

# PFAS in Leachate Treatment SAFF40<sup>®</sup>

US-ITRC Remediation Theme: Separation + Concentration + Destruction



RESTRICTED AREA  
AUTHORISED PERSONNEL ONLY

OP  
EC  
SYSTEMS

OP  
EC  
SYSTEMS

SAFF40™  
PFAS Water Treatment Plant

BUND

BUND

BUND

# SAFF40<sup>®</sup> Container

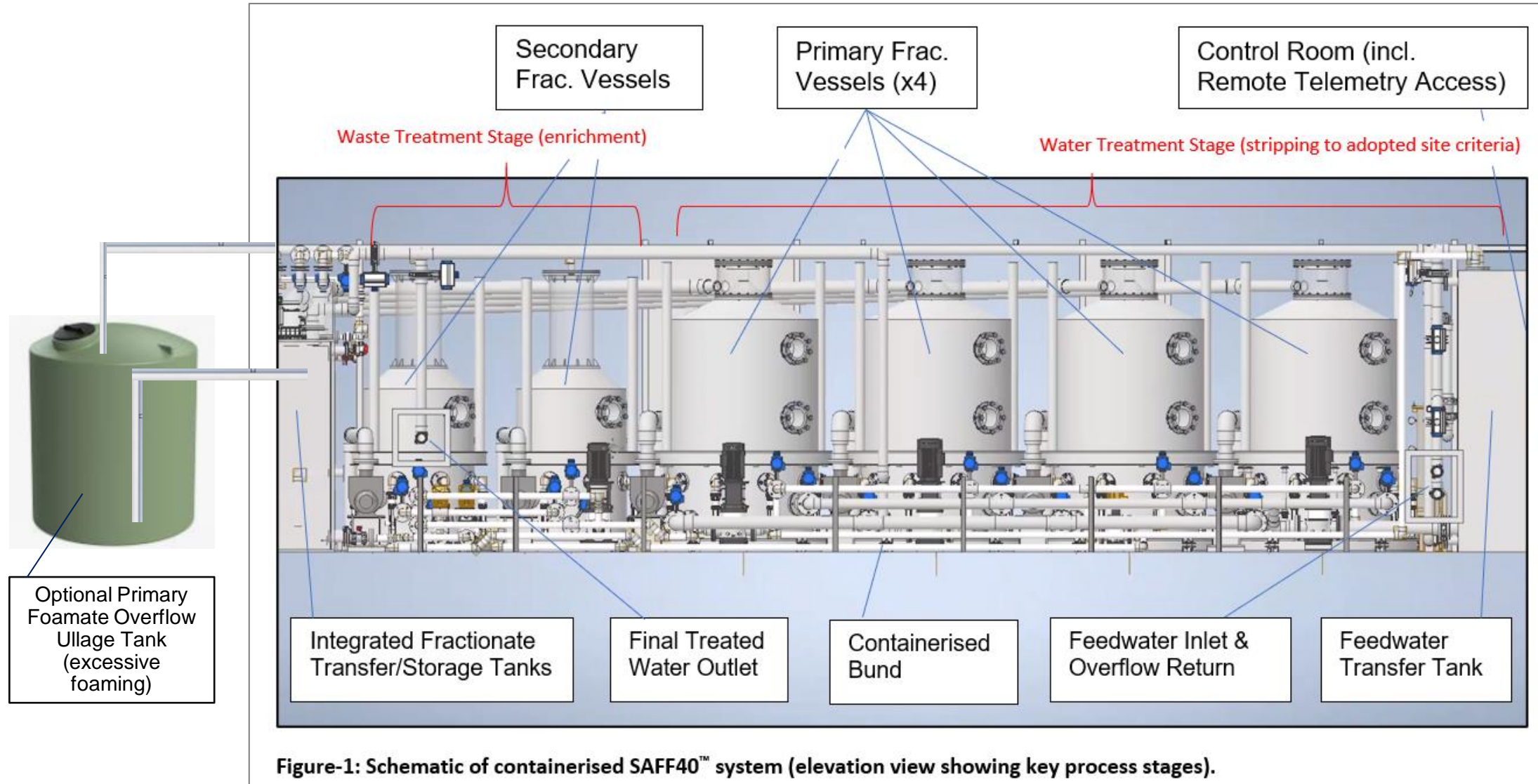


Figure-1: Schematic of containerised SAFF40™ system (elevation view showing key process stages).

