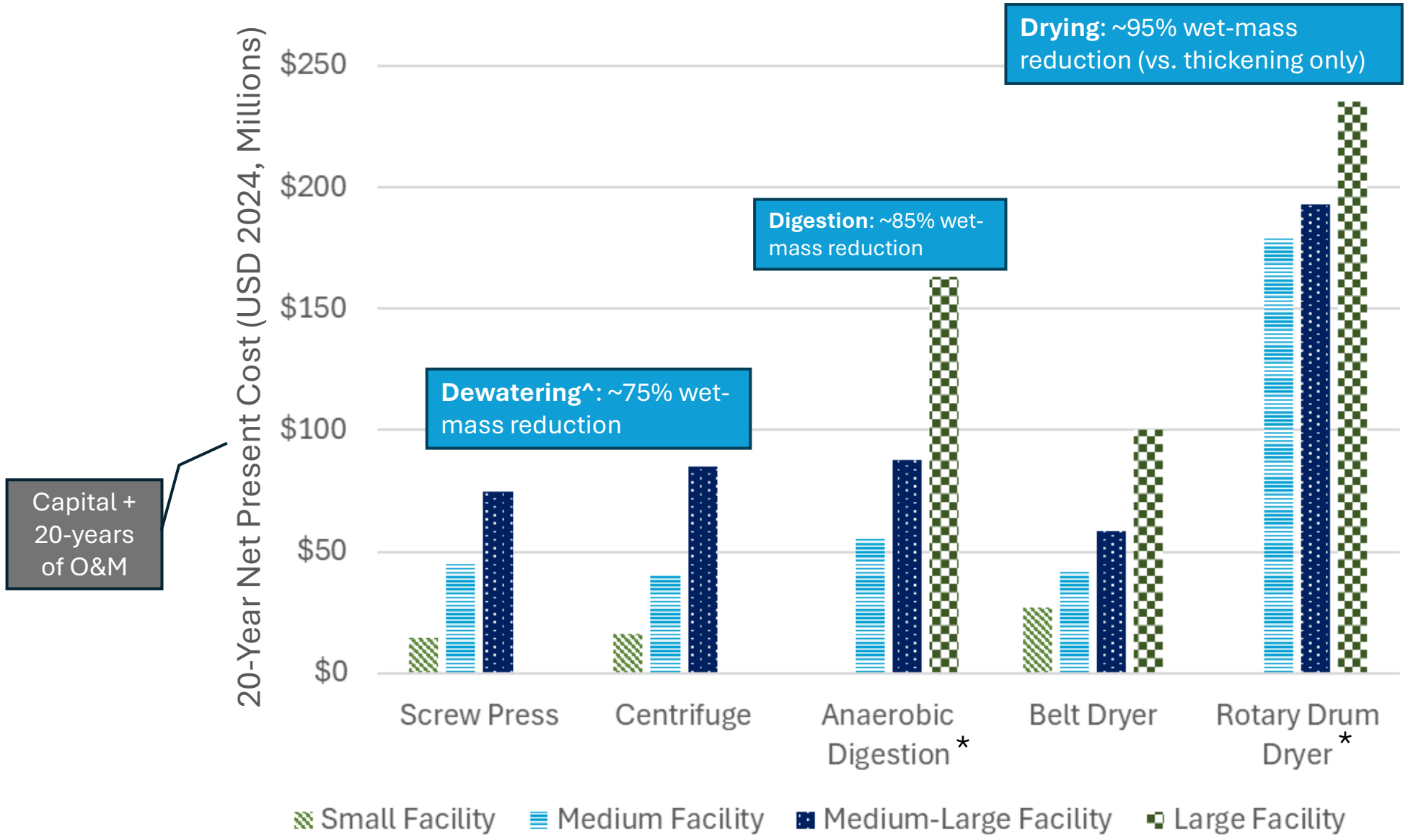
Thermal Drying

- Belt Dryers
- Indirect Dryers
- Rotary Drum Dryers

[selected technologies]

