PESTICIDES AND TFA IN DANISH GROUNDWATER

DEN 30. OKTOBER 2025

DORTE SKRÆM, DISCIPLINE LEAD, DRINKING WATER

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6 SUBSTANCES

33 PRODUCTS

28,2 % OF USE

FLUAZINAM

FLUOPYRAM

DIFLUFENICAN

MEFENTRIFLUCONAZOL

TAU-FLUVANILAT

FLONICAMID

SWIFT ACTION

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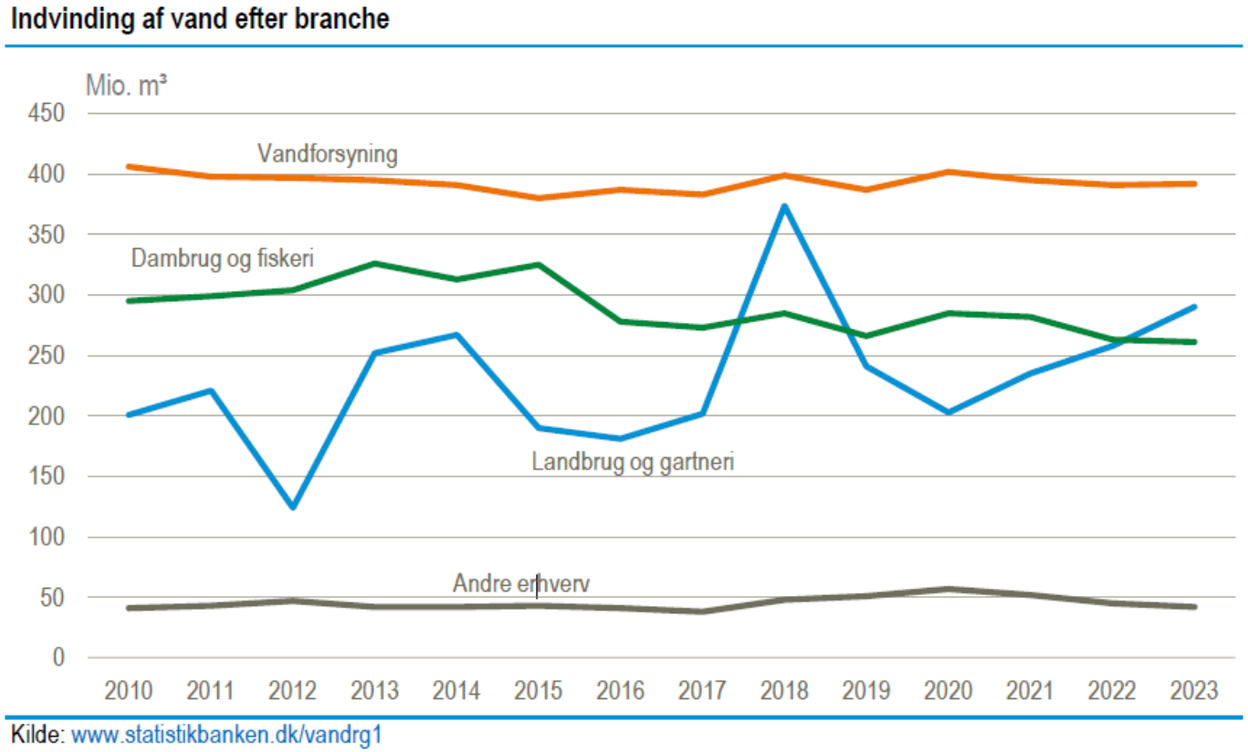
Danish Water Supply

- 2700 puplic water supplies
- 9100 wells
- 392 mio. m3 abstracted water
- 6 mio. people
- >50% of all wells affected by pesticides
- 50% of analyzed wells affected by TFA

- 60 % Farmland
- 5 % Needed for groundwater protection



- DK water supply 99,9 Groundwater based
- Simple water treatment – aeration and filtration as a rule

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All is well in Danish Drinking water
We are in control

Then came 2017 – more pesticides and metabolites
Then came PFAS
Then came TFA
And now they are combined

OUR BIGGEST FEARS

PMT SUBSTANCES

VPVMVT

???

LISTEN CAREFULLY.....

We will exceed the limits eventually without action..

We measure less than 1% of PFAS in the environment through targeted analysis

PFAS intake through food is exceeding EFSA recommended levels

TFA in rainwater has increased fivefold over the past 20 years in Germany

If PFAS use continues unabated, the drinking water sector will face an annual increase of €18 billion in treatment costs

Solutions may cause even higher costs, require 20% more abstracted water, be very energy intensive and create a waste (brine) that is very difficult to dispose of. It results in a chemically pure, demineralised water product that needs to be re-mineralised to meet drinking water standards. None of these solutions destroy the PFAS molecules.

