

PFAS Removal and Destruction Solution for Landfill Leachate

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Product Manager
E2METRIX



10/27/2026

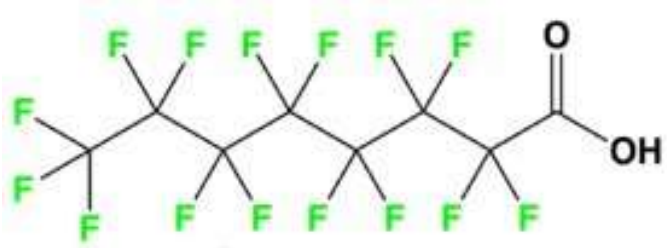
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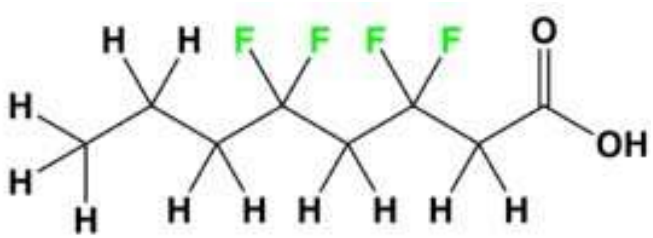
What Are These “Forever Chemicals”



- Per- and polyfluoroalkyl substances (PFAS) is an umbrella term for a growing class of 15,000+ man-made chemicals

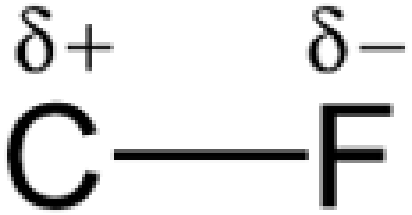


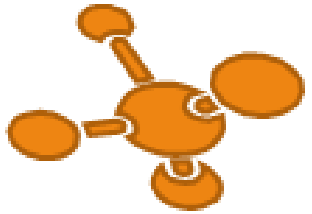
Perfluorooctanoic acid



Polyfluorooctanoic acid

- C-F is one of the strongest bonds in organic chemistry and makes class of chemicals resistant to oil, water, and high temperatures



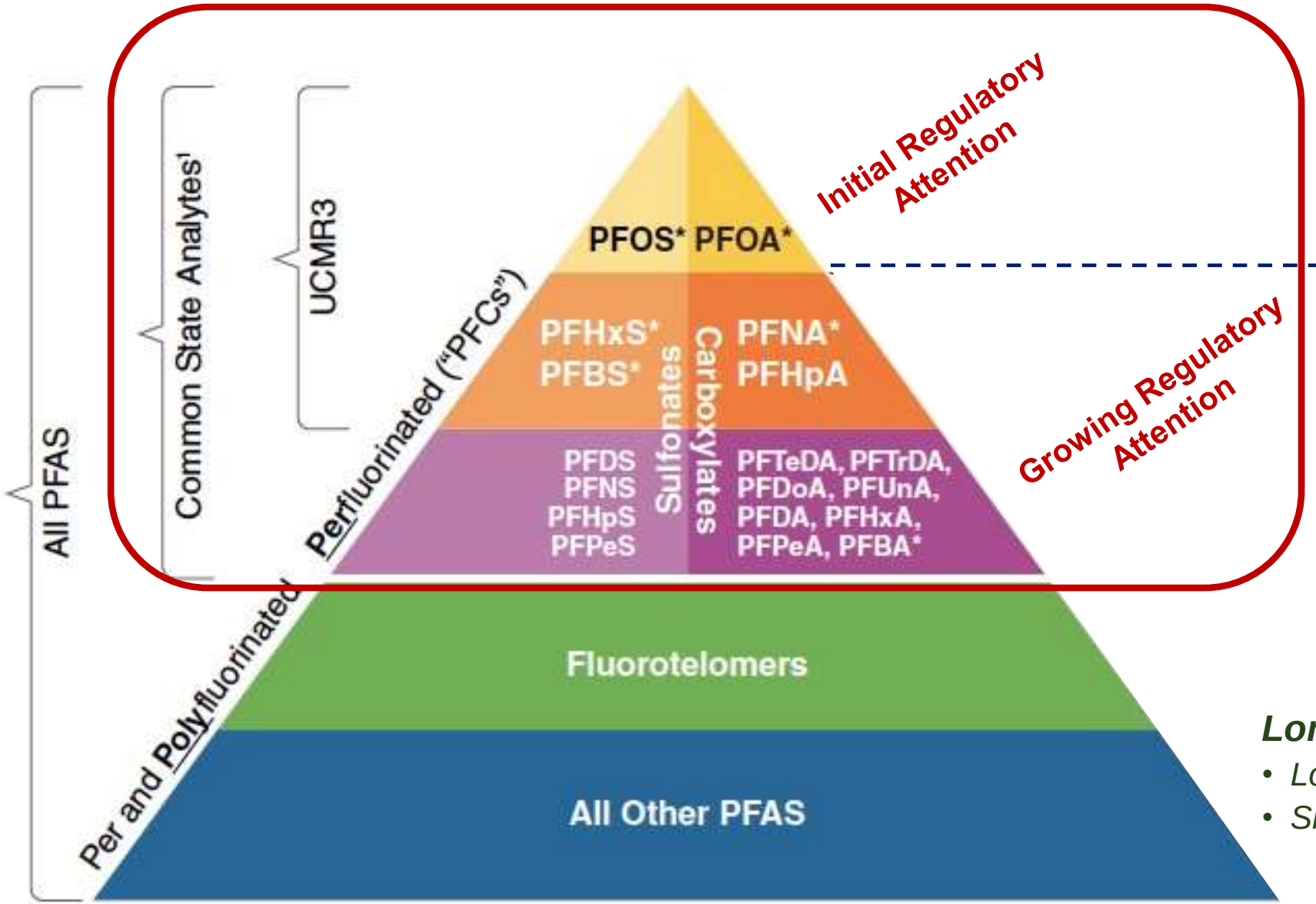


What Are These Forever Chemicals





Replacement Chemicals



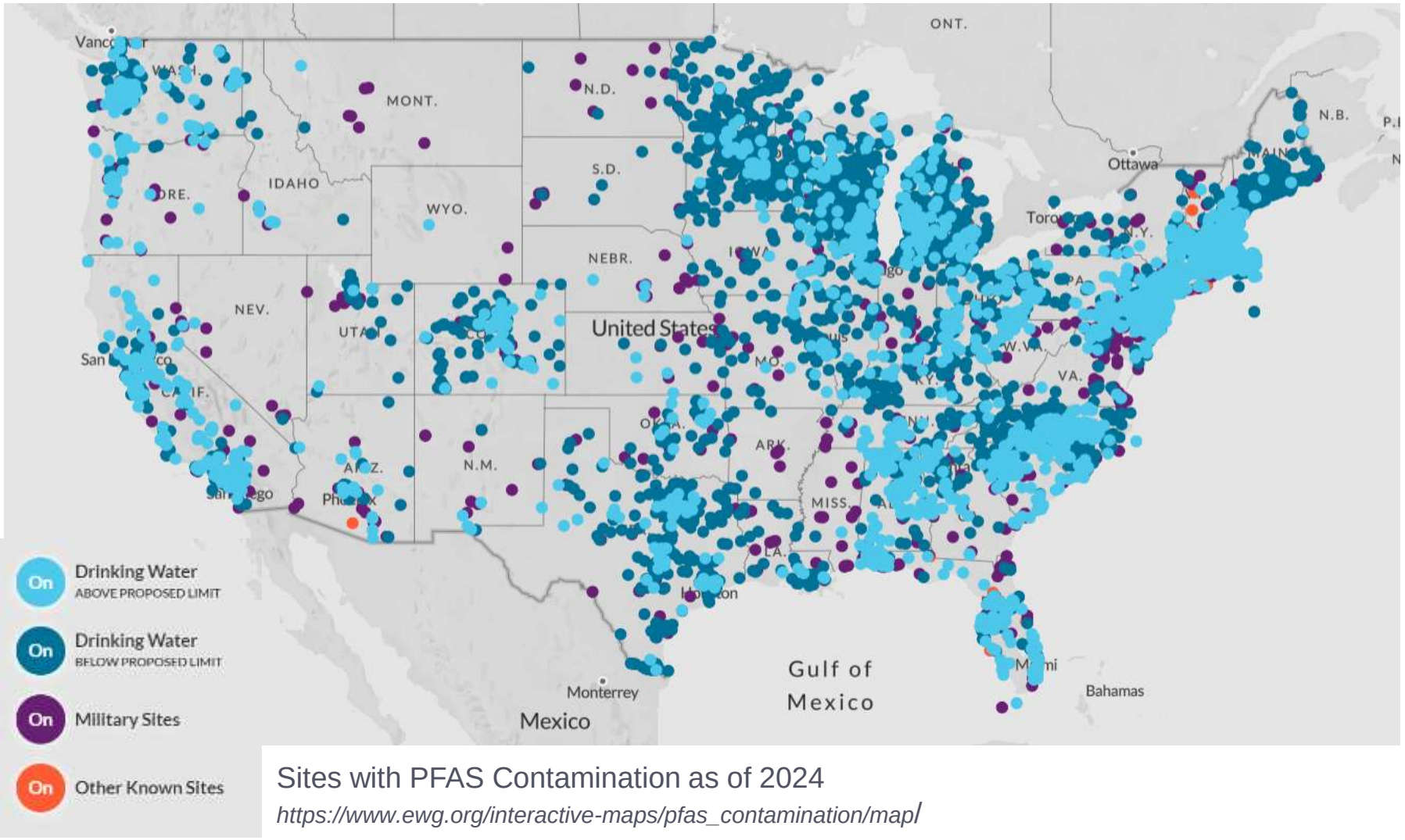
LEGACY PFAS
Long Chain

REPLACMENT PFAS
Short Chain

Long vs. Short Chain

- *Long-Chain PFAS ≥ ~7 Carbons*
- *Short-Chain PFAS< ~6 Carbons*

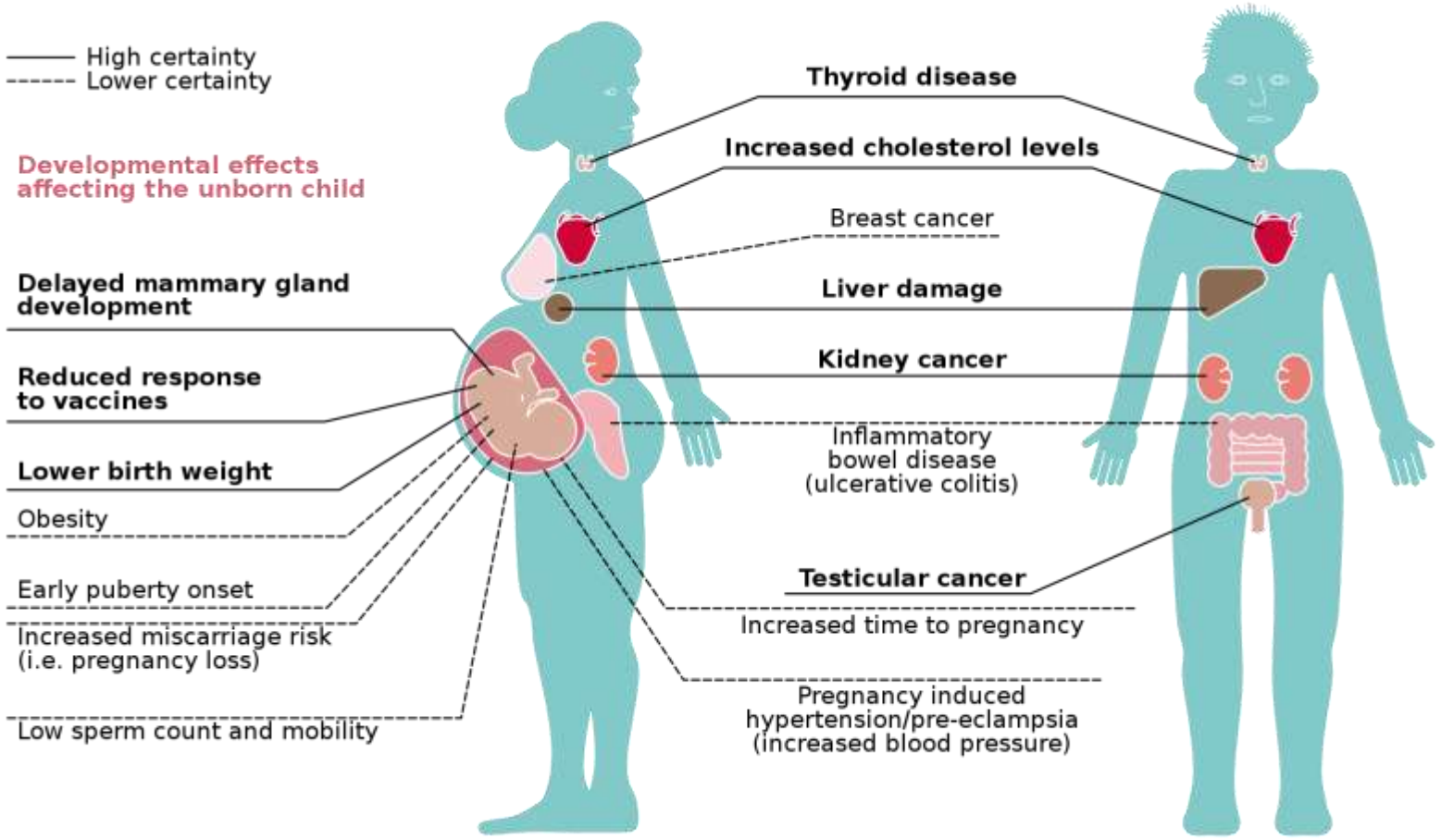
Mobile, Persistent, and Bioaccumulate

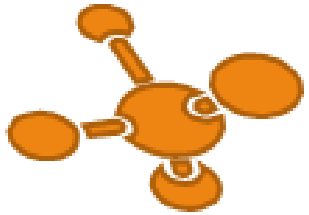


Sites with PFAS Contamination as of 2024
https://www.ewg.org/interactive-maps/pfas_contamination/map/

The use of PFAS is attracting regulatory and public attention due to some PFAS **persistence**, potential for **bioaccumulation**, and **mobility** as greater understanding of their **toxicity** evolves.

