Breaking the Chain:
PFAS Intervention in the One Water Cycle

NEWEA Conference, Session 12:
What's in Your Industrial Wastewater?

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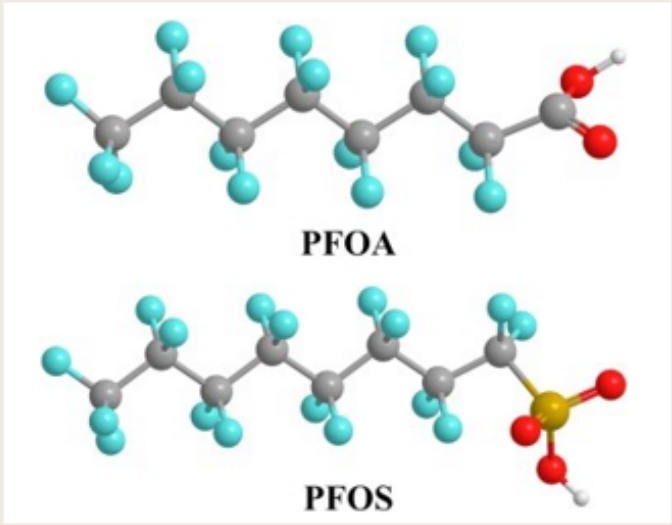
Agenda

- Per- and polyfluoroalkyl substances (PFAS) Sources
- One-Water Cycle
- PFAS Source Control
- PFAS Water Treatment Options



What is a PFAS source? Where might PFAS occur?

Aqueous Film Forming Foam (AFFF)

- Federal sites
- Airports
- Fire stations
- Power plants
- Fuel bulk storage & refineries

AFFF

Industrial processes

- PFAS manufacturing
- Metals plating/finishing
- Hi-tech industry
- Fire retardant manufacturing
- Poultry farms
- Uranium enrichment

Metals Plating

Manufactured goods (stain-, grease-, waterproofing)

- Landfills
- Pulp and paper
- Water/ stain proofing operations

Landfills and Leachate

Contaminated waters

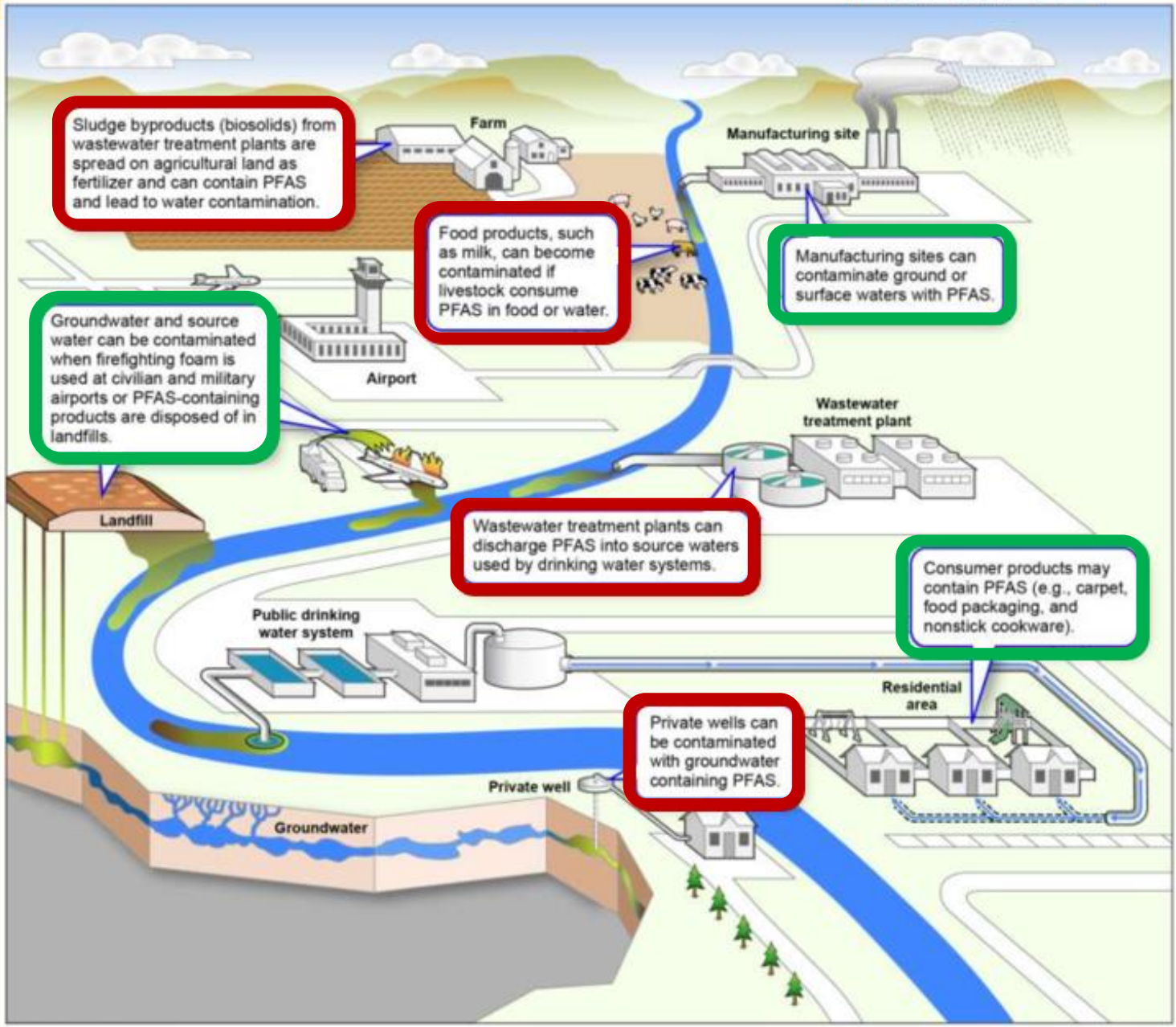
- Potable water plants
- Wastewater treatment plants