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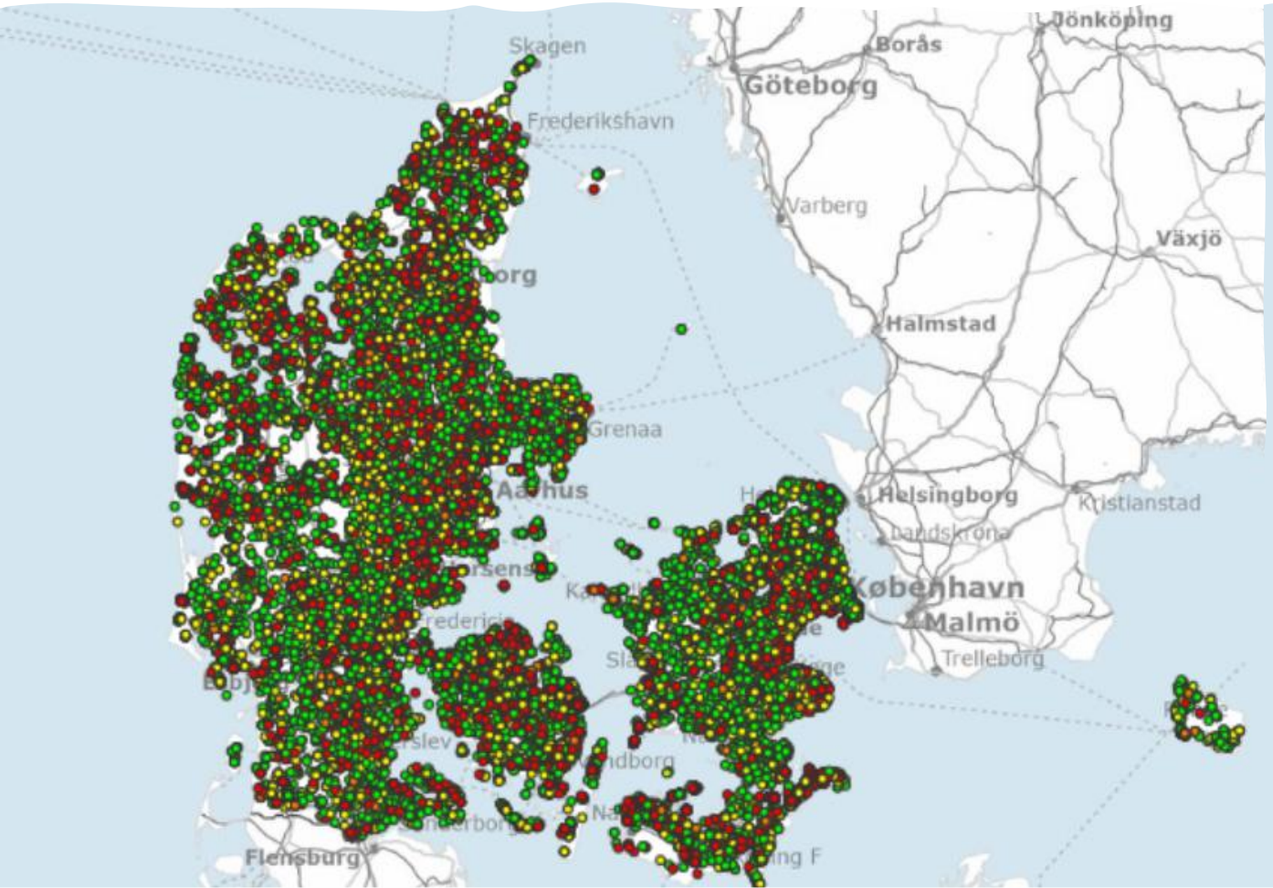
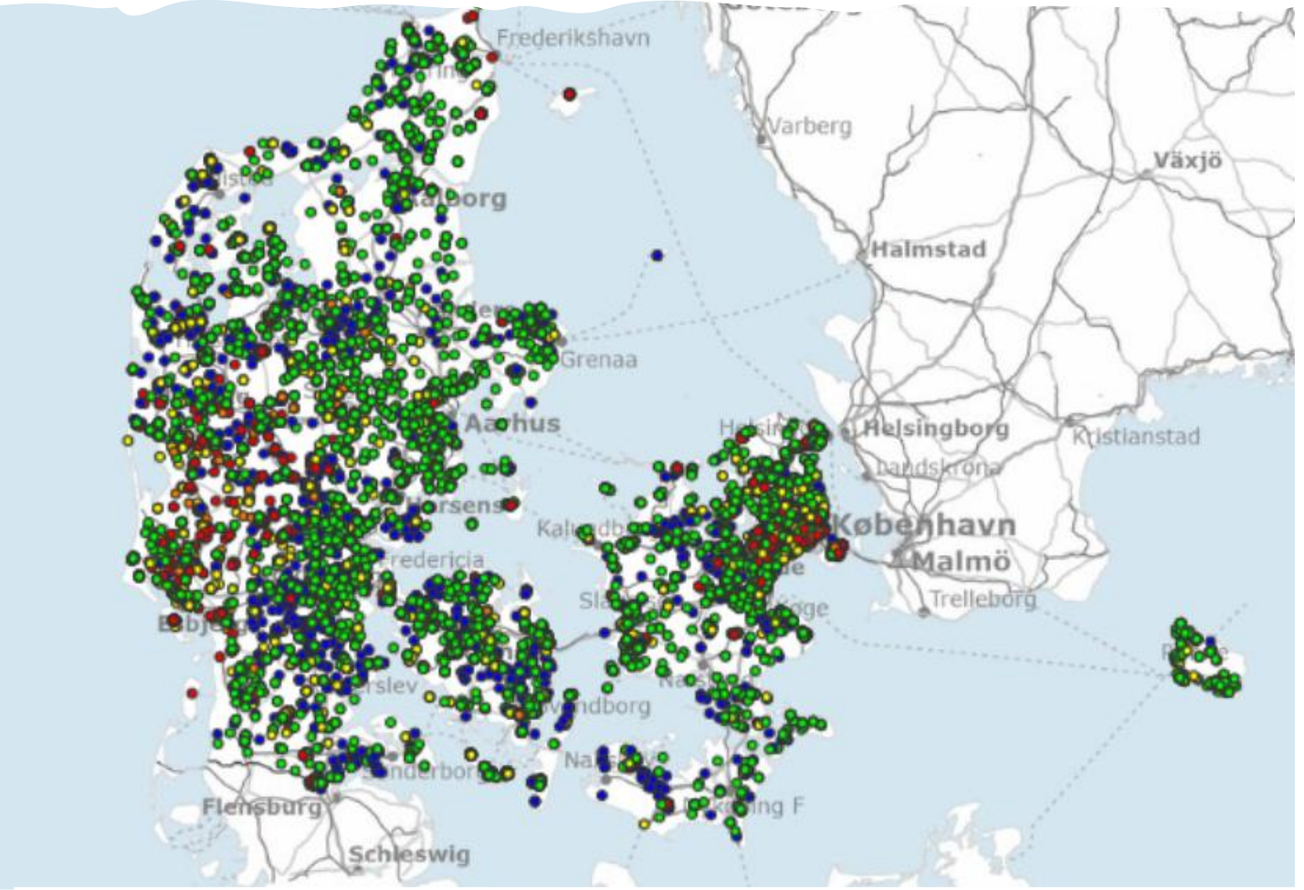
