



The LIFE SOuRCE project (LIFE20 ENV/ES/000880) has received funding from the LIFE Programme of the European Union



LIFE
SOuRCE

Elektrokemisk Oxidation (EO) med Diamantelektroder bryter ner PFAS-ämnen

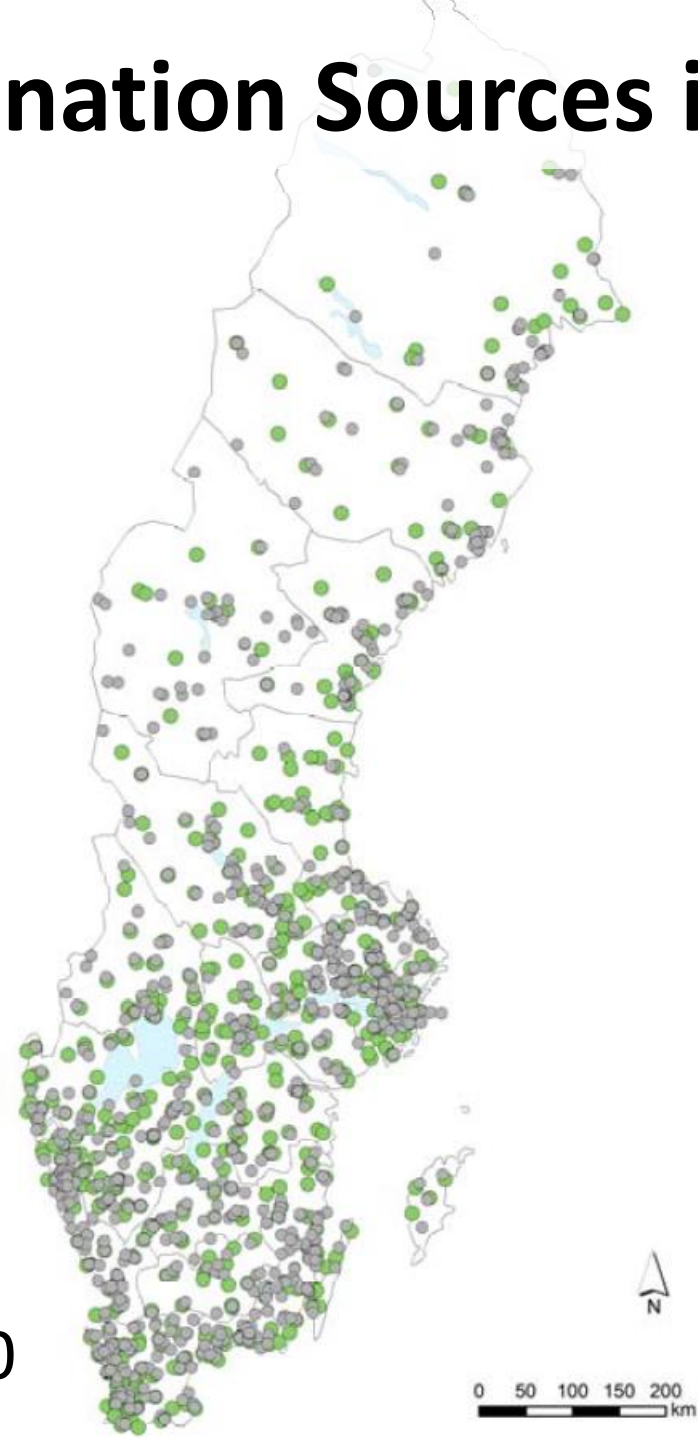
- Electrochemical Oxidation (EO) with Diamond Electrodes to break down PFAS -

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²Nova Diamant AB, 75646 Uppsala, Sweden