Wastewater Treatment Plants

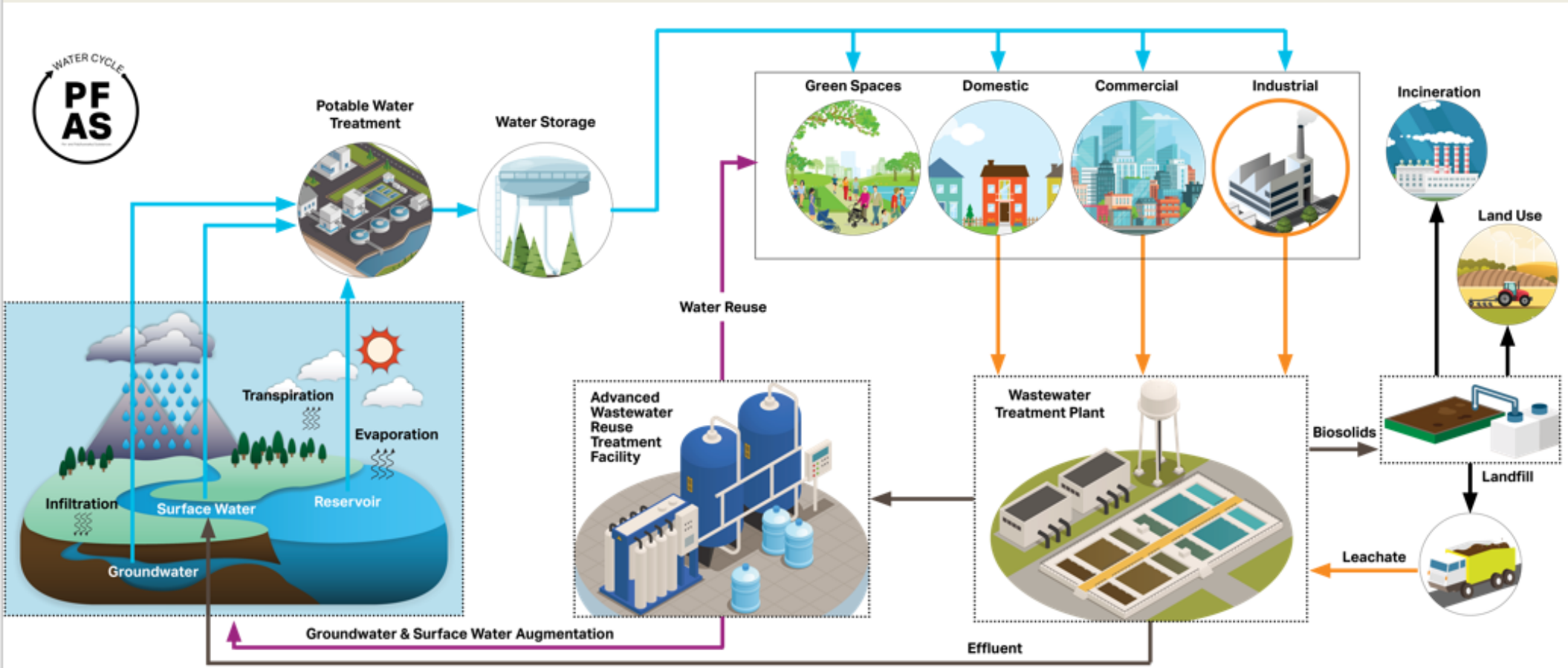
PFAS:
Sources and Impacts

PFAS Sources

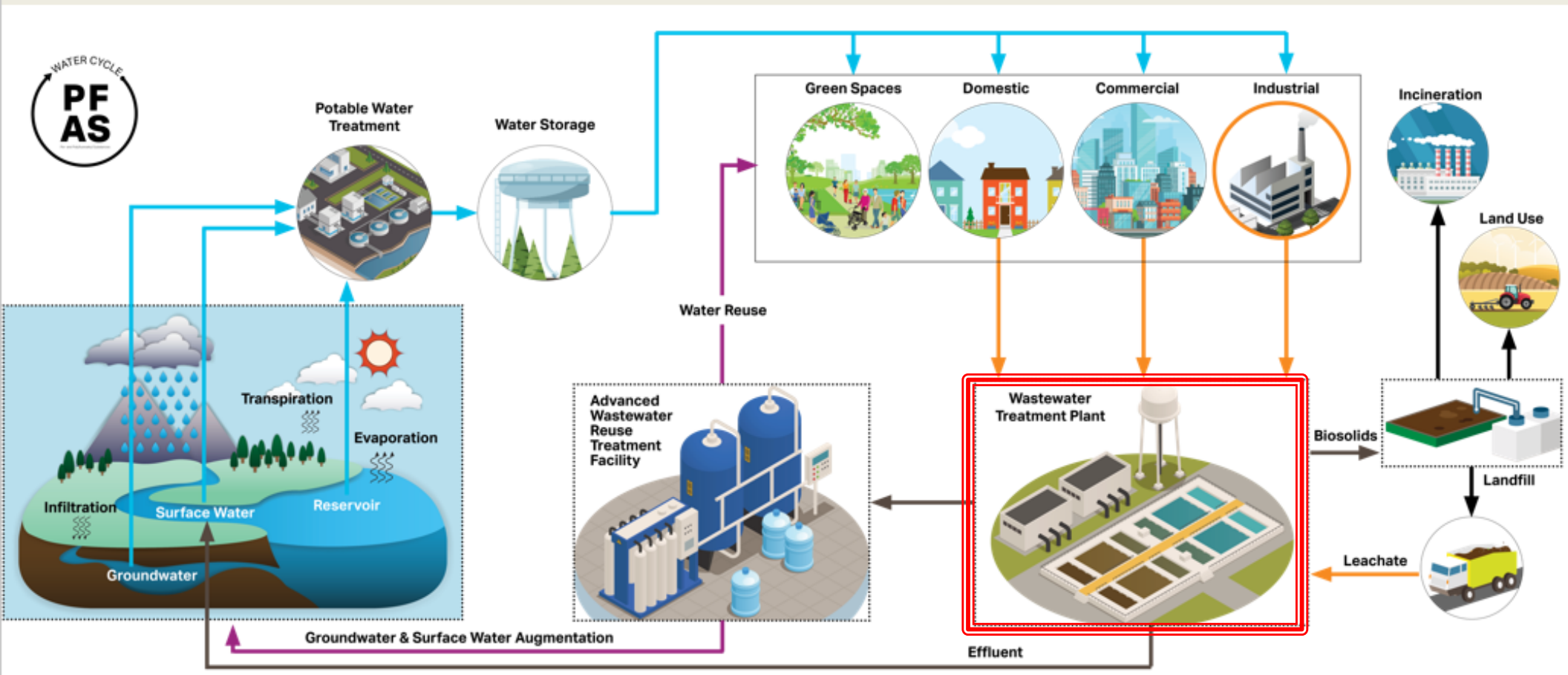
PFAS Impacts



PFAS in the One-Water Cycle



PFAS in the One-Water Cycle – Wastewater Treatment Plants