Pesticides

All wells

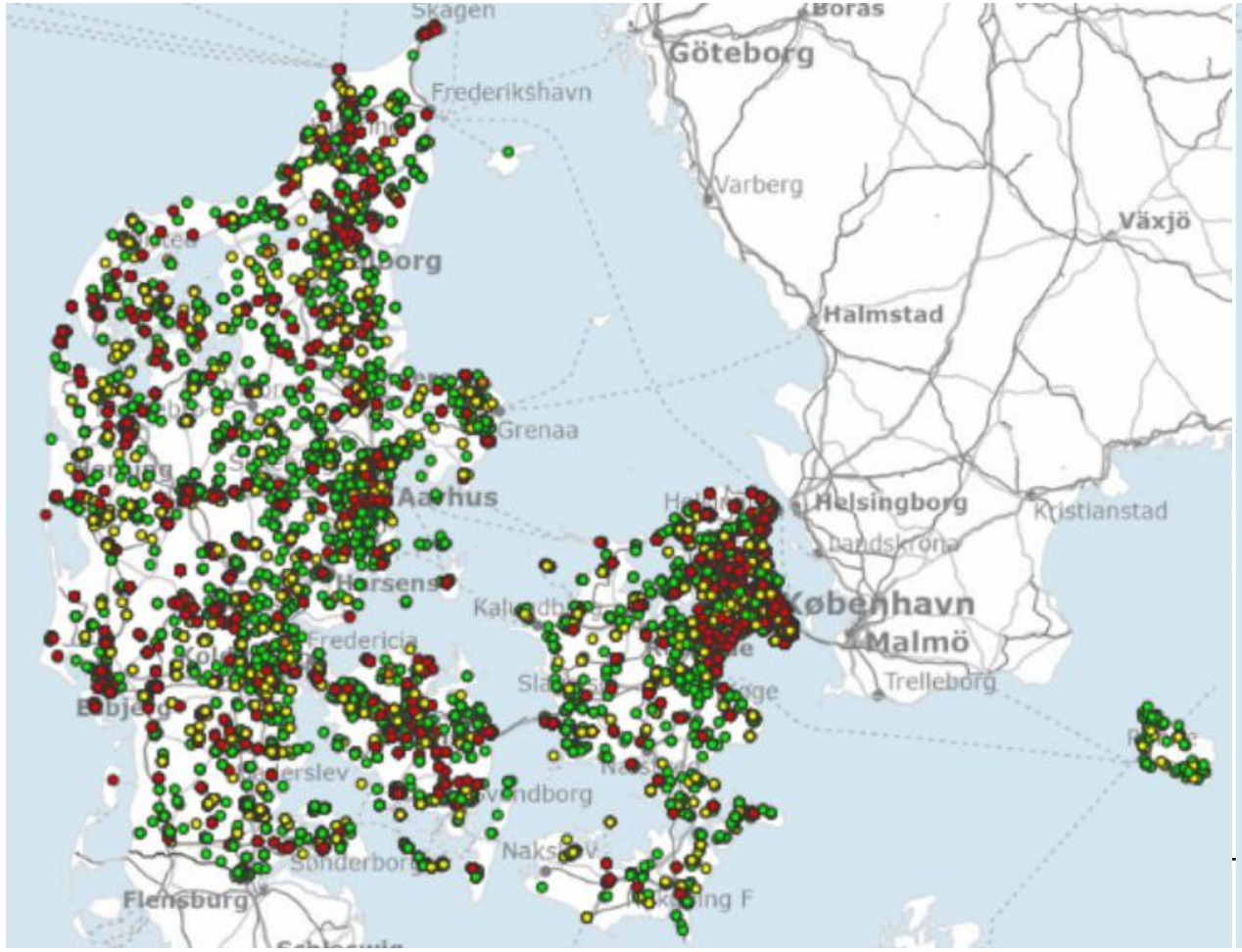


Water supply only



PFAS findings in DK (0,1 ug/l)