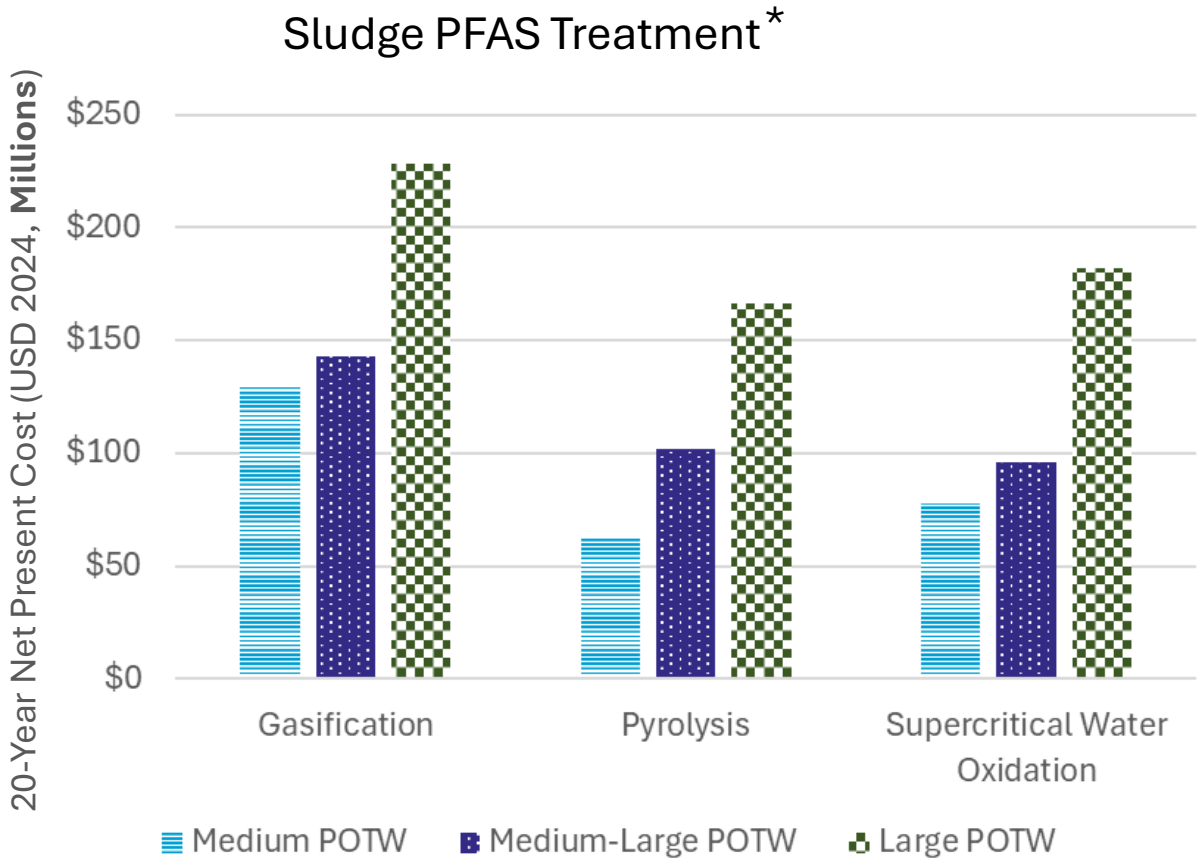
Cost of Sludge Volume Reduction (Estimates per facility)

