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TIMFIE sampler

– a new time-integrating, active, low-cost sampling device for quantitative determination of organic micropollutants in whole water

(Time Integrating, Micro Flow, In situ Extraction)

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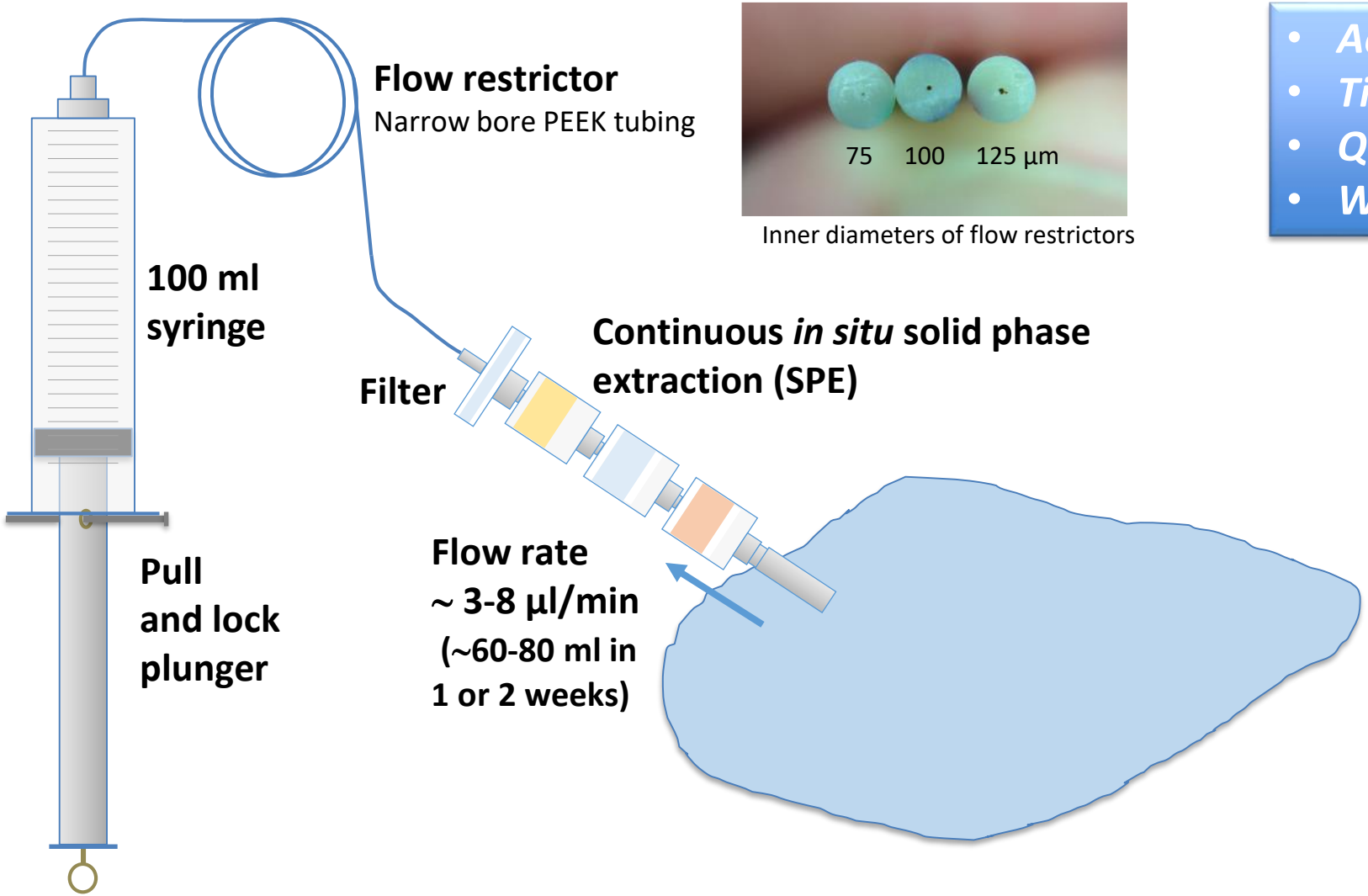
TIMFIE principle