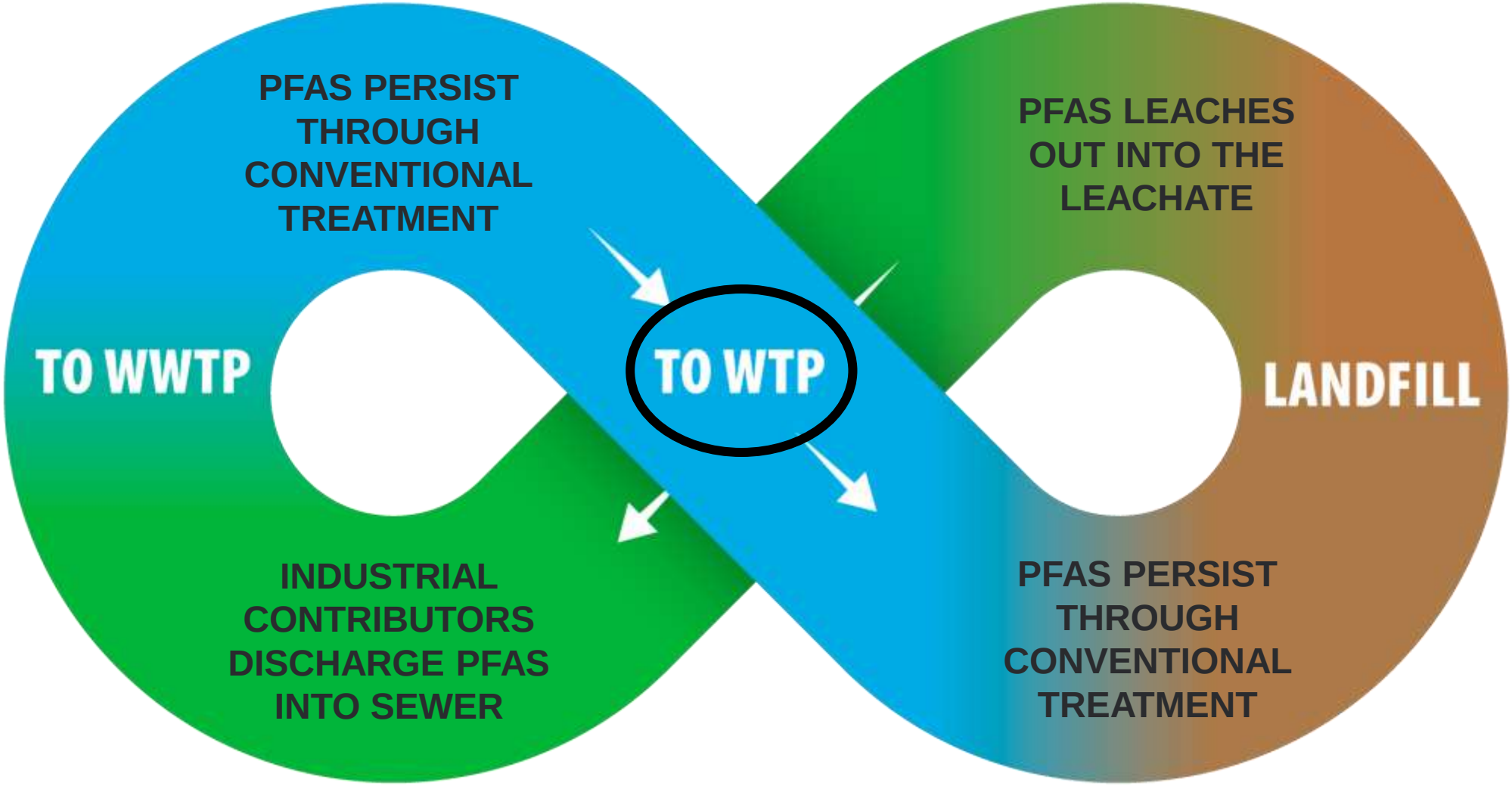
Mobile, Persistent, and Bioaccumulate





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The “Forever Chemical” Cycle



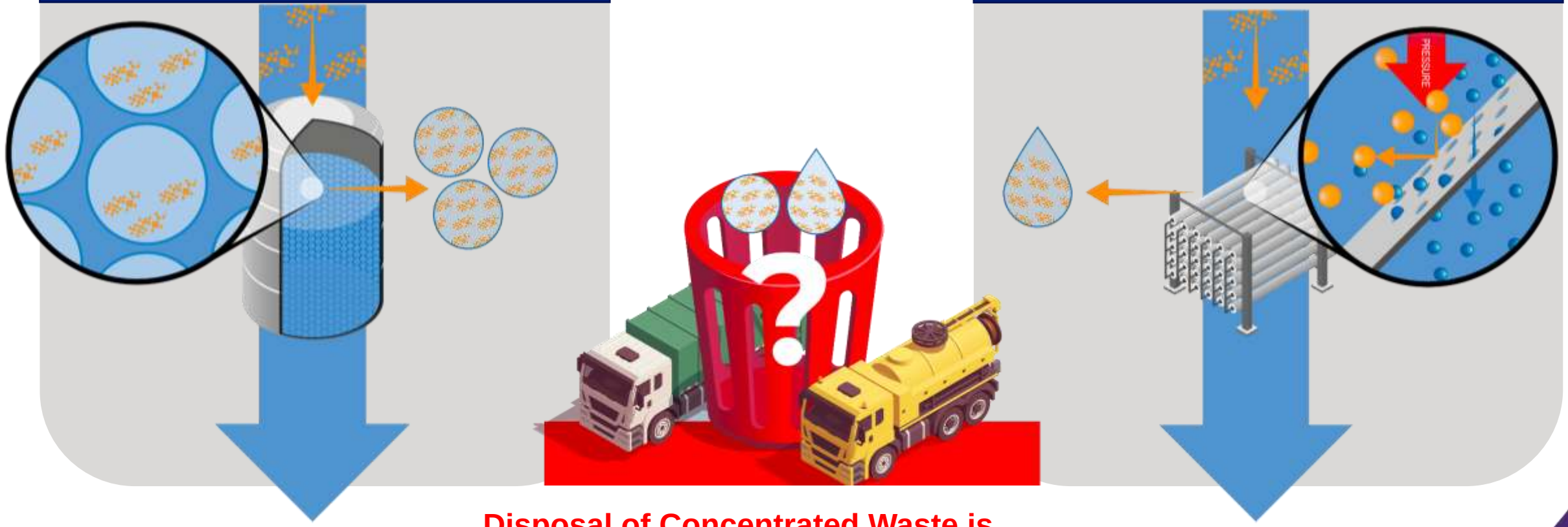
Why should landfills be worried about PFAS in leachate?

- **USEPA 2021 PFAS Strategic Road Map –** limit PFAS discharges to environment from multiple Industrial Categories including Landfills
- **USEPA Plan 15 & 16 –** revisions to Effluent Guidelines & Standards for Landfill Category are warranted and coming in 2027 (40 CFR 445)
- **USEPA POTW Influent Study**
- **NC DEQ** is requiring all solid waste sanitary landfills to include PFAS analyses in ground water, surface water, and leachate samples.
- **Public Pressure –** no longer just odor and truck traffic!
  - Few lawsuits as of June 2026 for landfills allowing PFAS to leach into local drinking water

Existing PFAS Removal Technologies

Granular-Activated Carbon and Ion Exchange

High-Pressure Membrane Filtration



Disposal of Concentrated Waste is Increasingly Challenging

How does E2METRIX Remove, Concentrate and Destruct PFAS from PFAS Contaminated Waters & Wastewaters?



Remove & Concentrate

- Olift® Foam Fractionation using Air & Ozone
- PFAS removed into Foamate
  - Volume typically <0.1% of influent wastewater
- FF effluent discharged to POTW
  - meets POTW influent criteria



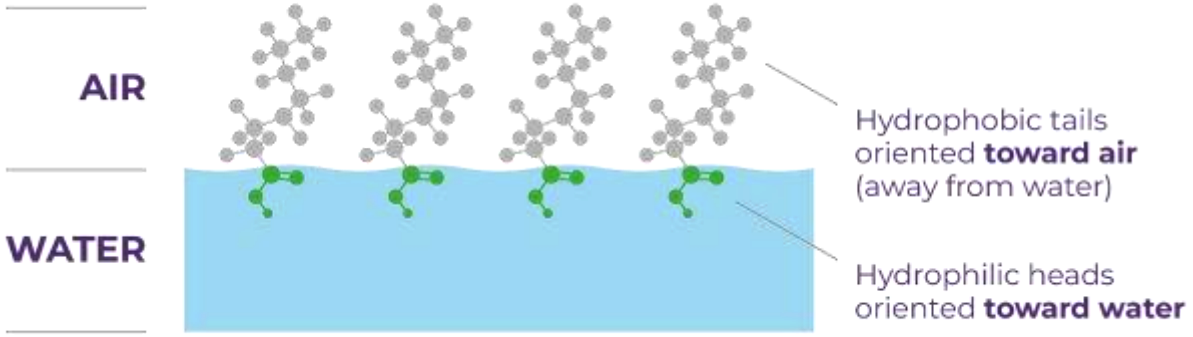
Destruction of Foamate

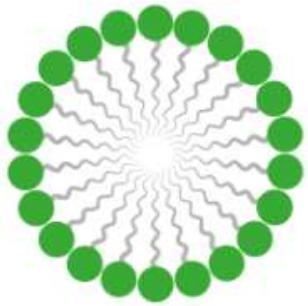
- Obreak® Electro-Oxidation
- <100% destruction to match influent wastewater PFAS concentration
- Effluent recycled to Olift®

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Olift® Foam Fractionation for PFAS Removal & Concentration

- Foam Fractionation utilizes PFAS attraction to the air-water interface to remove and concentrate PFAS







- Foamate can be 10,000X more concentrated and <0.1% of the volume of the influent

- Foam Fractionation removal of PFAS is not unduly impacted by other co-contaminants that are present in the Industrial Wastewaters

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Olift® Foam Fractionation

- Runs continuously and selectively uses both air and ozone to create micro bubbles
- Bubbles generated via the venturi principle
- Ozone bubbles have higher overall surface area and higher electrostatic charge, compared to air-only bubbles, which can significantly boost PFAS removal and concentration factors (reducing treatment volume for downstream destruction)
- Ozone oxidizes other co-contaminants which can increase efficiencies of downstream destruction and media polishing systems



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Olift® Foam Fractionation





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Olift® Overall Layout

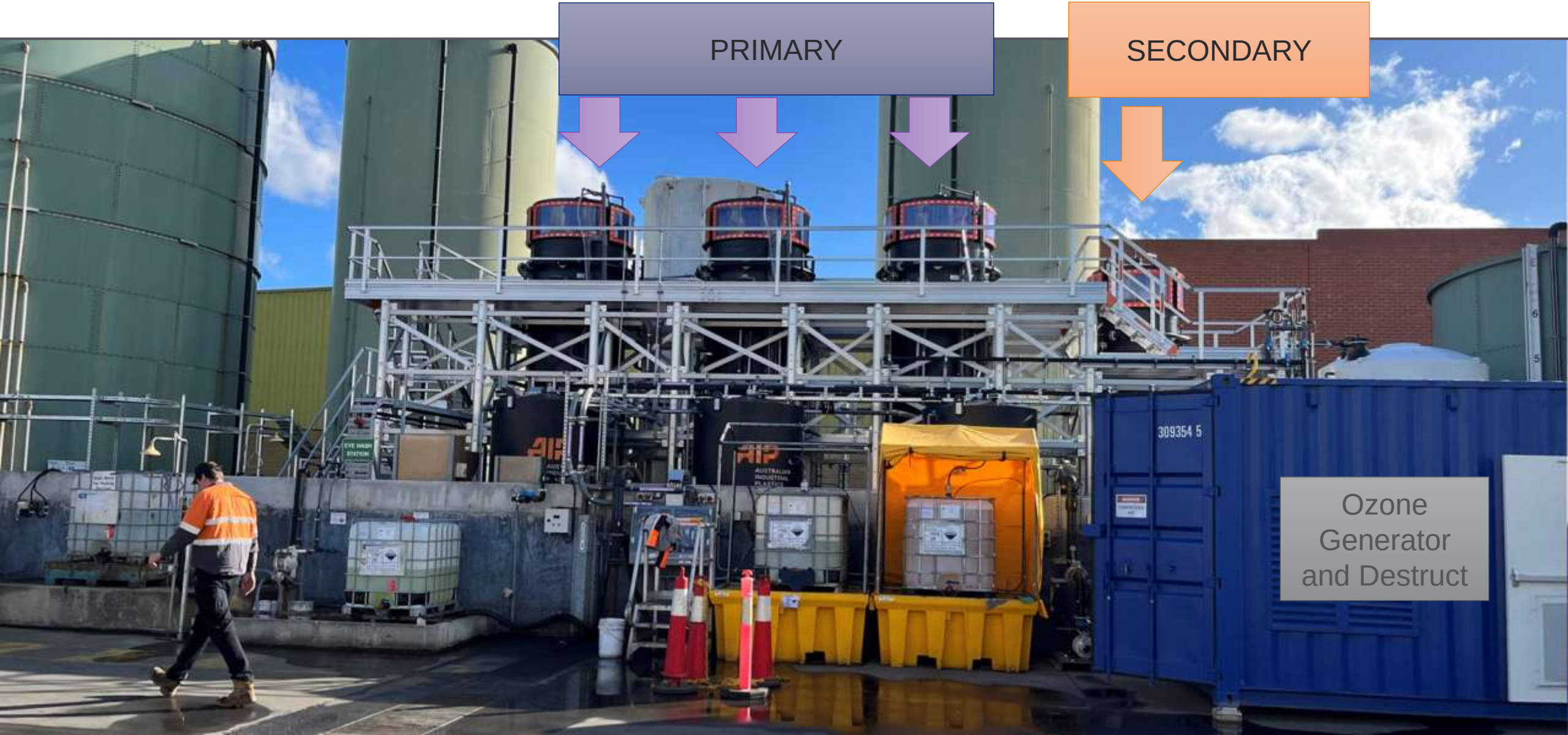






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Olift® Full Scale System Installation



E2METRIX's Obreak® Electro-Oxidation Destruction



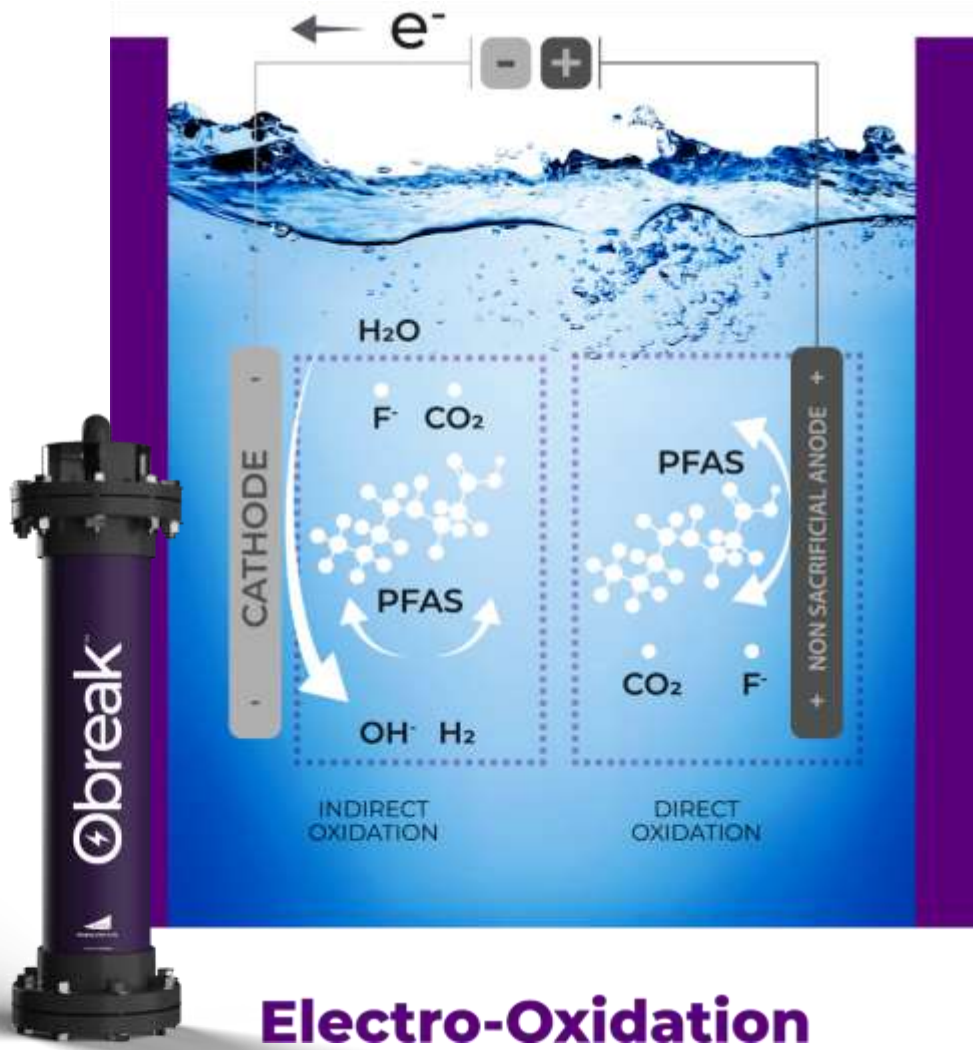
- **Patented electrotechnology platform** (24 patents, 16 issued, 8 pending) for water, wastewater, and industrial wastewater treatment.
- **218 reactors deployed on 25 sites**.
- Commercial electrochemical oxidation systems successfully utilized for onsite PFAS Destruction.