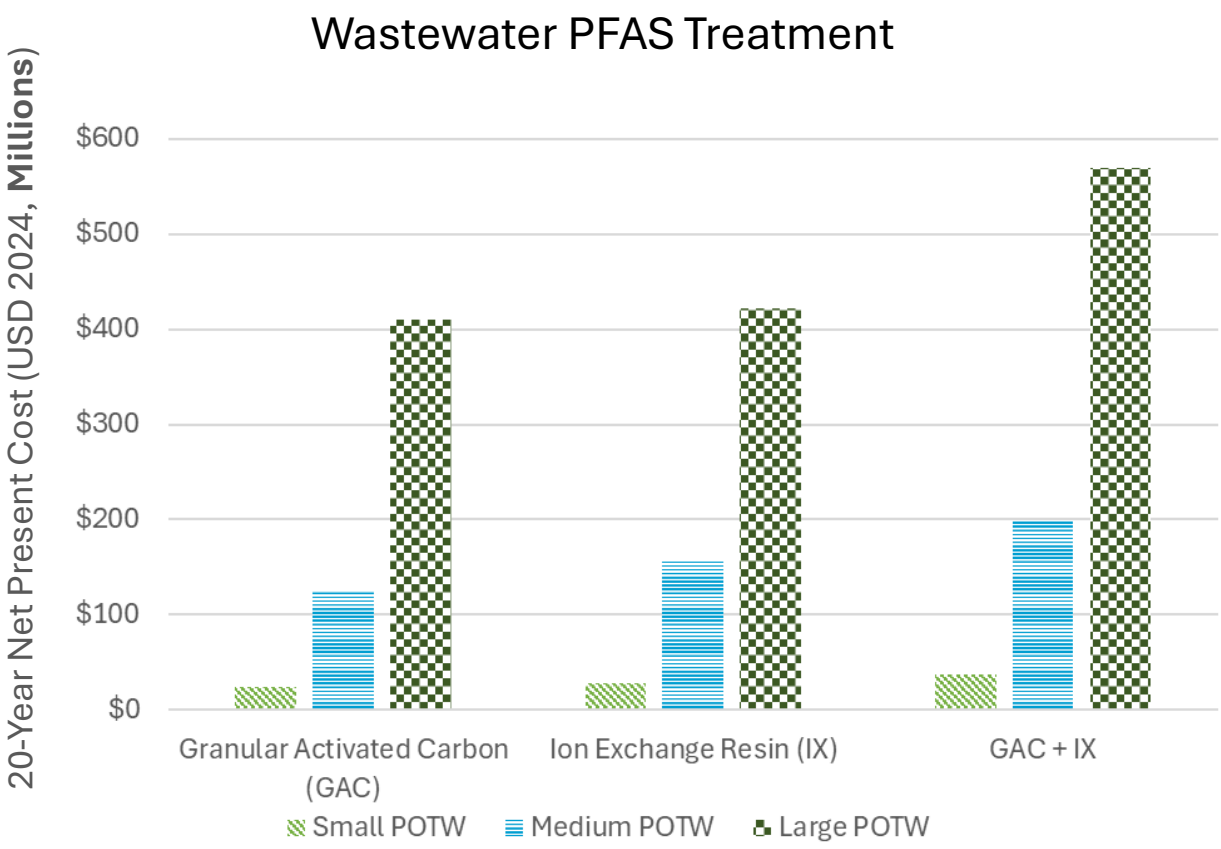
- **Small** (<0.5 mgd):
  - 42 Facilities
- **Medium** (<5 mgd):
  - 65 Facilities
- **Medium-large** (<10 mgd):
  - 7 Facilities
- **Large** (>10 mgd):
  - 8 Facilities



** Small facilities: cost prohibitive*
^Large facilities assumed to already have dewatering

Cost of PFAS Treatment (Per Facility)



