

Full destruction of short and long chain PFAS with PFAS Destruct™



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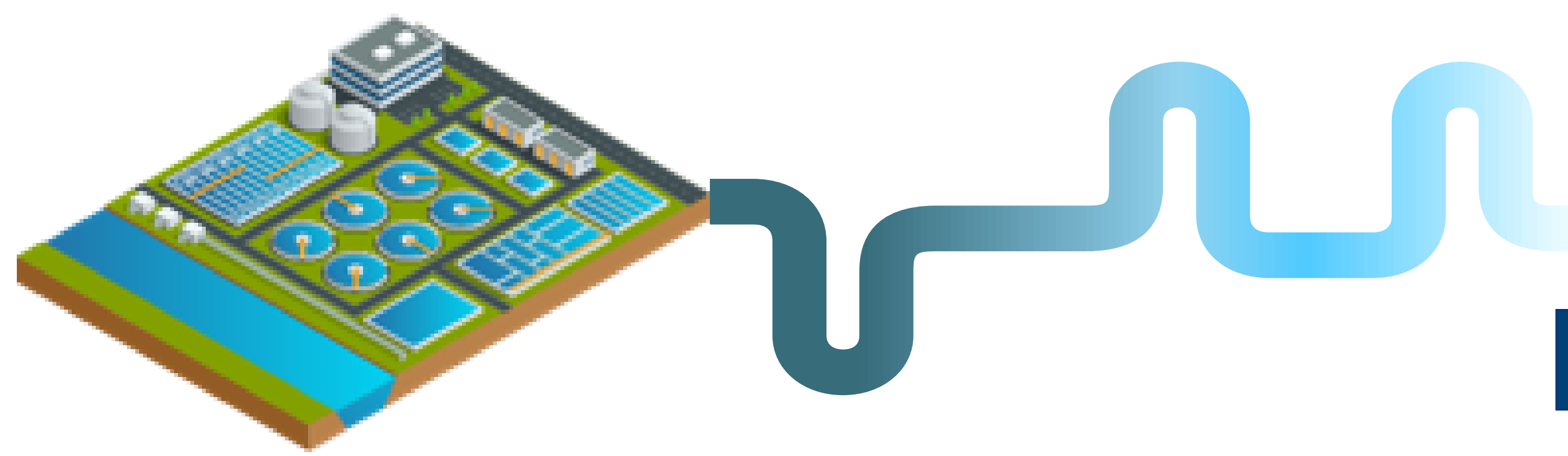