	Systems providers	Key markets	HQ	Year founded	Recent funding / ownership	Technology focus
More established	E2metrix		Canada	2010	Acquired by Ovivo in 2024	EO
	Arvia		UK	2007	–	EO
	Hydro Industries Limited		UK	2010	–	EC & EO
	Hydroleap		Singapore	2016	$4.4m (2023)	EC & EO
	Indra Water		India	2018	$4.0m (2023)	EC & EO
	Origin Clear		USA	2007	Listed	EC & EO
	Axine		Canada	2010	$1.69m (2023)	EO
	AECOM		USA	1990	–	EO
	Aclarity		USA	2017	$15.9m (2023)	EO
	Elateq		USA	2019	$240,000 (2022)	EO
Challengers	OXbyEL		USA	2018	$150,000 (2023)	EO

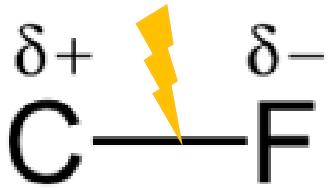
Global Water Intelligence, March 2024 – EO

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Obreak® Electro-Oxidation (EO) for PFAS Destruction



- Pass an electrical current through the electrodes submerged in water (anode and cathode)
  - Non-sacrificial electrodes
- **Direct oxidation** happens at the **surface of the anode** that cleaves the C-F bond



- Indirect oxidation through other electrochemically-created oxidants also react with and break down PFAS in the bulk liquid
- **Safely Operates at Low Temps and Pressures**

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Destruction Performance with E2METRIX EO

Selected Destruction Performance

WATER MATRIX	MARKET	% MASS REDUCTION	
		TOTAL PFAS	PFOA-PFOS
RO Concentrate	Drinking Water, Municipal	87%	92%
Foamate	Drinking Water, Municipal	80%	85%
IX Resin Regeneration Solution	Drinking Water, Municipal	82%	> 99.9%
Contaminated groundwater	Site Remediation (AFFF)	76%	98%
Contaminated groundwater	Site Remediation (AFFF)	96%	99%
Raw Leachate	MSW Landfill	69%	99.2%
Foamate	MSW Landfill	98.9%	99.97%
	INTEGRATED SOLUTIONS	**> 99.9%**	**> 99.9%**

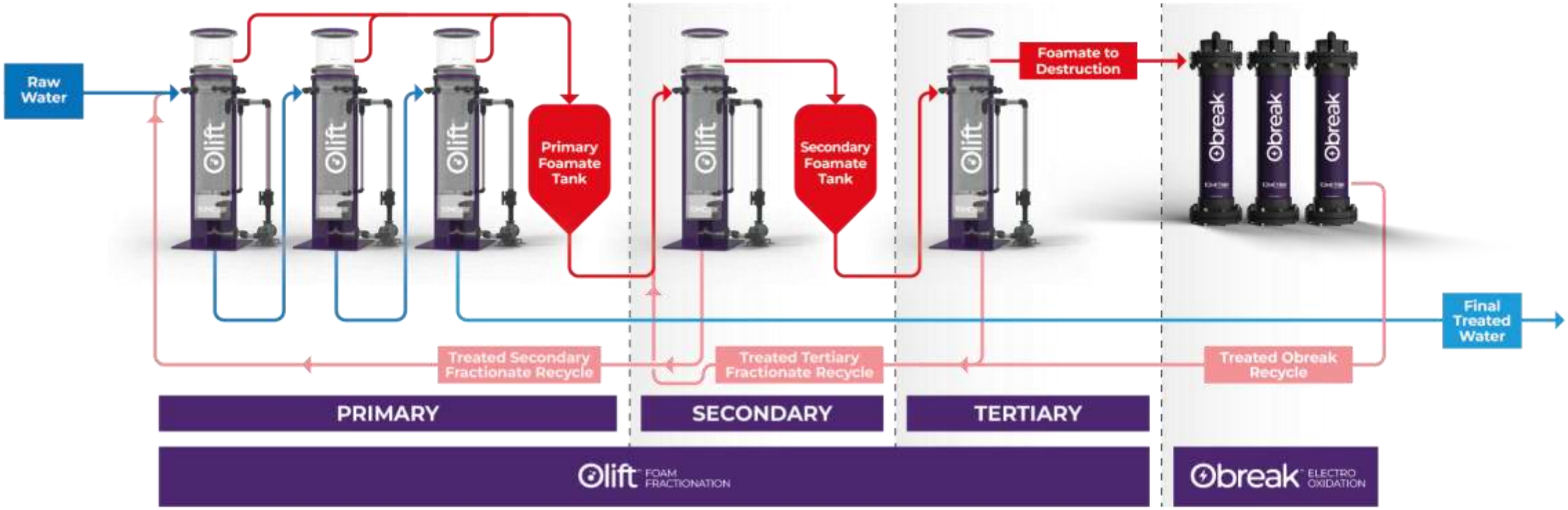


Other Markets/ Applications

- Water Reuse
- Industrial Waters
- Surface Finishing
- Food & Beverage
- Anything With PFAS in a Liquid Phase

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Coupling Foam Fractionation and Electro-Oxidation



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Path to Commercial

Off-site Pilot Testing → **Onsite Pilot Demonstrations** → **Commercial Equipment**











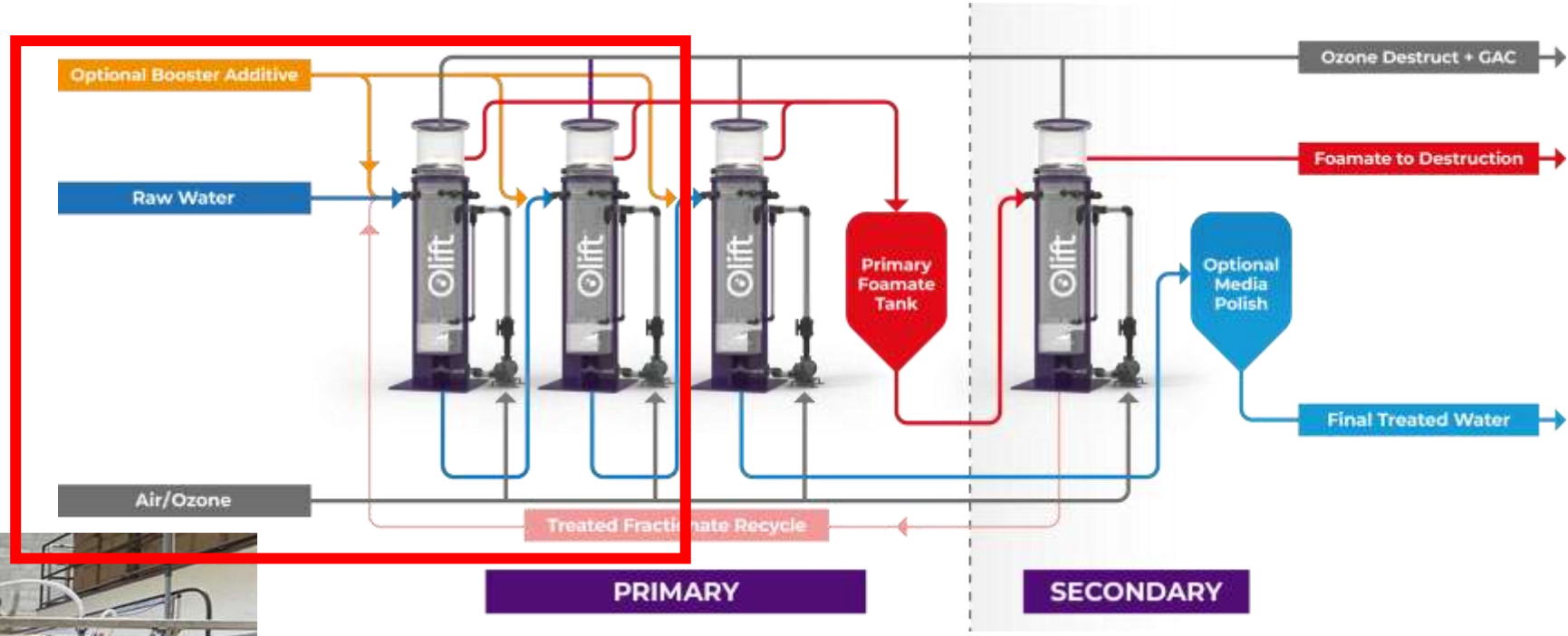


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Foam Fractionation & Electro-Oxidation Off-site Pilot Testing

Requires 3-6 IBC Totes of sample liquid

Off-site Pilot Testing Evaluates Only the Primary Stage System with Two Column



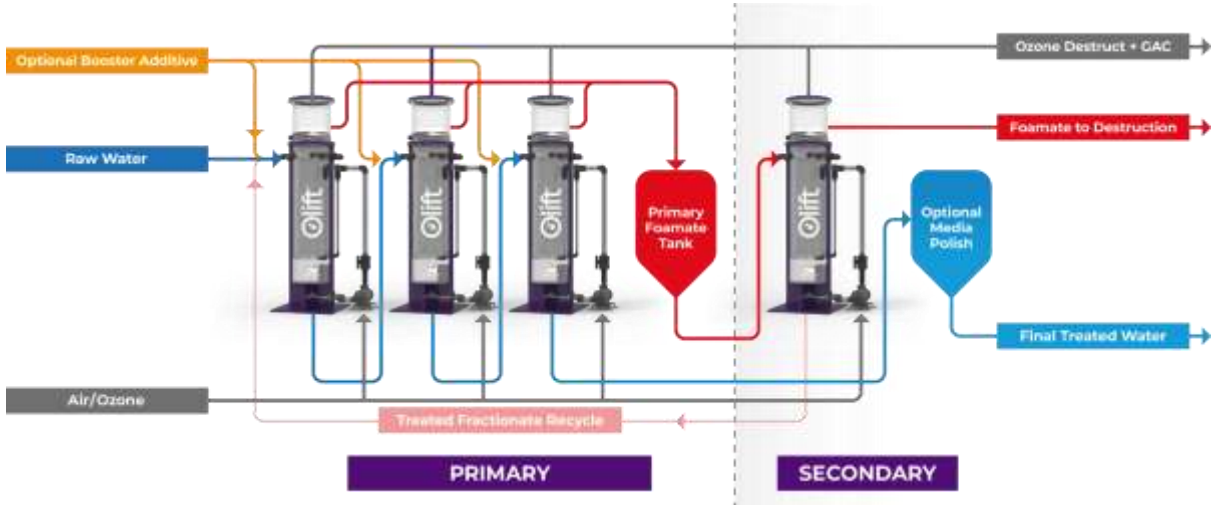


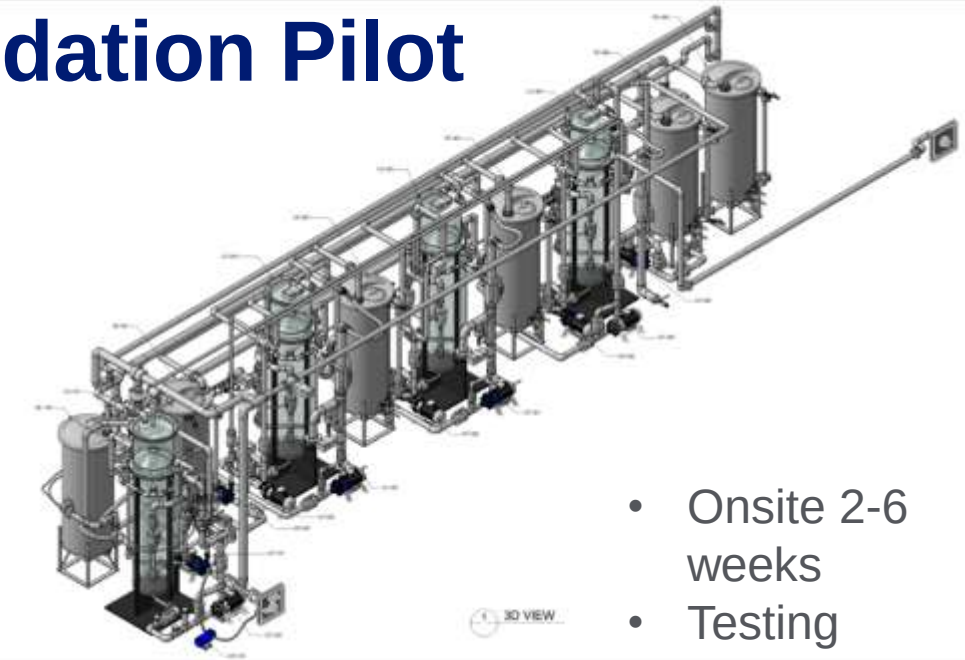
FF Off-site Pilot Testing Evaluates:

- PFAS Removal %
- Required HRTs
- Primary Foamate Production Estimates
- Generate Foamate for initial Obreak Testing

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Foam Fractionation + Electro-Oxidation Pilot Testing





- Onsite 2-6 weeks
- Testing optimizes protocols established from Off-site Piloting and sets commercial design parameters







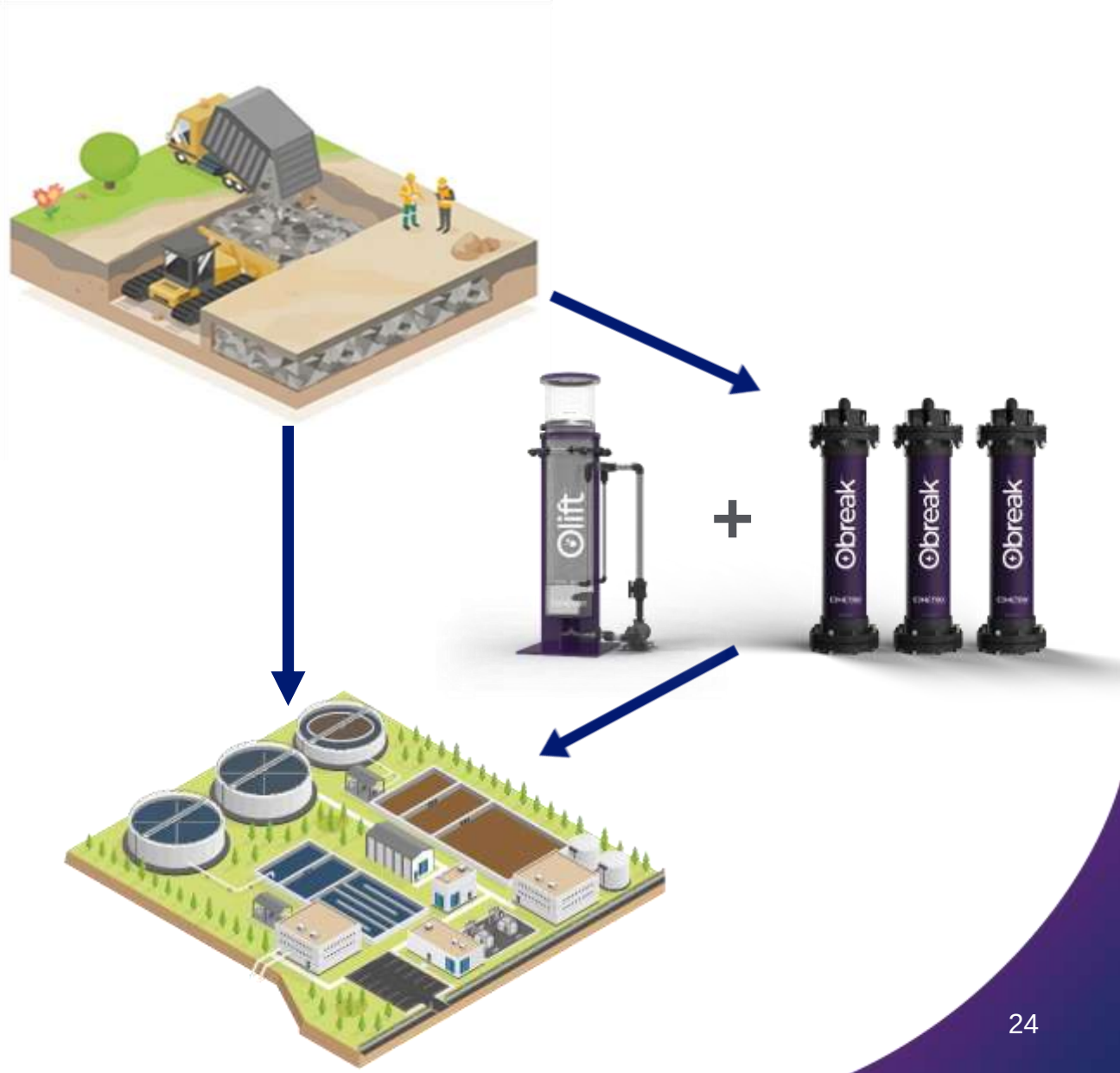




Closed-Loop PFAS Destruction Approach For Landfill Leachate (Air–only) Case Study #1

