



Dr. Frank KARG / CEO (PDG) HPC INTERNATIONAL SAS / France

Scientific Director of HPC-Group International

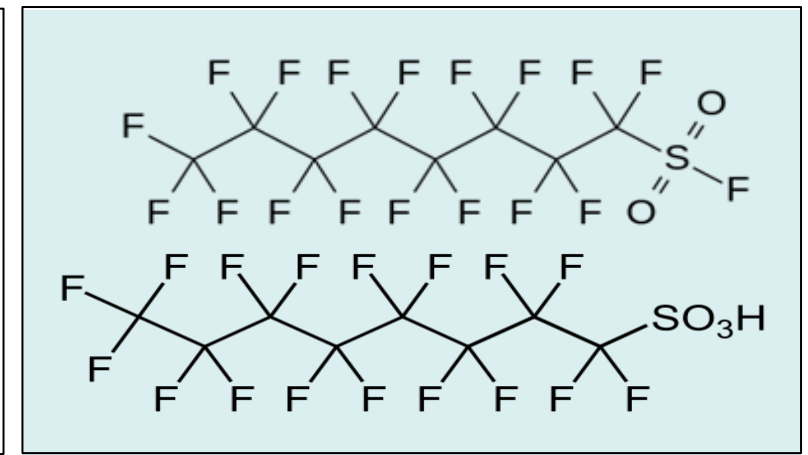
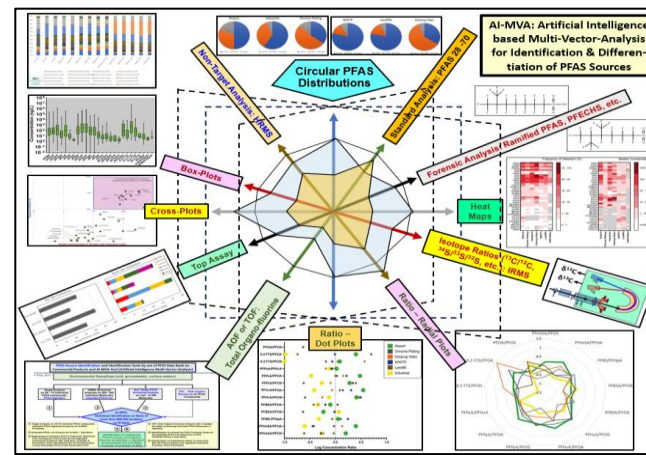
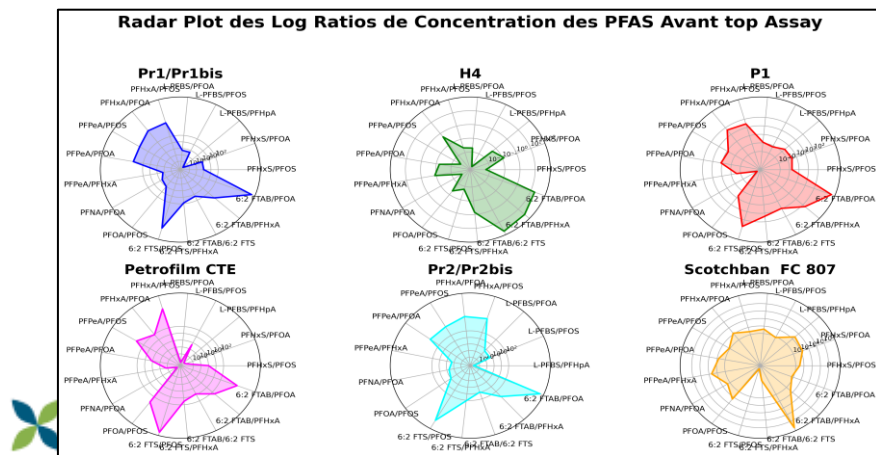
Tél : +33 (0) 607 346 916, Email : frank.karg@hpc-international.com

Advancements of PFAS Source Identification & Differentiation based on MVA and AI: Artificial Intelligence Clustering for Responsibility Clearing

Avancements dans l'identification et différenciation des sources de pollutions par les PFAS via la MVA sur base de l'IA: Intelligence Artificielle pour clarification des responsabilités

Dr. (es. Sc.) Frank Karg / Scientific Director of HPC-Group (INOGEN JV) and
CEO-President of HPC INTERNATIONAL / France, Germany, Suisse, Hungary, Balkan, etc.

Email: frank.karg@hpc-international.com / Tél: +33 607 346 916



In
minimum
33
Categories

1. **Perfluoroalkane-sulfonic-acids (PFASs),**
2. Perfluoroalkane-sulfonats (salts),
3. Perfluoroalkane-sulfinic-acid/sulfonates,
4. Perfluoro-cycloalkane-sulfonic-acids & derivats,
5. Perfluoroalkane-sulfonamids (FASAs),
6. Perfluoroalkane-sulfonamide & quaternary ammonium salts,
7. Acrylate de perfluoroalkane-sulfonamide (MeFASACs),
8. Perfluoroalkane-sulfonamide methylacrylates,
9. Perfluoroalkane-sulfonamide phosphates,
10. Perfluoroalkane-sulfonyl halogenureas,
11. Different polyfluoroalkyl-sulfur compounds,
12. **Perfluoroalkyl-carboxyl-acids (PFCA),**
13. Perfluoroalkyl-carboxyl-acids,
14. Perfluoroalkyl-alcohols/cetones,
15. Halogenurea perfluoroalkyl-carboxylic acids,
16. Perfluoroalkyl-halogenureas,
17. Perfluoroalkyl-ethers,
18. Perfluoroalkyl-amines,
19. Perfluoroalkyl-amino-acides/salts/esters,
20. **Perfluoroalkyl-phosphates,**
21. Perfluoroalkyl-acrylate,
22. Perfluoroalkyl-methacrylates,
23. Other Perfluoroalkyl-carboxylic esters,
24. Perfluoroalkyl-heterocyclic Compounds,
25. Perfluoroalkyl-silanes,
26. **Fluorotelomer-alcools,**
27. Fluorotelomer halogenides,
28. Fluorotelomer sulfonates, sulfonyl chlorides and
sulfonamides,
29. Fluorotelomer Acrylates,
30. Fluorotelomer Methylacrylates
31. Other Fluorotelomer Acrylates
32. Fluorotelomer phosphates,
33. Other fluorotelomers.

**In total > 9 000 – 12 000 PFAS
are existing !**

Production & Applications depuis 1960

- Galvanisation
- Production des Textiles
- Food Packaging (Polymers)
- Production des Papiers & Cartons
- Raffineries, Industrie Photographique & incres
- Matériel de Construction (Bétons):
par ex. C₈-C₂₀-gamma-omega-perfluoro Thiols)
- Peintures, Encres & Laces
- Modules électroniques & semi-conducteurs
- Huiles Hydrauliques,
- Production de Teflon (Fluoropolymères)
- Mousses anti-incendie (AFFF)
- Papiers traités en surface & Cartons....