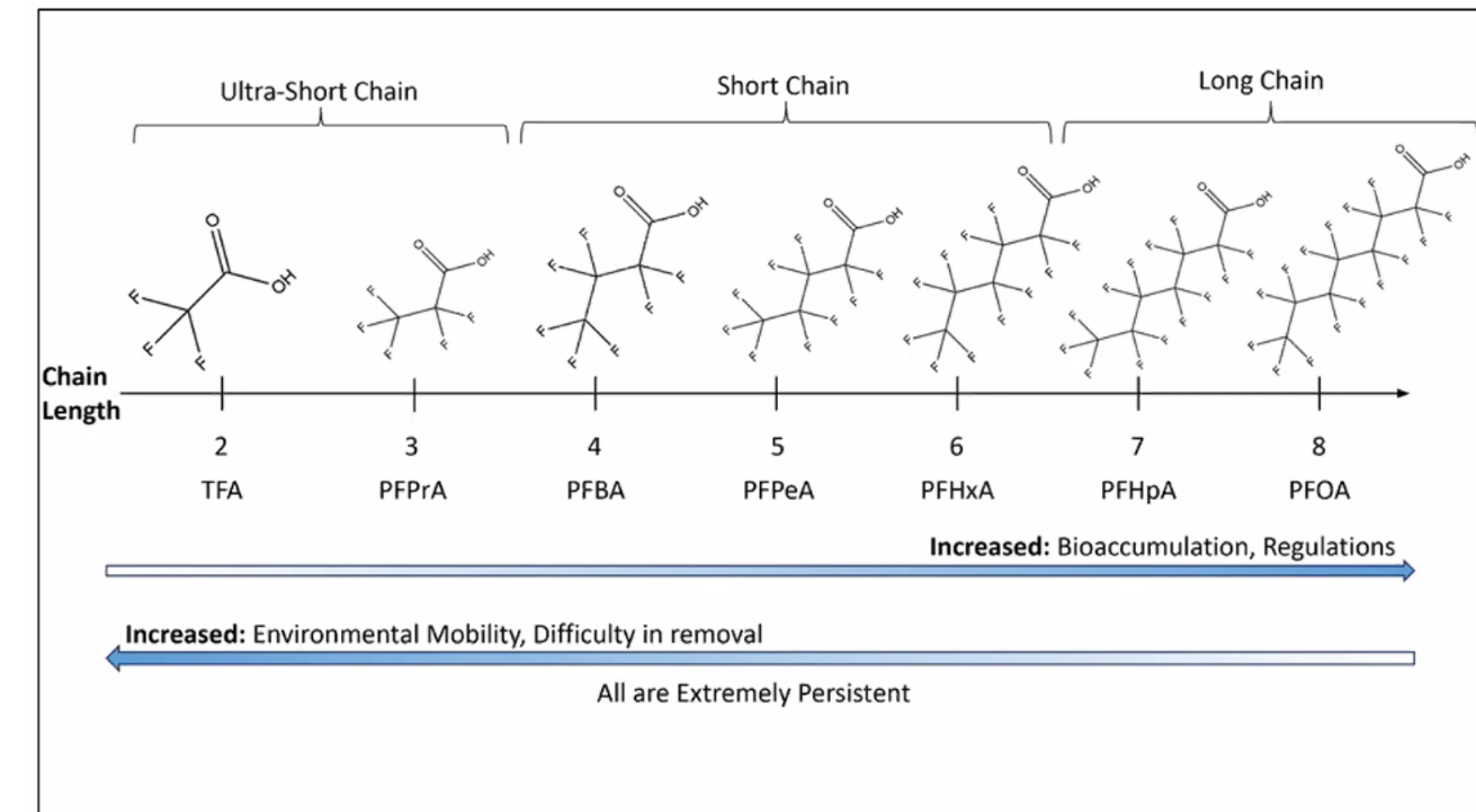
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The PFAS Challenge: Concentration + Destruction = Complete solution