Landfill Leachate Treatment at a Municipal WWTP

- Located in Northern New Jersey, Passaic Valley Sewerage Commission (PVSC) treats an average of 240 MGD and permitted capacity to 330 MGD
- PFAS detected in industrial waste streams and was most prevalent in landfill leachate
- In November 2024 E2METRIX deployed a 53-foot container for an onsite pilot study to remove and destroy PFAS in landfill leachate prior to discharge to the WWTP
- Landfill leachate was trucked in and treated over a 6-week period



Treatment Goals

- Individual PFAS Treatment Targets:
  - PFOA <14 ppt
  - PFOS <13 ppt
  - PFNA <13 ppt
  - PFBS < 2,000 ppt

- Overall mass reduction targets of 70%-90% when accounting for other PFAS compounds



Results in Primary Foam Fractionation



PRIMARY

lift FOAM FRACTIONATION

Results in Primary Foam Fractionation

500,000 gpd

Raw Water



PRIMARY

lift FOAM FRACTIONATION

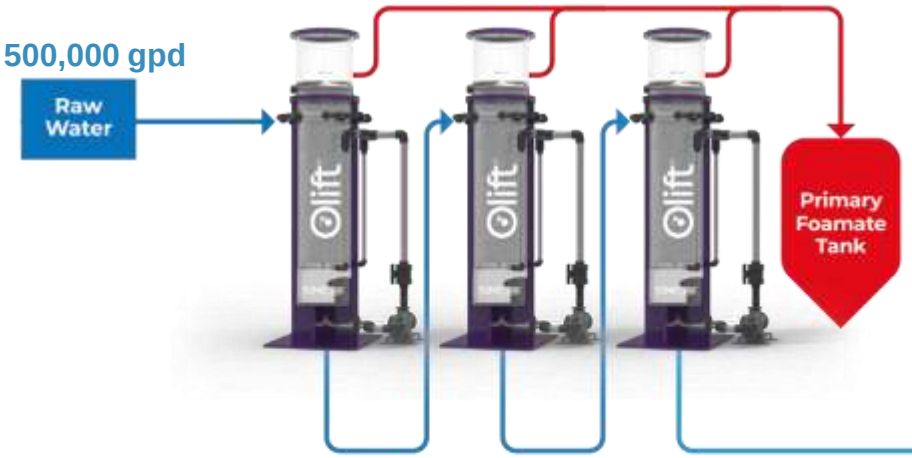
Results in Primary Foam Fractionation



Primary Foam Fractionation Stage

Commercial
Design Basis

500,000 gpd



The Primary Stage Goal is PFAS Removal

500,000 gpd

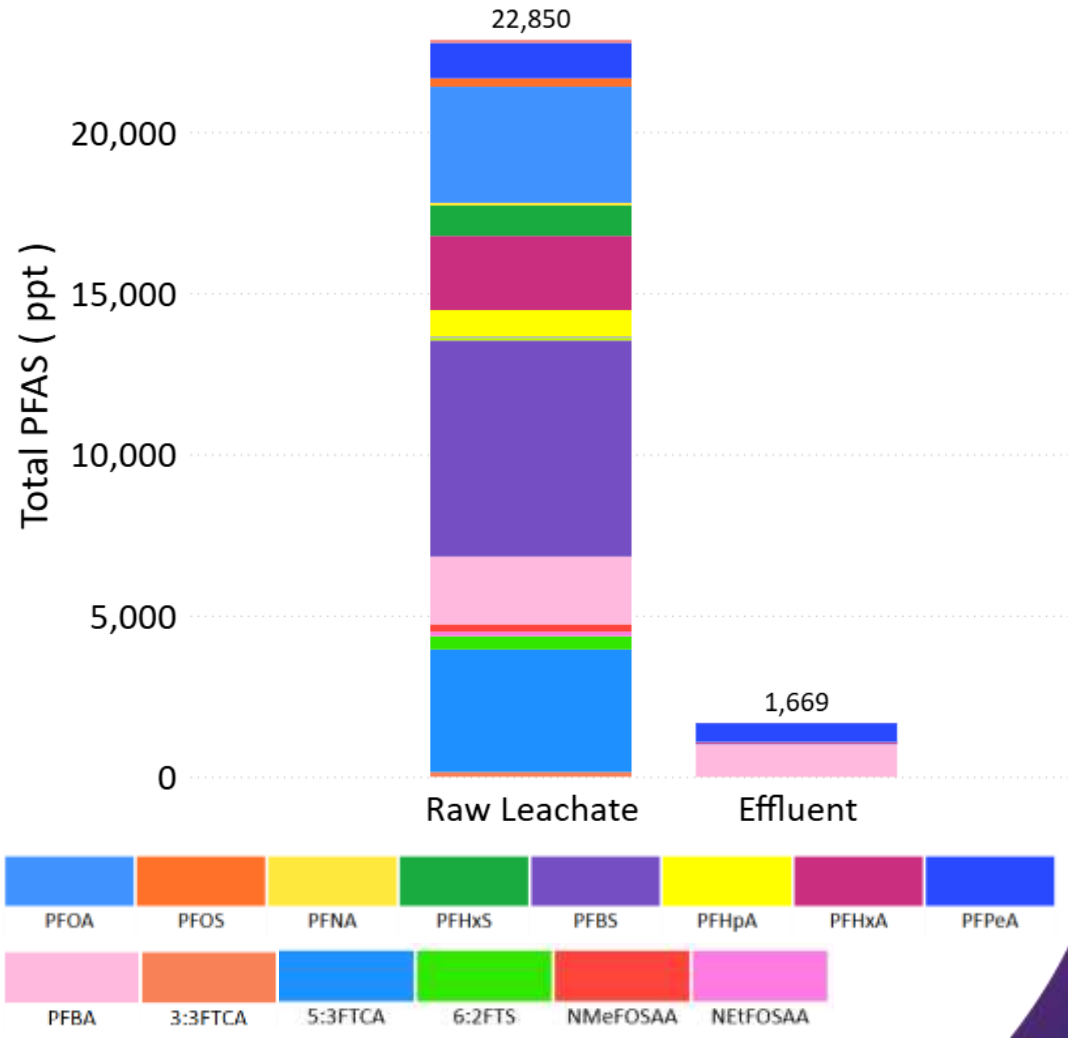
Final Treated Water

PRIMARY

Olift FOAM FRACTIONATION

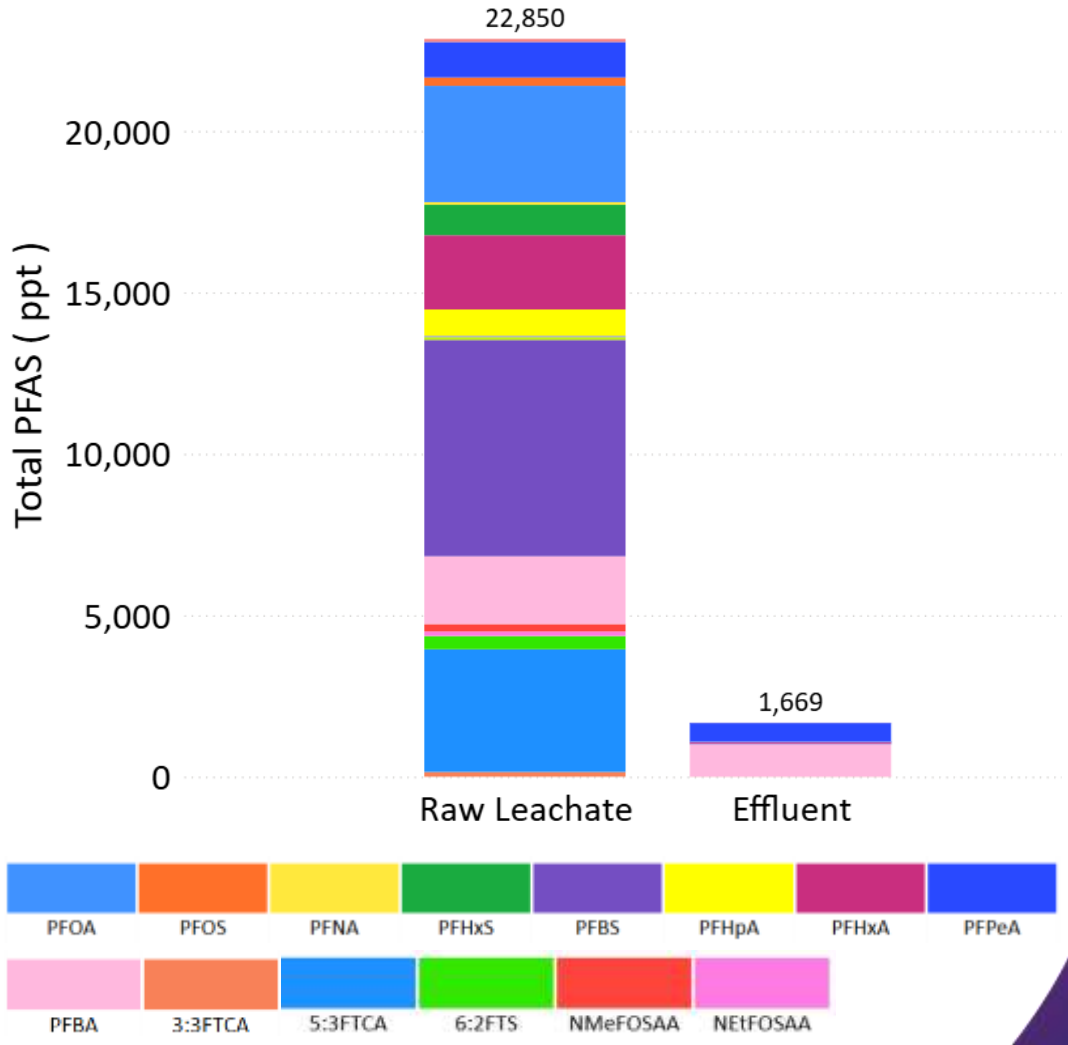
Results in Primary Foam Fractionation

Olift FF Landfill Leachate Results				
Analyte	Raw Leachate (ppt)	System Effluent (ppt)	Removal (%)	
PFOA	**3,600**	**11**	**99.7%**	
PFOS	**260**	**5**	**96.2%**	
PFNA	**85**	**< RL**	**>88.2%**	
PFBS	**6,700**	**21**	**99.7%**	
PFDA	85	< RL	>88.2%	
PFHxA	2,300	41	98.2%	
PFHxS	940	< RL	>98.9%	
PFBA	2,100	1,000	52.4%	
PFDoS	38	< RL	>73.7%	
PFHpA	820	< RL	>98.8%	
PFPeA	*1,100*	*580*	*47.3%*	
PFPeS	92	4	95.9%	
3:3 FTCA	150	< RL	>93.3%	
5:3 FTCA	3,800	< RL	>99.7%	
6:2FTS	410	< RL	>97.6%	
NEtFOSAA	140	2	92.9%	
NMeFOSAA	230	5	95.7%	
SUM OF PFAS	**22,850**	**1,669**	**93%**	