All wells



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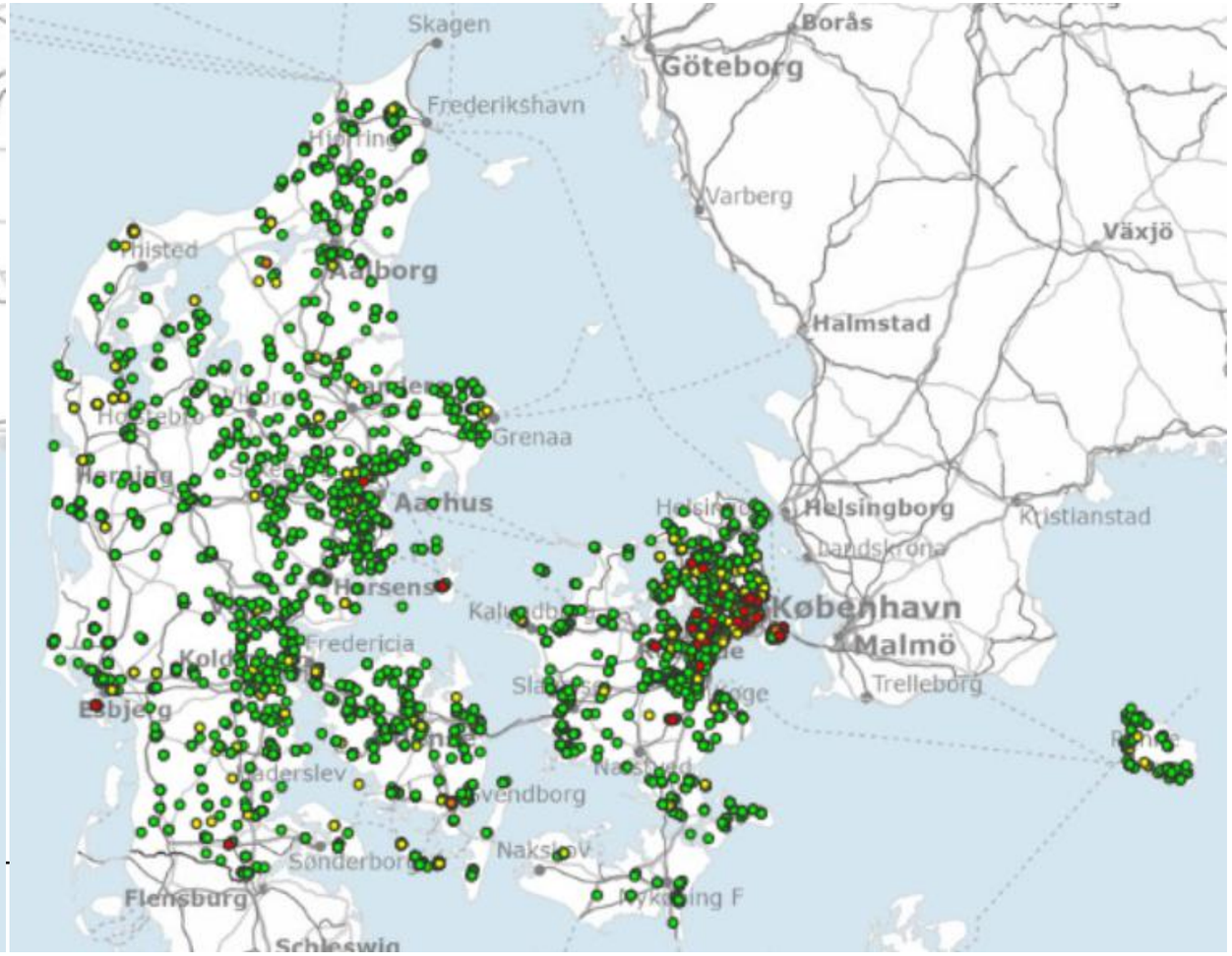
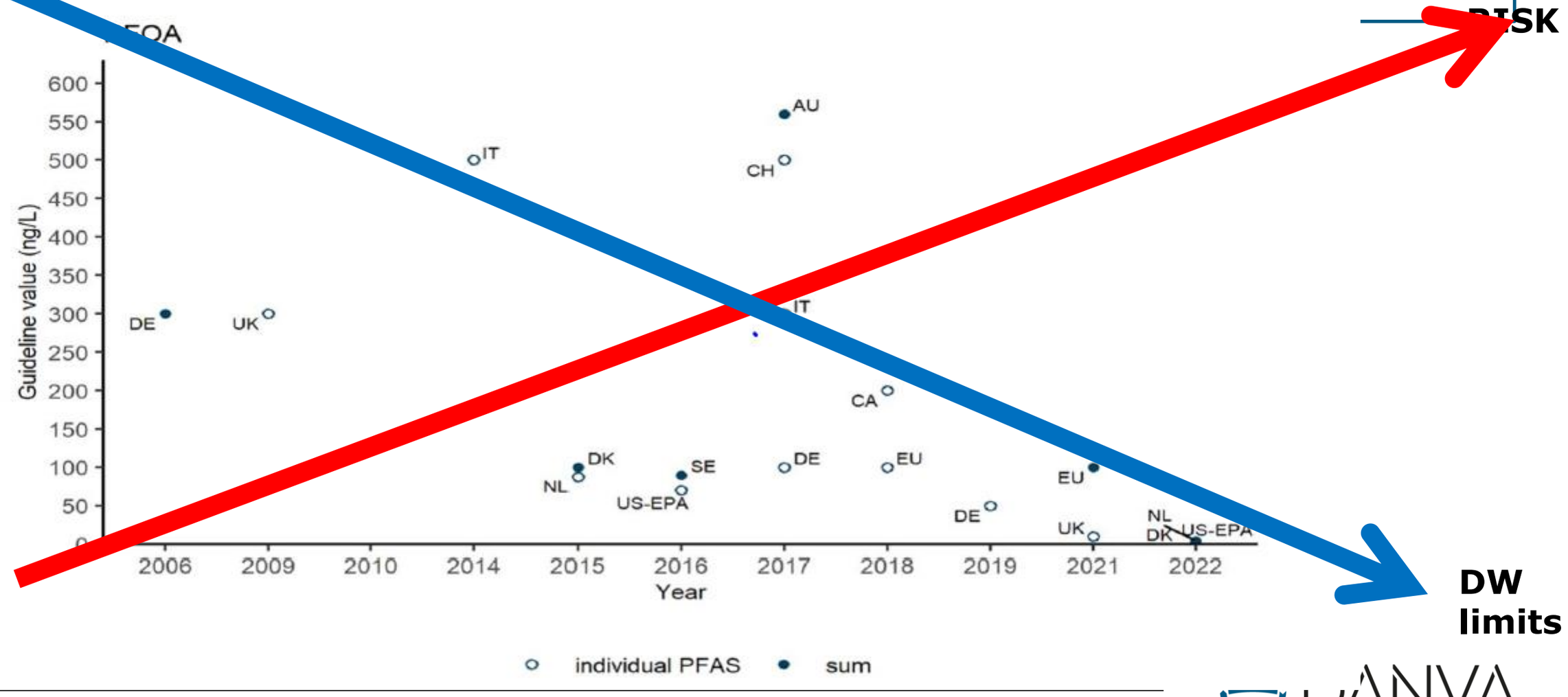
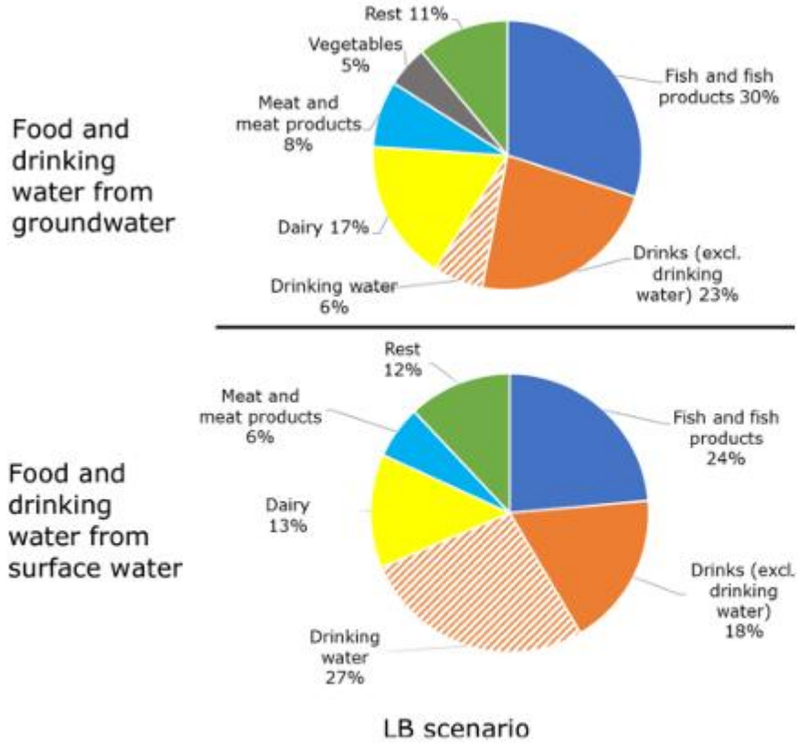
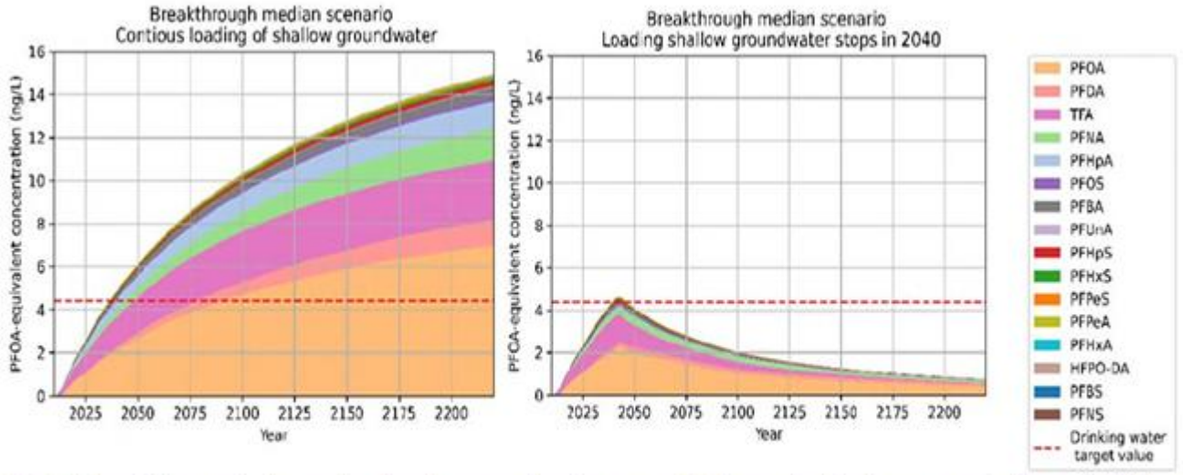