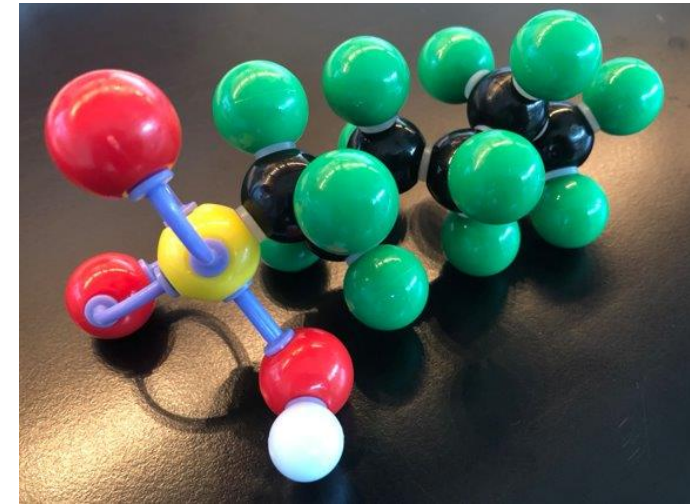
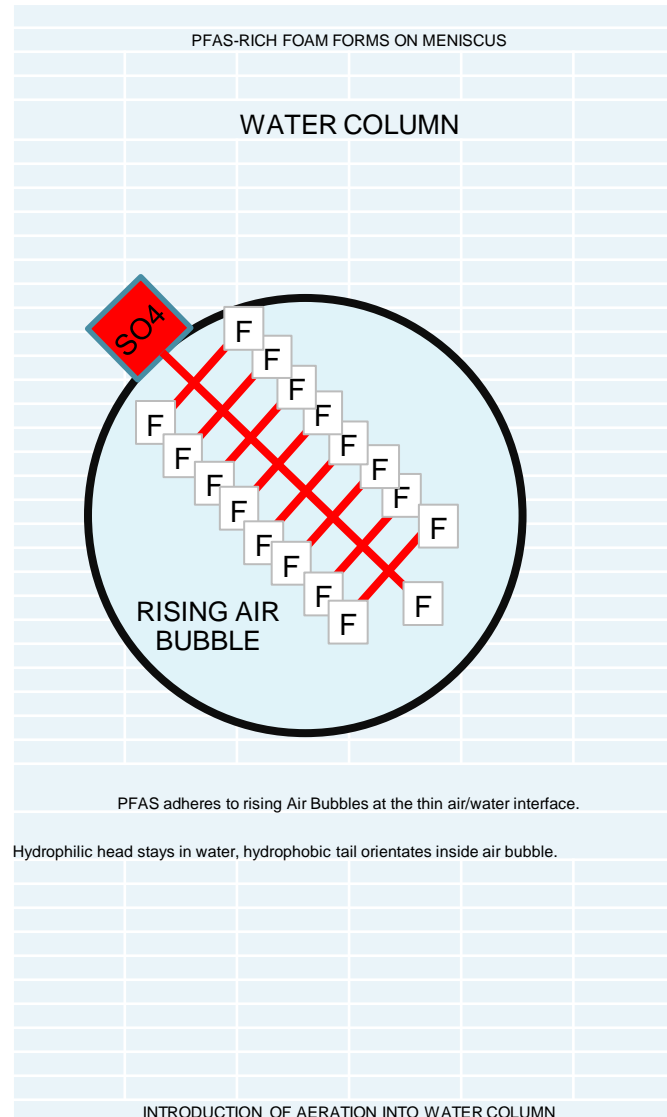