(Time Integrating, Micro Flow, In-situ Extraction)

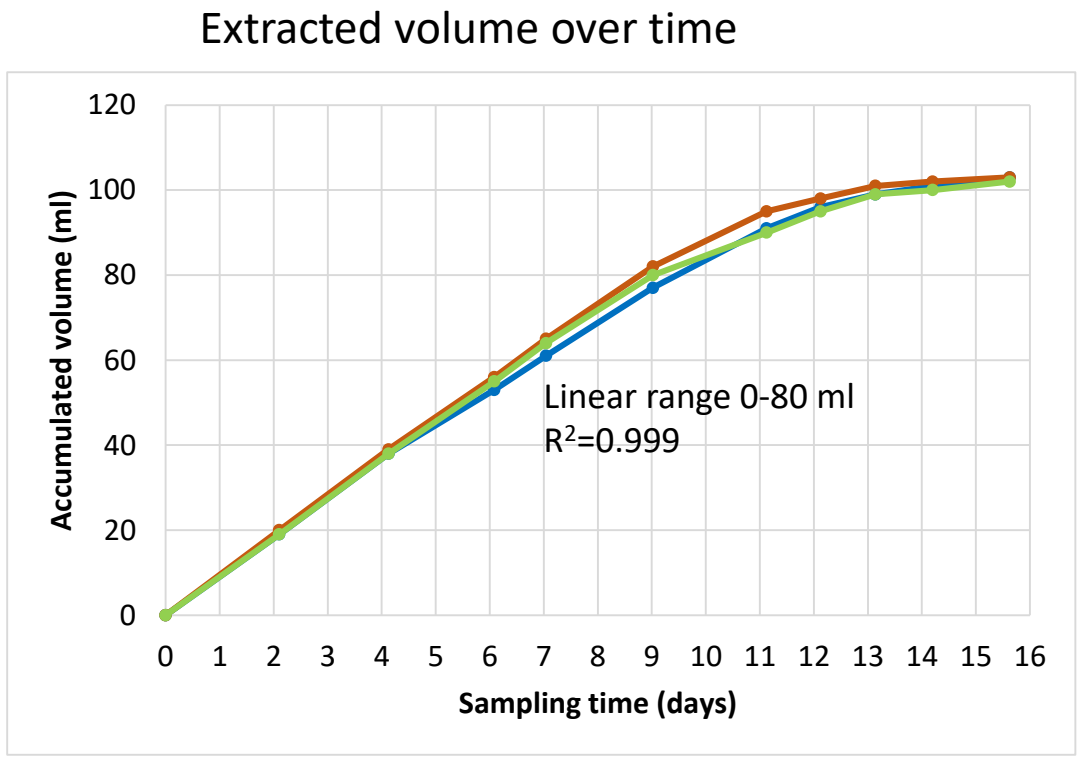


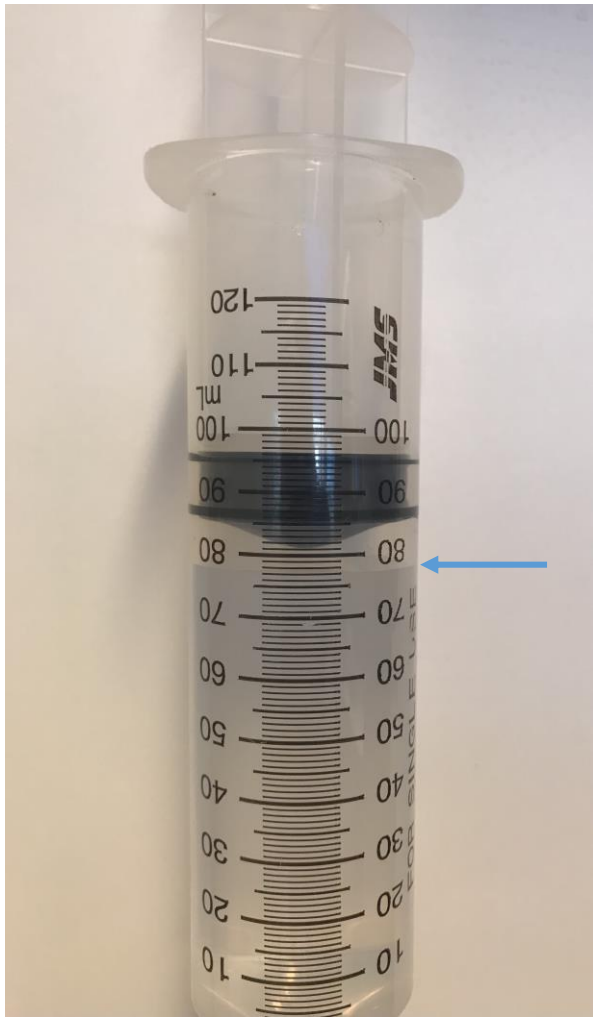
Inner diameters of flow restrictors

- *Active sampling*
- *Time integrating*
- *Quantitative*
- *Whole water*

TIMFIE principle, cont.

Flow rate is constant up to ~80-85 mL
Methods validated with 50 mL sample
(Final extract volume 0,5 ml)





Accurate determination of sample volume enables quantitative analysis

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New TIMFIE study

Primary goal of study:

Organic compounds, LC-MS/MS

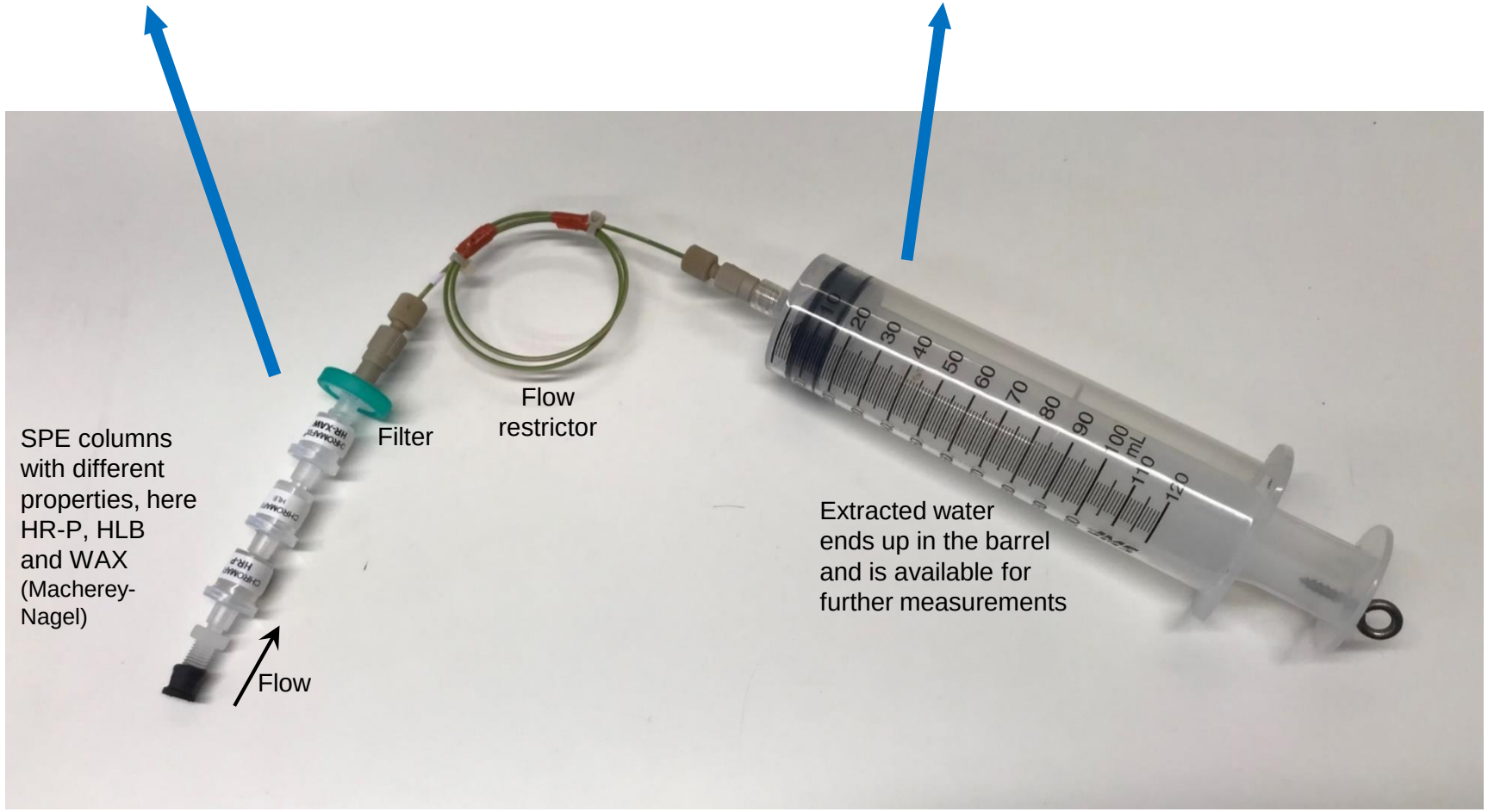
(Some 100 pesticides, 30 PFAS and

70 pharmaceutical/personal care products)

Broadening the scope of TIMFIE:

Can non-extractable compounds like metals and nutrients be analysed using the water in the syringe?

(Tested 21 metals, ICP-MS (mercury not included))