Utilisation des PFAS (AFFF) sur l'ancienne Base Aérienne BA 103 (700 ha)



17.10.2018 Gartenhalle, Karlsruhe

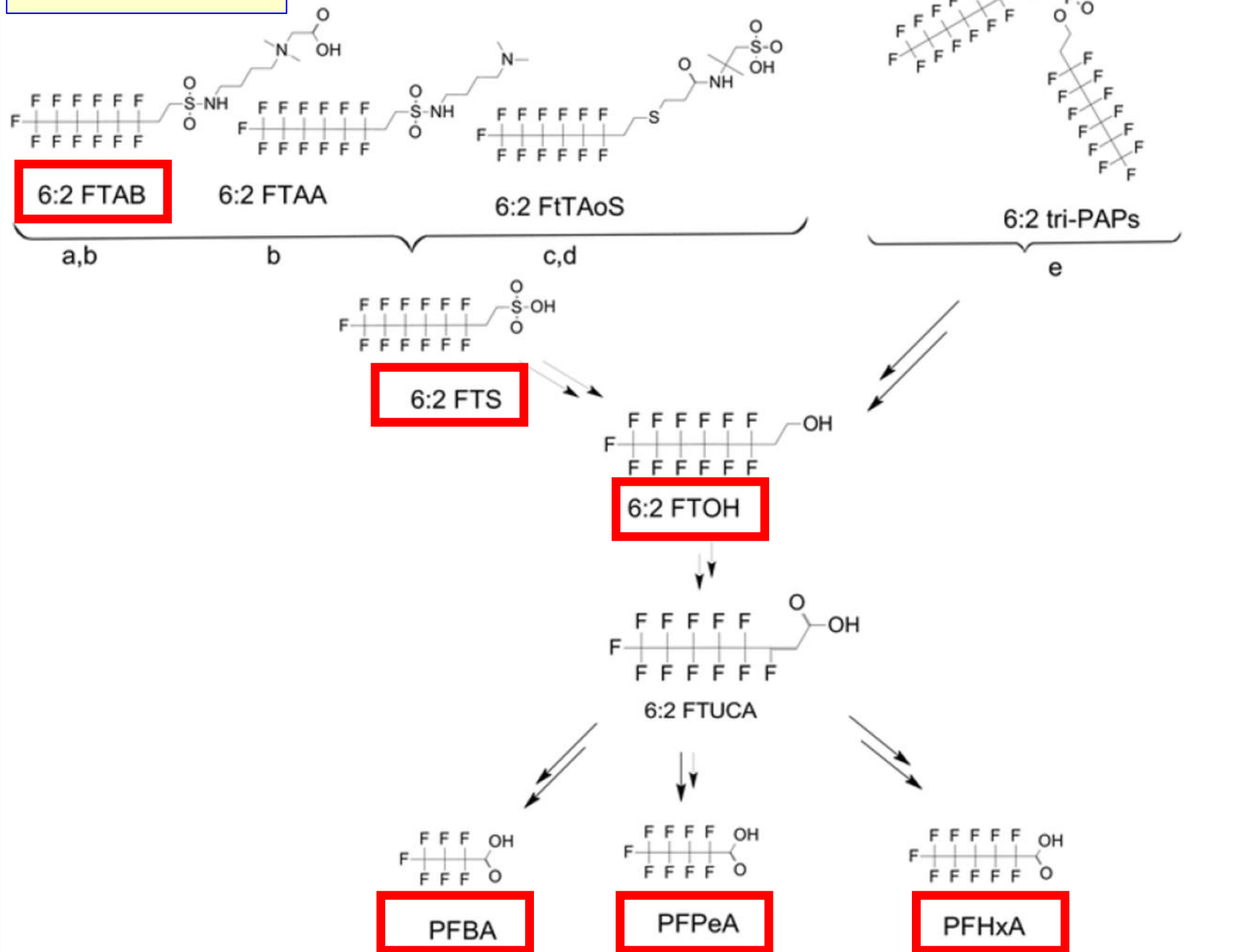


Source:

28. Karlsruher Deponie- und Altlastenseminar



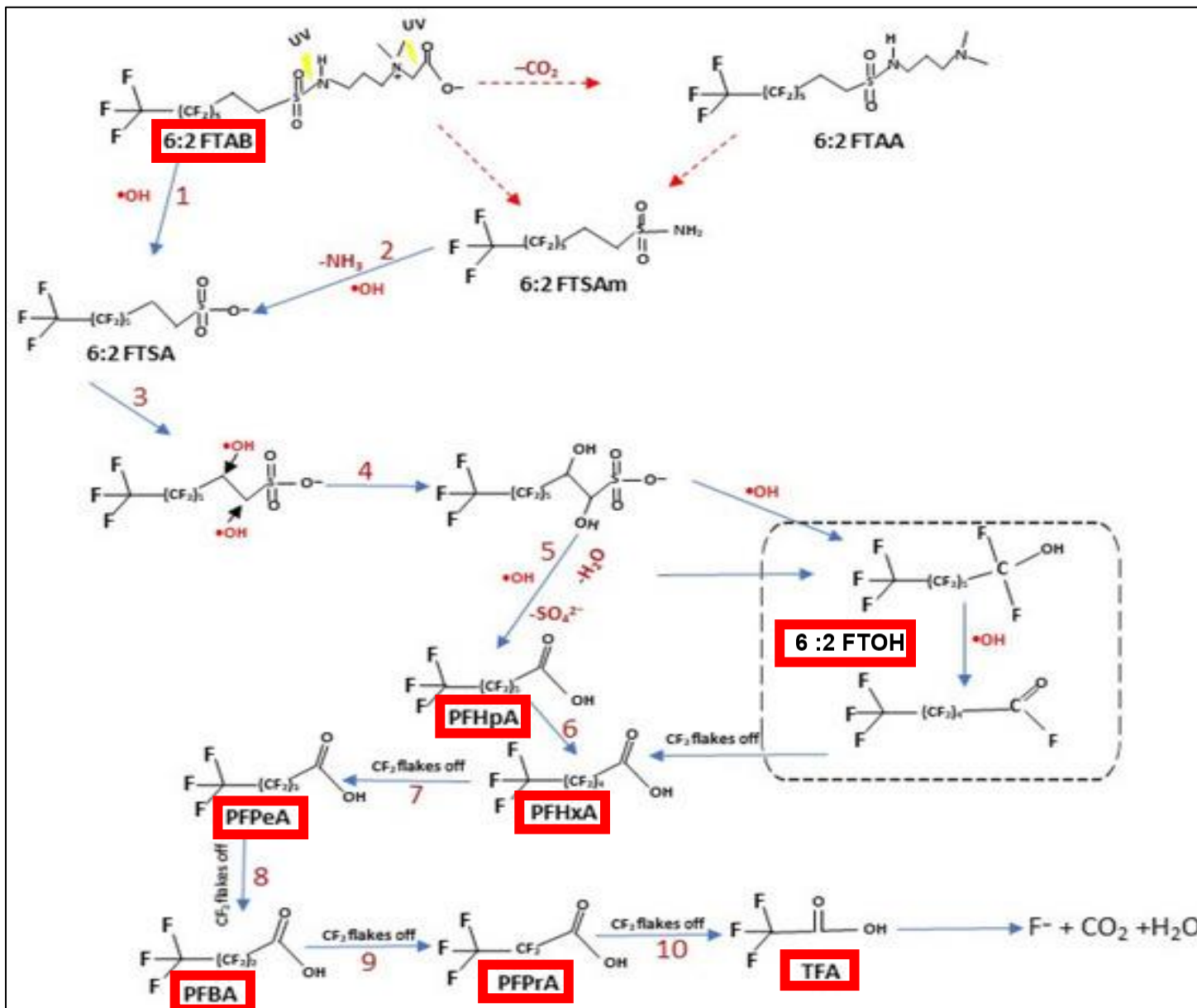
6:2-FTAB



based on
Clearing

**Biotransformation
of 6 :2 FTAB
via 6 :2 FTS & 6 :2
FTOH to
perfluorinated PFAS:
PFBA, PFPeA &
PFHxA**

(LaFond et al. 2023, D.M.J.
Shaw et al. 2019 ,Ying Shi,
2018 et V. Mendeza et. al.
2022)