# SAFF™ Separation Mechanism

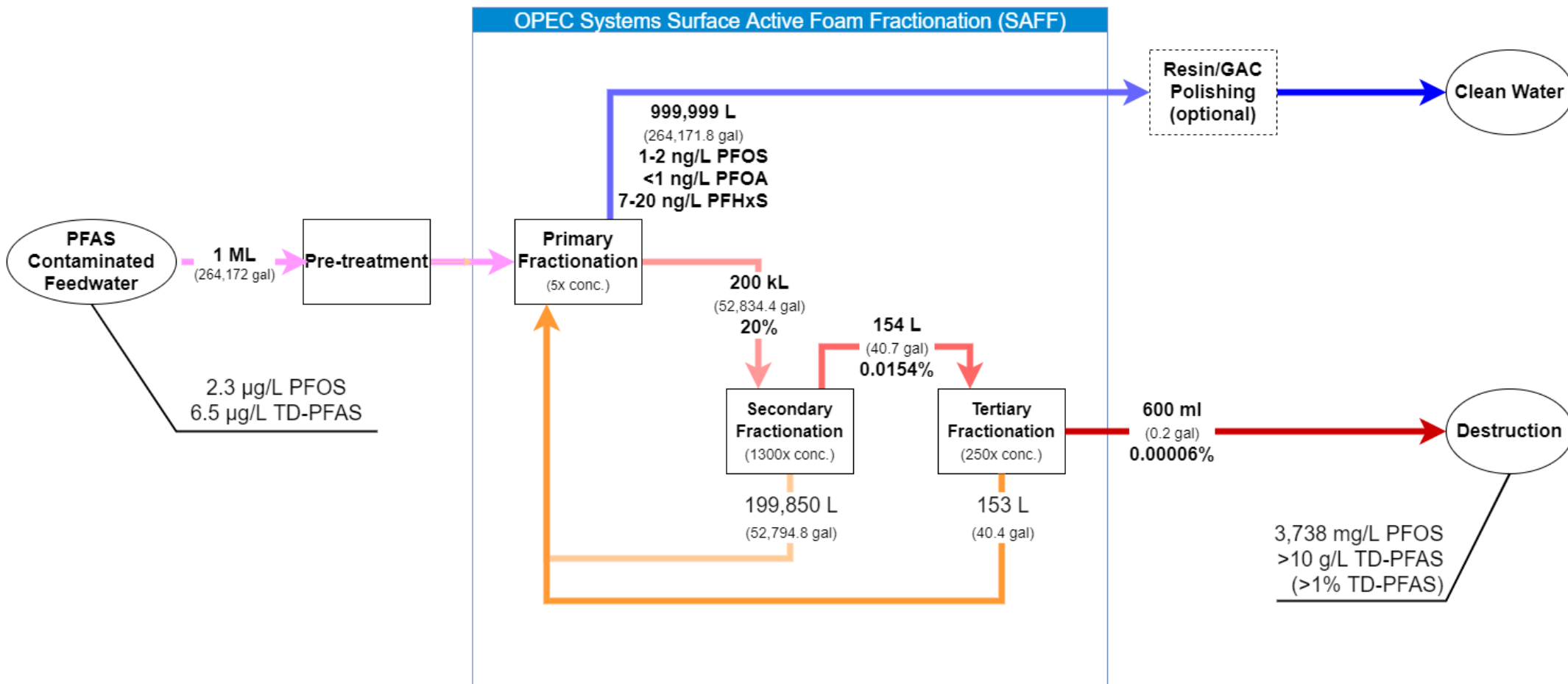
## Rising Air Bubbles

### – Separates PFAS to surface

- Hydrophilic Head
  - Orientates in water
- Hydrophobic Tail
  - Orientates in air-bubble