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TIMFIE
field application examples

2 TIMFIE mounted on telescopic stick

4 parallel TIMFIE applied downstream landfill

TIMFIE in storm water well

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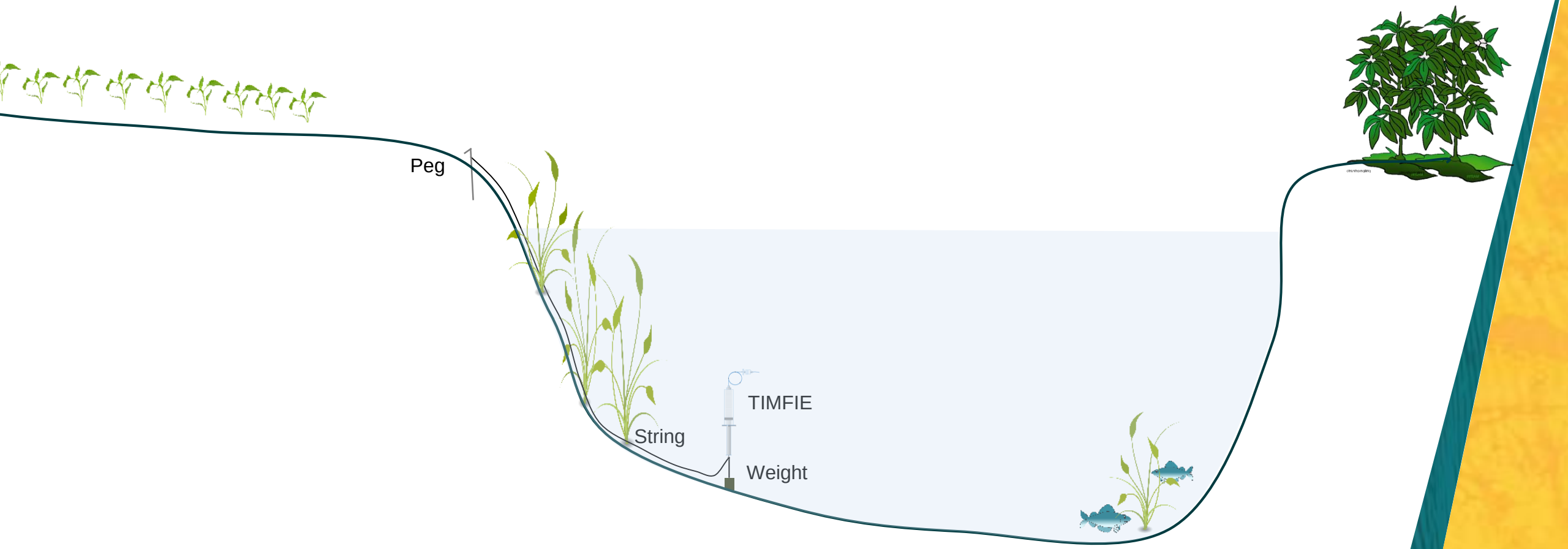
Apply TIMFIE below surface