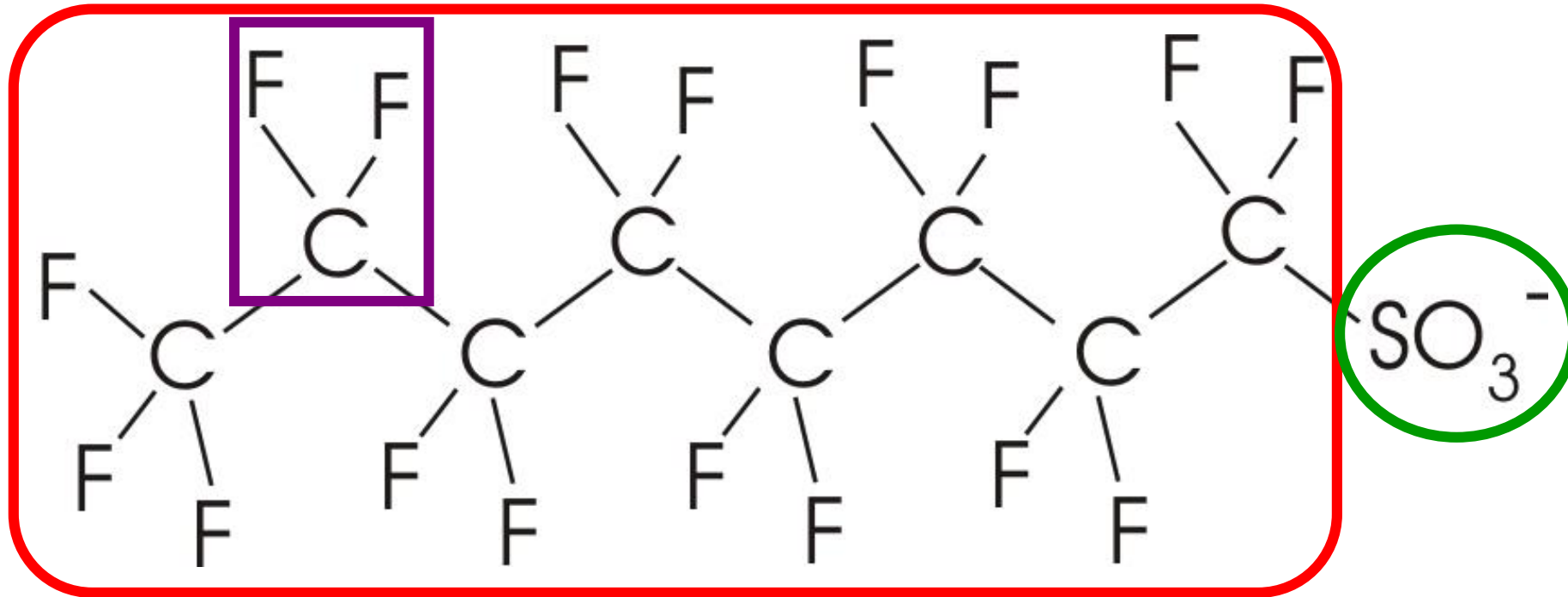
PFAS Contamination Sources in Sweden



>2000

Swedish EPA

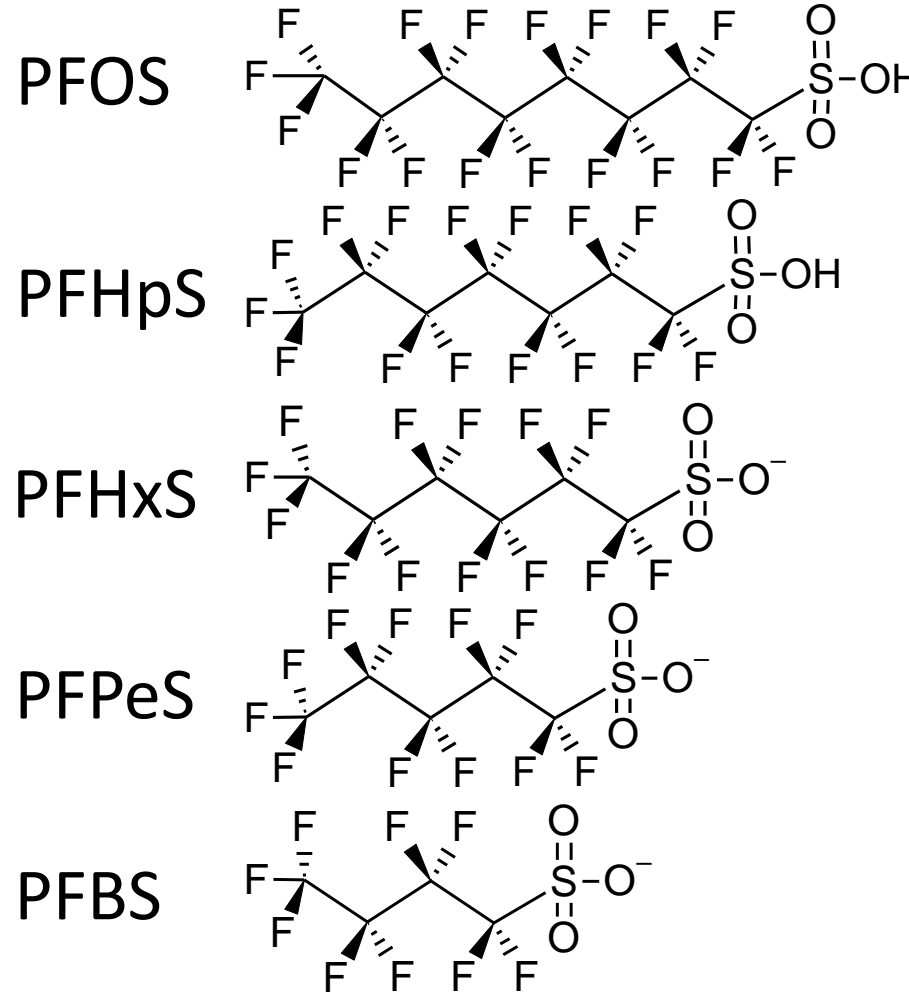
Characteristics of Per- and Polyfluoroalkyl Substances (PFASs)



Perfluorooctane sulfonate (PFOS)