PFAS increased human risk affects drinking water limits



PFAS –The Netherlands





PFAS breakthrough in extracted groundwater as PFOA-equivalent concentration (PEQ) with continuous loading of the shallow groundwater (left) and stopping the load in 2040 as a result of a PFAS ban in 2025.[10]

Example from the Netherlands: *Percentage contribution of drinking water and food groups that contributed to the long-term summed exposure to PFAS, expressed in PFOA equivalents for the Dutch consumer aged 1-79 years.*[1]

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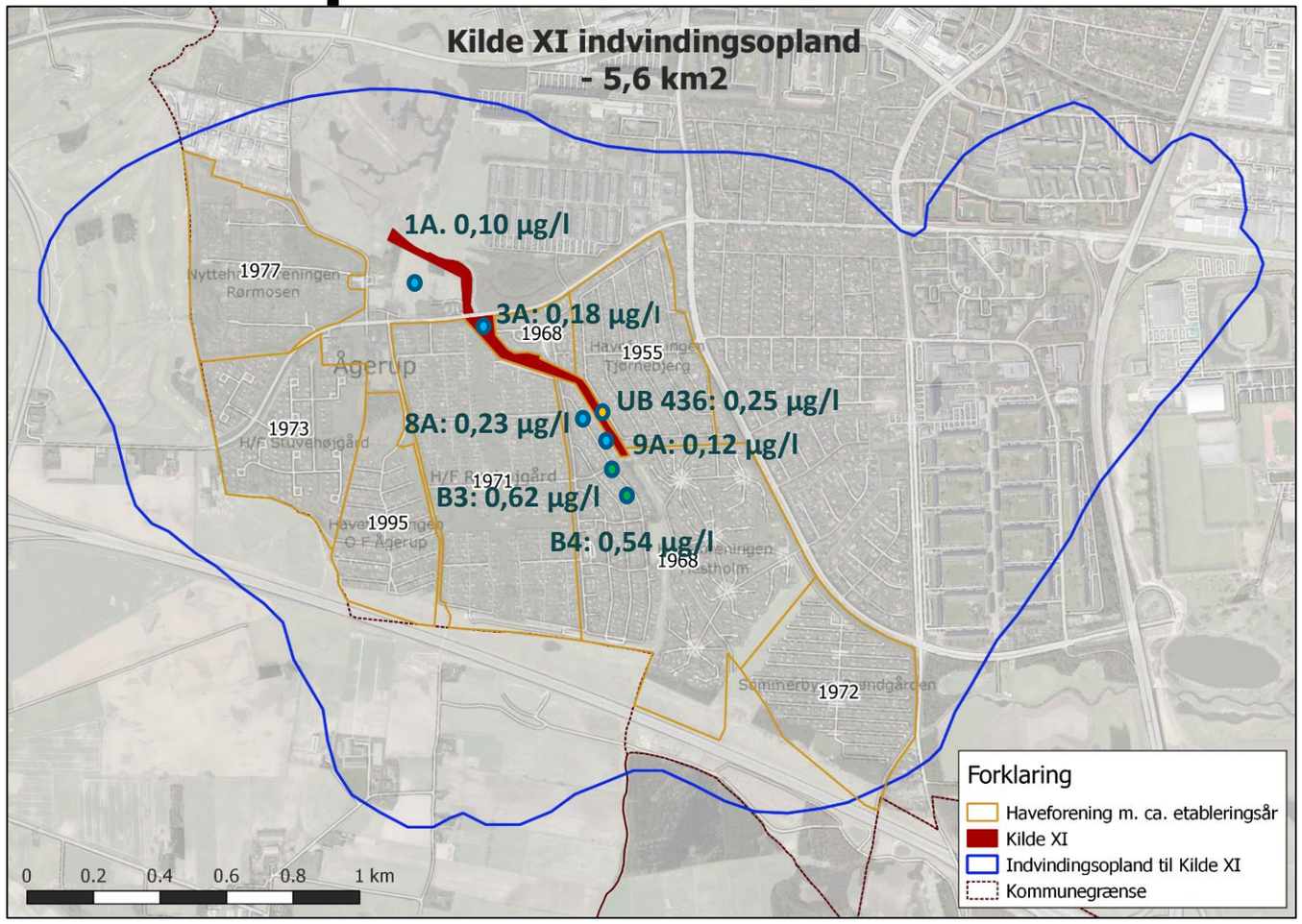
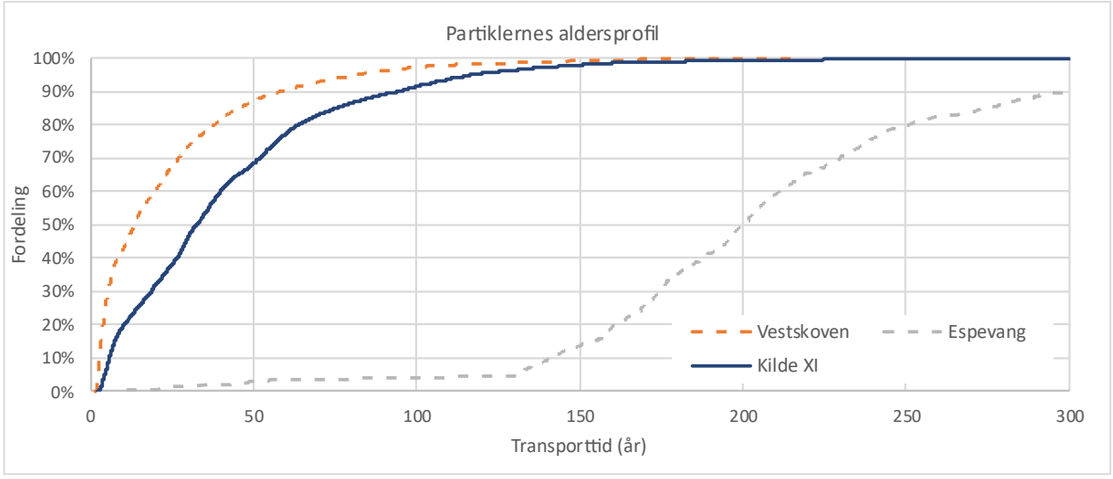
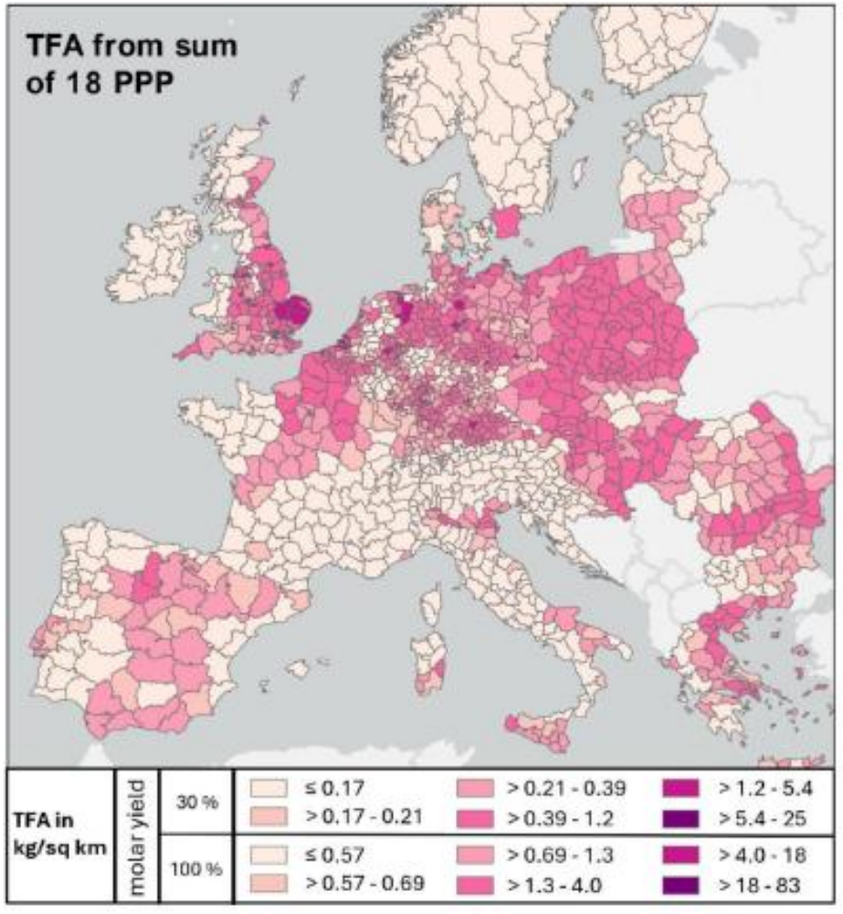
TFA from the atmosphere – Scenarios for future impact on groundwater - Modelled for HOFOR's source site”Kilde XI” i Ballerup Kommune



DGU nr.	Boring	Indtag dybde (m)	Tri-He-alder (år)	TFA (µg/l)
200.4915	1A	20-120	-	0,10
200.4916	3A	21-70	-	0,18
200.3870	8A	16-44	-	0,23
200.3871	9A	15-76	-	0,12
200. 171	UB 436	14,9-15,9	15	0,25
200. 5733	B3	5,15-10,15	<5	0,62
200. 5732	B4	5,9-10,9	<5	0,54

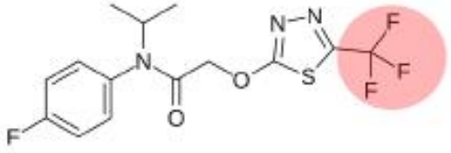


/Christian Nyrop Albers et al.: "Trifluoroacetic acid (TFA) from the atmosphere - Past source strength and scenarios for future impact on groundwater". The memo is expected to be published on GEUS' website in December 2025/

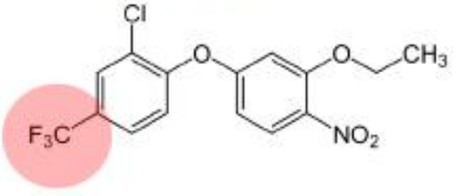


Major precursors:

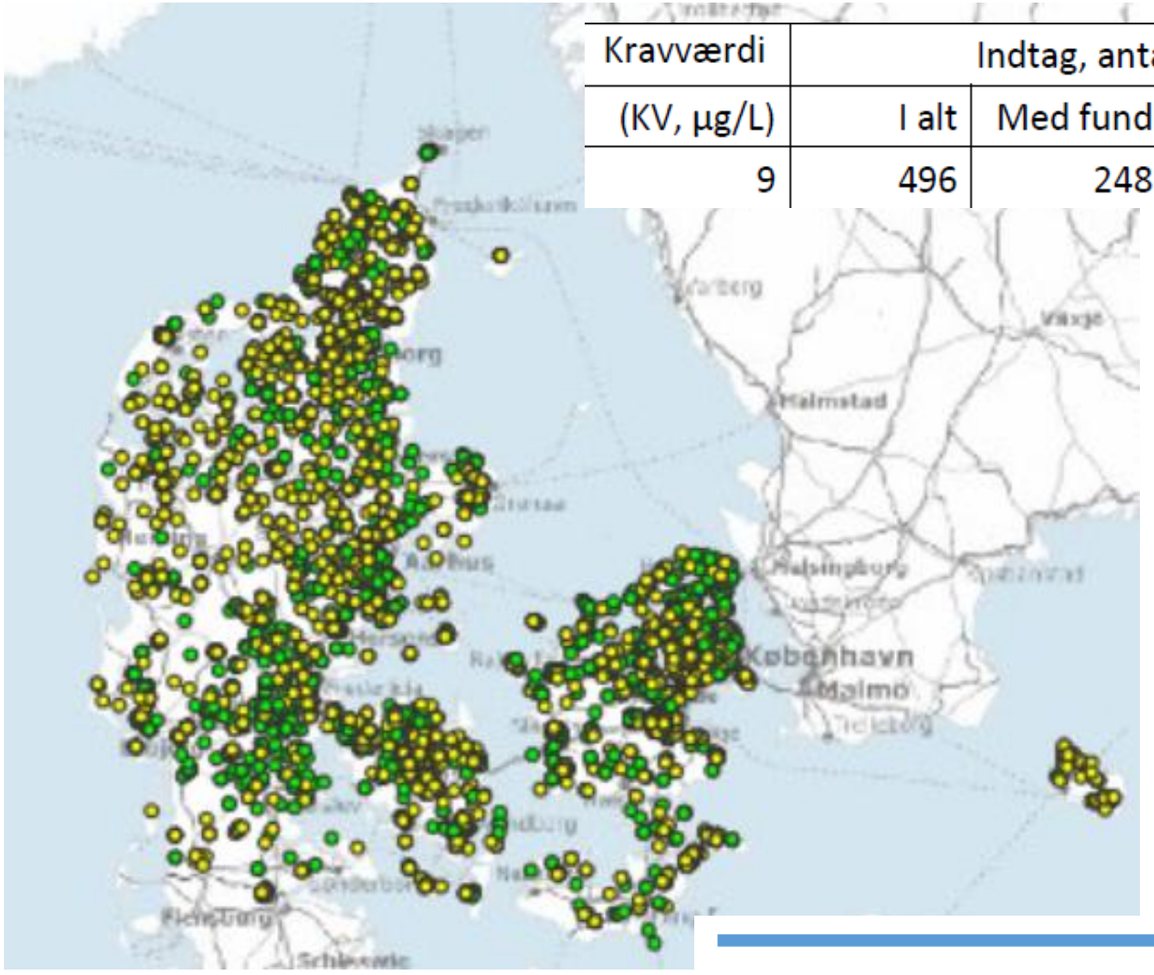
flufenacet



oxyfluorfen



Joerss et al. (2024) *Environment International*, *193*, 109061.



Kravværdi	Indtag, antal	
(KV, µg/L)	I alt	Med fund
9	496	248

0,34 ug/L TFA(GER)
0,07-0,1100 ug TFA/L(S)

TFA in rainwater has increased fivefold over the past 20 years in Germany

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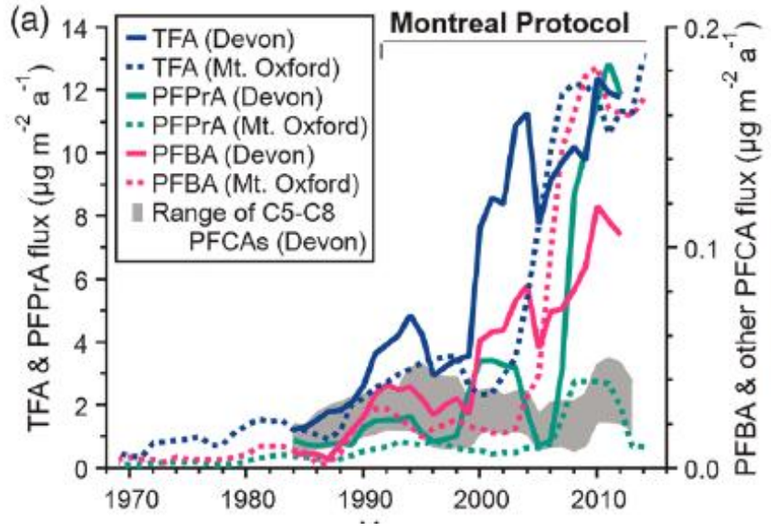
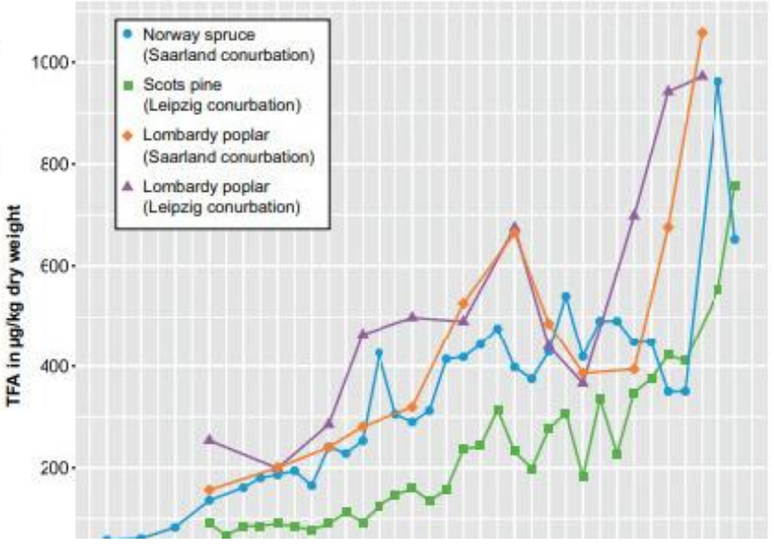
TFA

TFA is accumulating everywhere, largely coinciding with F-gas use following the Montreal Protocol