# SAFF™ Concentration Process



# Performance Data: Rates of Removal

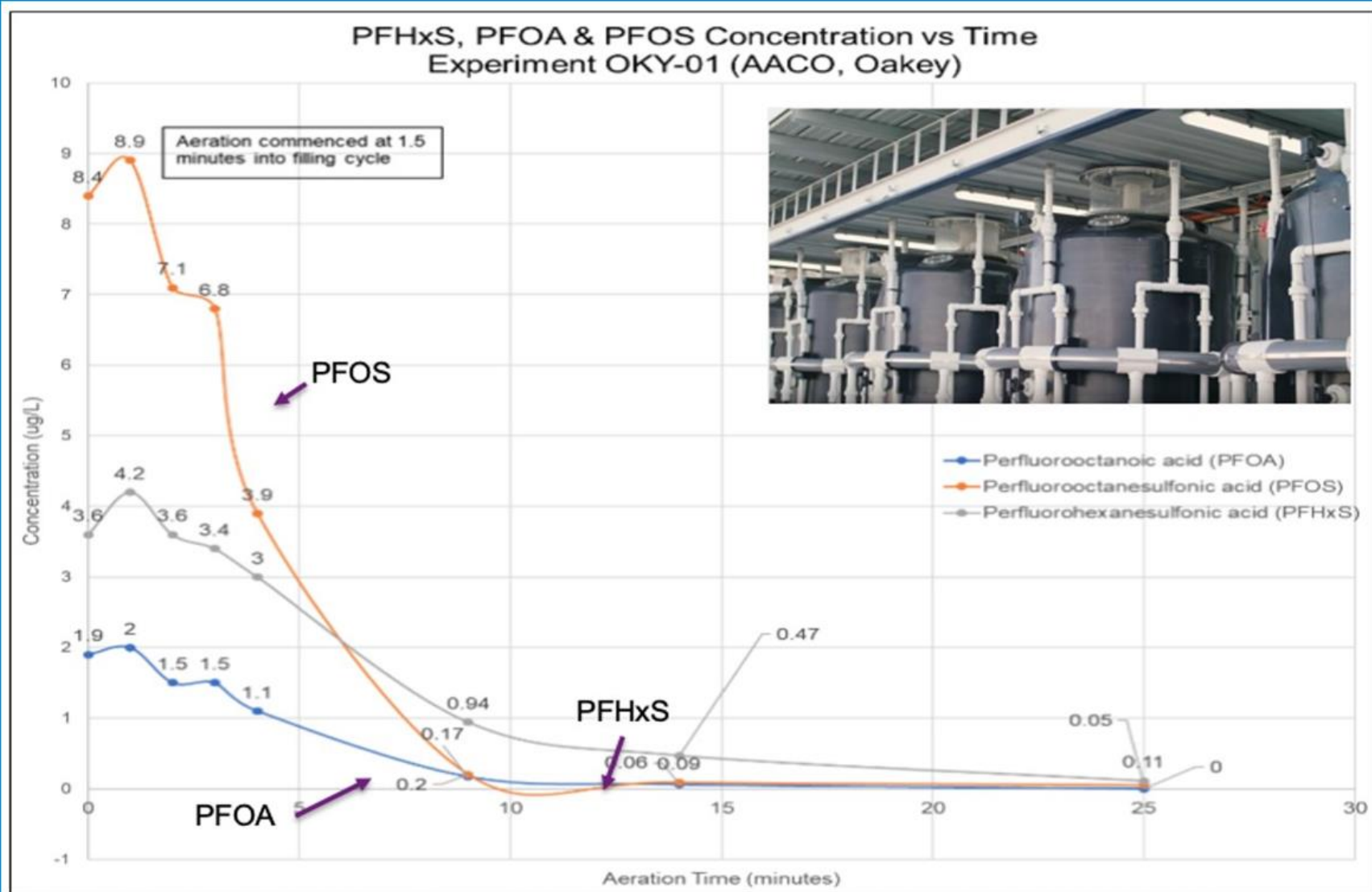


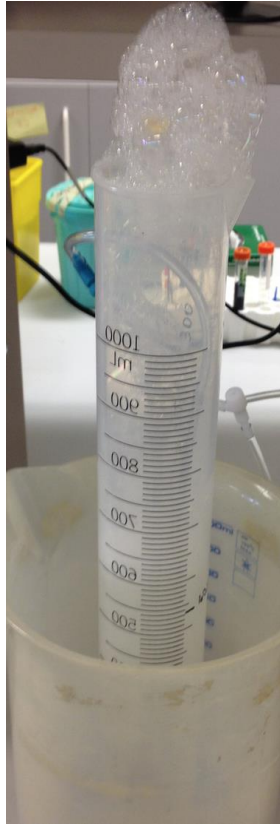
Chart-3: PFOS, PFHxS and PFOA removal Rates from AACO WTP (Commissioning Data 2019).

## KEY POINTS

Stripping with water recirculation.