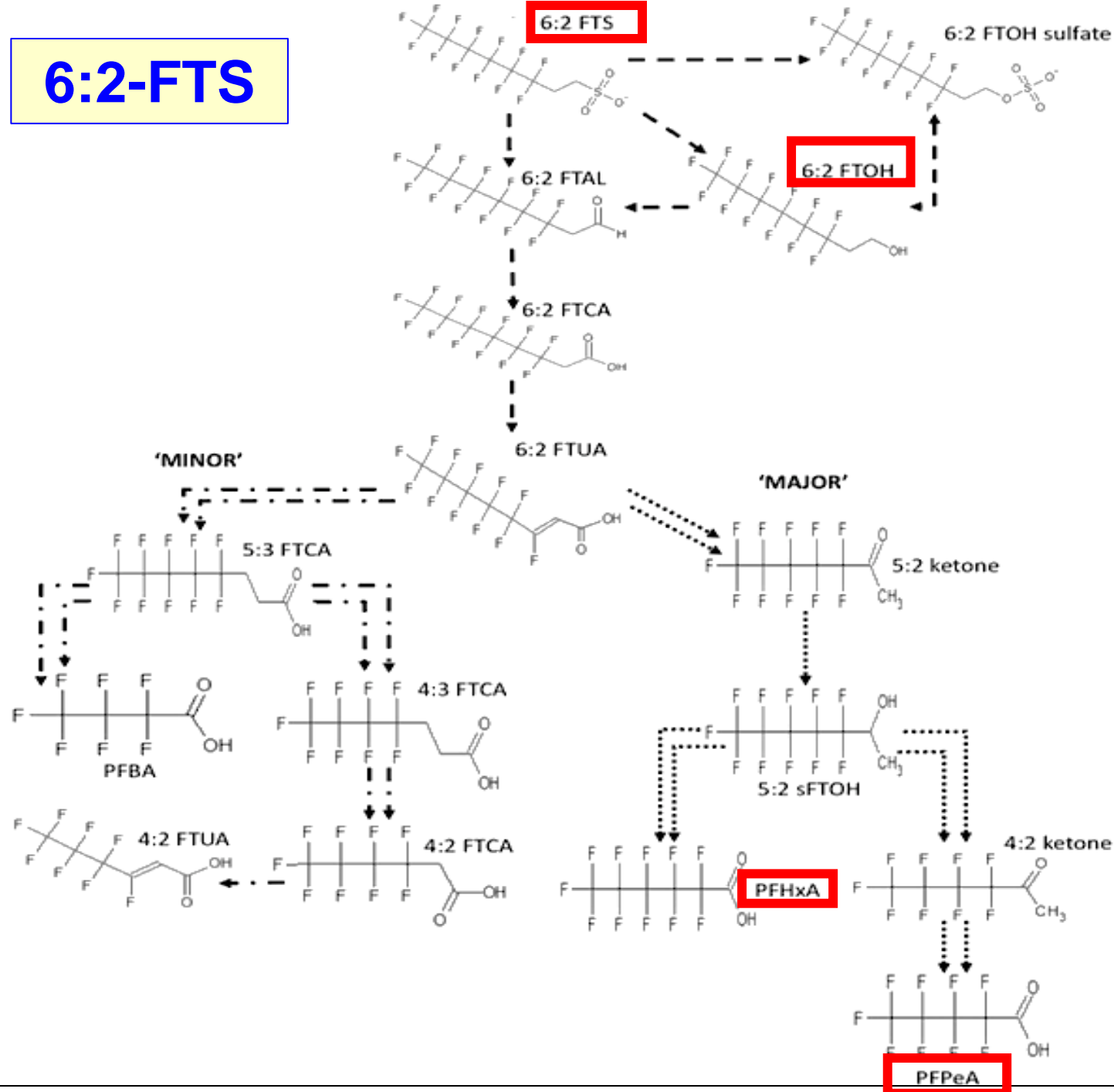


**6 :2 FTAB
Photolysis:**

via 6:2 FTOH to
PFHxA, PFPeA, PFBA,
PFPrA & TFA

(Naveed, A. et al 2024)