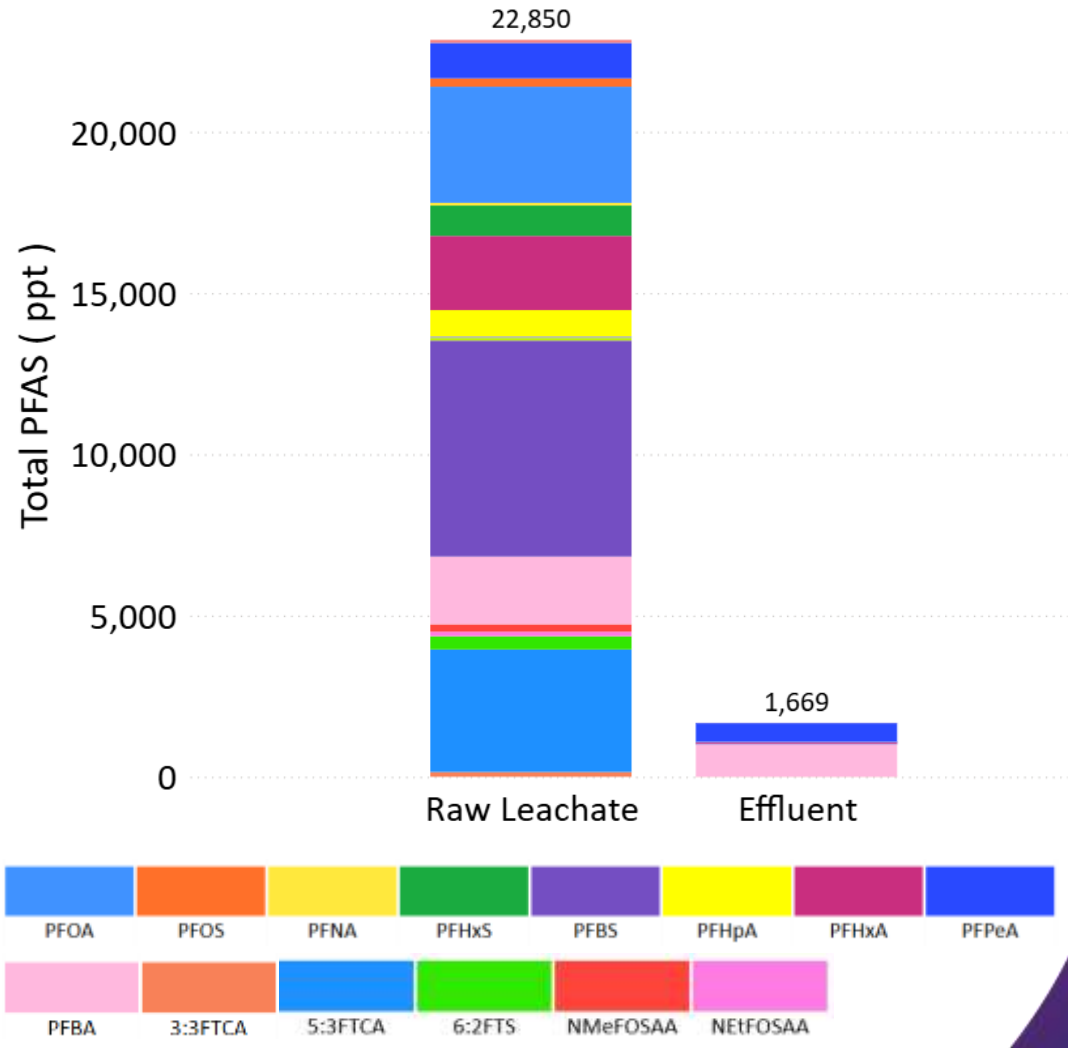
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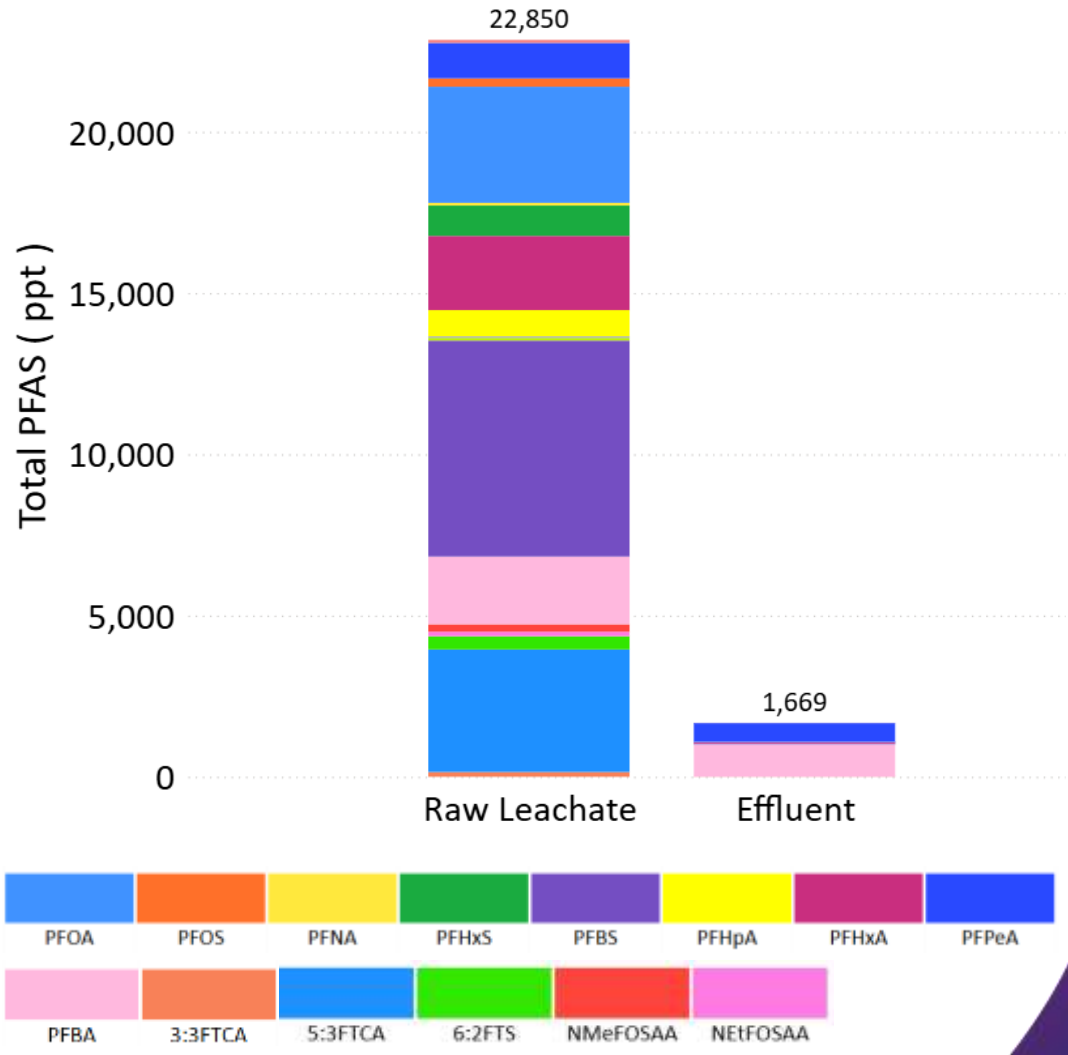
Results in Primary Foam Fractionation

Olift FF Landfill Leachate Results				
Analyte	**Raw Leachate (ppt)**	**System Effluent (ppt)**	**Removal (%)**	**Treatment Goal**
PFOA	**3,600**	**11**	**99.7%**	**14** ✓
PFOS	**260**	**5**	**96.2%**	**13** ✓
PFNA	**85**	**< RL**	**>88.2%**	**13** ✓
PFBS	**6,700**	**21**	**99.7%**	**2,000** ✓
PFDA	85	< RL	>88.2%	-
PFHxA	2,300	41	98.2%	
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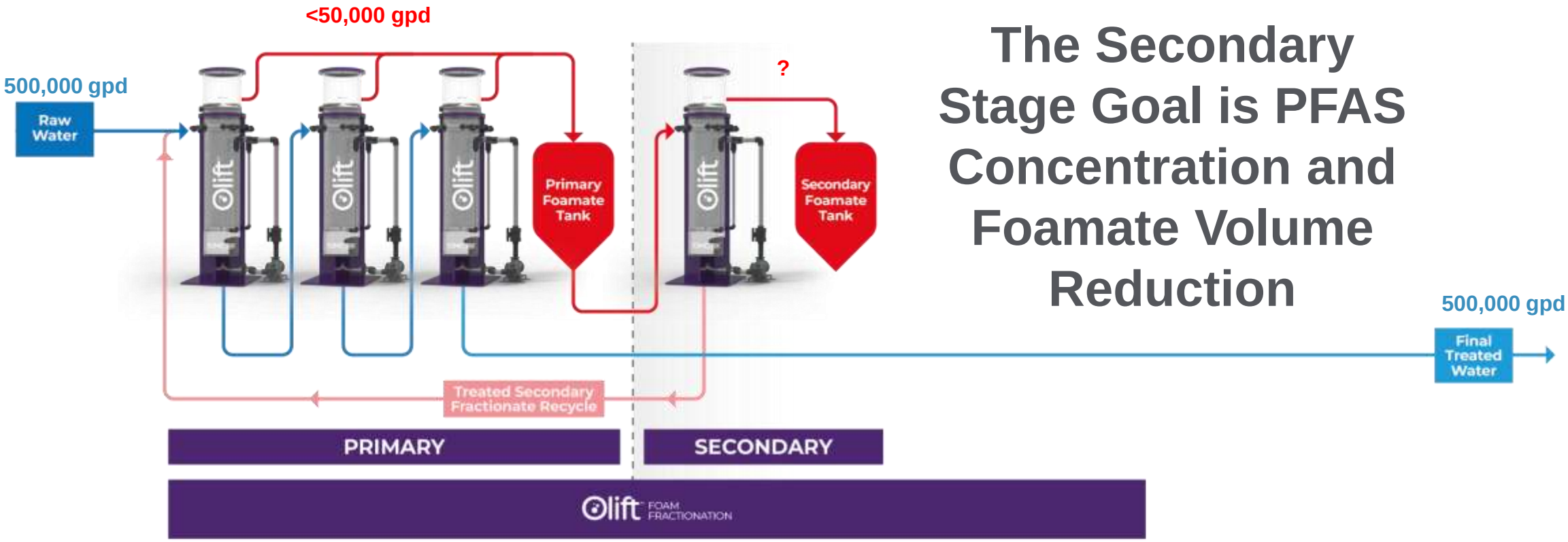
Primary Foam Fractionation Stage – Removal Results

Olift FF landfill Leachate Results				
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PFBS	**6,700**	**21**	**99.7%**	**2,000** ✓
PFDA	85	< RL	>88.2%	-
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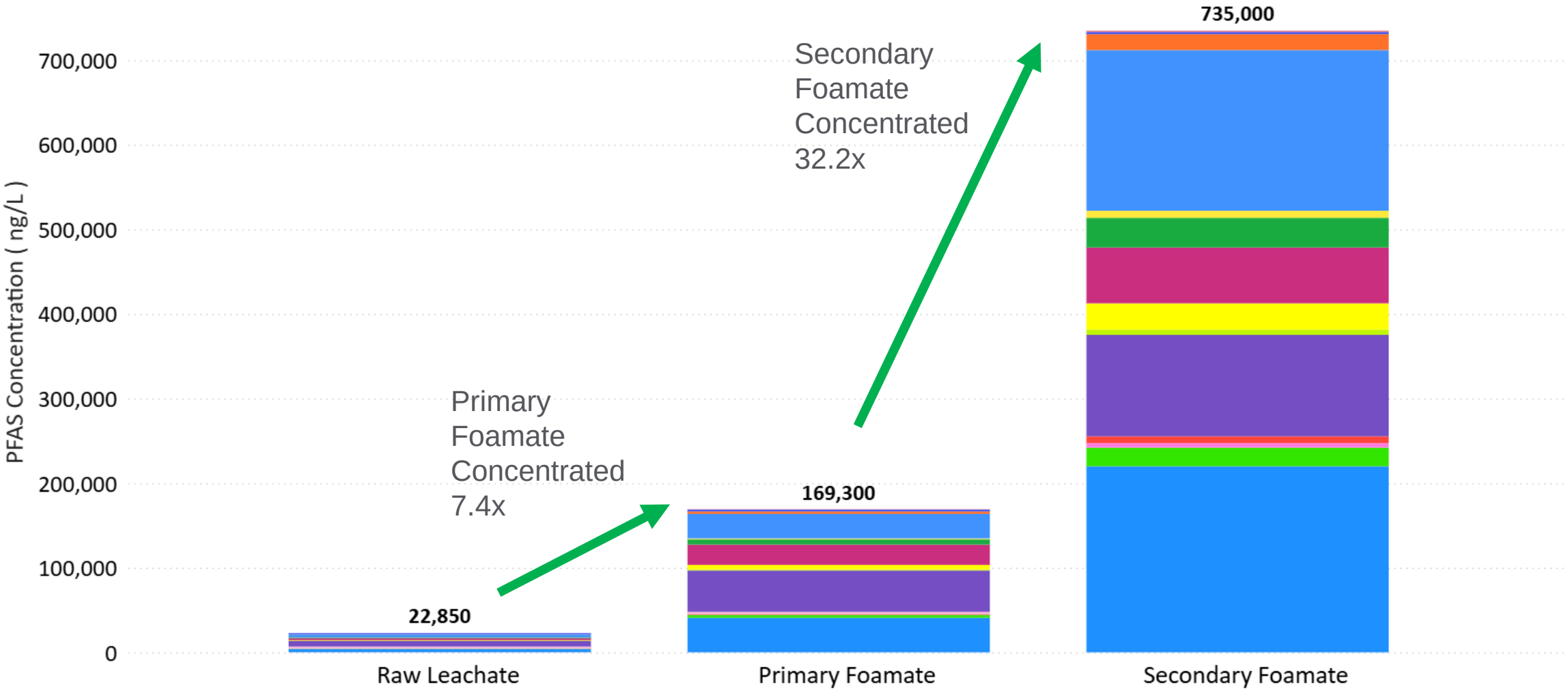
Foamate Type	Primary Foamate
Foamate Production (%)	8.0%

Secondary Foam Fractionation Stage



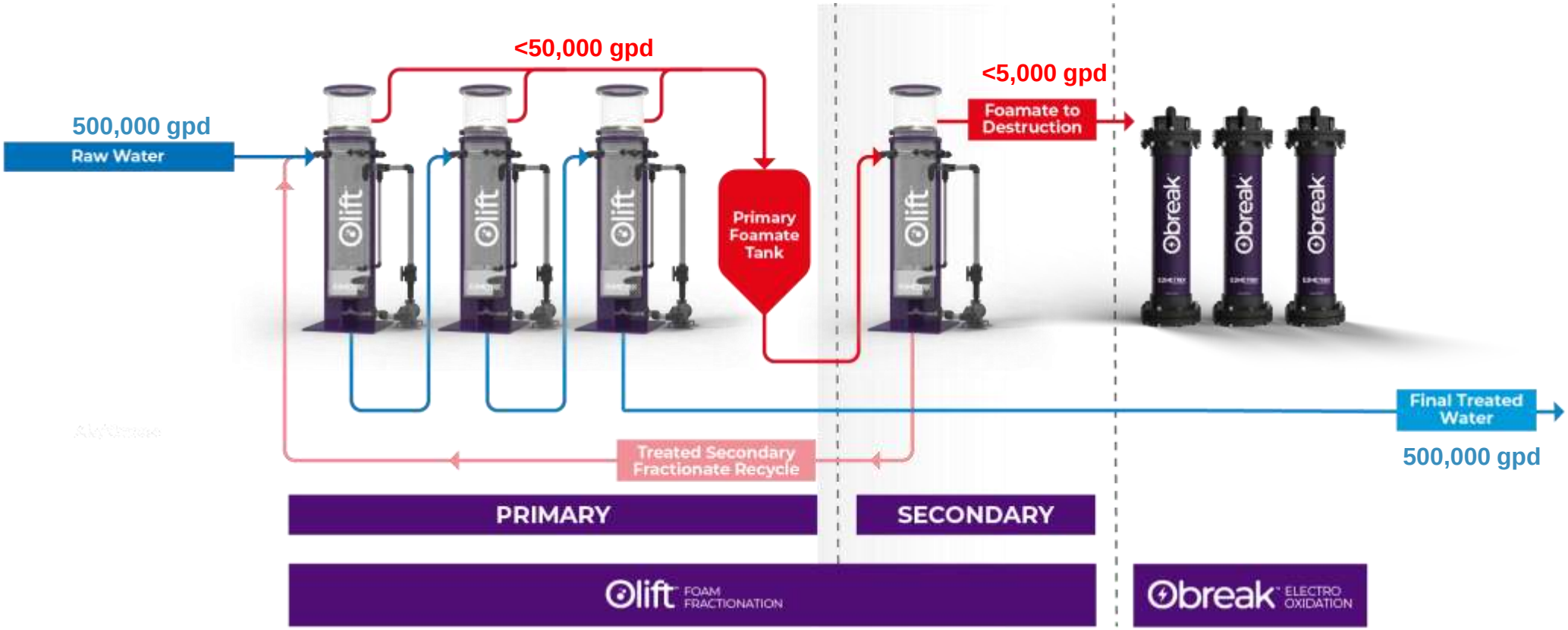
The Secondary Stage Goal is PFAS Concentration and Foamate Volume Reduction