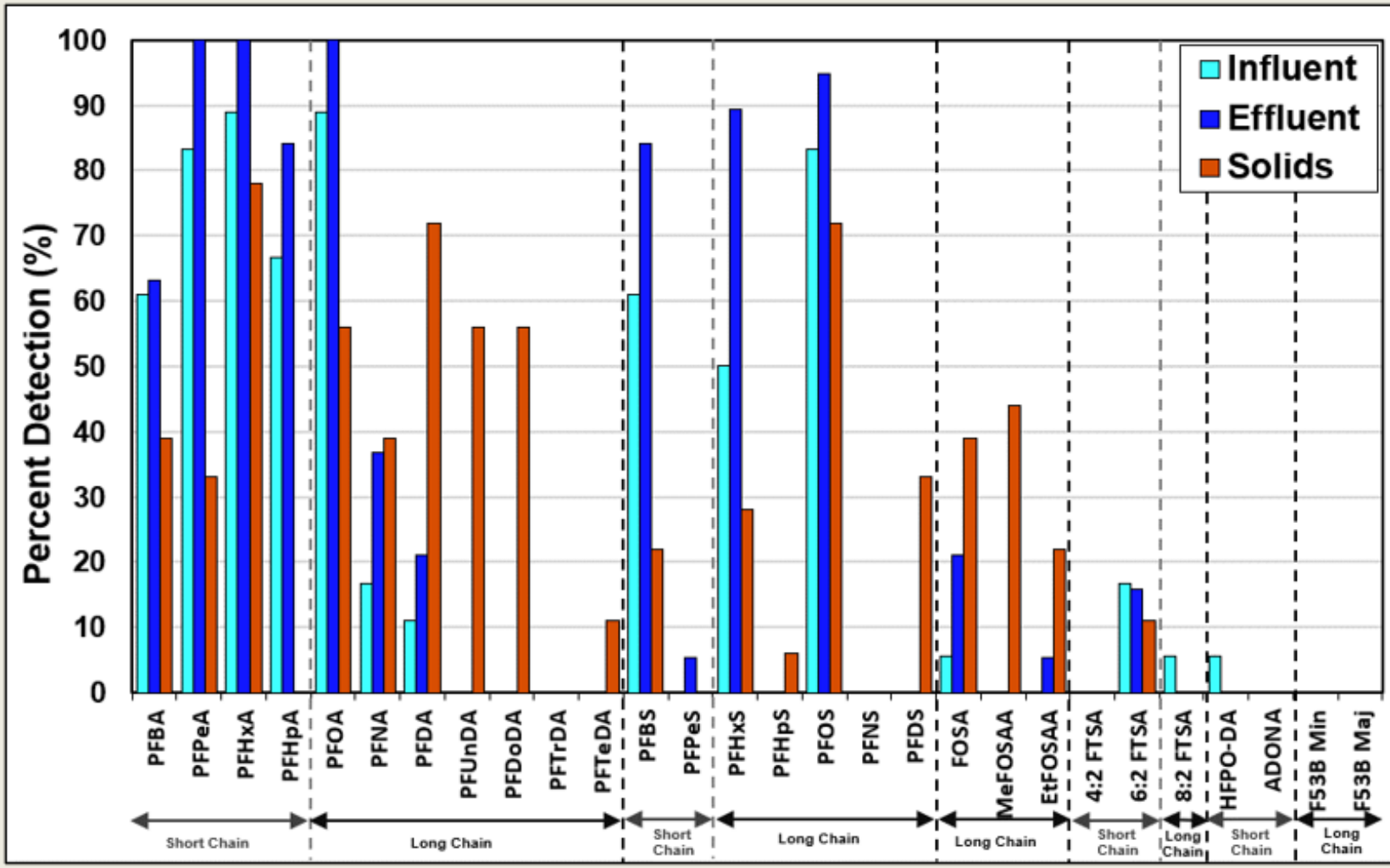


PFAS in Wastewater Treatment Plants – Nationwide Studies

AECOM Study
- 19 WWTPs

California Study
- 180 WWTPs

Michigan Study
- 42 WWTP



https://www.michigan.gov/documents/egle/wrd-pfas-initiatives