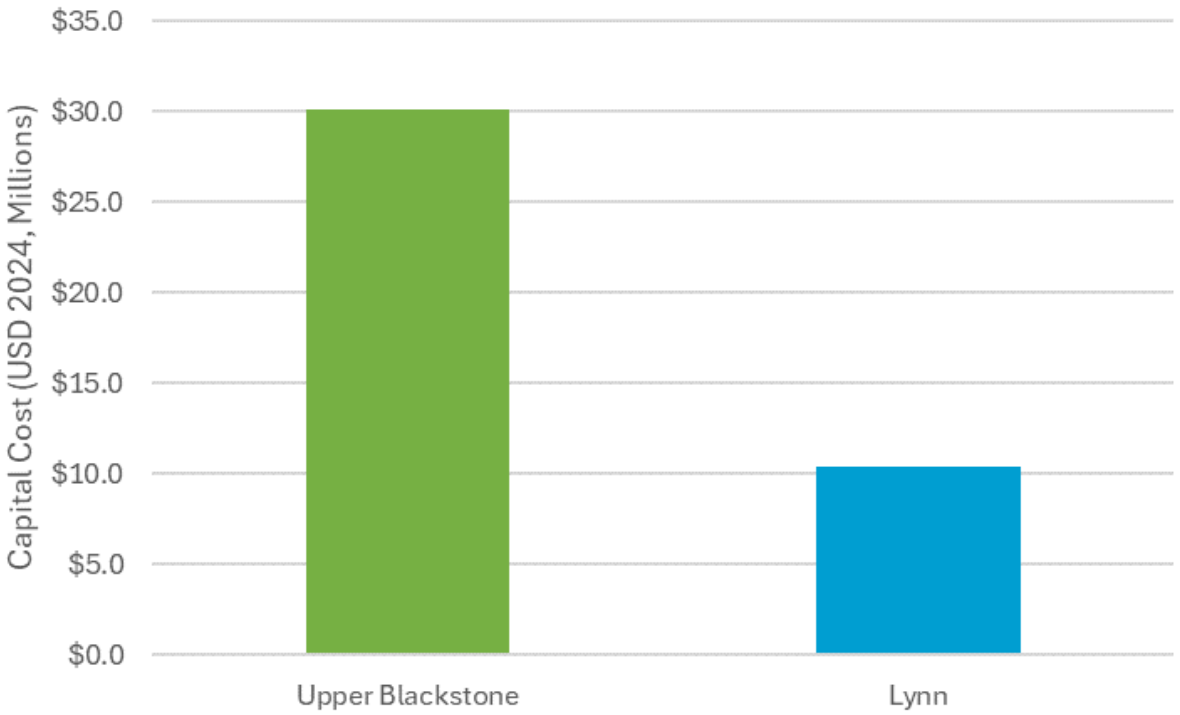


** Small facilities: cost prohibitive*

Wastewater PFAS Treatment Categories:
Small= 0.5 MGD, Medium= 5 MGD, and Large= 20 MGD

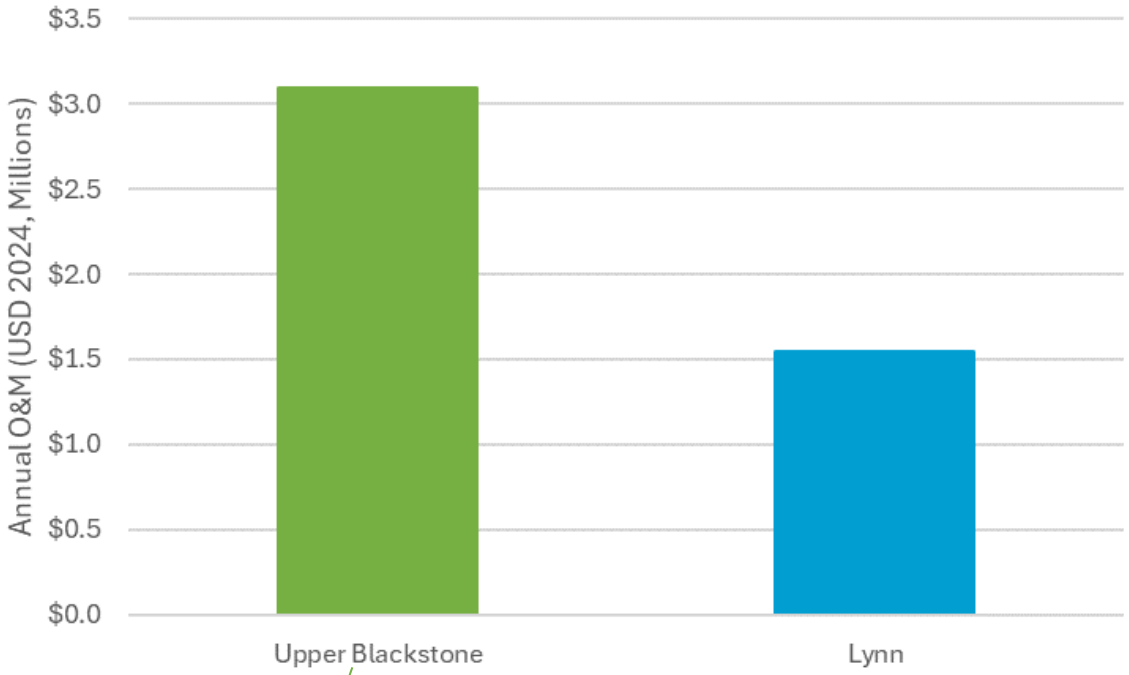
Sludge –Incinerator Retrofit for PFAS Mitigation