Secondary Concentration and Volume Reduction

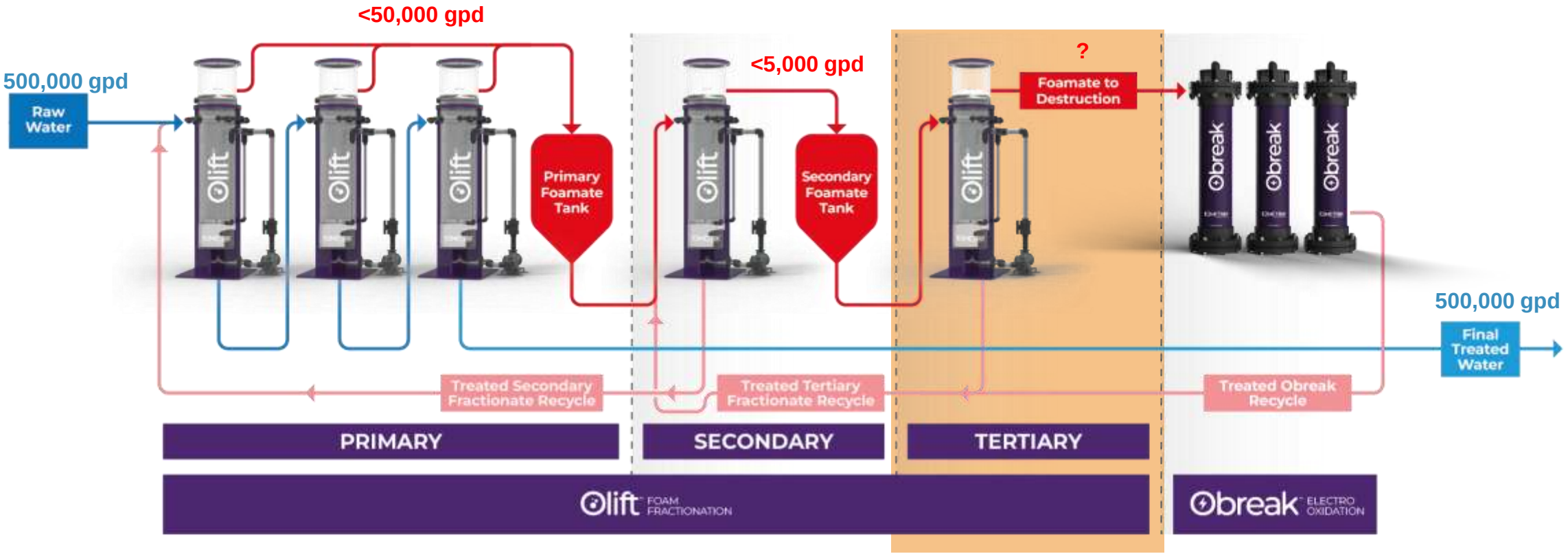


Foamate Type	Primary Foamate	Secondary Foamate
Foamate Production (%)	8.0%	1.0%

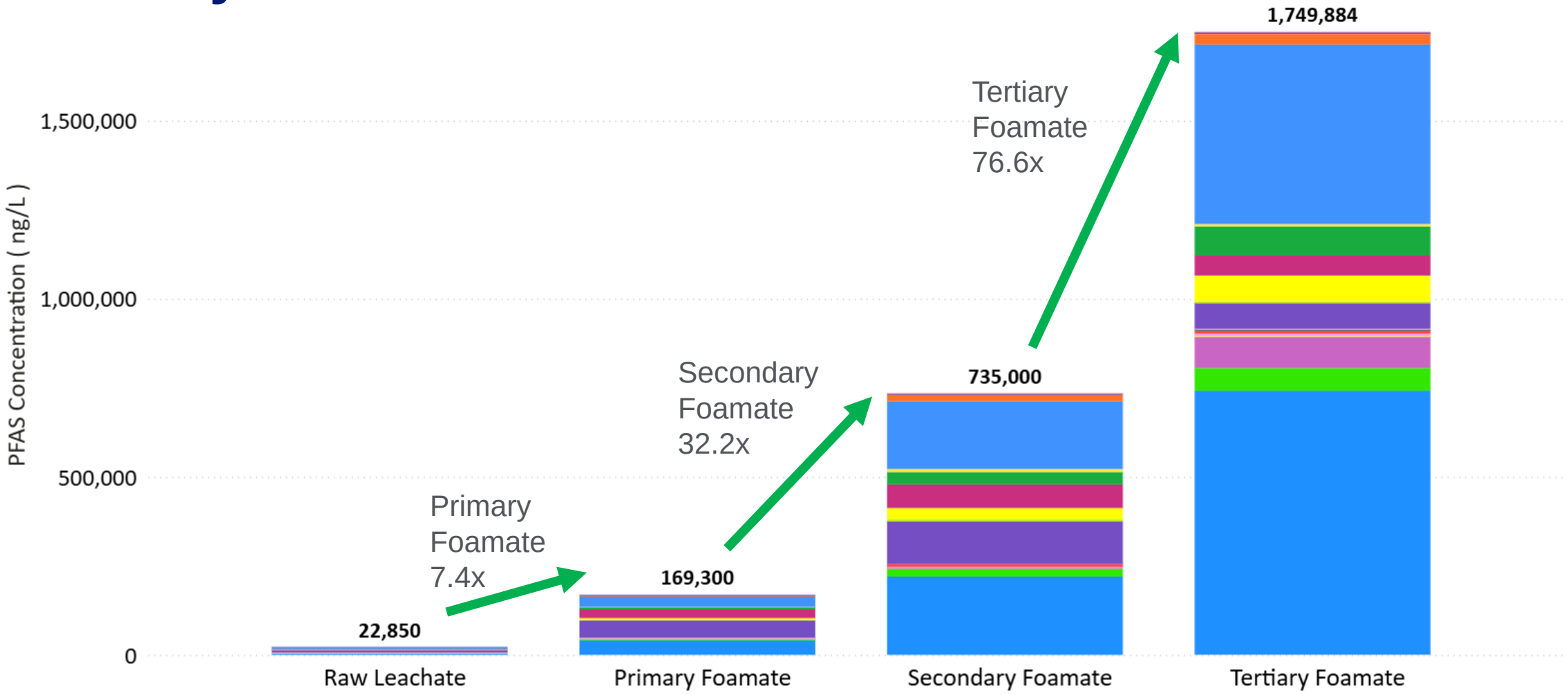
Secondary vs. Tertiary Foamate Electro-Oxidation Destruction



Does Further Foamate Concentration Result in Improved Destruction?

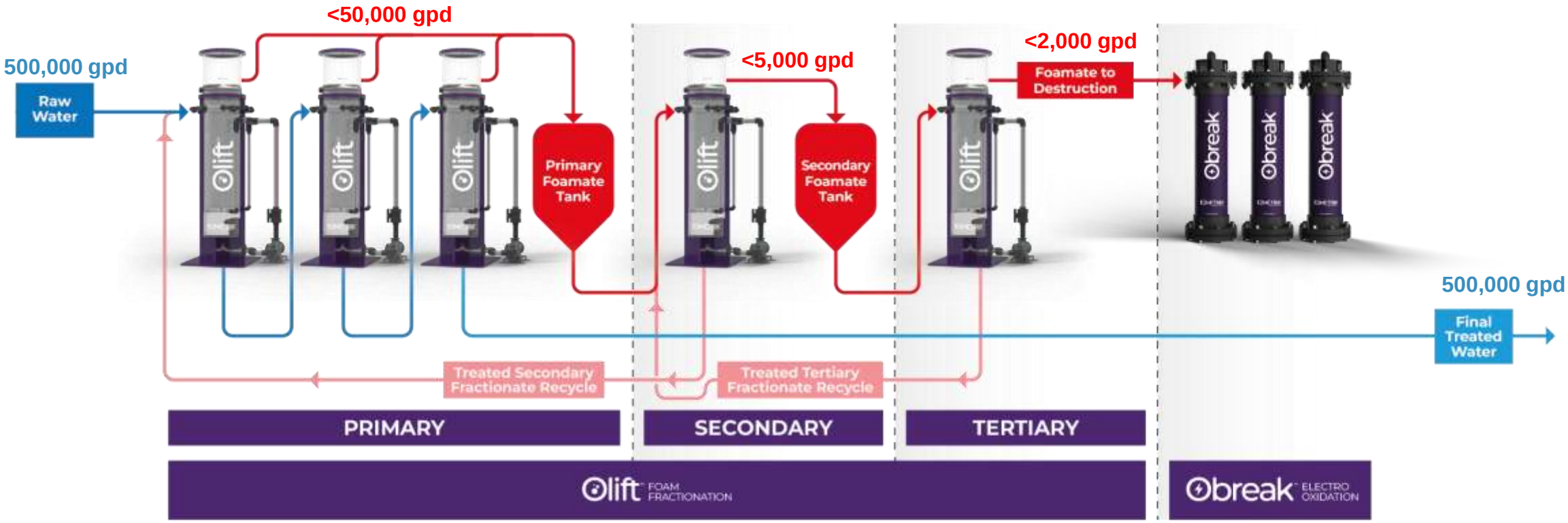


Tertiary Concentration and Volume Reduction



Foamate Type	Primary Foamate	Secondary Foamate	Tertiary Foamate
Foamate Production (%)	8.0%	1.0%	0.4%

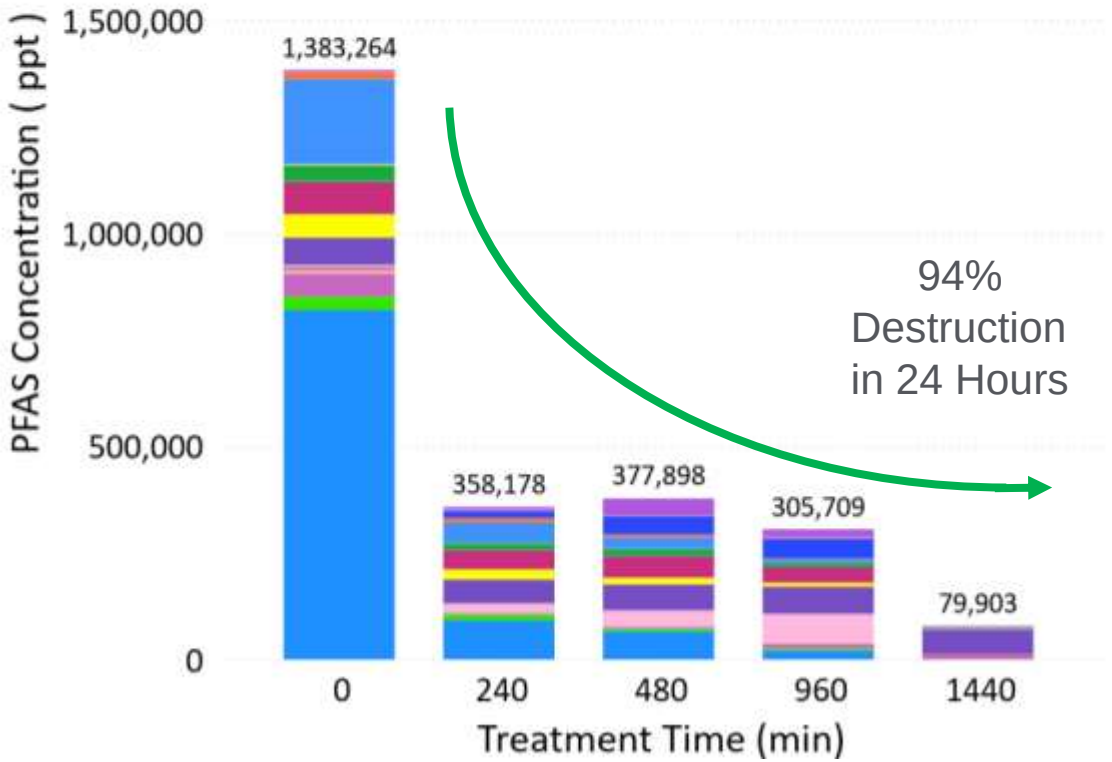
PFAS Destruction by Electro-Oxidation



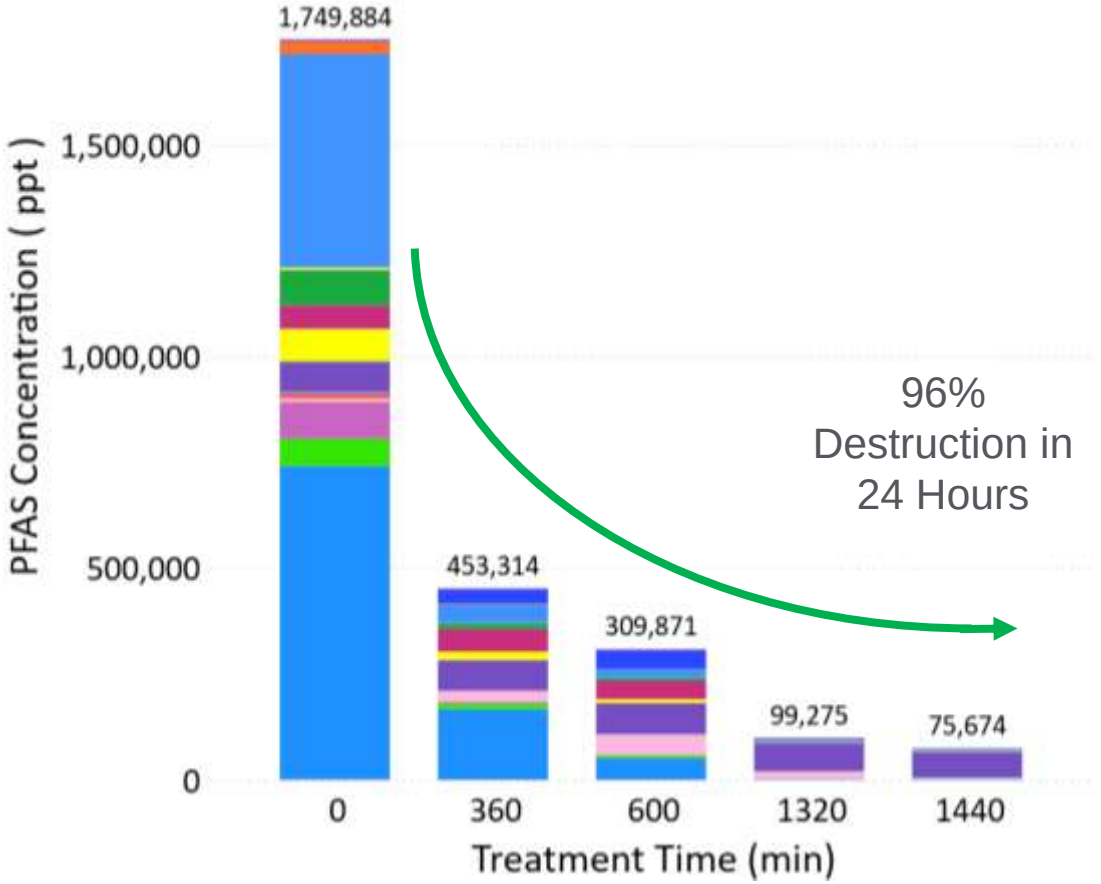
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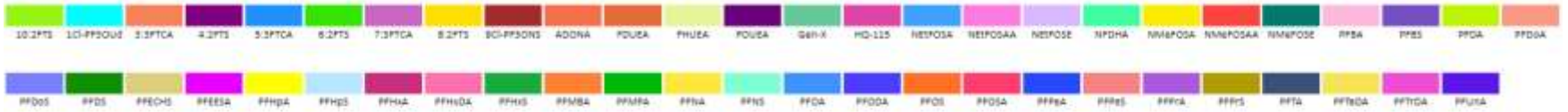
Electro-Oxidation Destruction: Secondary vs. Tertiary Foamate