-statewide-full-report_722902_7.pdf

https://www.waterboards.ca.gov/pfas/

PFAS Source Control – Michigan Case Study

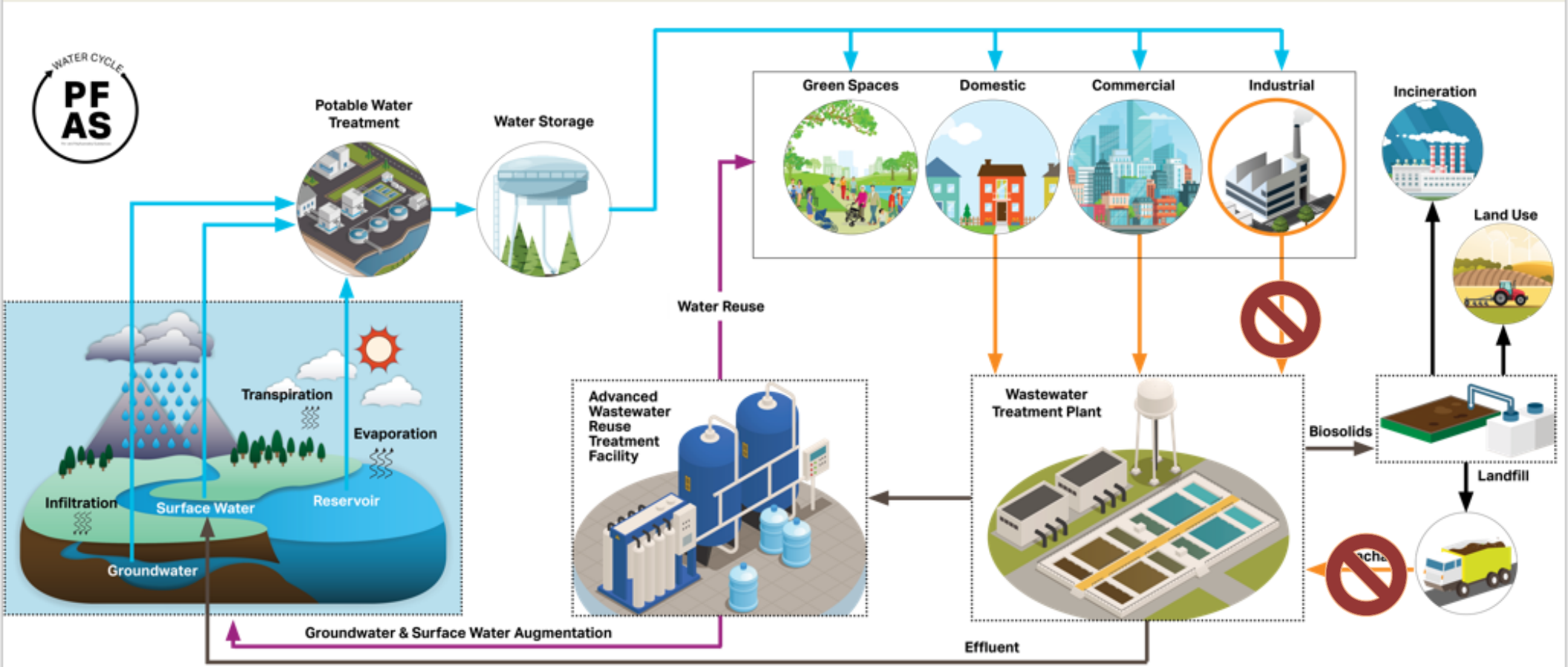
2,000 PFAS industrial effluent samples
574 industrial facilities
PFAS sources identified