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TIMFIE sampler can easily by placed in the stream using a modified fishing rod

Some results and learnings from new study: **PFAS**

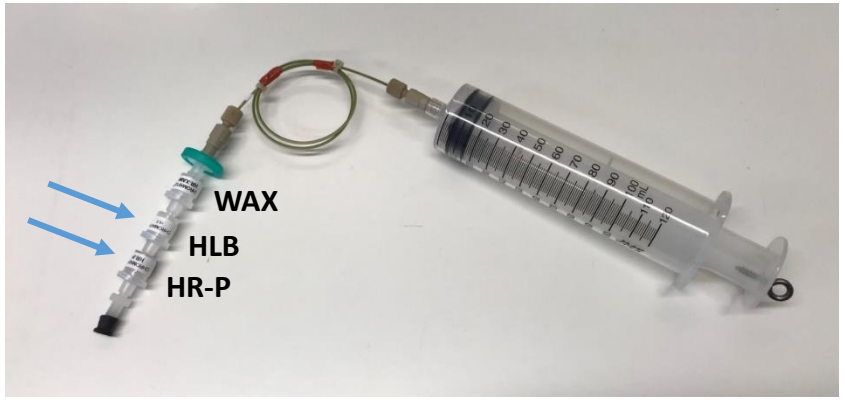
(ng/L)	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill	Landfill
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Period	3/6 - 11/6	3/6 - 11/6	8/7 - 15/7	8/7 - 15/7[a]	27/8 - 3/9	27/8 - 3/9	10/9 - 17/9	10/9 - 17/9
Year	2021	2021	2021	2021	2021	2021	2021	2021
PFBA	9	361	60	811	7	629	19	620
PFPeA		458		1008		807		831
L-PFBS		315		659		620		595
4:2FTS								
PFHxA	2	774		1702		1591		1571
L-PFPeS		193		460		479		445
HFPO-DA								
FBSA		45		105		86		68
FHxSA		27		93		102		60
PFHxS		408		1399		1091		1059
PFHpA		182		528		410		458
NaDONA								
L-PFHpS		7		20		14		18
PFOA	2	104	1	297	2	207	1	253
6:2FTS	1	24		74		44		82
PFOS		66		142		91		119
PFNA		4		8		5		7
9-Cl-PF3ONS								
L-PFNS								
PFDA								
8:2FTS								
N-MeFOSAA								
L-PFDS								
PFUdA								
N-EtFOSAA								
11-Cl-PF3OUdS								
PFDoA								
FOSA								
PFTrDA								
PFTeDA								
Sum PFAS 11 (ng/L)	15	2695	61	6627	8	5496	20	5595
Sum PFAS (ng/L)	15	2966	61	7305	8	6176	20	6186