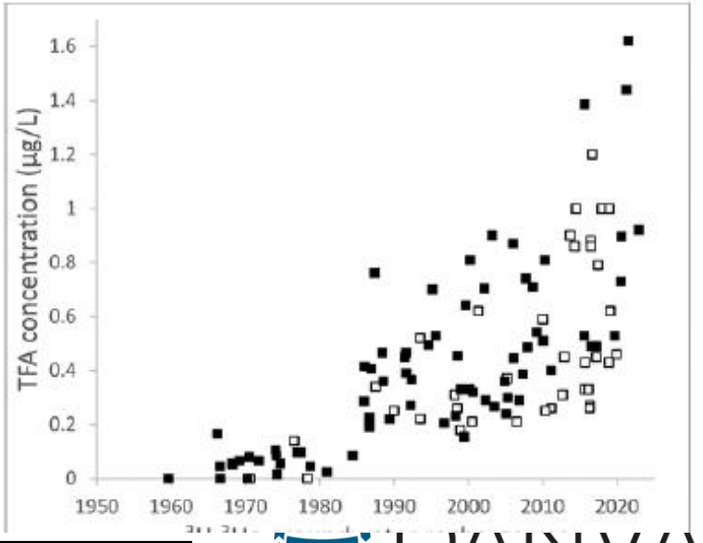
TFA accumulating in arctic ice cores



and in tree leafs



and in groundwater

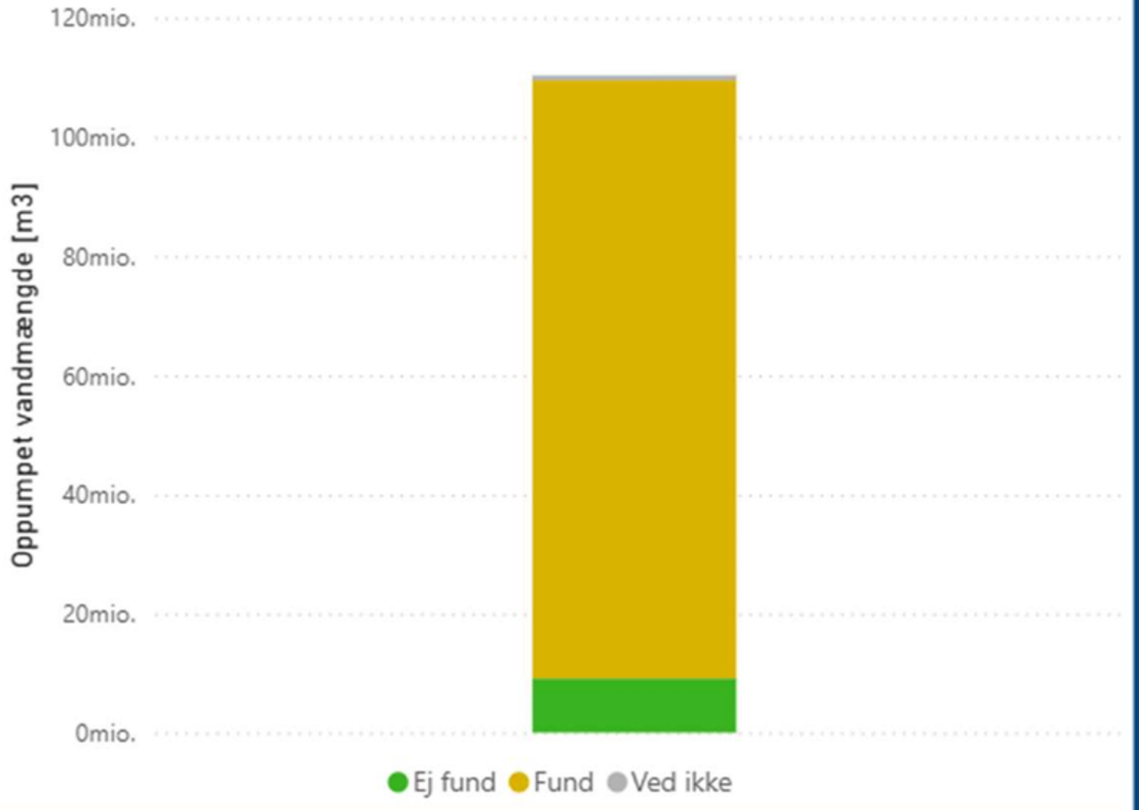


InSa-Drikkevand

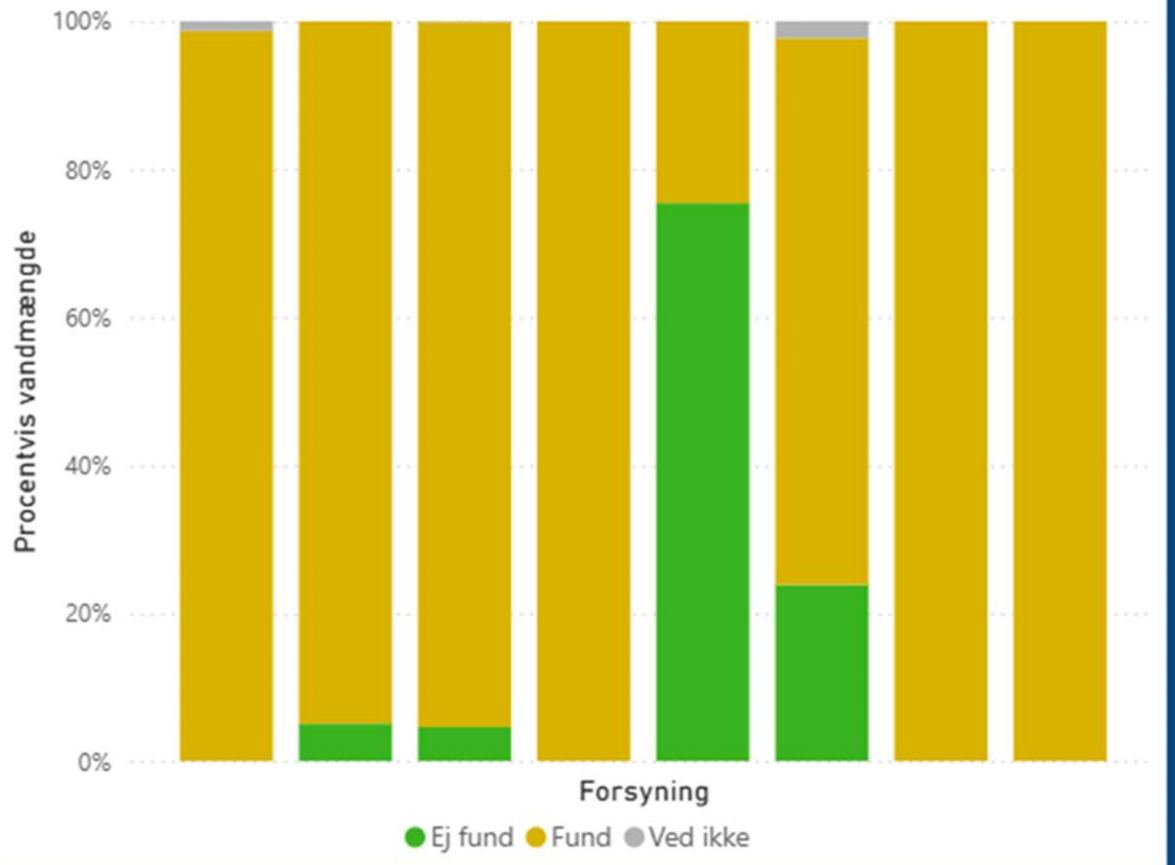
Fund når f > 1 i perioden 01-01-2023 til 30-09-2025
Vandmgd. for 2024 ikke opdateret i Jupiter pr. 30-09-2025
OBS! Data ikke valideret af forsyninger

Vandmgd. opgjort	Forsyninger	Vandværker	Kildepladser	Vandværker med fund	Boringer
2023	8	69	129	50	700

Samlet oppumpet vandmængde påvirket af PFAS og pesticidrester



Påvirket vand pr. forsyning påvirket af PFAS og pesticidrester



InSa-Drikkevand

Fund af MFS pr. vandværk

Stofnavn									Total
N,N-Dimethylsulfamid	2	2		6	13	2	3	3	31
Trifluoreddikesyre	4	1	1	9	3	4	5	3	30
Desphenyl chloridazon	3	1			1	4	6	5	20
4-Bis-amido-3,5,6-trichlorobenzenesulfonat	1								17
Perfluoroctansyre									12
2,6-Dichlorbenzamid	2								11
Perfluorhexansulfonsyre									6
Dimethachlor ESA									5
Perfluoroctansulfonsyre (sum forgrenet og lineær)			1	4					5
Perfluornonansyre				2	2				4
6-(tert-Butylamino)-1,3,5-triazin-2,4-diol	2								2
6-Hydroxy-7,7-dimethyl-6,8-dihydroimidazo[1,2-a][1,3,5]triazin-2,4-dion	2								2
Alachlor ESA					2				2
N-(2,6-dimethylphenyl)-N-(methoxyacetyl)alanin					2				2
Perfluorbutansyre (lineær)									2
(2,6-Dimethylphenylcarbamoyl)methansulfonsyre									1
[(2,6-Dimethylphenyl)(2-sulfoacetyl)amino]eddikesyre									1
4-(tert-Butylamino)-6-hydroxy-1-methyl-1,3,5-triazin-2(1H)-one									1
CGA 108906									1
Desethyl-hydroxyatrazin					1				1
Hexazinon								1	1
Perfluorbutansulfonsyre (lineær)					1				1
Trifluormethansulfonsyre					1				1