Examples of Industrial Effluent PFOS Concentrations

Industry/Category/Type	# Sampled	% Detection	PFOS Range (ng/L)
Metal Finishing	212	33 %	0.7 – 240,000
Electroplating	44	66 %	0.4 – 50,000
Centralized Waste Treaters	17	86%	1 – 53,000
AFFF-Contaminated Sewers	5	100%	5 – 45,000
Type II Sanitary Landfills	48	94%	6 – 5,000
Type III Sanitary Landfills	7	57%	4 – 4,000
Pulp, Paper and Paperboard	4	100%	2 – 190
Commercial Industrial Laundry Facilities	12	42%	6 – 69

https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Programs/WRD/IPP/pfas-initiatives-statewide-full-report.pdf?rev=6cd77ab93ff441faaa43fc5e9dc3e09a

Restrict and Remediate PFAS in the One-Water Cycle



PFAS Source Reduction – Michigan Case Study

Effectiveness of Source Reduction Strategies with Industrial Discharges to the System Resulting in PFOS Decreases over Time

Figure 9. Temporal PFOA and PFOS Effluent and Biosolids Concentrations in Ionia WWTP

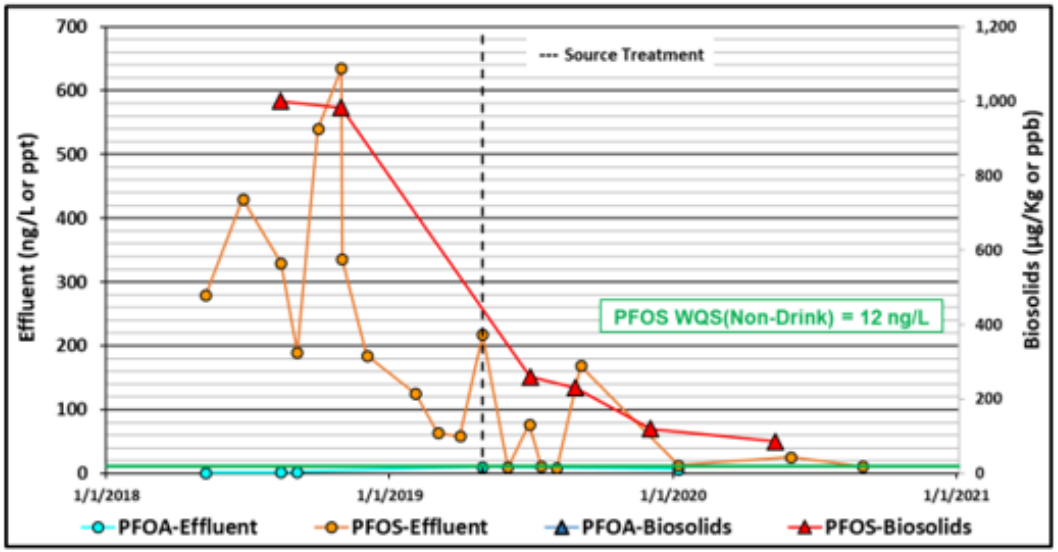
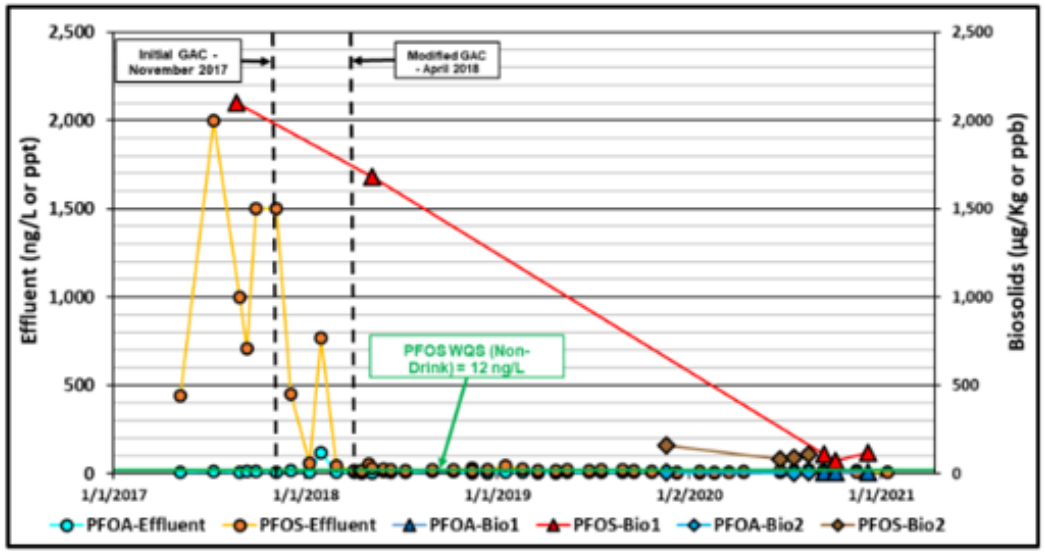
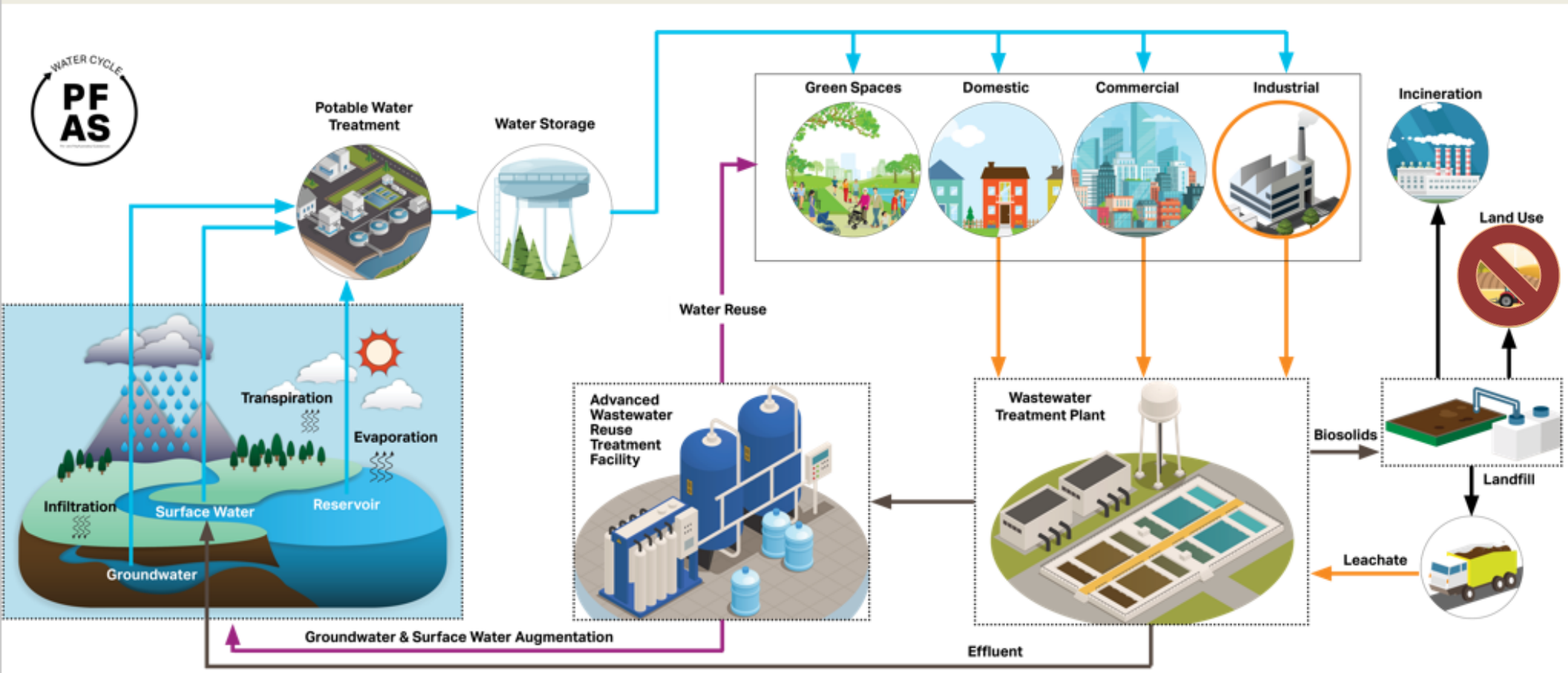