Capital Cost Estimate



UBCW: ~18,000 dry-tons/yr
Lynn: ~5,700 dry-tons/yr

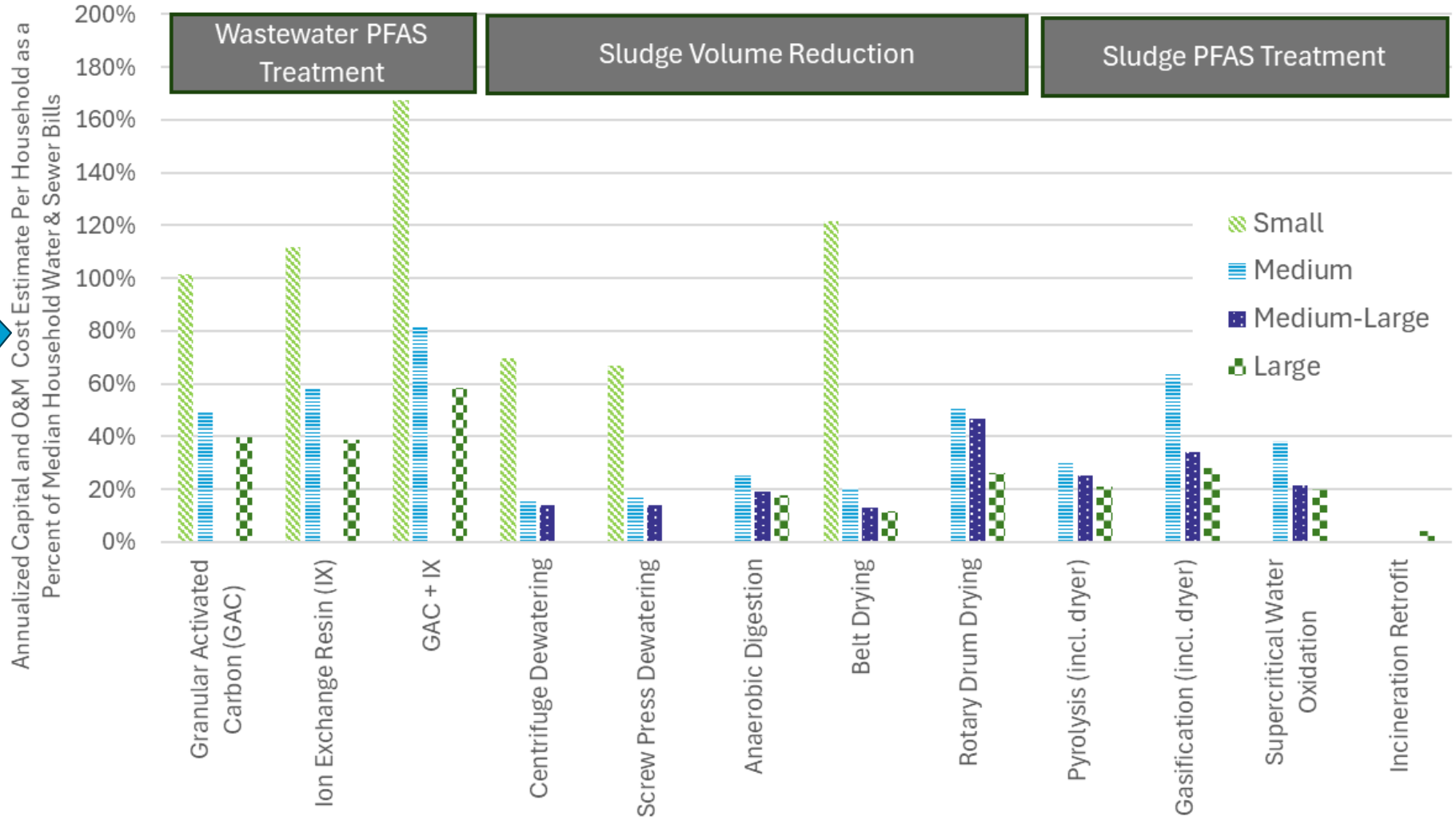
Annual O&M Cost Estimate



total FY25 O&M budget: ~$21M

Impact of Installing Evaluated Technologies on