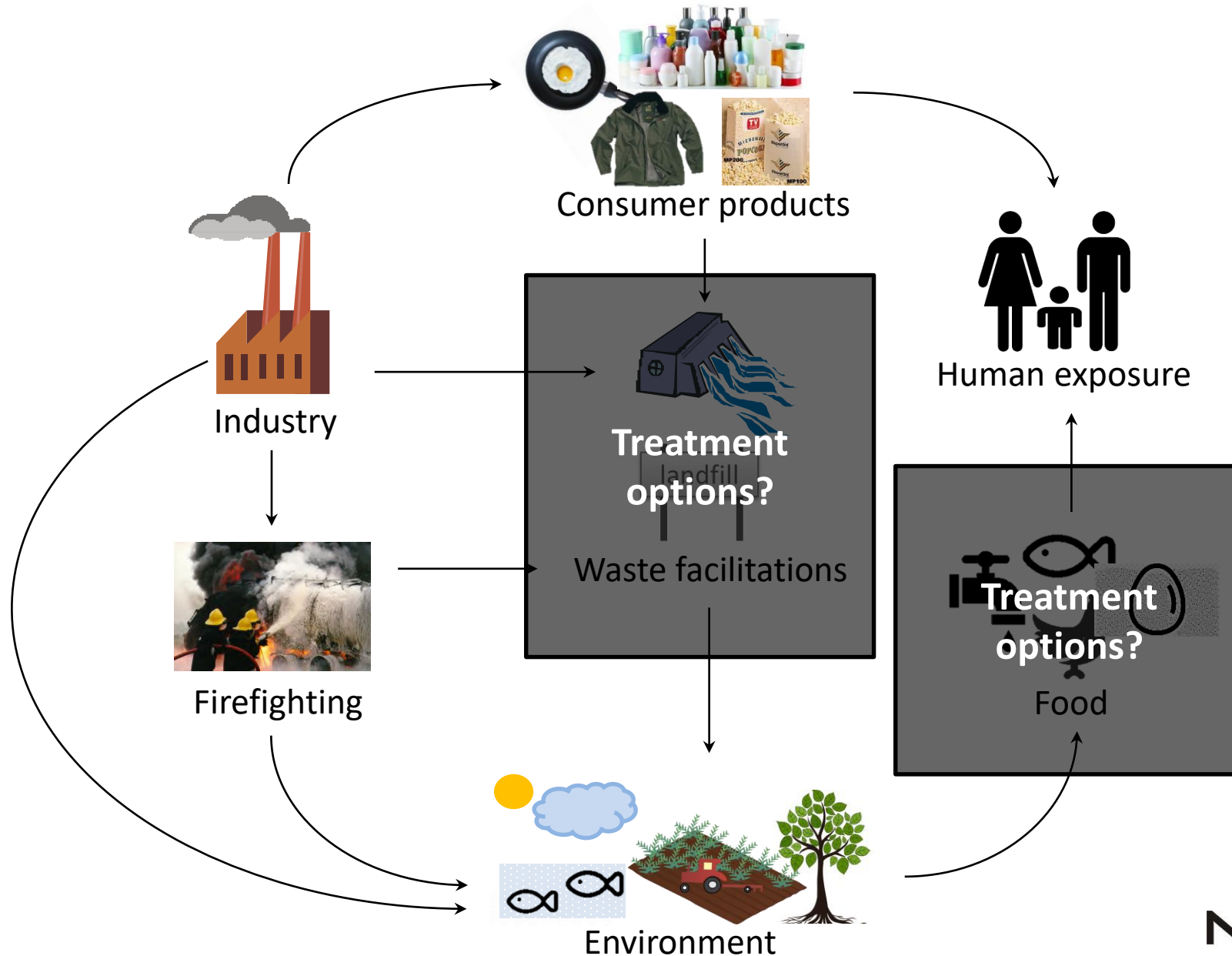
Characteristics of PFASs

Increasing sorption potential

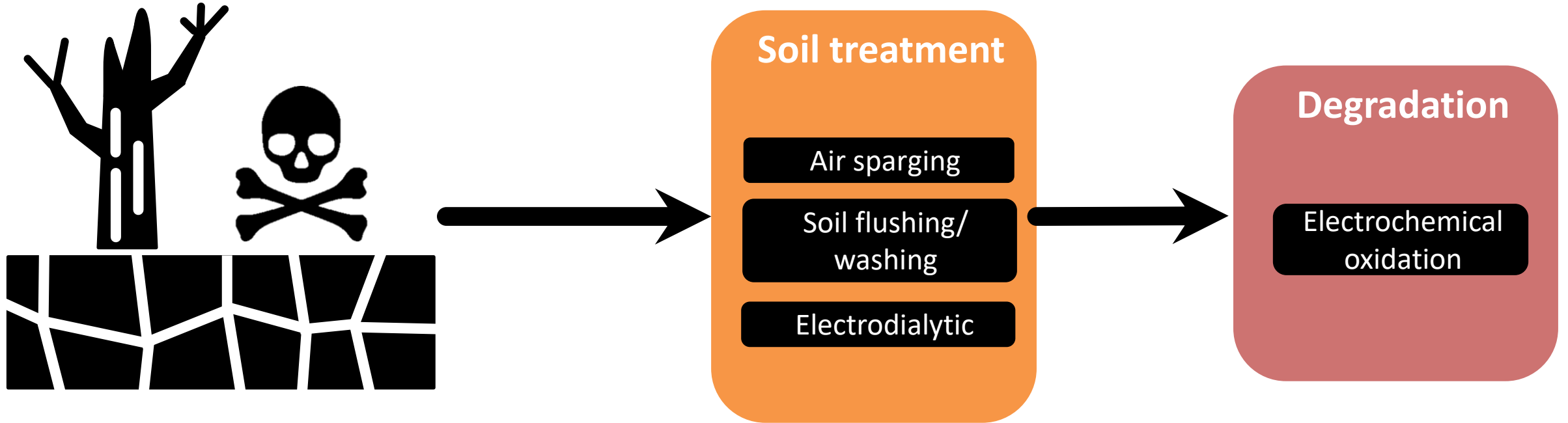


Increasing mobility

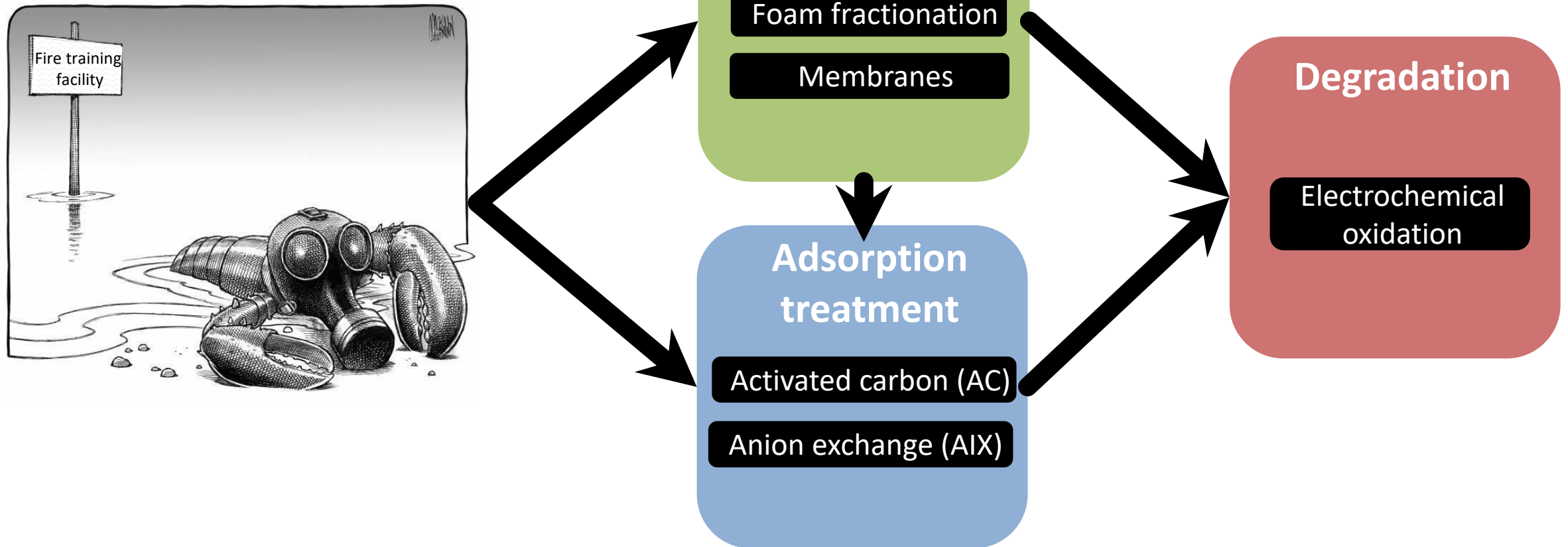
Circulation of PFASs in the Environment



PFAS Treatment Strategies for Soil



PFAS Treatment Strategies for Water



McCleaf P, Kjellgren Y, Ahrens L. 2021. AWWA, e1238

Franke V, McCleaf P, Lindegren K, Ahrens L. 2019. *ESWRT*, 5, 1836–1843

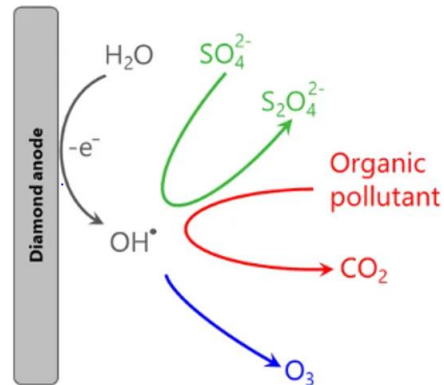
Gobelius L, Lewis J., Ahrens L. 2017, *ES&T*, 51, 12602-12610

McCleaf, Englund, Östlund, Lindegren, Wiberg, Ahrens, 2017, *Water Res*, 120, 77-87

Belkouteb N, Franke V, McCleaf P, Köhler S, Ahrens L. 2020. *Water Res*, 182, 115913