Figure 12. Temporal PFOA and PFOS Effluent and Biosolids Concentrations in Lapeer WWTP



https://www.michigan.gov/documents/egle/wrd-PFAS-Biosolids-Strategy_720326_7.pdf

Restrict and Remediate PFAS in the One-Water Cycle



Michigan's Interim Strategy to Land Application of Biosolids Containing PFAS

Tier 3: PFOS ≥ 125 µg/kg.

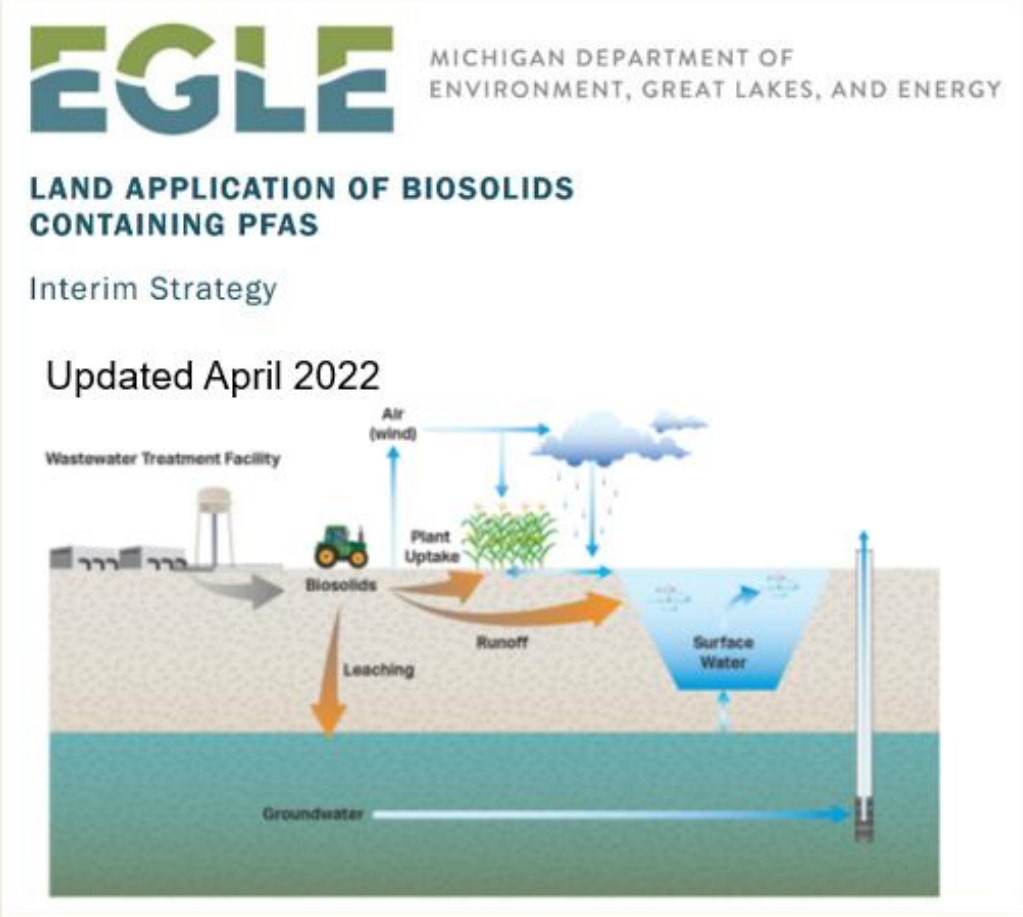
- Cannot be land applied
- Investigate potential sources to develop a source reduction program