- (1) PFOS: 10 mins
- (2) PFOA: 12 mins
- (3) PFHxS: 18 mins

# Development of SAFF<sup>®</sup> Technology



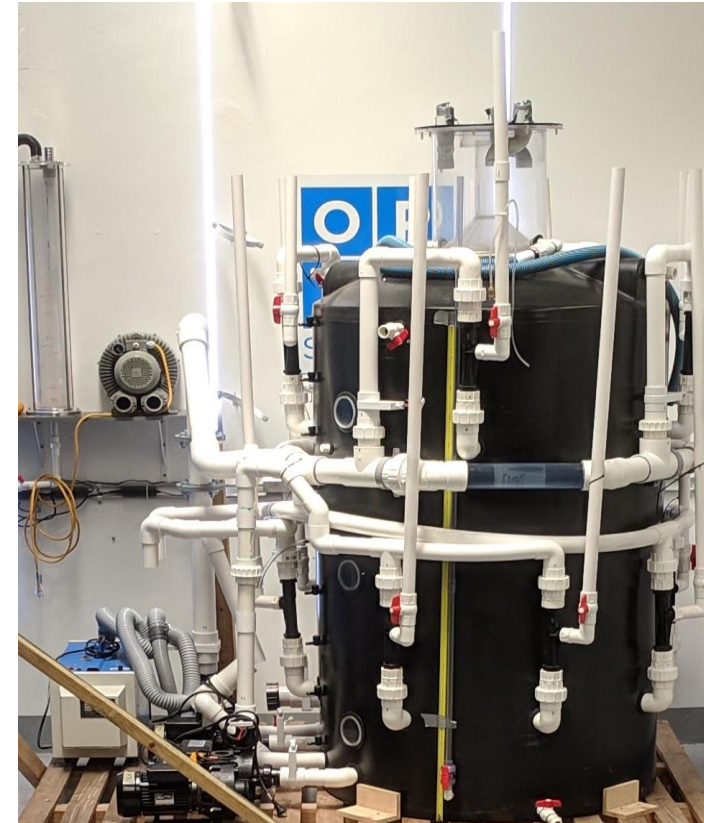
Jan 2016



2016 - 2017



2017 - 2018



2018



# First Full-Scale Field Trial SAFF40<sup>®</sup> (AACO)

## Oakey Results

### SAFF™ + AIX (FTA GWEW Array-1)

Commissioned 19th May 2019

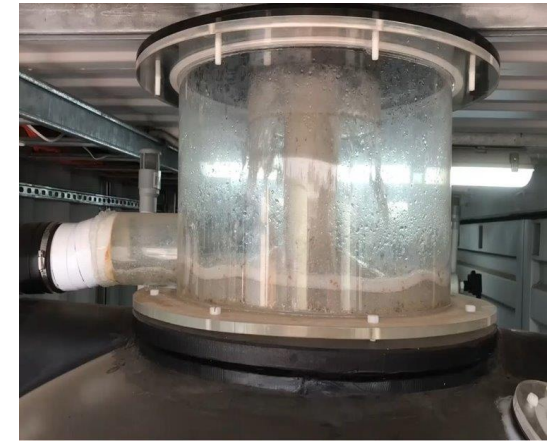
- 250kL/ day
- Term: 3yrs, (2+2yr options)
- 20 ML Treated (GW & SW)
- 500L PFAS Waste Conc. (cont. COC)
- 2.7kWh/m<sup>3</sup> (WTP + SAFF)
- CF 42,000x, (CF 442,000x tested)
- New CF 1-10Mx in-development

### SAFF™ + AIX

- Contract <0.07µg/l
- Aust. DoD website reporting <0.01µg/l



[www.opecsystems.com](http://www.opecsystems.com)