Smith, Wiberg, McCleaf, Ahrens. 2022. *ES&T Water*, 2, 841-851

Elektrokemisk Oxidation(EO)



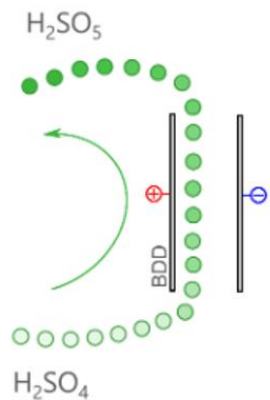
Synthesis

Wastewater

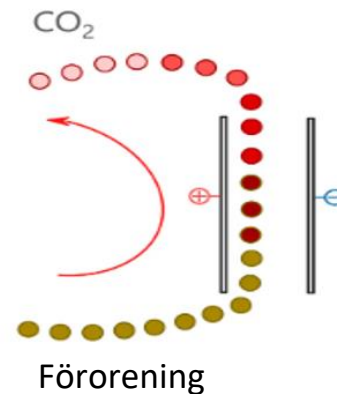
Disinfection

De unika egenskaperna hos Bor Dopade Diamant (BDD) elektroder skapar radikaler direkt från vattnet. Blä annat hydroxyl radikaler vilka är extremt effektiva.

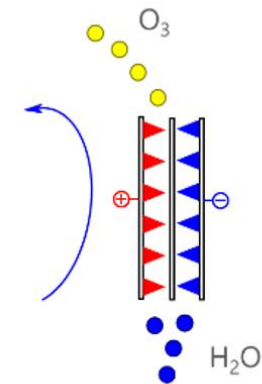
Elektrokemisk syntes



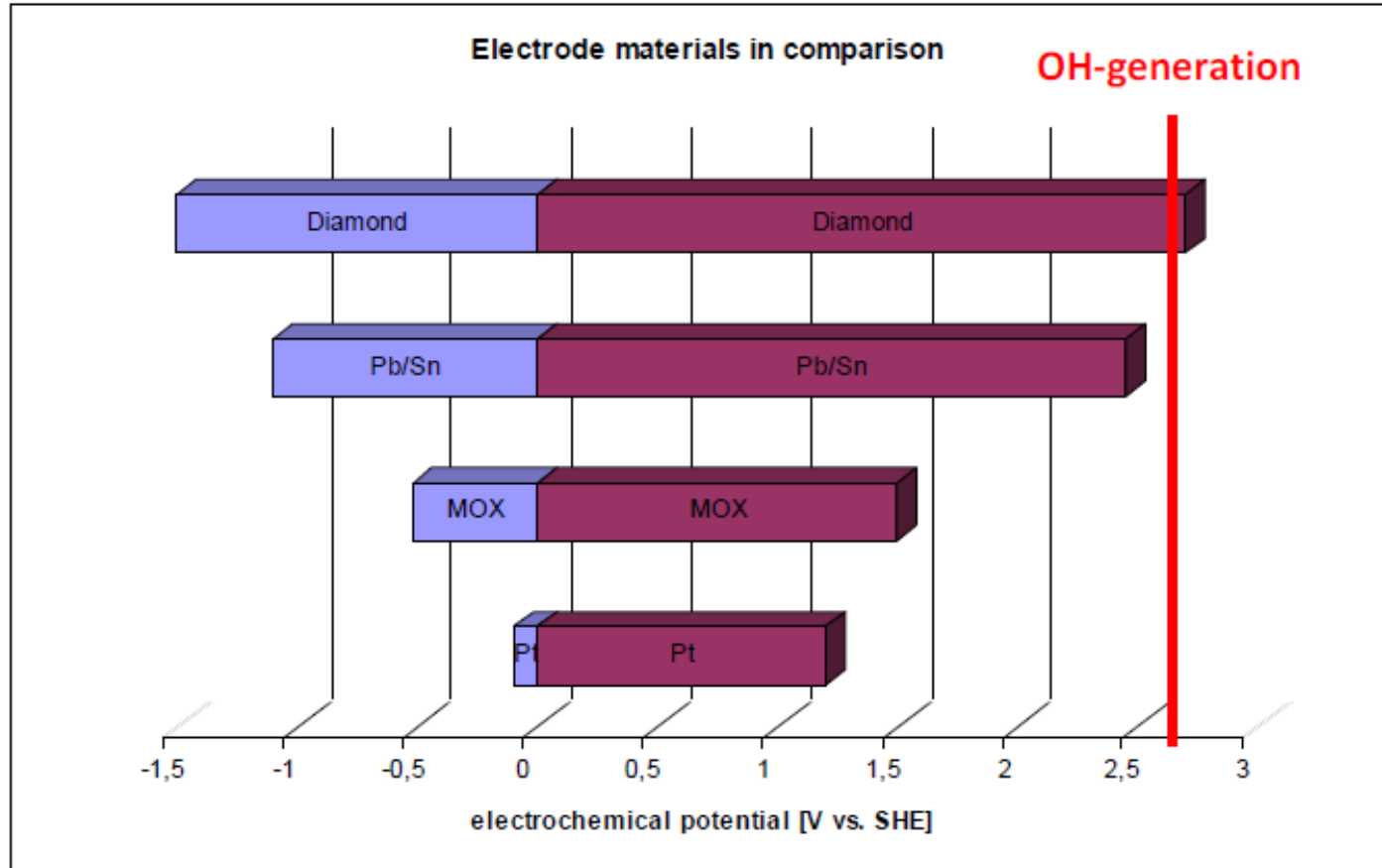
Rening av förorenat vatten
Nedbrytning och oxidation av
en majoritet av föroreningar



Desinfektion av vatten
Dödar virus och bakterier direkt på
ytan men också av skapade radikaler