6:2-FTS



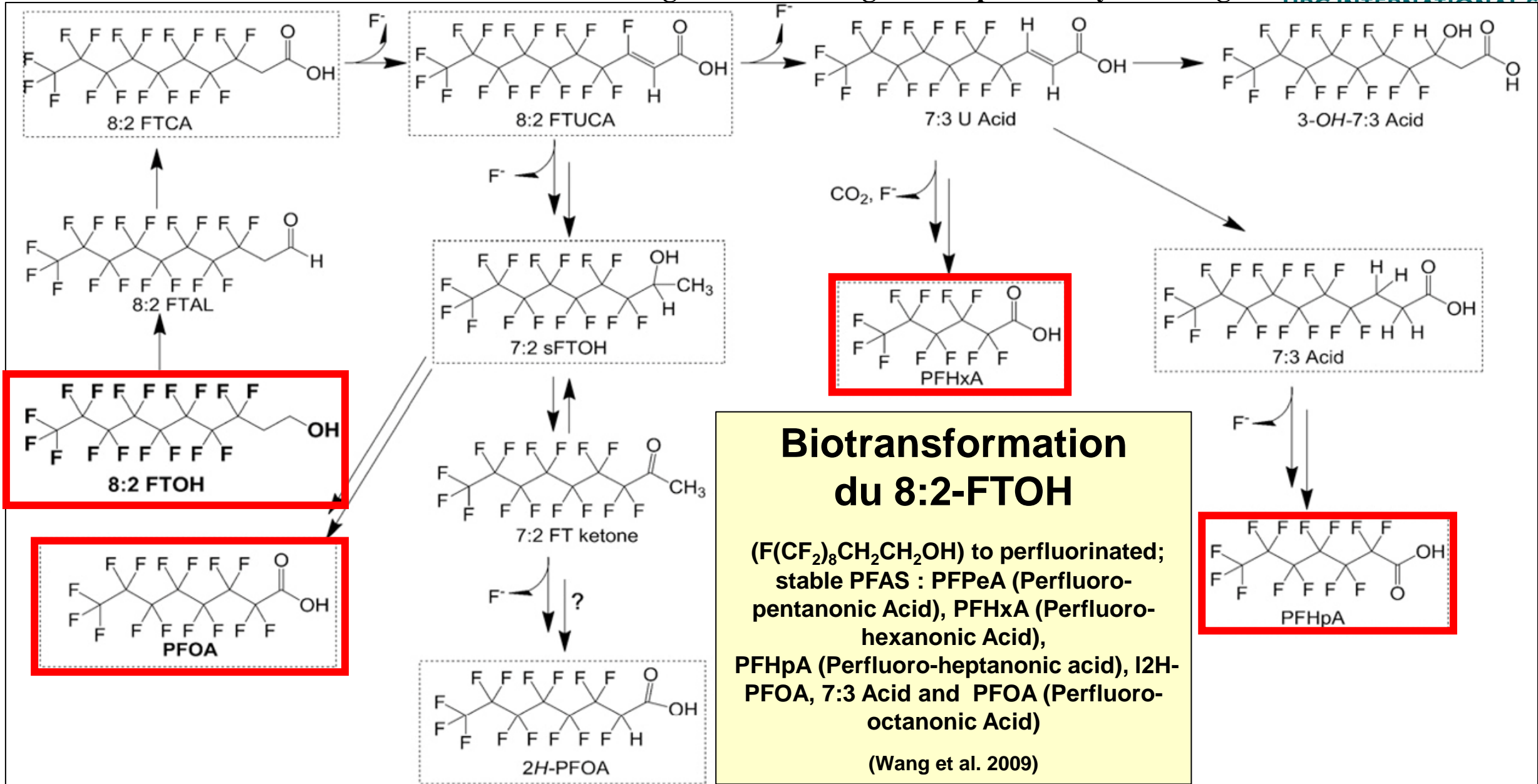
ased on
Clearing

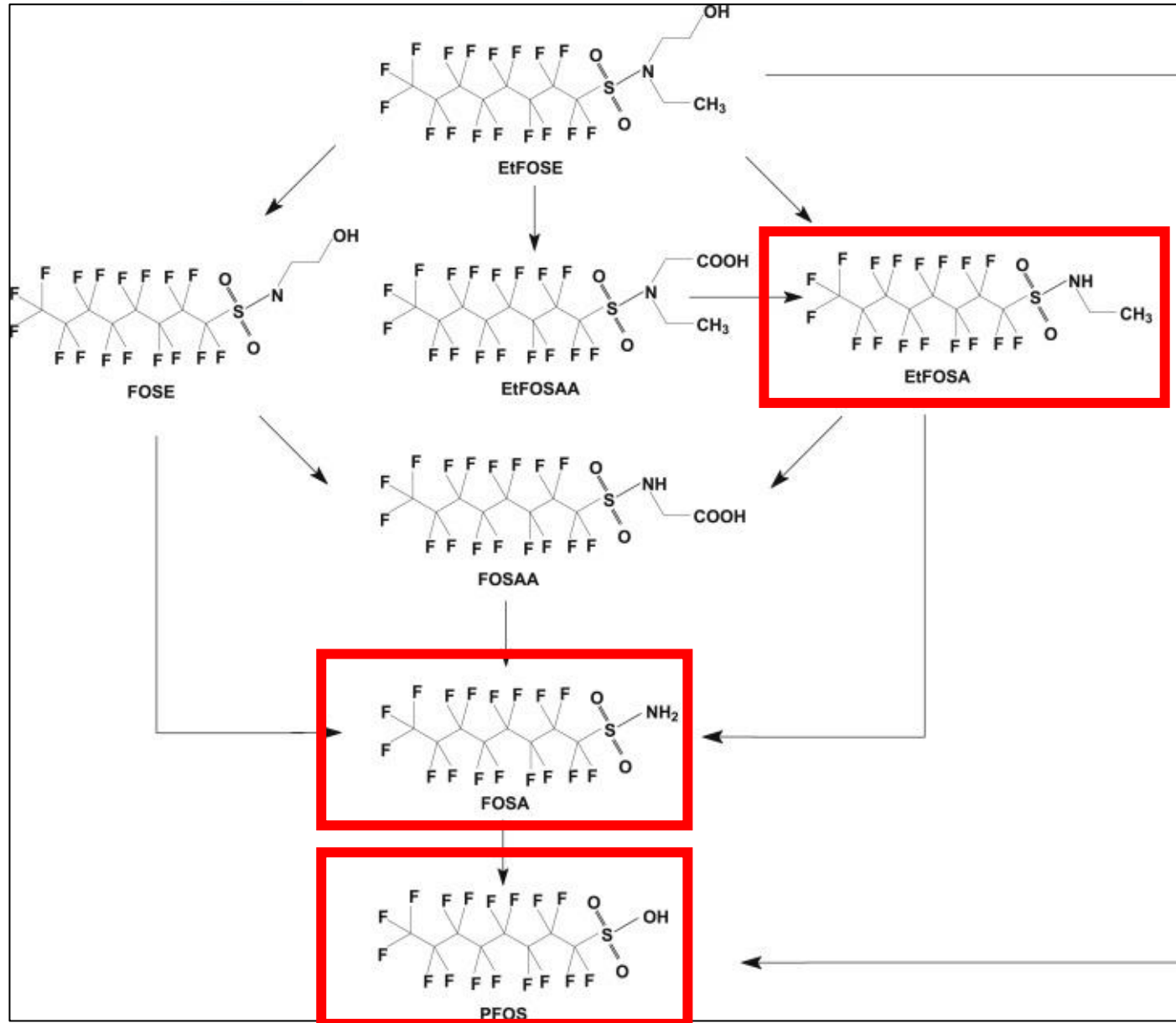
Biotransformation du 6:2-FTS

to stable perfluorinated, stable
PFAS:

PFBA
(Perfluoro-butanonic Acid),
PFPeA
(Perfluoro-pentanonic Acid),
PFHxA
(Perfluoro-hexanonic Acid)

(D.M.J. Shaw et al. 2019 ,Ying Shi,
2018 et V. Mendeza et. al. 2022)