Water and Sewer Rates: How Much Might Bills Need to Rise?*

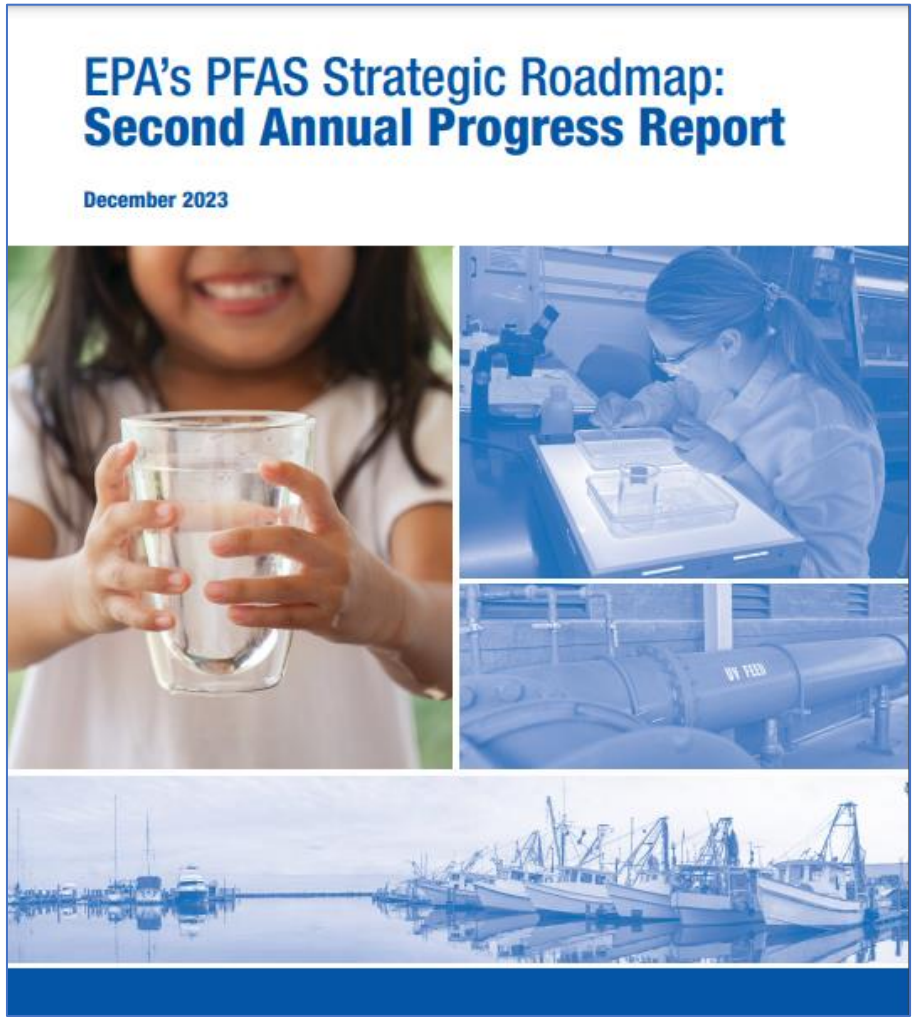
Annualized costs for O&M and capital per "Equivalent Residential Unit" as a percent of current median water and sewer rates