Secondary Foamate



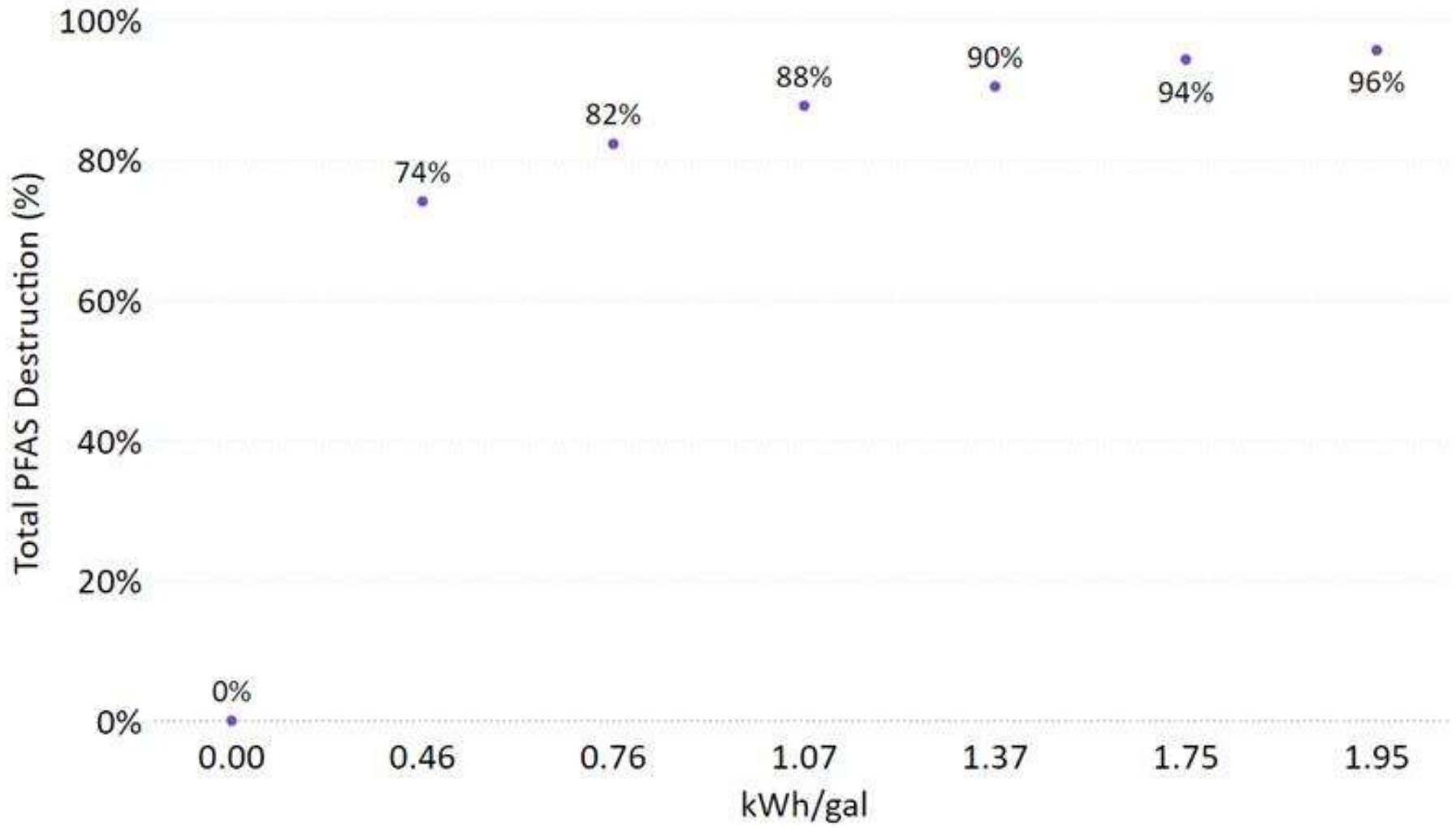
Tertiary Foamate



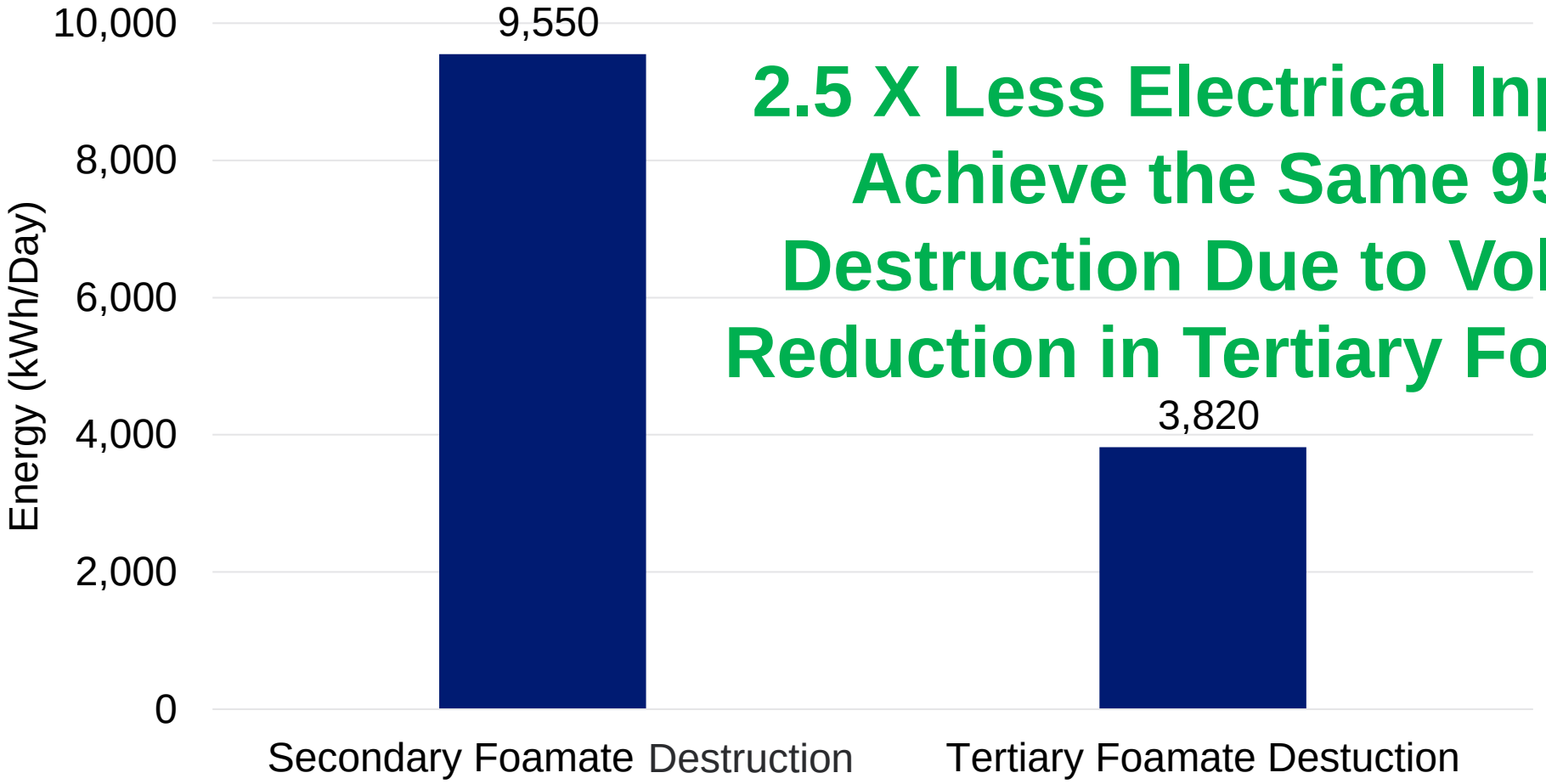


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Tertiary Electro-Oxidation Energy vs. Destruction



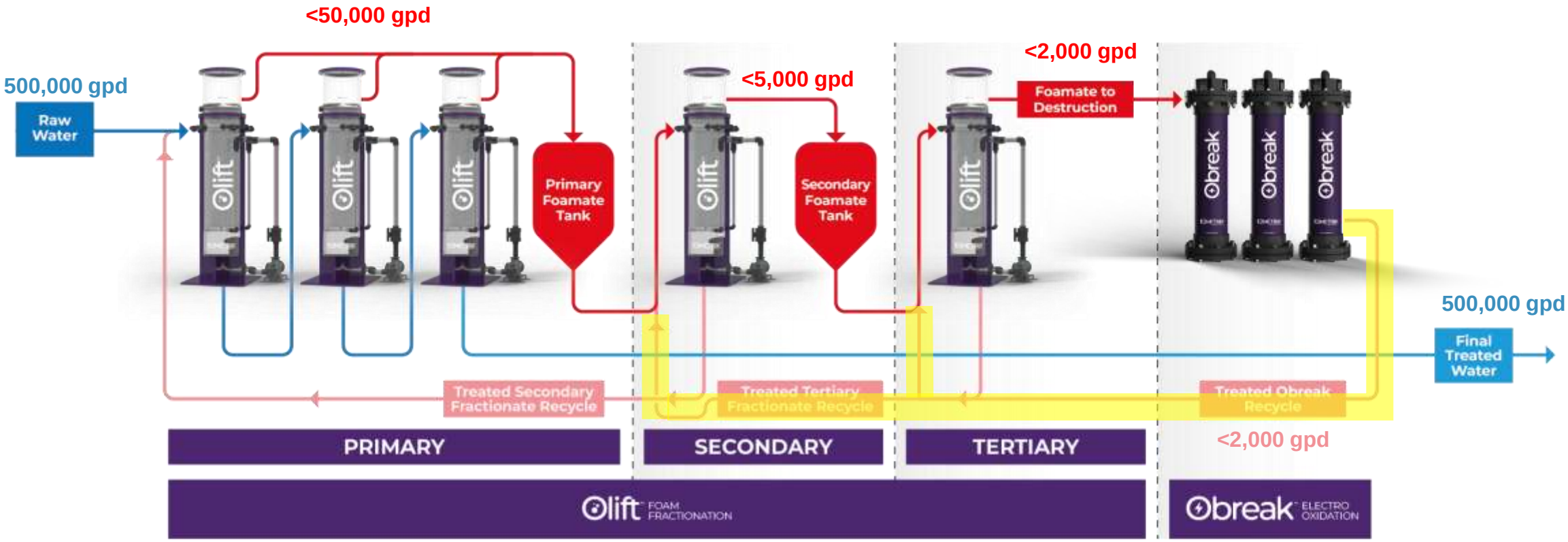
Electro-Oxidation Energy Evaluation: Secondary vs. Tertiary



2.5 X Less Electrical Input to Achieve the Same 95% Destruction Due to Volume Reduction in Tertiary Foamate

Foamate Type	Secondary Foamate	Tertiary Foamate
Foamate Generated Per day	5,000 gpd	2,000 gpd

How to Determine Electro-Oxidation Treatment Times



Foamate Type	Primary Foamate	Secondary Foamate	Tertiary Foamate
Foamate Production (%)	8.0%	1.0%	0.4%

Closed-Loop PFAS Demonstration Conclusions



- A closed-loop destruction solution can meet or even exceed regulatory and site-specific treatment targets
- Onsite PFAS removal and destruction achieved with **less than 0.016 kWhr per gallon**
- **System CAPEX is reduced by 20% and OPEX is reduced by 25%** by adding a Tertiary Olift FF stage





Foam Fractionation PFAS Removal from Landfill Leachate (Air-Ozone)

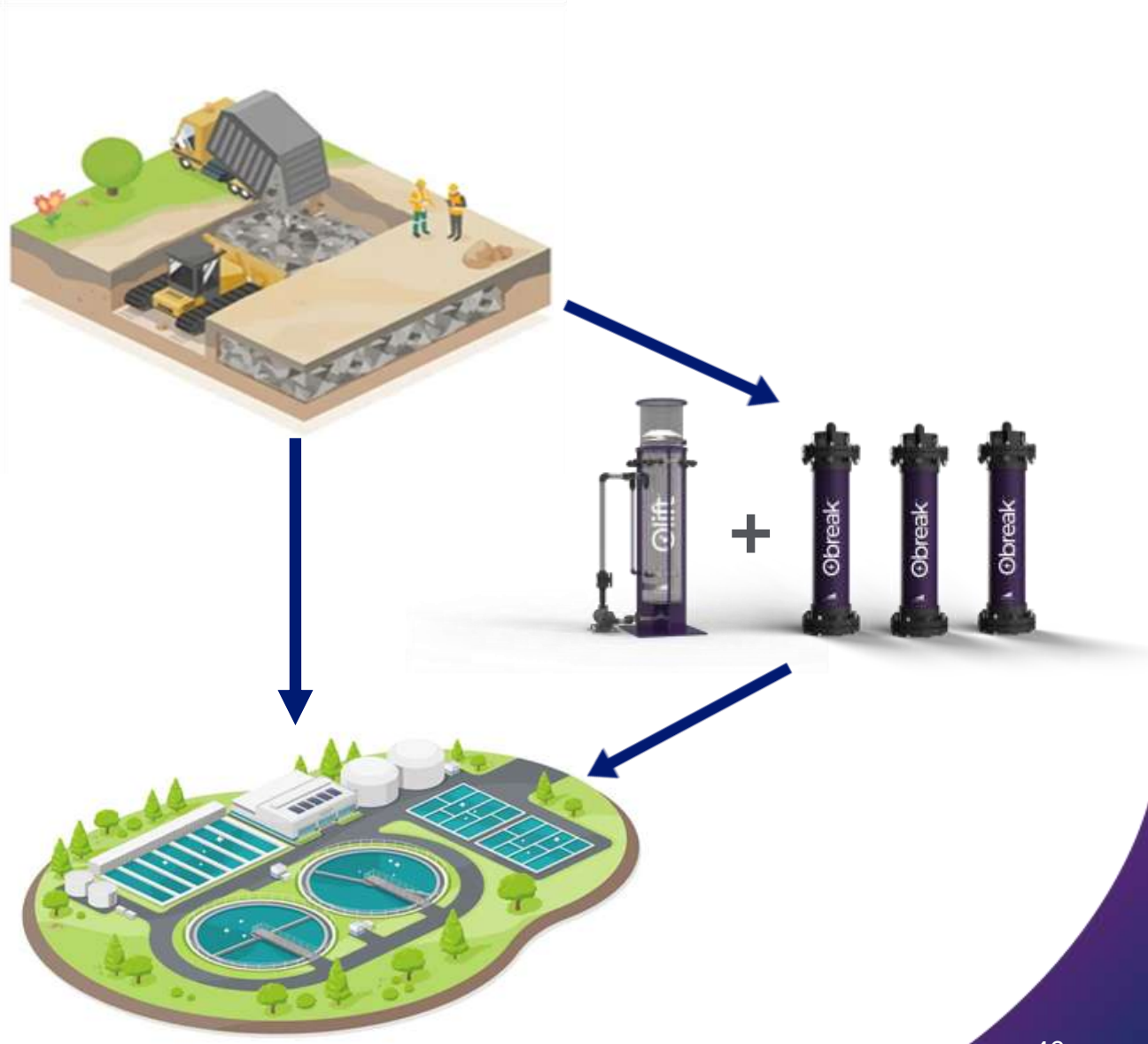
Case Study #2



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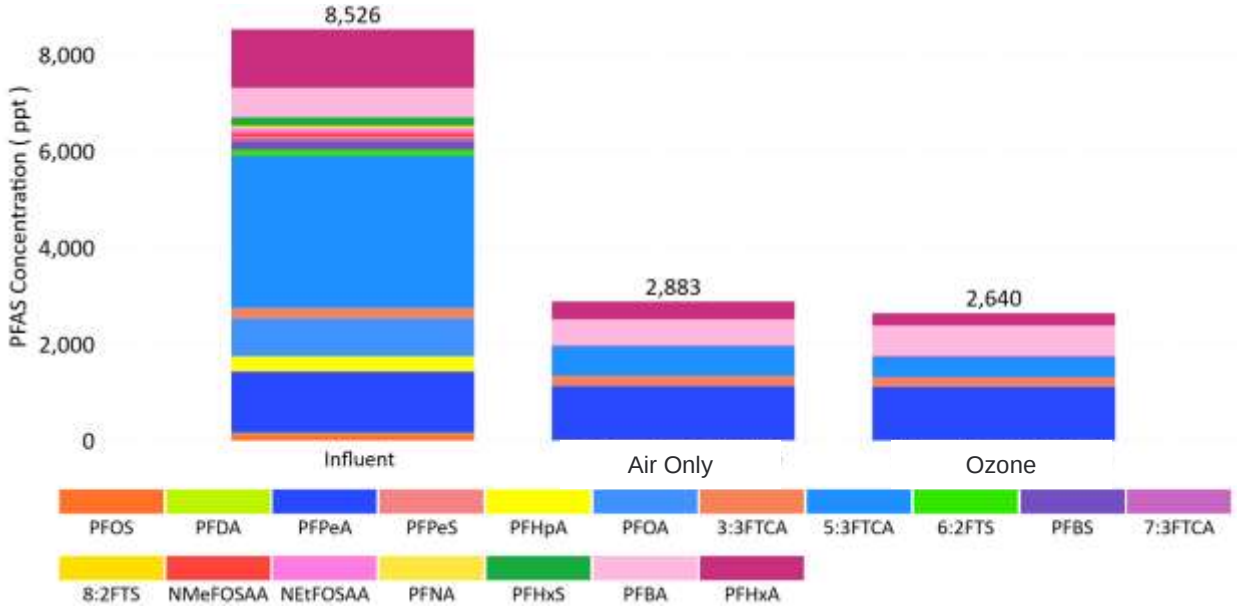
Landfill Leachate Treatment at a Municipal Site