PFAS: Chimie environnementale

**Bio-transformation
of EtFOSE, EtFOSA &
FOSA to PFOS**

S. Chen et al. 2021

Scotchban FC 807

= 100 % EtFOSA

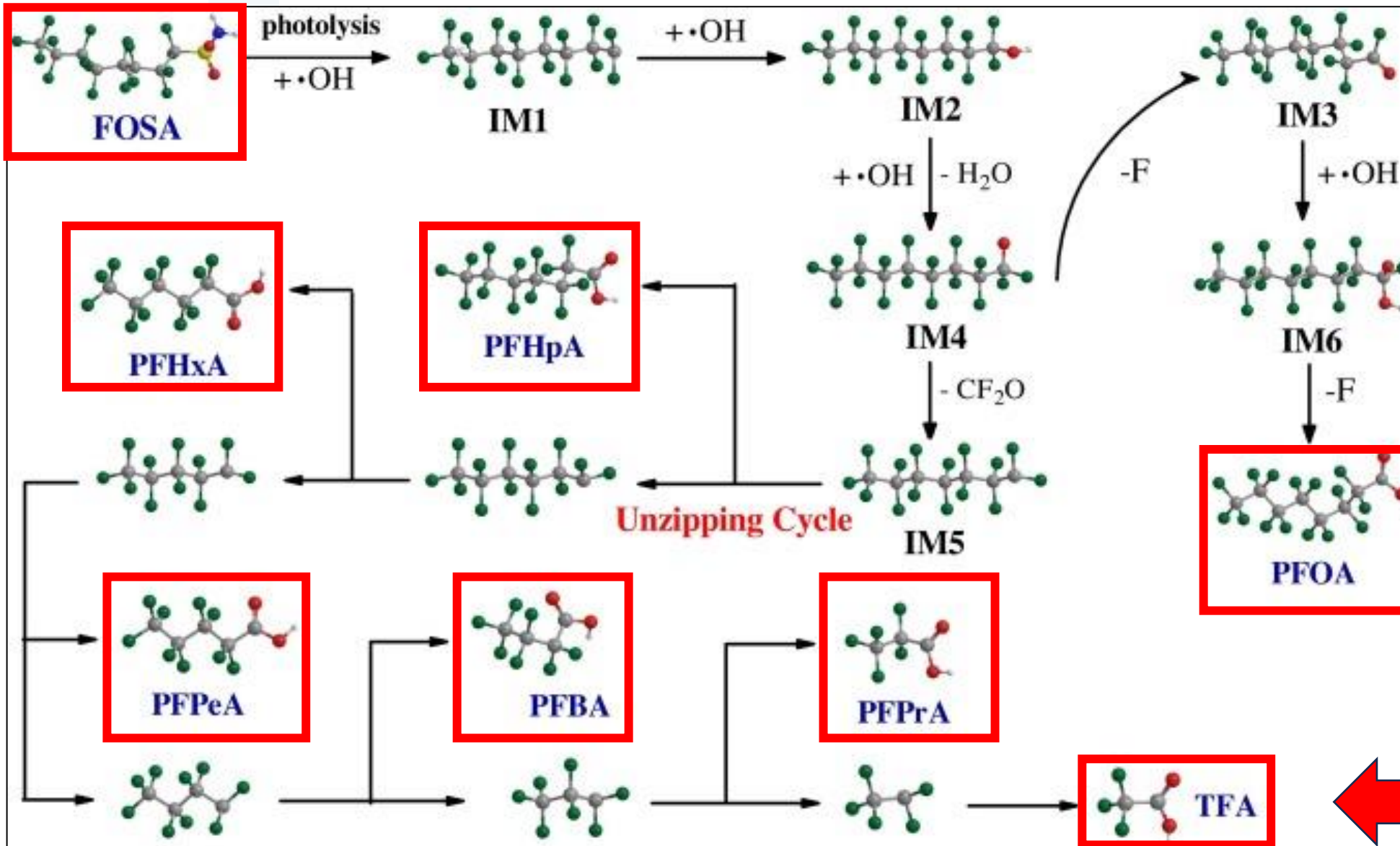
**Impregnation of
Paper and Textiles**

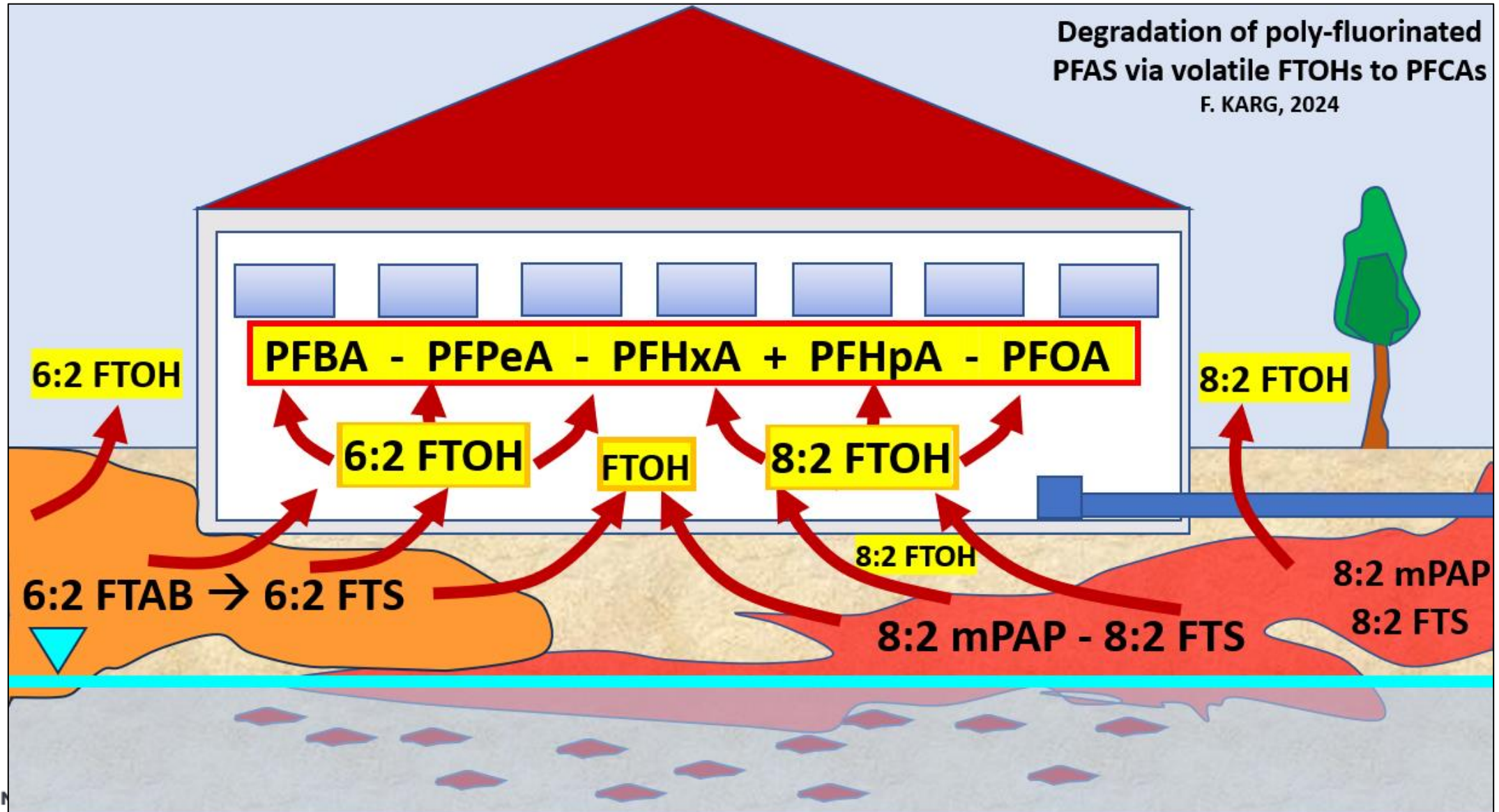
PFOS

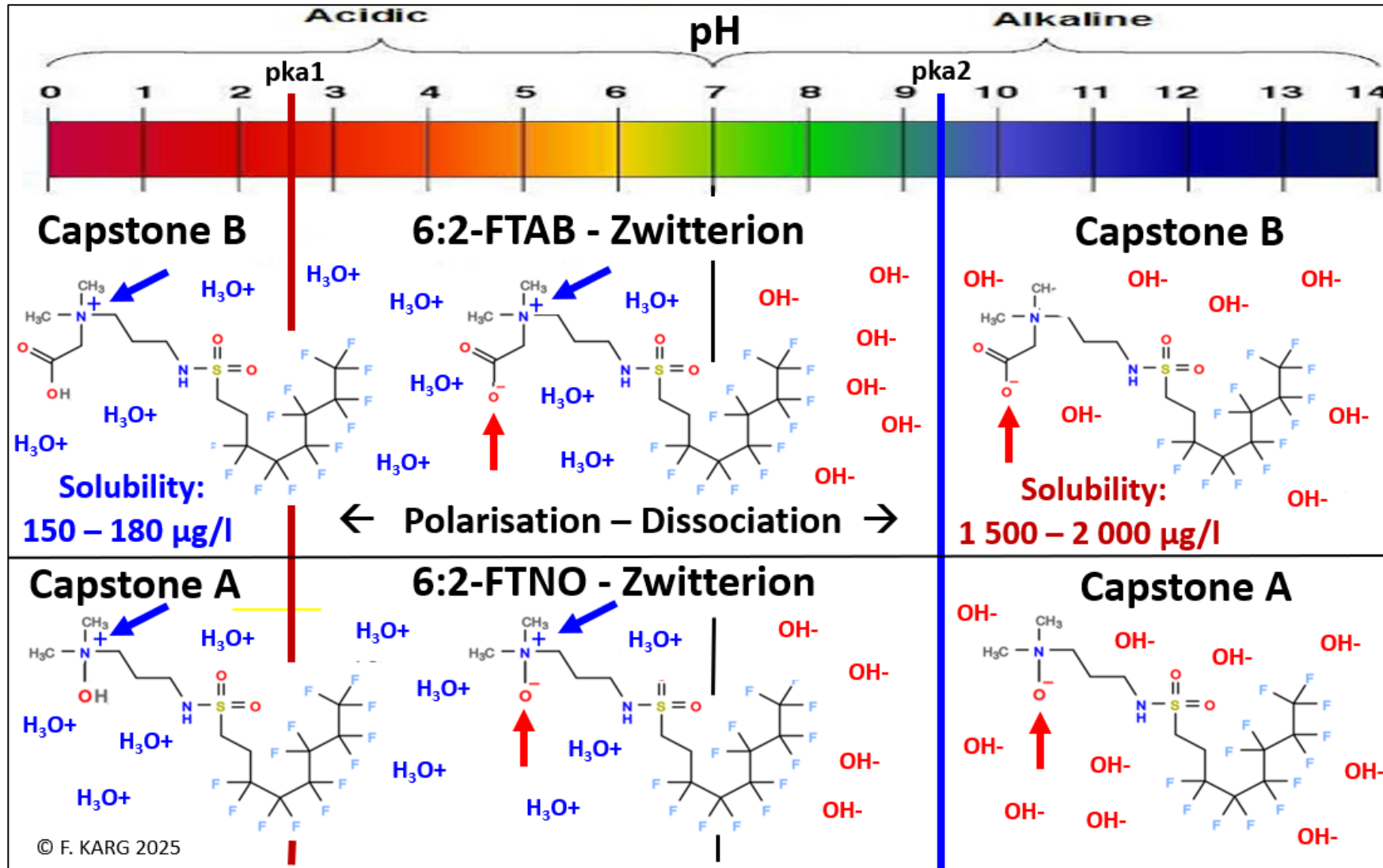
PFAS: Chimie
environnementale

Photochemical
Transformation
of FOSA to
PFOA, PFNA,
PFHpA, PFHxA,
PFPeA, PFBA,
PFPrA, TFA

Y. Wang 2020







Environmental Chemistry according pH of Capstone A & B: Changing of Solubility and Sorption Effects



Databank Registering of Commercial PFAS Products and their degraded individual PFAS Molecules, based on more than 800 000 Analysis experiences.