PFAS (poly- and perfluoroalkyl substances) are over 9.000 synthetic chemicals with strong carbon-fluorine bonds. They pose a significant environmental and health risk due to their persistence and toxicity. Especially the short chain ones (with <6 carbon atoms) are particularly hard to be removed.



Choice of technology depends on:

- Chain length and initial PFAS concentration
- Water matrix
- Targeted effluent quality



PFAS Ion Exchange



Reverse Osmosis
NMS-RO



Foam fractionation

Next to conventional Activated Carbon and (single use) Ion Exchange, NSI offers a comprehensive portfolio of concentration technologies:

- **Ion exchange (regenerable):** Concentrates short chain PFAS in a very small volume
- **Reverse Osmosis:** Effective and compact solution to concentrate PFAS both long and short chain
- **PFAS FoamFrac™:** Selective concentration of PFAS through the adsorption at the air-liquid interface of bubbles. Works well for mid and long chain PFAS, as concentration step.

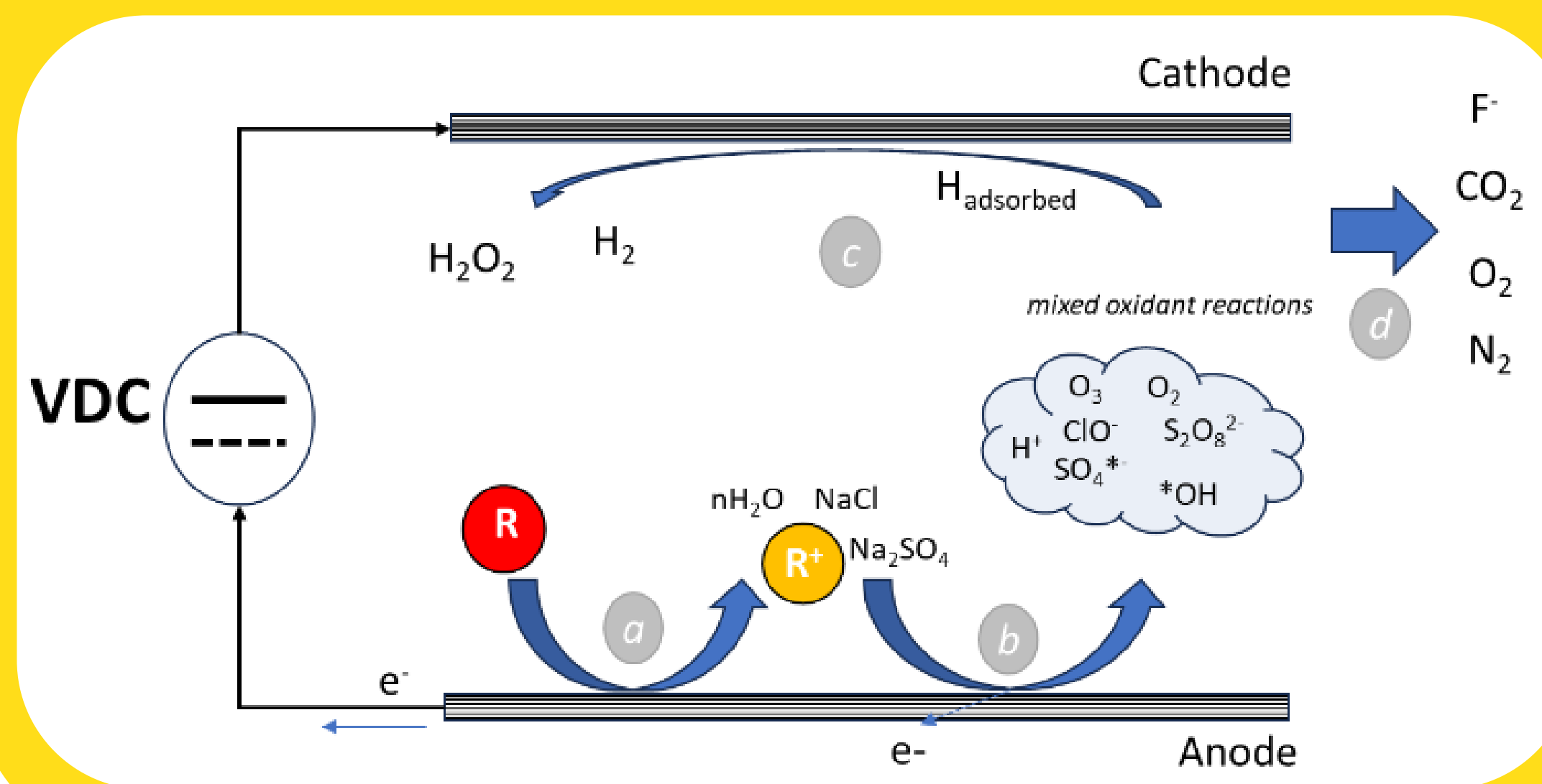
PFAS FoamFrac™ highlights:

- Whole reactor under vacuum which enhances gas- liquid reactions and process reliability
- Can be constructed in one or several stages in series to increase the concentration factor from 200 up to 1000+ times



PFAS Destruct™ highlights:

Proven (TRL 9) technology which applies an electrical current to electrodes submerged in the contaminated effluent generating reactive species that break down the strong fluorine bonds in PFAS.