**Graph includes only combinations of Small, Medium, Medium-Large, and Large facilities as presented previously*

Recent and Pending Regulatory Actions – Federal

- 2024 CERCLA Designation of PFOA and PFOS
  - Effects to wastewater and sludge management currently unclear
- 2025 EPA PFAS Biosolids Risk Assessment
  - Not a regulation, though typically informs future regulations
  - Analysis found potential human health impacts for all biosolids management approaches
  - Land application analysis only applies to highly exposed individuals living on or near land application sites, not the general population



Source: EPA'S PFAS Strategic Roadmap: https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

Biosolids Land Application PFAS Restrictions in Other States

State	No Restriction (No additional requirements)	Restriction (Reduce application rates and/or source identification and reduction)	Prohibition (Land application not allowed)
	PFOS or PFOA concentration (ppb)		
Maine	Legislature banned all land application		
Connecticut	Legislature banned all land application		
New York	≤ 20	> 20 but < 50	≥ 50
Minnesota	≤ 19 (Tier 1)	20 – 49 (Tier 2) 50 – 124 (Tier 3)	≥ 125 (Tier 4)

Biosolids Land Application PFAS Restrictions in Other States (cont.)

State	No Restriction (No additional requirements)	Restriction (Reduce application rates and/or source identification and reduction)	Prohibition (Land application not allowed)
	PFOS or PFOA concentration (ppb)		
Michigan	< 20	≥ 20 but < 100	≥ 100
Wisconsin (sum of PFOA and PFOS)	< 20	> 20 but < 50 > 50 but < 150	≥ 150
Maryland	< 20	≥ 20 but < 50 ≥ 50 but < 100	≥ 100
Vermont	PFOS <3.40 PFOA <1.60 PFHpA <0.84 PFNA <0.44 PFHxS <0.38	PFOS >3.40 PFOA >1.60 PFHpA >0.84 PFNA >0.44 PFHxS >0.38	

POTWs: Options to Consider

KEY

Low | Medium | High

	Options	Potential Timeline (Years)	Potential to Increase Sludge Management Options	Potential to Reduce PFAS	Relative Cost	Comments
POTWs	Undertake Local PFAS Source Reduction through Industrial Pretreatment Programs	0-2		(Low-Med-or High)		Efficacy depends on proportion of PFAS load from industry
	Regular Monitoring and Accurate Reporting	0-2				Good data are needed for decision making
	Reduce Sludge Volume	2-5				Producing less sludge with more potential outlets reduces market risks
	Commit to Sending Sludge to Regional Facilities	5-10		(Low or High)		PFAS reduction depends on technology

Legislators & Regulators: Options to Consider

KEY

Low Medium High

	Options	Potential Timeline (Years)	Potential to Increase Sludge Management Options	Potential to Reduce PFAS	Relative Cost	Comments
Legislature & Regulators	Establish PFAS Limits for Biosolids Land Application	0-2				Can build off the tiered approach of most other states. Compliance could be costly for some POTWs.
	Provide Regulatory Certainty for PFAS Treatment Technologies	0-2				PFAS treatment technology systems typically greatly reduce sludge volume, as well
	Implement PFAS Source Control Measures-Consumer Products & Manufacturing Processes	2-5	(Low or Med)	(Med or High)		Office of Technical Assistance can assist industries
	Support Volume Reduction and PFAS Treatment Projects	2-5				Funding needed for full-scale and pilot installations; regulatory certainty needed for pilots
	Promote Regional Facilities	5-10		(Low or High)		PFAS reduction depends on technology; regulatory certainty and funding needed

Conclusions: Where can Massachusetts go from here?

- Implement PFAS source control measures
- Establish PFAS sludge limits for land application
- Establish volume reduction facilities
- Provide regulatory certainty for PFAS treatment technologies
  - Develop a straightforward permitting approach (air, wastewater, siting, end product usage information)
- Facilitate piloting and support funding of full-scale projects of emerging technologies
- Support developing regional facilities through regulatory guidance and funding

Open Discussion

Todd Brown, TMBrown@tighebond.com
Bill Brower, BBrower@brwncald.com
Lealdon Langley, lealdon.langley@mass.gov

Superseded Slides

PFAS Treatment for Landfill Leachate