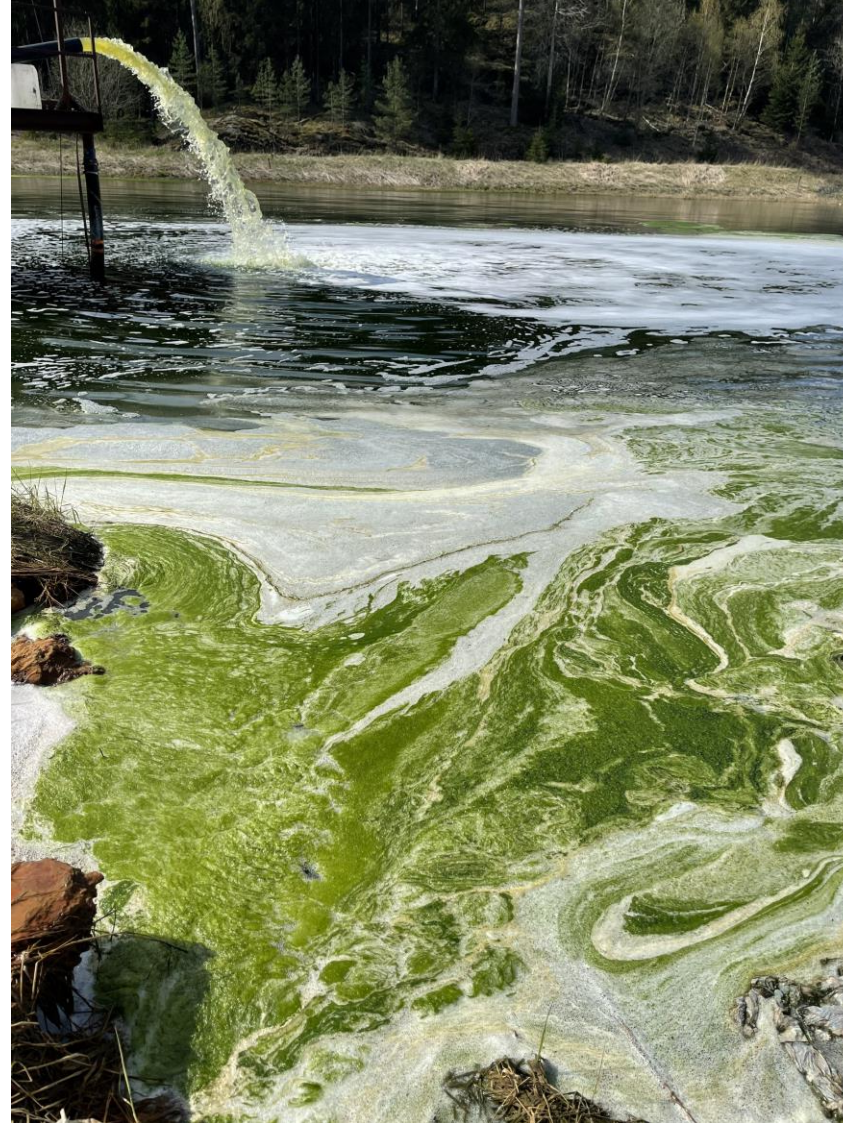


# AACO SAFF40® Groundwater Results (FT data Oct. 2019-Oct 2020)



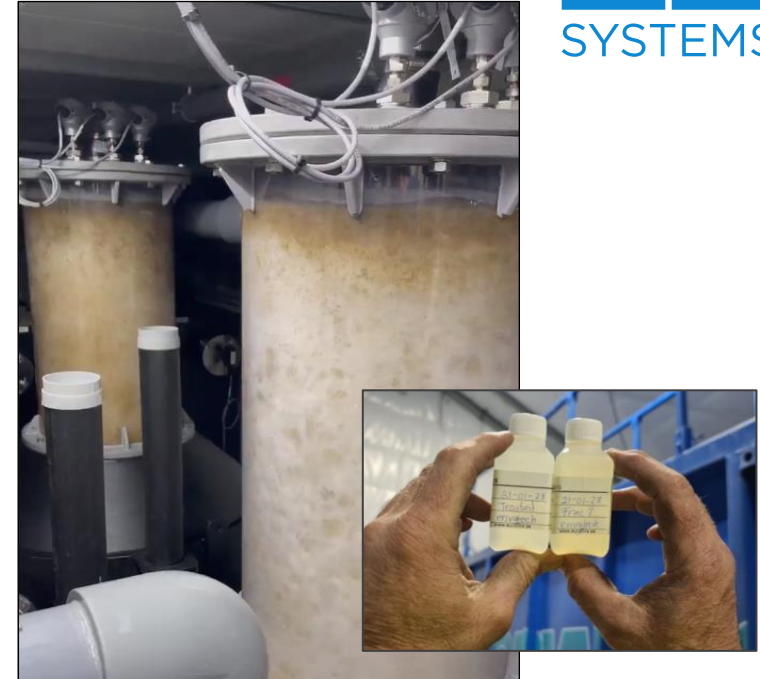
Aust. & NZ NEMP (2020) PFAS Suite <sup>(3)</sup>	Removal Percentages (%R)			Treatment Results (Field Trial)		
	Predictive Desktop Audit <sup>(1)</sup>	15L Bench- Scale Testing <sup>(1,4)</sup>	Full-Scale Field Trial Removal Results <sup>(4)</sup>	Feedwater Conc. <sup>(2)</sup> (ng/l)	Criteria (ng/l)	Treated Water Results (ng/l)
<b>PFOS</b>	<b>98-99%</b>	<b>98%</b> <sup>(4)</sup>	<b>99.8%</b> <sup>(4)</sup>	<b>2,790</b>	<b>70</b>	<b>&lt; 4</b>
<b>PFOA</b>	<b>98-99%</b>	<b>98%</b> <sup>(4)</sup>	<b>99.8%</b> <sup>(4)</sup>	<b>480</b>	<b>560</b>	<b>&lt; 1</b>
<b>PFHxS</b>	<b>95-97%</b>	<b>97%</b> <sup>(4)</sup>	<b>98.4%</b> <sup>(4)</sup>	<b>1,030</b>	<b>70</b>	<b>&lt; 17</b>
<b>Combined PFOS + PFHxS</b>	<b>96-98%</b>	<b>97-98%</b> <sup>(4)</sup>	<b>99.1%</b> <sup>(4)</sup>	<b>3,810</b>	<b>70</b>	<b>&lt; 11</b>
<b>8:2-FTS</b>	100%	98% <sup>(4)</sup>	100% <sup>(4)</sup>	32	-	< 1
<b>PFDA</b>	100%	98% <sup>(4)</sup>	98.8% <sup>(4)</sup>	156	-	< 3
<b>PFNA</b>	100%	98% <sup>(4)</sup>	100% <sup>(4)</sup>	116	-	< 1
<b>6:2-FTS</b>	100%	98% <sup>(4)</sup>	100% <sup>(4)</sup>	100	-	< 6
<b>PFHpS</b>	95%	75% <sup>(4)</sup>	80.8% <sup>(4)</sup>	104	-	< 20
<b>PFHpA</b>	95%	70% <sup>(4)</sup>	81.5% <sup>(4)</sup>	367	-	68
<b>PFHxA</b>	<50%	51% <sup>(4)</sup>	46.7% <sup>(4)</sup>	755	-	402