Triplicate 1-week sampling landfill

(ng/L)	Triplicate sampling				
Downstream landfill	TIMFIE A	TIMFIE B	TIMFIE C		
Period	10/9 - 17/9	10/9 - 17/9	10/9 - 17/9		
Year	2021	2021	2021	Mean	% RSD (n=3)
PFBA	624	634	600	620	2,3
PFPeA	842	855	797	831	3,0
L-PFBS	603	613	568	595	3,2
PFHxA	1523	1615	1577	1571	2,4
L-PFPeS	461	441	434	445	2,6
FBSA	71	73	58	68	10
FHxSA	59	62	60	60	2,1
PFHxS	1054	1051	1072	1059	0,9
PFHpA	457	456	462	458	0,6
L-PFHpS	18	19	18	18	1,6
PFOA	242	268	249	253	4,4
6:2FTS	87	76	83	82	5,4
PFOS	115	119	122	119	2,3
PFNA	6,6	6,8	6,6	6,7	1,7
RSD= relative standard deviation				Mean RSD (%)	
					3,0

PFAS TIMFIE sampling and instrumental analysis show good precision
Average RSD=3.0 % (0.6-10%)

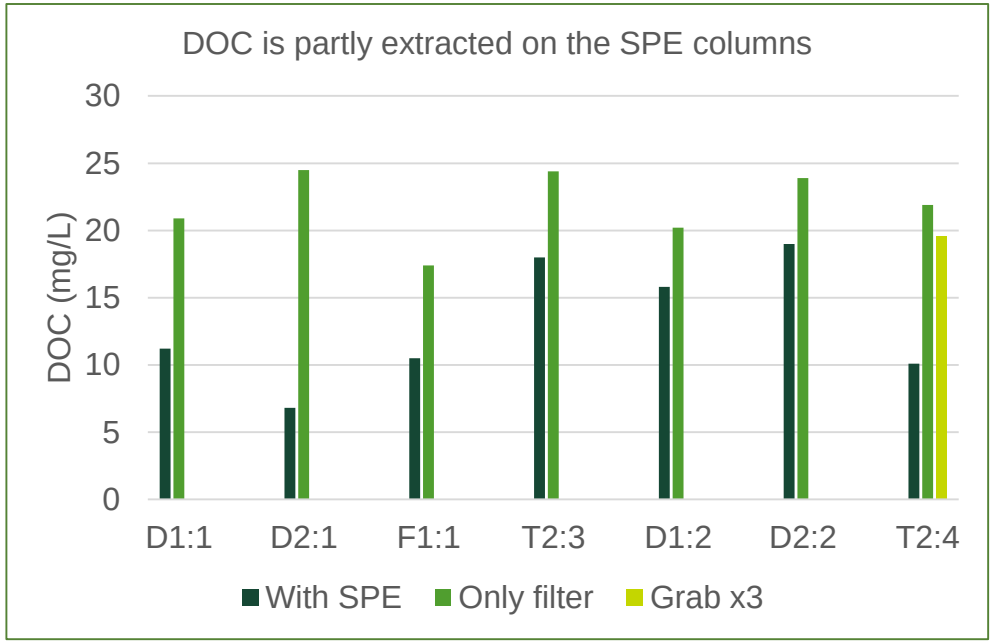
Some results and learnings from new study: **Metals**



Contamination from 2 of the SPE columns
(HR-P and HLB from Macherey Nagel)
High levels of Cu, Pb and Zn (10-100 times the levels in tested surface water)
Also traces of Ni

Separate pre-conditioning of these two SPE columns with 1% HCl and milliQ water seem to solve the problem but makes method complicated and less attractive

Also, metals need to be related to dissolved organic carbon (DOC) which is difficult to combine with wide range SPE



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Conclusions and way forward

- Inexpensive and low tech
- Time proportional sampling 1-2 weeks
- Quantitative analysis of whole water (organic compounds)
- Flexible with respect to SPE and field application
- Further investigate inorganic compounds with separate TIMFIE

- Future work will most likely bee with separate TIMFIE for organic and inorganic compounds

Thank you for listening

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