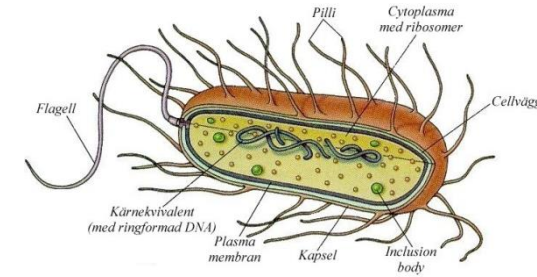
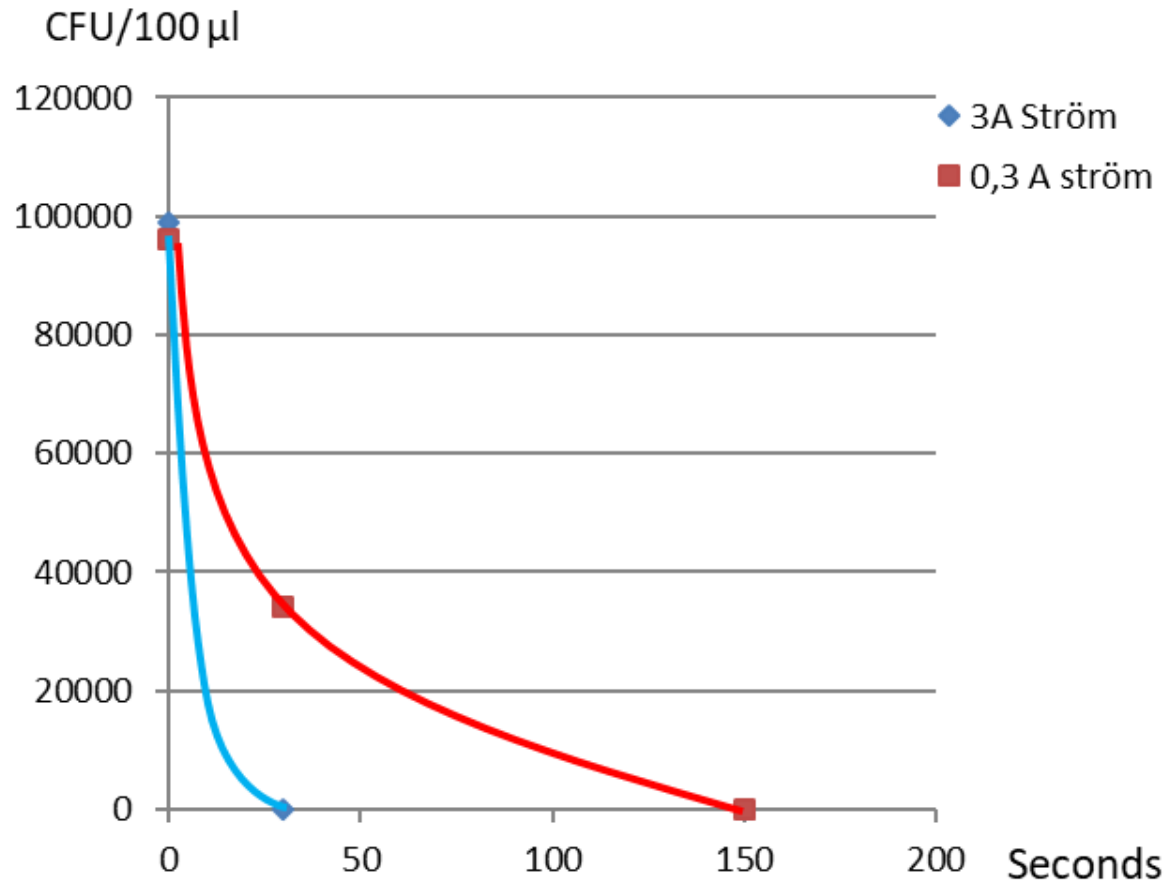


Electrochemical potential



substance	formation potential [V]
Hydroxyl radical (H ₂ O/OH [·])	2,80
Ozone (O ₃)	2,07
Peroxodisulfate (SO ₄ ²⁻ /S ₂ O ₈ ²⁻)	2,01
Hydrogen Peroxide (H ₂ O/H ₂ O ₂)	1,77

E. coli desinfektion



E. coli i vatten med 0.1%NaCl

Time (s)	CFU 3A	CFU 0,3A
0	99000	96000
30	50	34200
150	0	7
750	0	0

Obs Inga CFU kunde detekteras efter 150 s eller 750 s. Dvs ingen "svans" avd överlevare . Test gjorda på SLU Uppsala

ND FC Lab1000 – flödescell med diamantelektroder

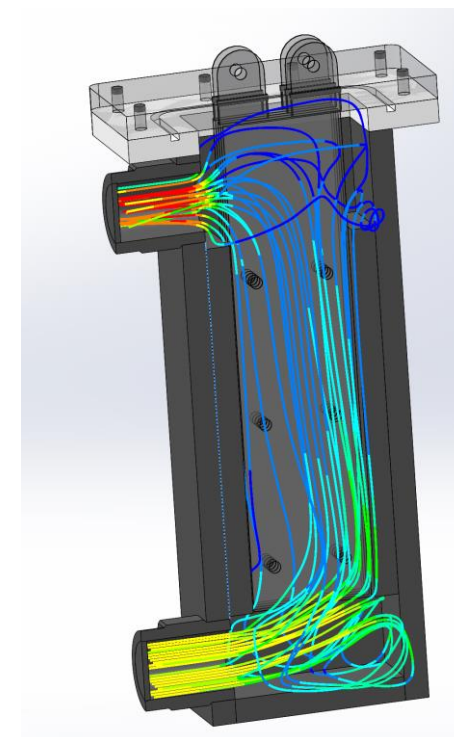


Egenskaper

Flödescell med bordopade diamantelektroder för vattenrening och desinficering av vatten. Cellen skapar extremt starkt oxiderande radikaler som bryter ner/oxiderar kemikalier/bakterier. Denna cell är helt fri från fluor för att kunna användas för studier av PFAx nedbrytning.

Modell Lab FC 1000

Max ström	60 A
Max spänning	24 V
Max temperatur	50°C
Max tryck	1 Bar
Material	PVC, Niob, Rostfritt stål, Silikon
Anodarea	10 dm ²
Anslutning	G ³ / ₄ " (R20) invändig gänga
Dimension	280x132x120 mm
Flöde	Rekommenderat ca 2-6 l/min (beroende på användningsområde)

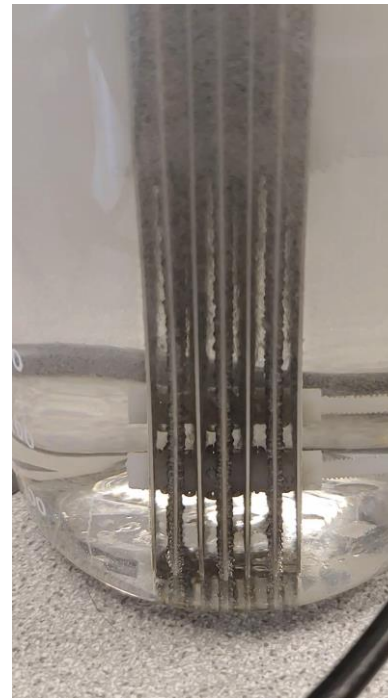


In real life.....