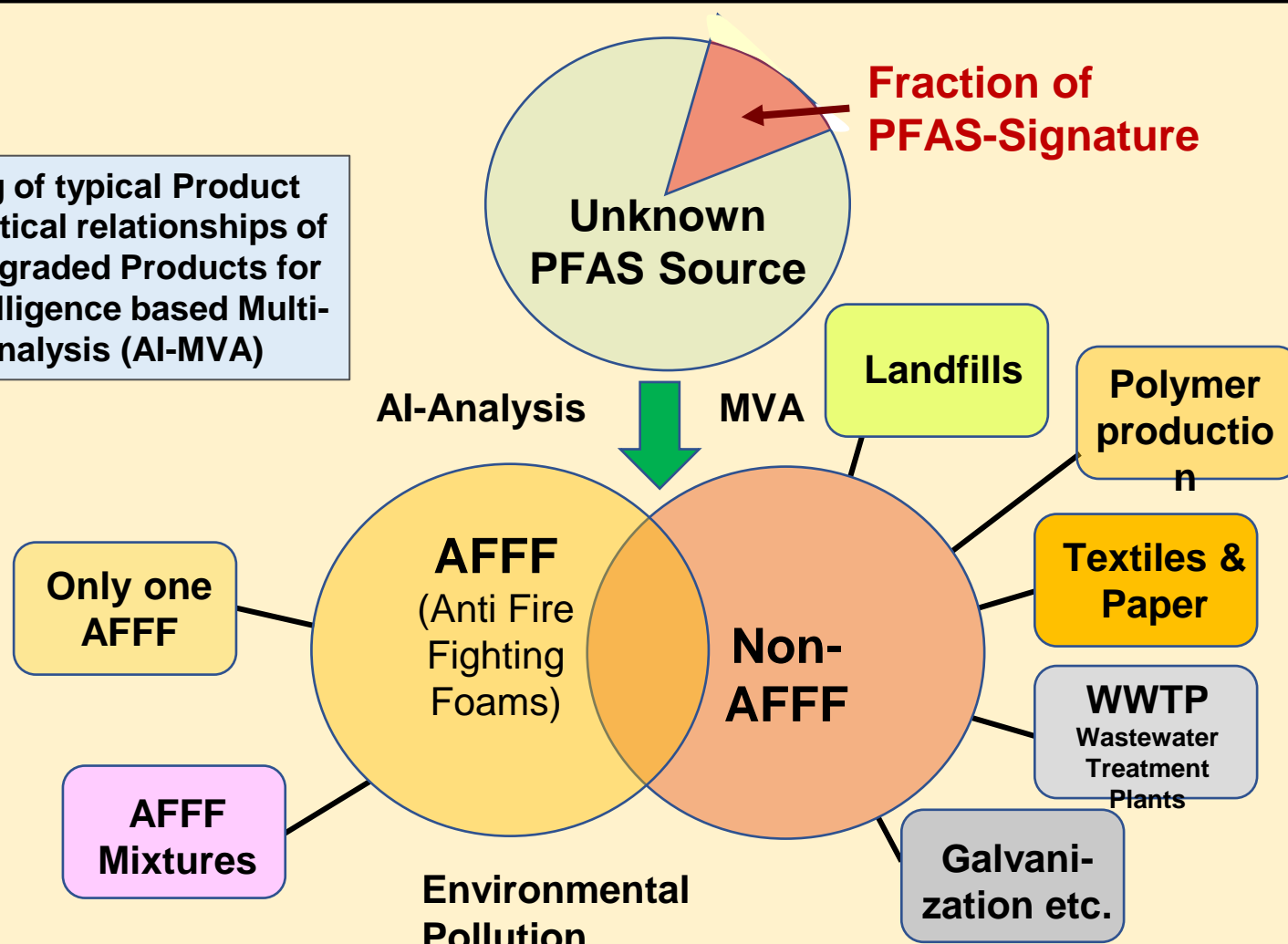
Registering of individual PFAS Product Spectrums and statistical Relation-ships of Commercial Product by non-Target Analysis (400–500 Compounds) on fresh Products and degraded Products, after 3 months Lysimeter Tests with bio-transforming Bacteria.

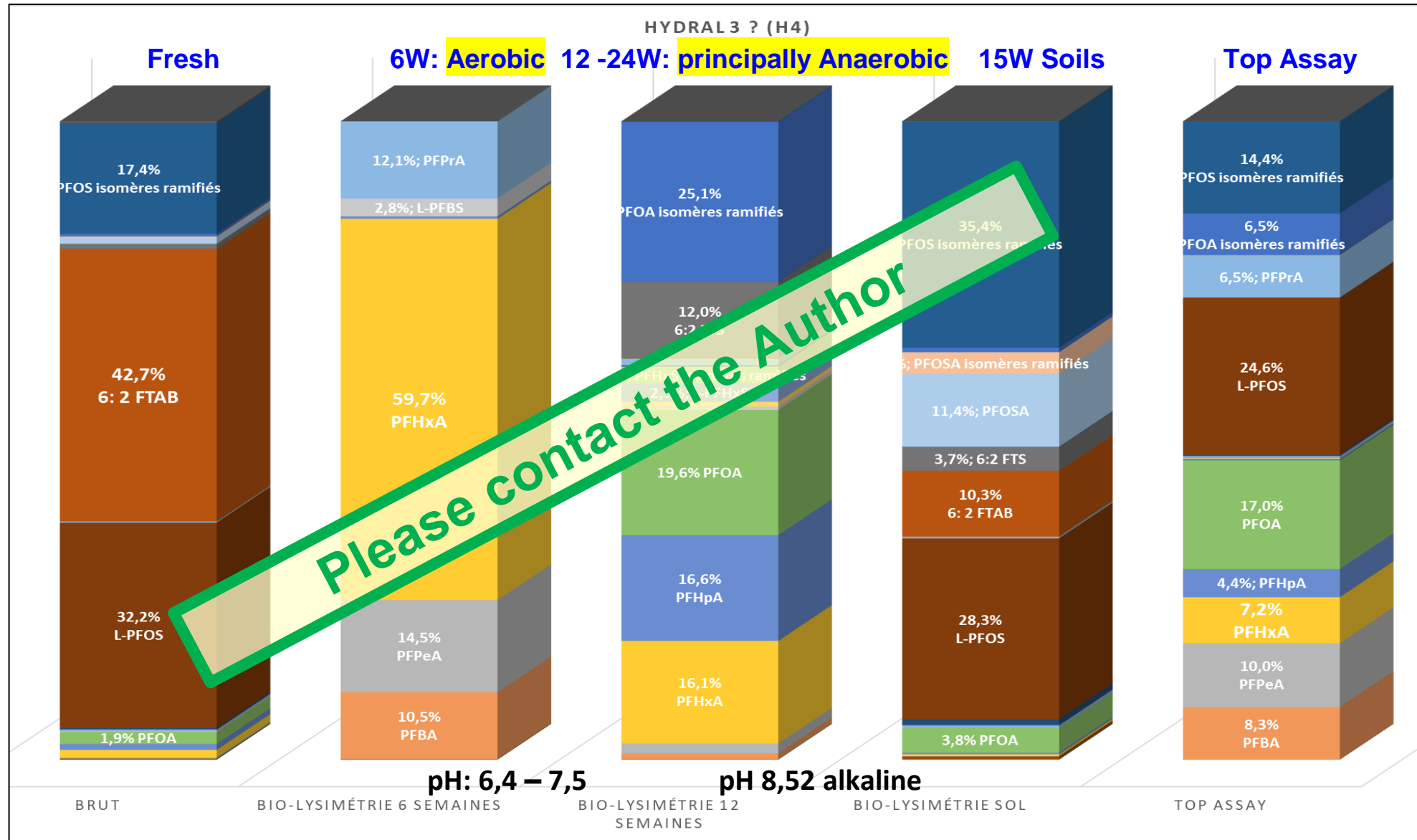
Identification of statistical Indicators per commercial Product via Standard Analyses(min. 20–70 Molecules in environmental soil and water samples)

AI-MVA-Identification of PFAS Contamination Sources and Commercial Products in Environmental Samples with Standard Analyses.