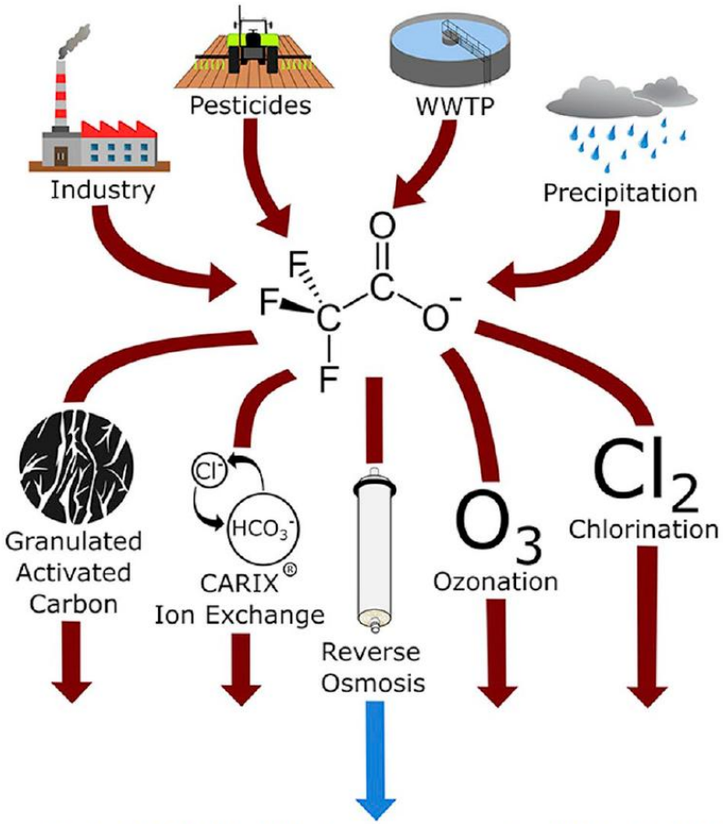
Der findes ingen renseteknologi der kan implementeres i drikkevandsforsyningen der kan fjerne DMS, R471811 og TFA – kun fortynding og ressourceafskrivning

DPC og BAM kan fjernes med kul

Water treatment ineffective at removing TFA, ….or can form TFA

PFAS remediation

- Sorption techniques (activated carbon, ion exchange resins) -> **do not filter TFA**
- **Enhanced degradation techniques** (ozonation, chlorination, photolysis, electrolysis, incineration, pyrolysos etc.) **can lead to TFA formation from precursors** (along with other PFAS, F-gases)
- **Reverse osmosis** only technique that works for TFA, but requires an expensive destruction step for brines



Scheurer et al. (2017). *Water research*, *126*, 460-471.

/Hans Peter Arp: Ultrashort-Chain PFAS: The global threat of trifluoroacetic acid — Collaborative for Health & Environment/

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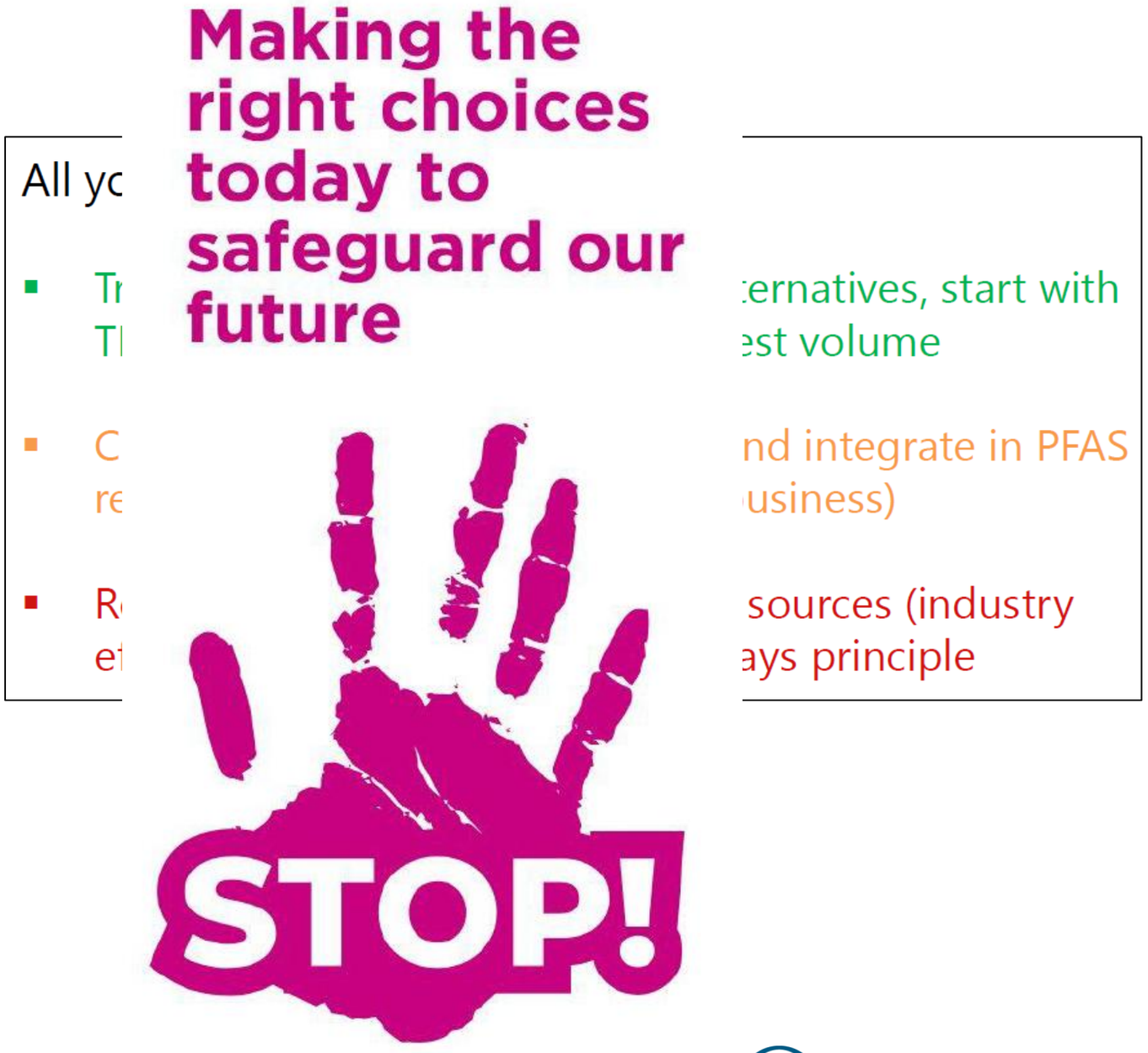
Thank you to

- Bo Lindhardt, Head of water etc.. NOVAFOS/ INSA Drinking Water
- Liselotte Clausen, Specialist advirsor, HOFOR
- Oliver Loebel, EurEau
- Hans Peter Arp: Ultrashort-Chain PFAS: The global threat of trifluoroacetic acid — Collaborative for Health & Environment/
- GEUS www.geus.dk



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Tak for opmærksomheden ...

DANVA er den samlende kraft i vandsektoren.

Gennem stærke alliancer og klare budskaber taler DANVA vandets sag, som vigtig ressource for den grønne omstilling og grundlaget for alt liv.

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