- Located in Northeast USA, Municipal Site manages a peak of 65,000 gpd of landfill leachate (trucked in)
- PFAS in leachate results in contamination of POTW biosolids and POTW effluent
- In November 2025 Ovivo deployed a 53’ container with both Olift and Obreak for an onsite pilot study to remove, concentrate and destroy PFAS in the landfill leachate
- Landfill leachate was treated over a 4-week period



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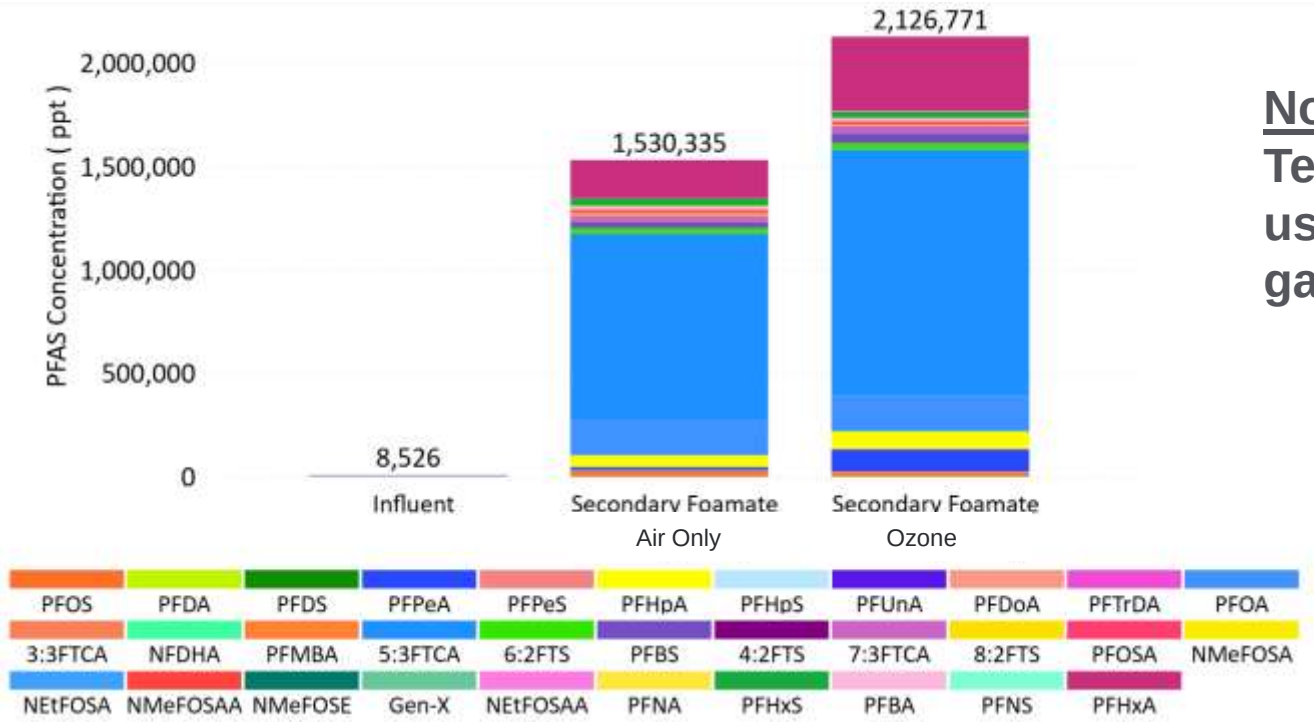
Foam Fractionation Effluent - Air-only vs Air-Ozone



PFAS Compound	Treatment Goal (ppt)	Air Only (ppt)	Ozone (ppt)
PFHpA	13	<RL	<RL
PFHxS	9	<RL	<RL
PFOA	45	<RL	<RL
PFNA	ND	<RL	<RL
PFOS	15	8	<RL
PFDA	ND	<RL	<RL
8:2 FTS	132	<RL	<RL
Total PFAS		2,883	2,640
Total PFAS Removal (%)		66%	69%

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Olift Secondary Foamate Concentration and Volume - Air vs Ozone

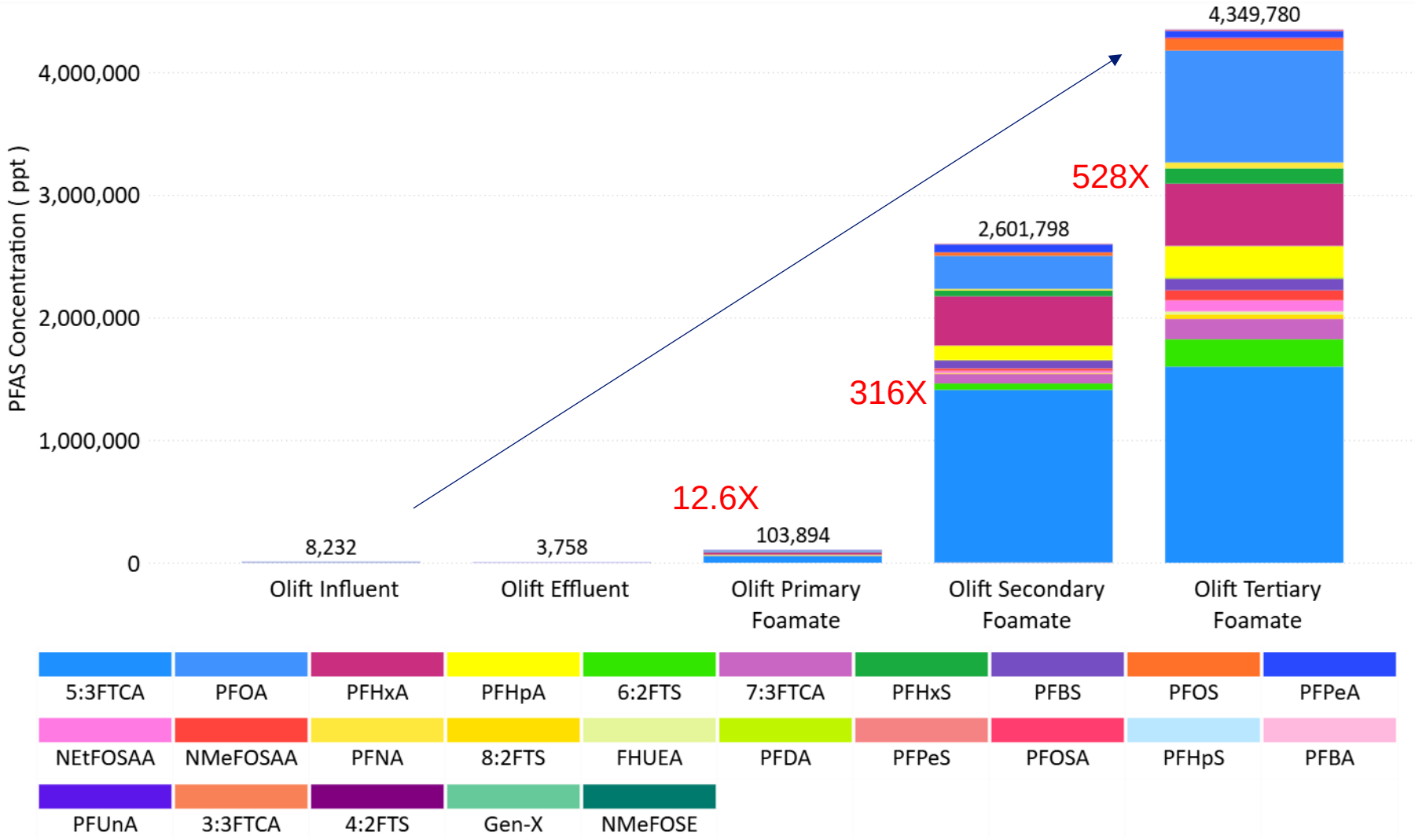


Note:
Tertiary Foamate Volume using Ozone was 0.0064% or 4 gallons from 65,000 gallons

Residual Management Criteria	Air Only	Ozone
Foamate Reject Percentage (%)	0.16%	0.02%
Projected Foamate Volume (gallons/day) for a 65,000 gpd system	104 gallons	13 gallons

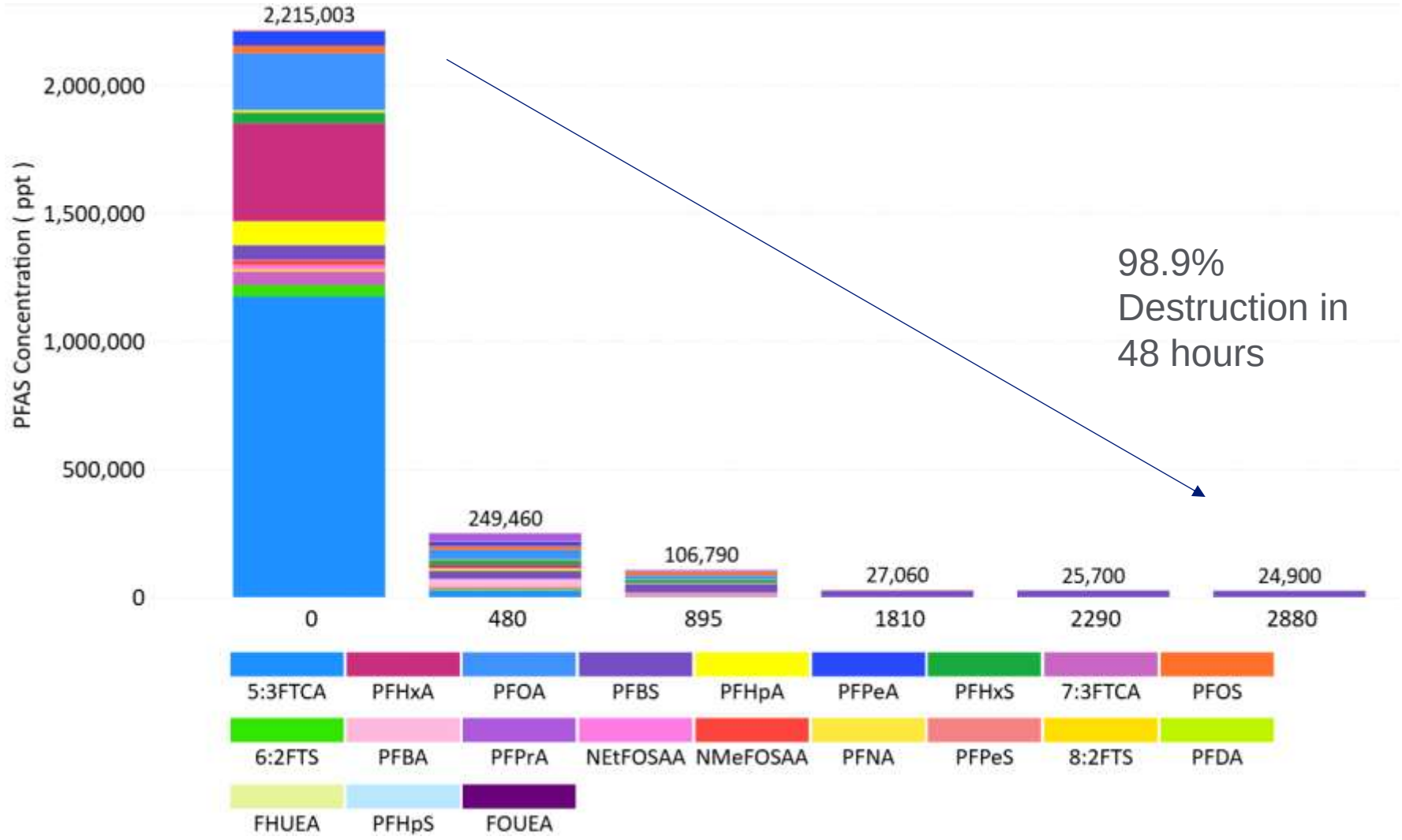
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Foam Fractionation Tertiary Foamate Concentrations



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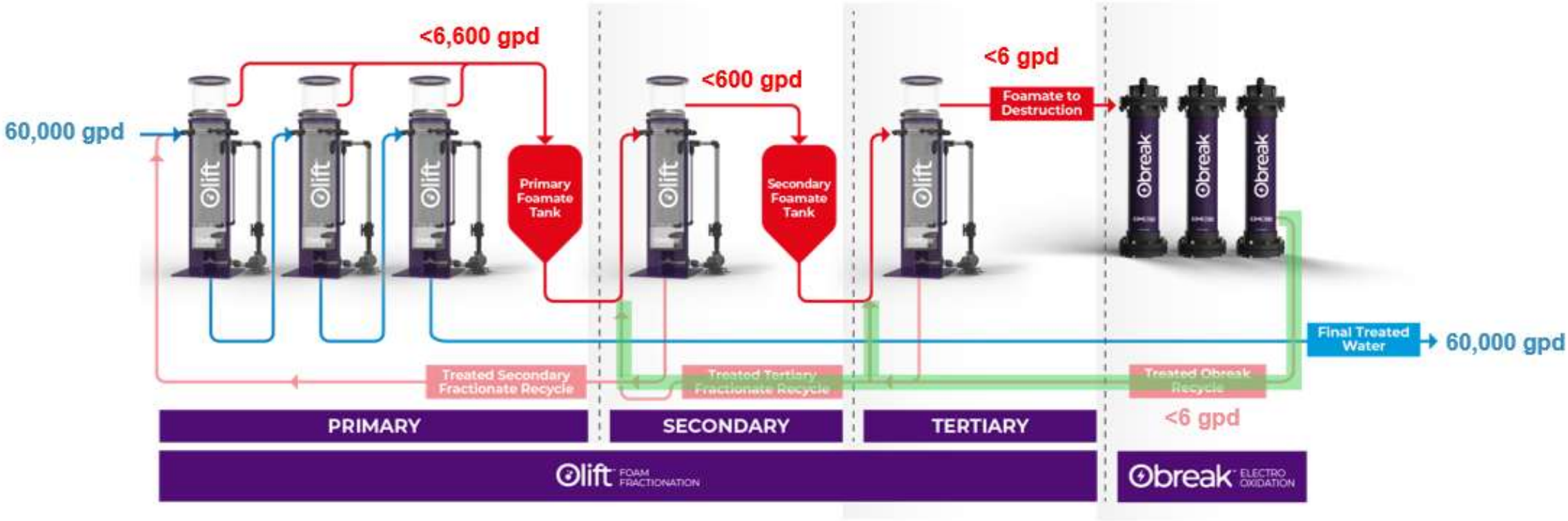
Electro-Oxidation on Secondary Foamate



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Electro-Oxidation Secondary Foamate Recycle

- Piloting for your unique site is recommended to understand performance and sizing considerations

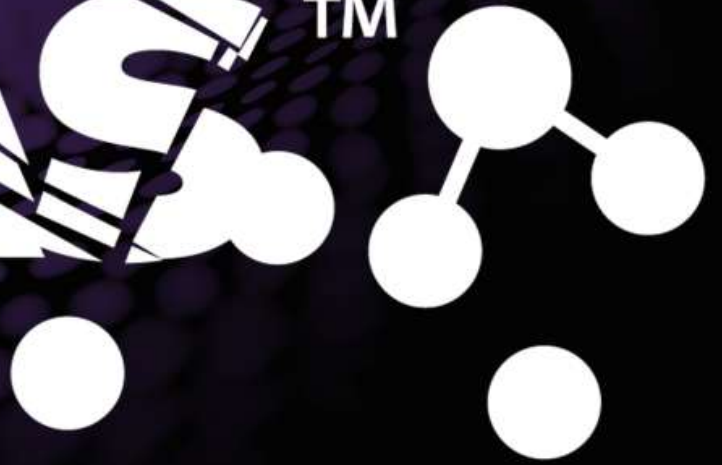


Foamate Type	Primary Foamate	Secondary Foamate	Tertiary Foamate
Foamate Production (%)	0.16%	0.02%	0.0064%

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THANK YOU!

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