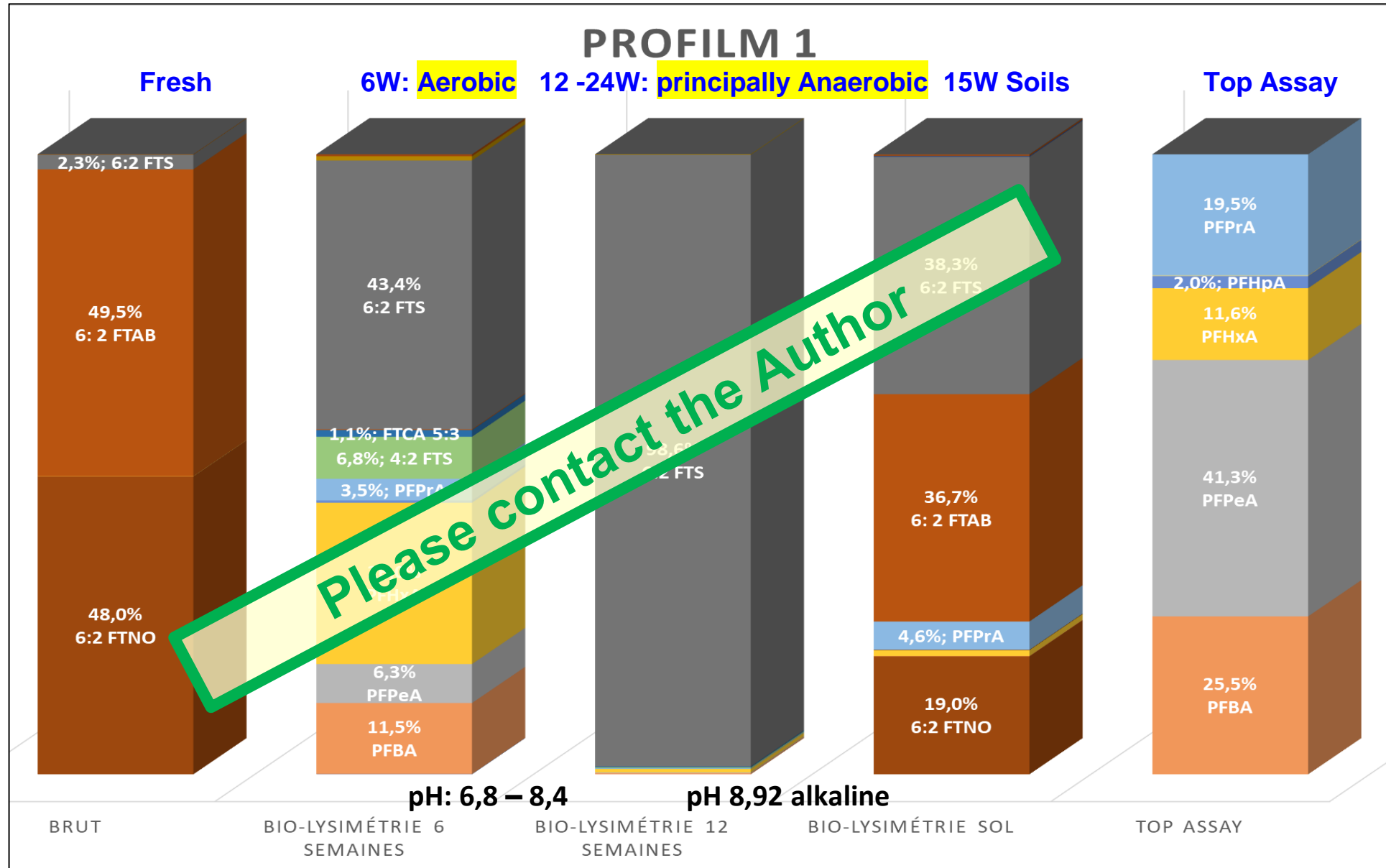
Artificial Intelligence Multi-Vector-Analysis (AI-MVA) for Identification & Differentiation of PFAS Sources & Commercial Products

Registering of typical Product related statistical relationships of fresh and degraded Products for Artificial Intelligence based Multi-Vector-Analysis (AI-MVA)

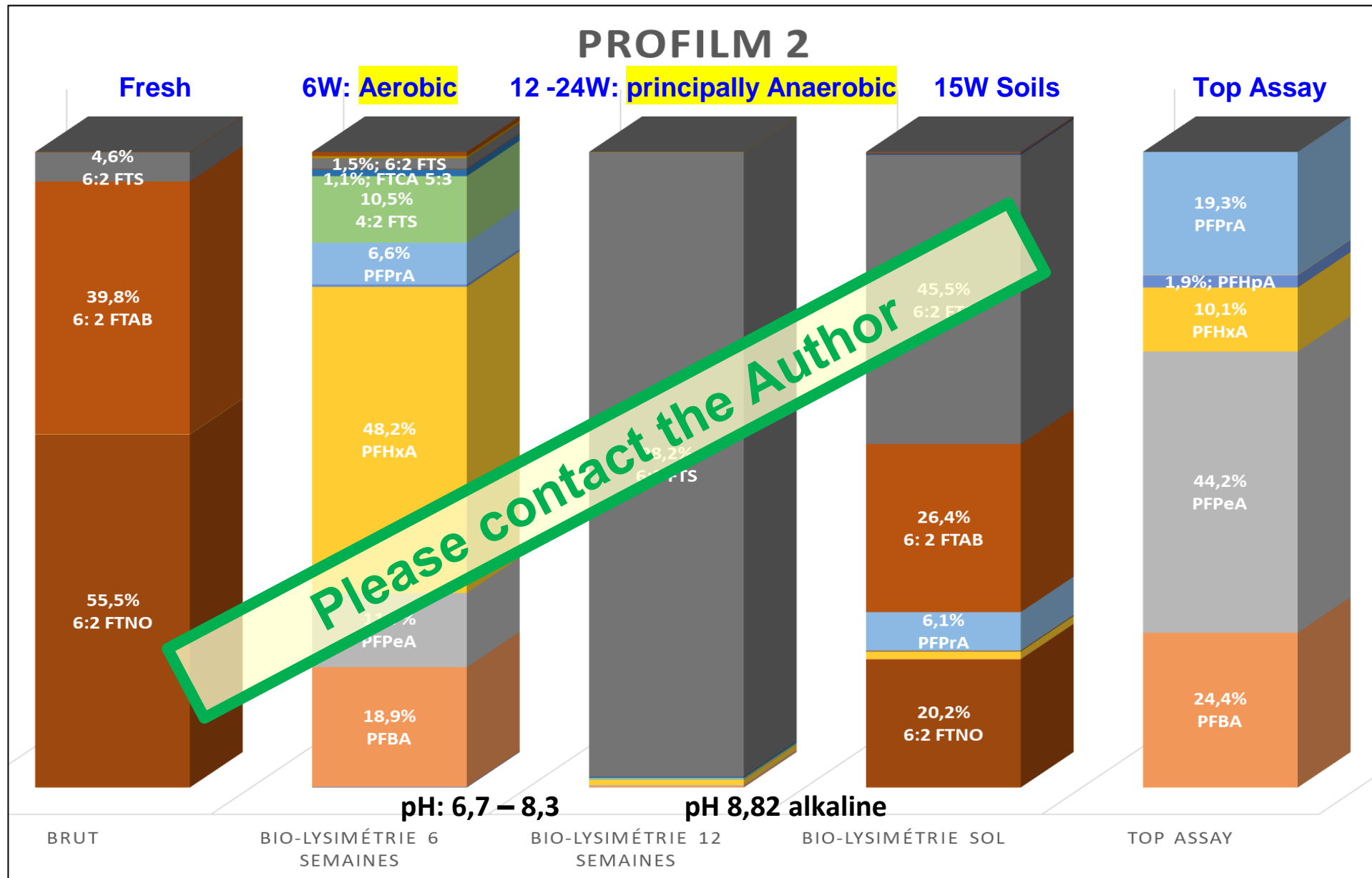




Anaerobic conditions slows down or stops the bio-transformation during the PFAS migration process



Anaerobic conditions stops the bio-transformation during the PFAS migration process