Första stora flödecellen för
lakvattenrening



Elektroder sitter
parallellt

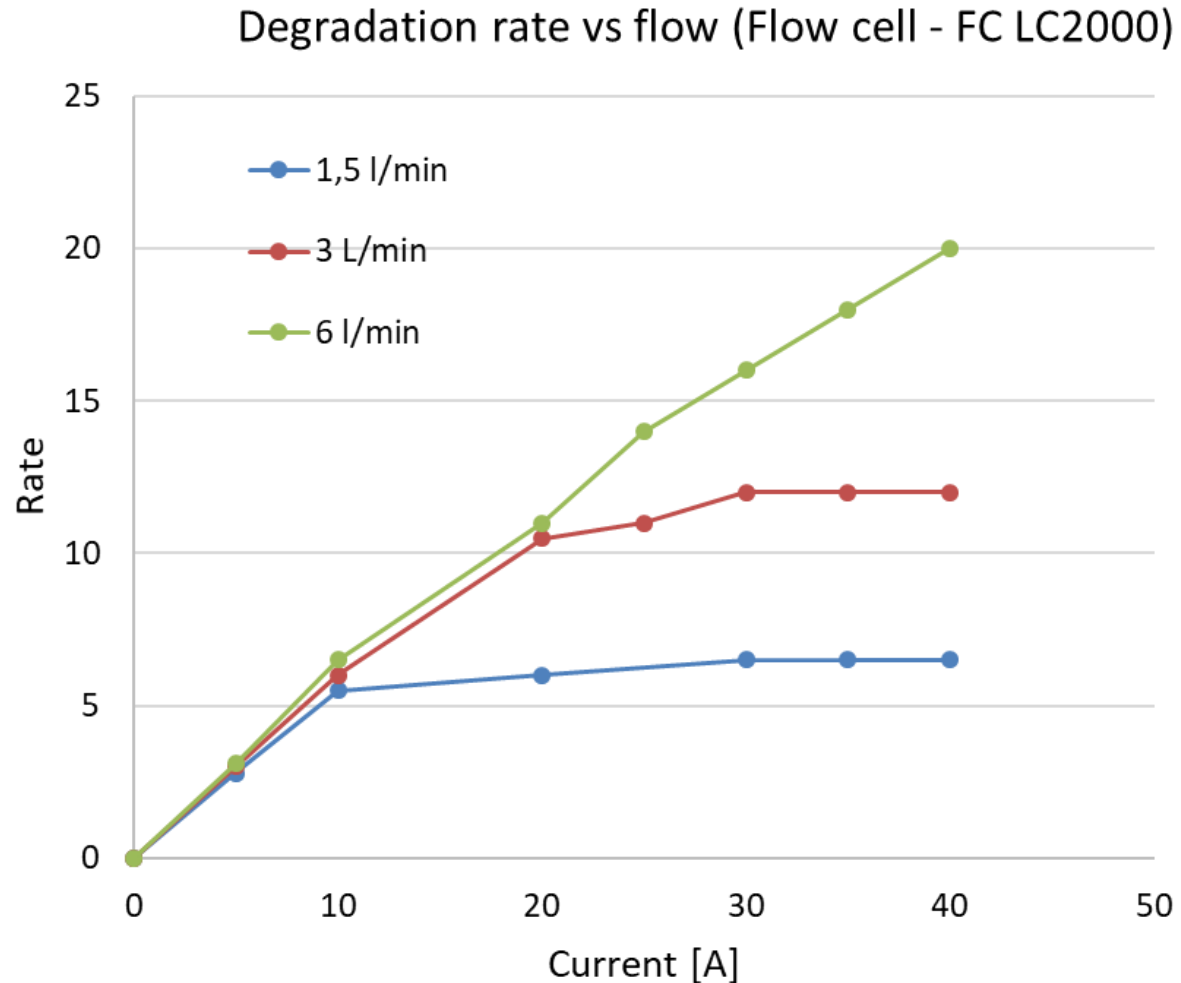


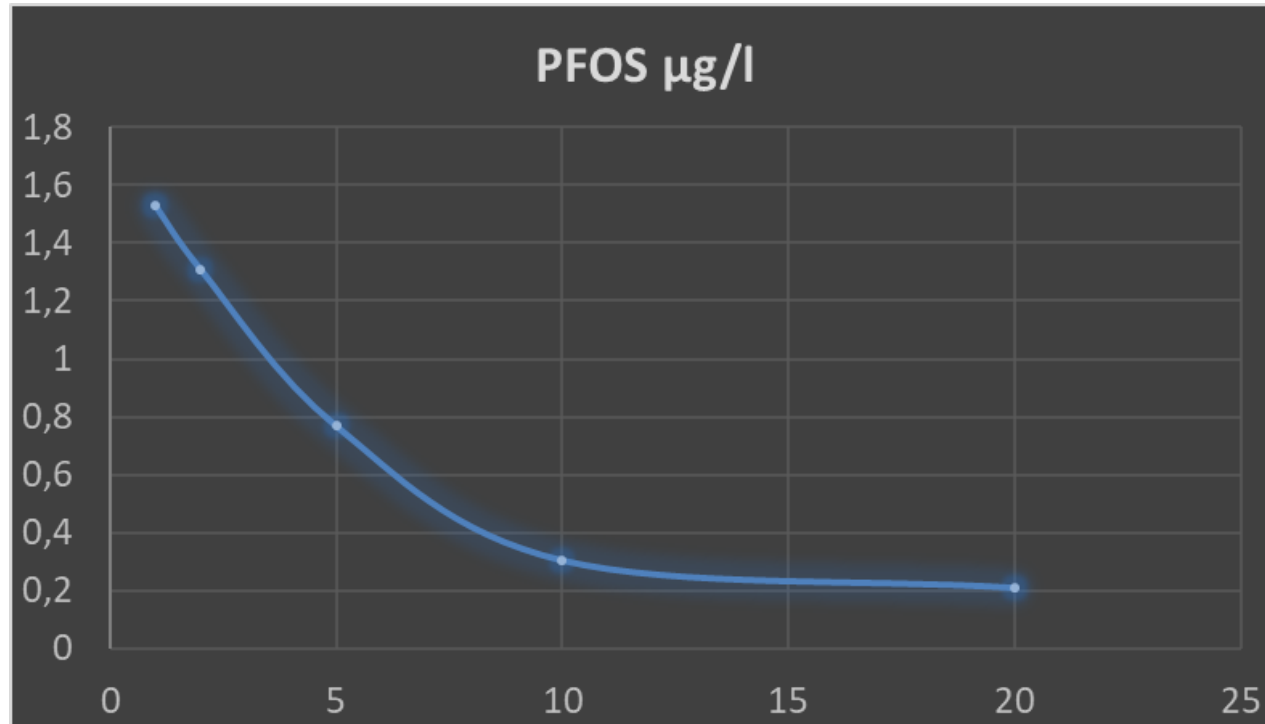
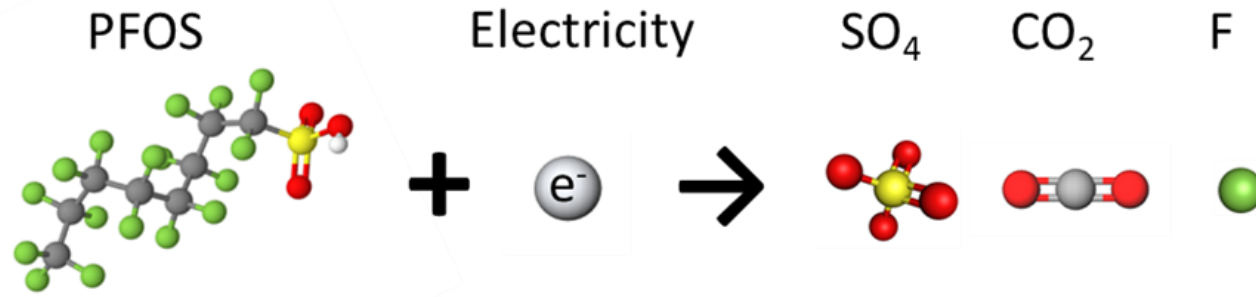
Grävatten
Typisk "före och
efter" rening