- a **Direct Oxidation** at the anode surface
- b **Indirect Oxidation** through generation of mixed oxidants.
- c **Reduction on cathode** completes redox reaction, contaminants undergo repeated cycles for continued degradation
- d **Completely mineralized organics** enables water discharge or reuse

Typical PFAS Treatment train



Energy requirement: 0,2 to 0,6 kWh/m³

TOTEX (10 year) range: 0,6 to 1,2 €/m³ for a 2000 m³/h plant with a 500x concentration factor

Results PFAS references

PFAS Compound	Carbon #	Industrial Wastewater	Landfill Leachate RO Concentrate	Landfill Leachate Foamate	AFFF Wastewater	IX Regenerate Brine Water	Ground Water SAFF Foamate	Ground Water RO Reject	Industrial Foamate	Semiconductor Water
n-Ethyl perfluorooctanesulfonamidoacetic acid	C12	-	-	99.989%	-	-	-	-	N.D.	-
Perfluorododecanoic acid	C12	-	-	99.900%	-	-	-	-	N.D.	N.D.
n-Methyl perfluorooctanesulfonamidoacetic acid	C11	-	-	99.987%	-	-	-	-	N.D.	-
n-Methyl perfluorooctanesulfonamidoethanol	C11	-	-	-	-	-	-	-	-	-
Perfluoroundecanoic Acid	C11	-	-	99.962%	99.563%	-	-	-	99.640%	N.D.
8:2 Fluorotelomer sulfonic acid	C10	N.D.	-	99.992%	88.067%	-	-	-	96.809%	N.D.
Perfluorodecanoic acid	C10	-	-	99.993%	-	-	N.D.	N.D.	N.D.	N.D.
Perfluorononanoic acid	C9	-	-	99.998%	99.992%	99.444%	N.D.	N.D.	N.D.	N.D.
Perfluorooctanesulfonic acid	C8	99.996%	N.D.	99.973%	99.995%	N.D.	99.9999%	N.D.	97.610%	92.668%
Perfluorooctanoic acid	C8	-	N.D.	99.997%	99.995%	99.965%	99.9997%	N.D.	99.908%	N.D.
6:2 Fluorotelomer sulfonic acid	C8	99.998%	-	99.997%	99.921%	99.730%	-	N.D.	99.304%	N.D.
Perfluorooctanesulfonamide	C8	-	-	99.027%	-	N.D.	-	-	99.704%	N.D.
Perfluoroheptanoic acid	C7	N.D.	N.D.	99.975%	99.986%	99.960%	N.D.	N.D.	N.D.	N.D.
Perfluoroheptanesulfonic acid	C7	N.D.	-	N.D.	99.991%	N.D.	N.D.	N.D.	N.D.	N.D.
4:2 Fluorotelomer sulfonic acid	C6	N.D.	-	-	99.286%	N.D.	-	-	-	-
Perfluorohexanoic acid	C6	99.993%	N.D.	99.893%	99.987%	99.972%	N.D.	N.D.	N.D.	N.D.
Perfluorohexanesulfonic acid	C6	N.D.	N.D.	99.973%	99.999%	99.995%	N.D.	N.D.	99.971%	N.D.
GenX	C6	-	-	-	-	N.D.	-	-	N.D.	-
Perfluoropentanoic acid	C5	-	N.D.	99.945%	99.939%	99.936%	N.D.	N.D.	N.D.	N.D.
Perfluoropentanesulfonic acid	C5	-	-	-	99.998%	N.D.	-	N.D.	N.D.	N.D.
Perfluorobutanesulfonic acid	C4	99.997%	93.049%	-	99.979%	95.596%	-	93.06%	88.549%	N.D.
Perfluorobutanoic Acid	C4	-	N.D.	-	99.296%	99.964%	N.D.	N.D.	N.D.	N.D.
2,3,3,3-tetrafluoropropanoic Acid	C3	-	-	-	-	97.059%	-	-	-	-
Perfluoropropionic acid	C3	-	-	-	-	99.841%	-	-	-	-
Trifluoroacetic acid	C2	-	-	-	-	96.325%	-	-	-	-
Total Influent Targeted PFAS (ng/L)		73,340,000	114,000	1,495,000	10,600,000	375,000,000	6,040,000	128,000	189,000	1,300
Influent Total Organic Carbon (mg/L)		230	3,200	1,600	700	4,500	20	3,190	392	5