# Site & Bench-scale Images from Swedish Telge Landfill





# Treatment Images from Swedish Telge Landfill Site





# SAFF40® Swedish Landfill Leachate (commissioned Jan. 2021)



Swedish SLV-11 PFAS Suite <sup>(3)</sup>	Removal Percentages (%R)			Treatment Results (Field Trial Data, 3- Month Average, Sampled Weekly)		
	Predictive Desktop Audit <sup>(1)</sup>	40L Bench- Scale Testing <sup>(1,4)</sup>	Full-Scale Field Trial Removal Results <sup>(4)</sup>	Feedwater Conc. <sup>(2)</sup> (ng/l)	Criteria (ng/l)	Treated Water Results (ng/l)
$\sum_{PFAS}$ (SLV-11)	50-60%	68% <sup>(4)</sup>	55.6% <sup>(4)</sup>	2,470	90	1,098
<b>PFOS</b>	98%	100% <sup>(4)</sup>	99.0% <sup>(4)</sup>	182	50	1.8
PFDA	100%	100% <sup>(4)</sup>	67.8% <sup>(4)</sup>	4.5	-	1.9
PFNA	100%	100% <sup>(4)</sup>	98.3% <sup>(4)</sup>	66	-	1.2
6.2-FTS	100%	100% <sup>(4)</sup>	97.5% <sup>(4)</sup>	39	-	1.0
PFOA	98%	100% <sup>(4)</sup>	99.5% <sup>(4)</sup>	403	-	2.0
PFHpA	85%	67% <sup>(4)</sup>	98.3% <sup>(4)</sup>	196	-	3.2
PFHxS	98%	97% <sup>(4)</sup>	98.5% <sup>(4)</sup>	65	-	1.0
PFHxA	50%	20% <sup>(4)</sup>	53.7% <sup>(4)</sup>	560	-	259
PFPeA	<20%	24% <sup>(4)</sup>	15.9% <sup>(4)</sup>	518	-	436
PFBS	<5%	22% <sup>(4)</sup>	26.7% <sup>(4)</sup>	117	-	86
PFBA	<1%	21% <sup>(4)</sup>	4.4% <sup>(4)</sup>	319	-	305

# OPEX Costs for Removing PFAS from Telge Landfill Leachate:

*First two months OPEX data*



Labour – AUD \$0.08/m<sup>3</sup> (treated)

Consumables - ZERO

Energy – AUD \$0.084/m<sup>3</sup> (treated)

Waste – AUD \$0.0165/m<sup>3</sup> (treated)

**Total – AUD \$0.1805/m<sup>3</sup> (treated)**

# Versatility

## Feed Waters

Landfill Leachate Water

Surface & Civil Construction Water

Ex-situ Groundwater Extraction Wells

In-situ Downhole Foam Fractionation Enrichment (DFF)

## Applications

- Sole Treatment
- Lead Treatment



RO Reject Brine

Soil Wash Waters (FFAST)