Measured limitations for degradation rate

- Note that this values change with concentration -



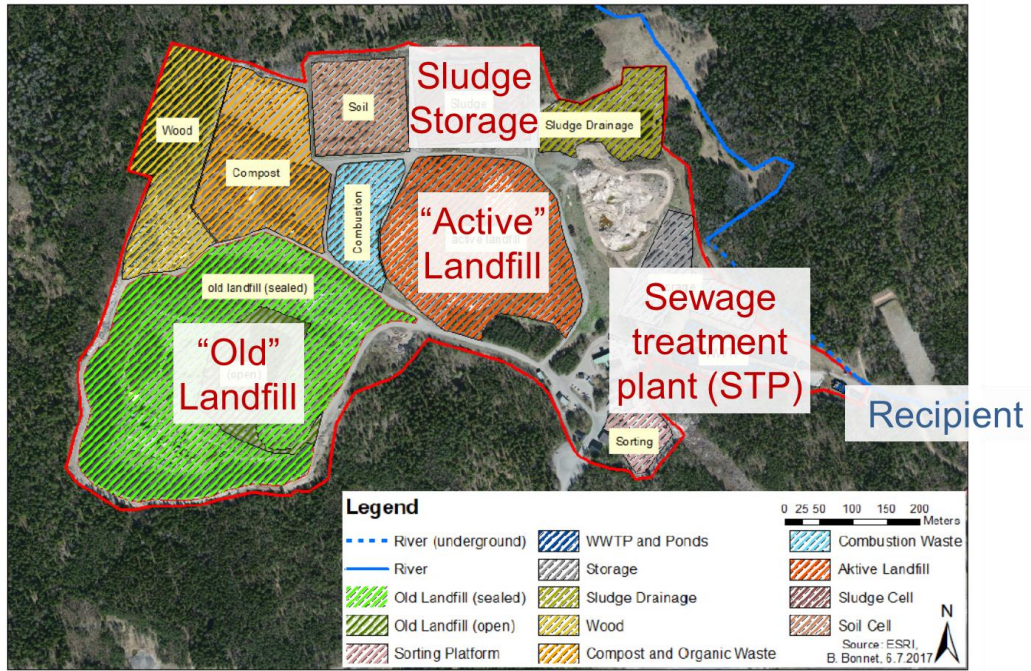


Case Studies using Electrochemical Oxidation for PFAS Degradation

LIFE SOuRCE – PFAS Treatment of Groundwater (2021-2025)