Tier 2: PFOS ≥ 50 µg/kg & < 125 µg/kg

- Investigate potential sources to develop a source reduction program
- Reduce land application rates to no more than 1.5 dry tons per acre (or submit an alternative risk mitigation strategy)

Tier 1: PFOS > 20 µg /kg & < 50 µg/kg

- Consider investigating sources and sampling the WWTP effluent for PFAS



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PFAS Water Treatment Approaches

Sorption/Separation

- Granular activated carbon
- Ion exchange resin
- Reverse osmosis, Nanofiltration
- Novel sorbents

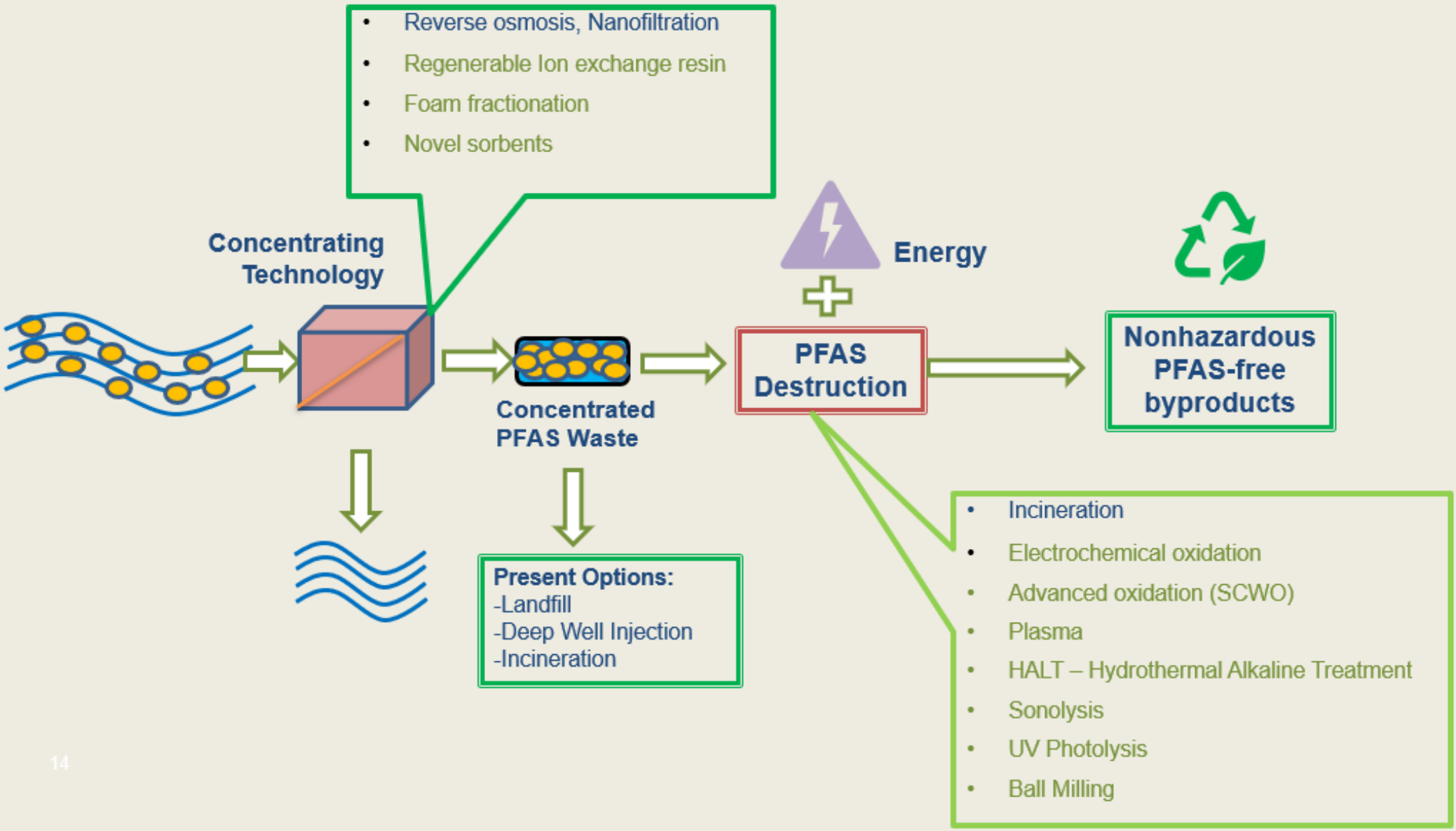
Separation/ Concentration

- Reverse osmosis, Nanofiltration
- Regenerable Ion exchange resin
- Foam fractionation
- Novel sorbents