## Treated Waters

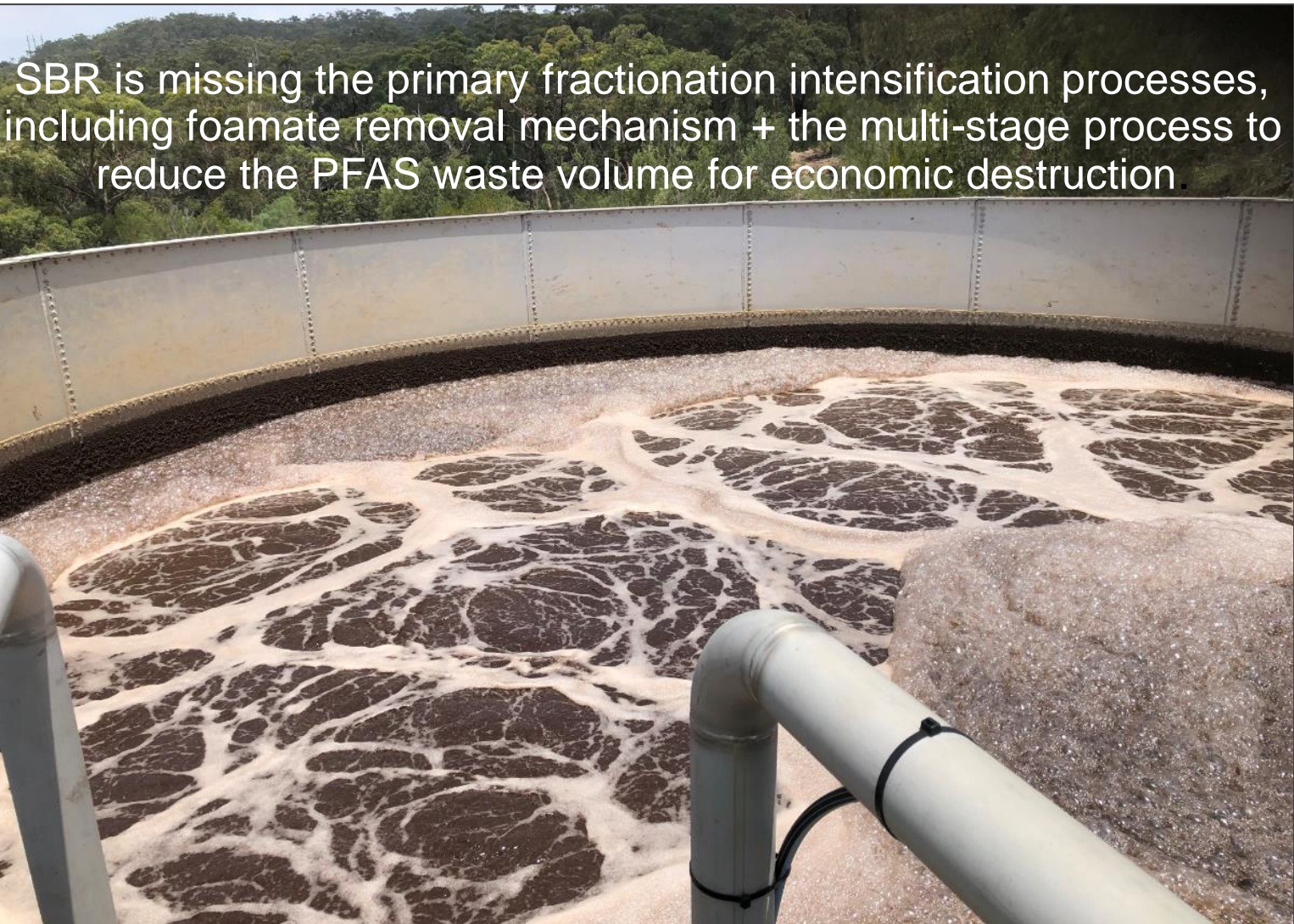
- Irrigation
- Aquifer reinjection
- Dust suppression
- Sewer

## PFAS Destruction

- Traditional Incineration
- ECO, RDF, SCWO, mPlasma, Ball Milling etc.



# Landfill SBR Treatment of Leachate



## STP's (since 2010)





Get in Touch or Learn More?

E: [dburns@opecsystems.com](mailto:dburns@opecsystems.com)

W: [opecsystems.com](https://opecsystems.com) to watch Webinar-004 (Swedish Landfill)



Webinar 4 - SAFF® for PFAS Remediation: Global Success Stories from the Field | OPEC Systems

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