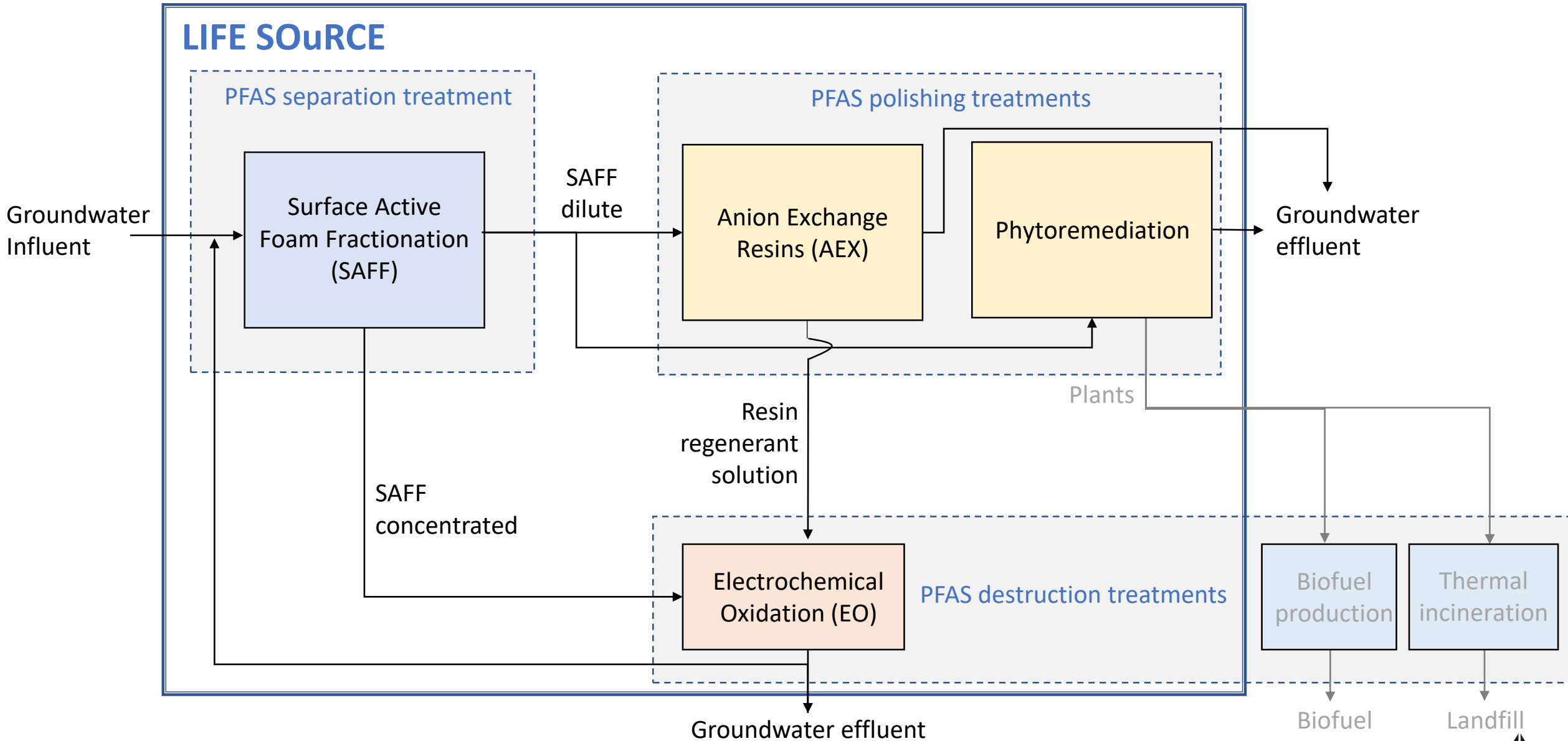
Landfill, Sweden

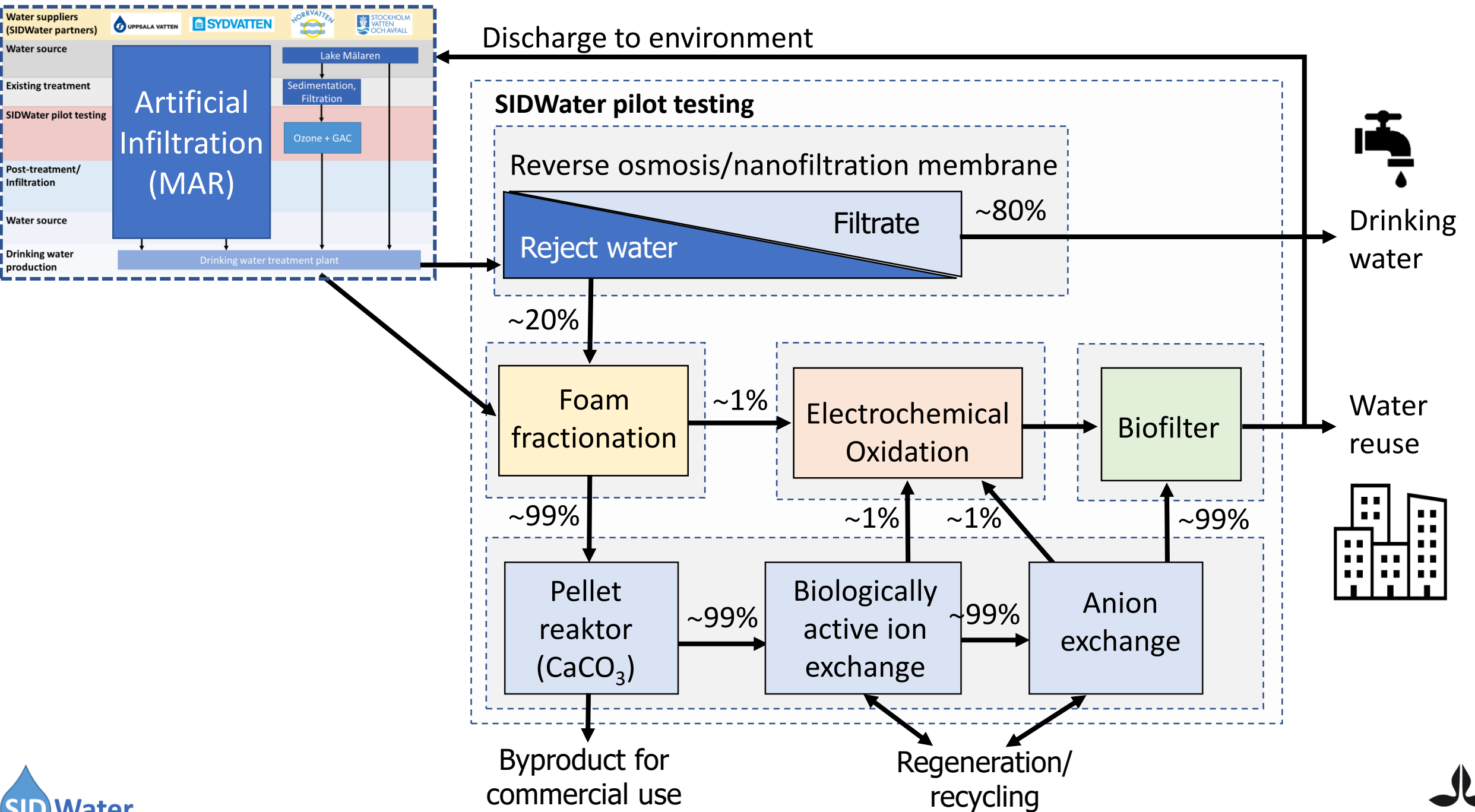


Industrial site, Spain



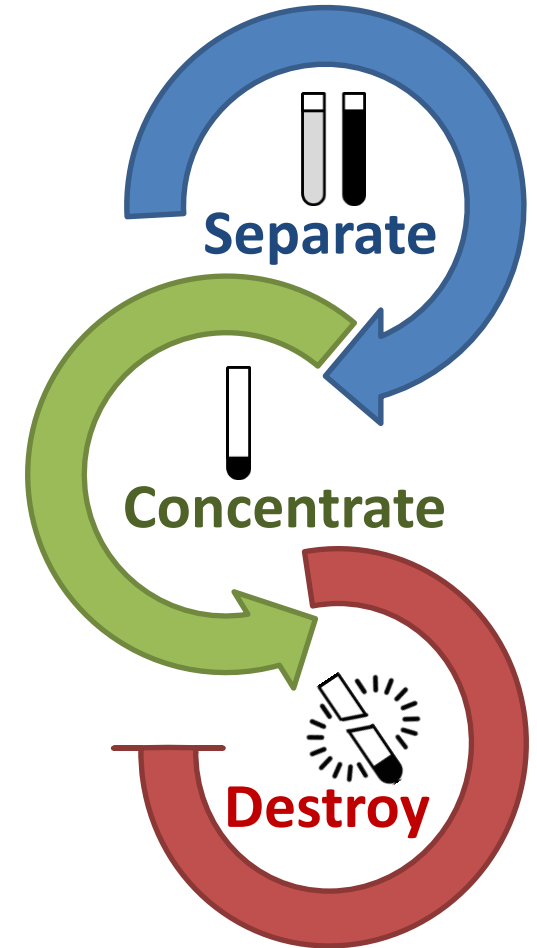
LIFE SOuRCE – PFAS Treatment of Groundwater





Take Home Message

- ❖ Each treatment technique has their **advantage** and **disadvantage**, so **combination of different treatment techniques is often the best solution**





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Thank you!
Tack!
¡Gracias!