Destruction

- Incineration
- Electrochemical oxidation
- Advanced oxidation (SCWO)
- Plasma
- HALT – Hydrothermal Alkaline Treatment
- Sonolysis
- UV Photolysis
- Ball Milling

Treatment Approach – Separate, Concentrate, Destroy



Eliminate PFAS from the One-Water Cycle

Protect drinking water

- Design/build PFAS removal systems using separation technologies (GAC, IX-R, RO)
- Focus research on improved methods

Protect water resources

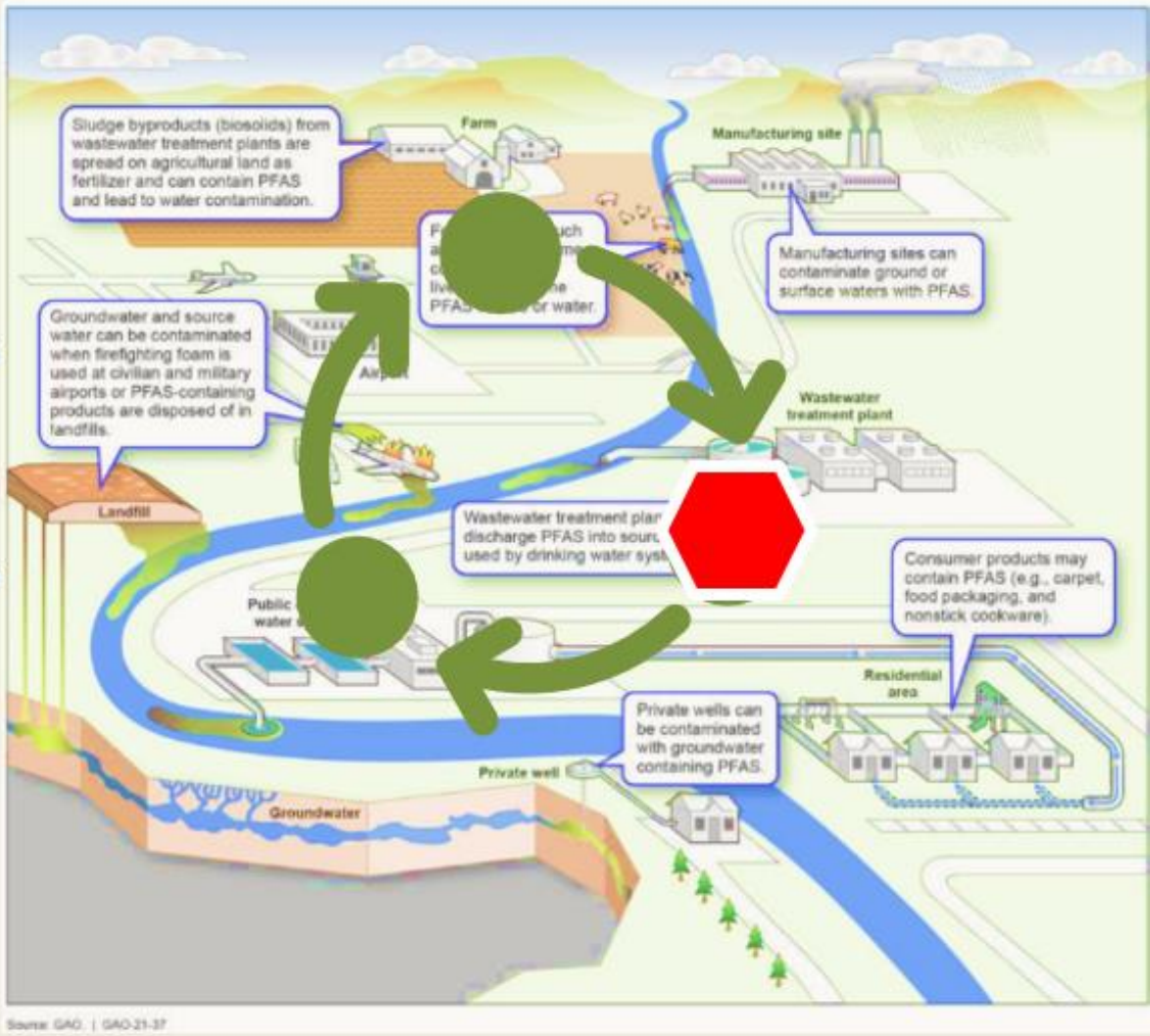
- Eliminate sources
- Intercept in-situ

Disrupt PFAS from discharges/ WWTPs

- Invoke industrial pretreatment
- Manage biosolids

Treat separated and removed PFAS-laden waste

- Manage disposal
- Focus on developing commercially effective destruction technologies



Source: GAO. | GAO-21-37

PFAS

IDENTIFY. RESOLVE.

AECOM Delivering a better world

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