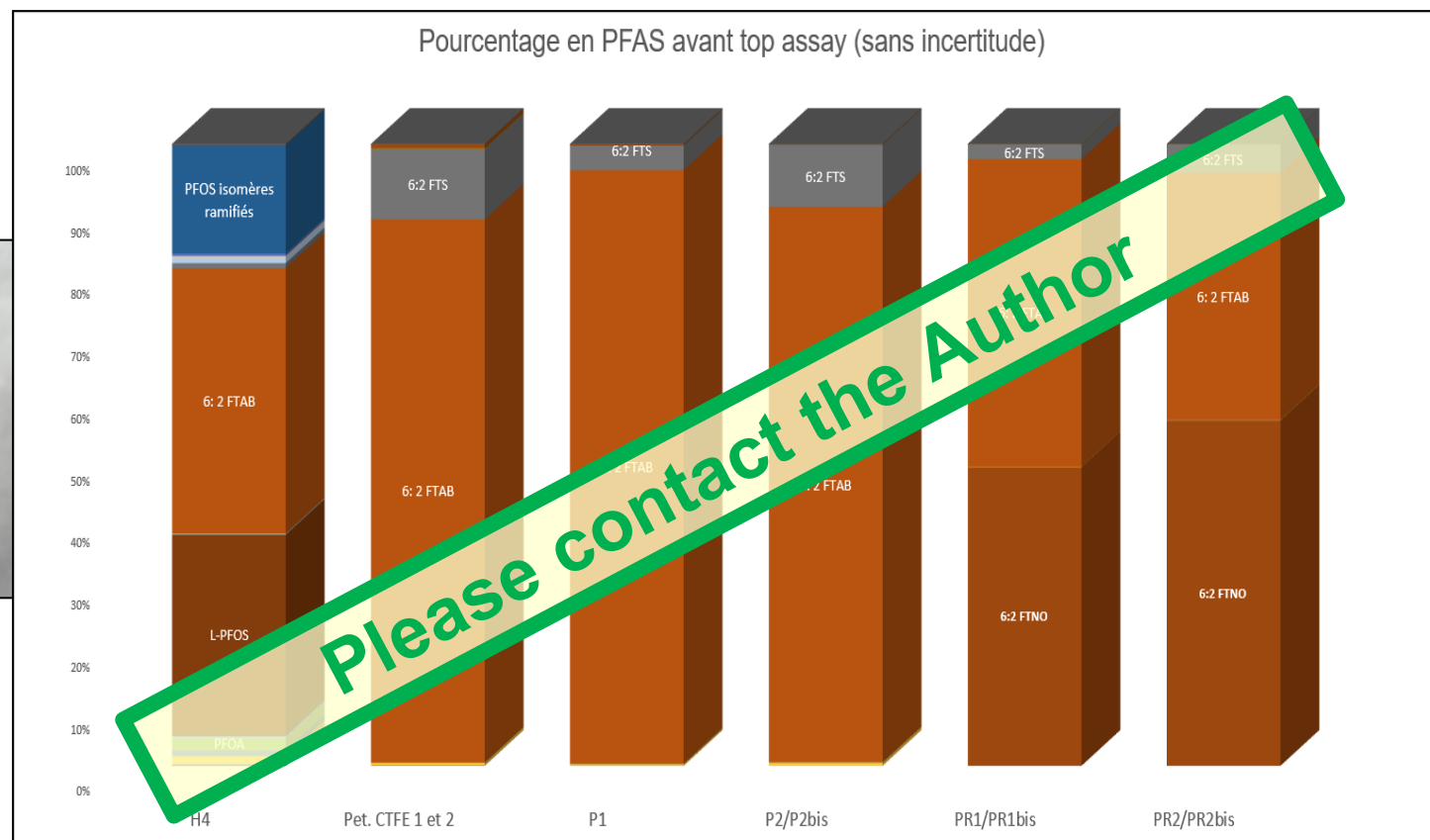


Anaerobic conditions stops the bio-transformation during the PFAS migration process

Présence of 6,2-FTAB in AFFFs

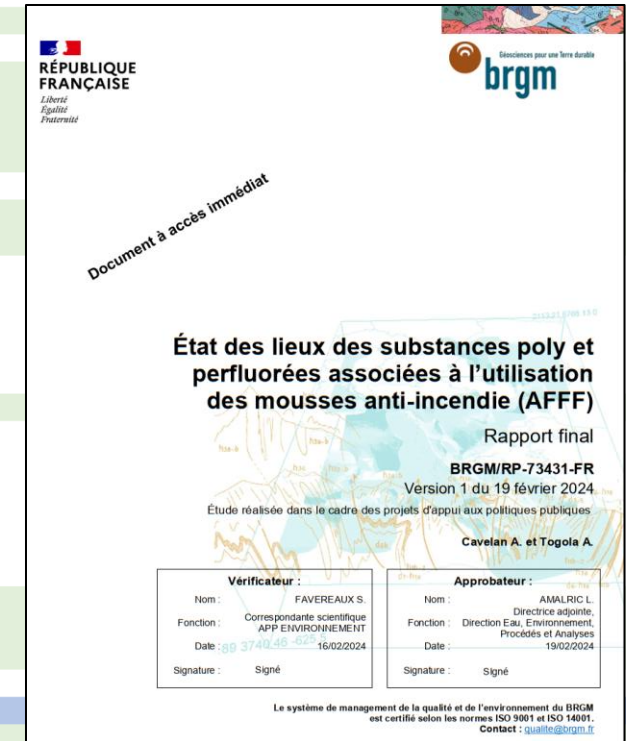
AFFF: Samples	Profilm 1	Profilm 2	Petrofilm CTFE	Petrofilm 1	Petrofilm 2	H4 (Hydral 3)	Superlube	Port Edouard Hérriot ARS
6:2 FTAB	49,5%	39,7%	87,3%	95,4%	89,3%	42,7%	58%	69%

> 66,3 % average of 6,2-FTAB in AFFFs



Classes	Chemguard	Angus Fire	Ansul Ansulite	Arctic foam	National foam	Hazard Contr Tech.	3M LightWater	3M 1988-2007	Fireade	Buckeye	Solberg	Niagara 1-3	Hi Combat A _{TM}	Shanghai Vatten
PFCA	X	X	X				X	X				X	X	X
PFSA	X	X	X				X	X				X	X	
S-PFCA								X						
H-PFSA							X	X						
K-PFSA								X						
H-PFCA							X	X						
UPFSA							X	X						
O-PFSA							X	X						
U-O-PFSA							X	X						
H-UPFSA							X							
Cl-PFSA							X	X						
FASA			X				X	X						
SPr-FASA							X							
TAm-OHPr-FASA							X							
TAm-OHPr-FASAPrA							X							
TAm-OHPr-EtFASA							X							
SPrAmPr-FASAPrS							X							
MeAnPr-FASA							X	X						
AmPr-FASAPrS							X							
EtOH-AmOHPr- MeFASA							X							
SPrAmPr-FASA							X							
FASAA							X							
SPrAmPr-FASAA							X							
AmPr-FASAA							X							
FTNO				X	X									
FTSA-PrMeAA				X	X									
Am-OHPr-FASA							X	X						
FTSAA				X										
FTSaAm					X		X	X	X					
PFOAAm							X	X						
FTSAPr-MeAn				X	X									
FTS	X	X	X		X	X					X	X		X
FTSi				X	X									
FTCA	X		X			X								
FTUCA	X		X											
ETP			X					X		X				
FTAB	X	X	X	X	X	X		X	X			X		X
PFSAM					X		X	X						
TAmPr-FASAPrA							X	X						
TAmPr-FASA							X	X						
TAmPr-FAAd							X	X						

Présence des PFAS dans les AFFFs (BRGM 2024)



TOF: Total Organo Fluorine

F. KARG 2025

= PFAS Monomers & Polymers +
other organo-fluorine Compounds;
Pesticides, Pharmaceuticals, etc.
→ → → *No Compound Identification !*

AOF: Adsorbable Organic Fluorine

= PFAS Monomers & Polymers +
other organo-fluorine Compounds;
Pesticides, Pharmaceuticals, etc.
→ → → *No Compound Identification !*

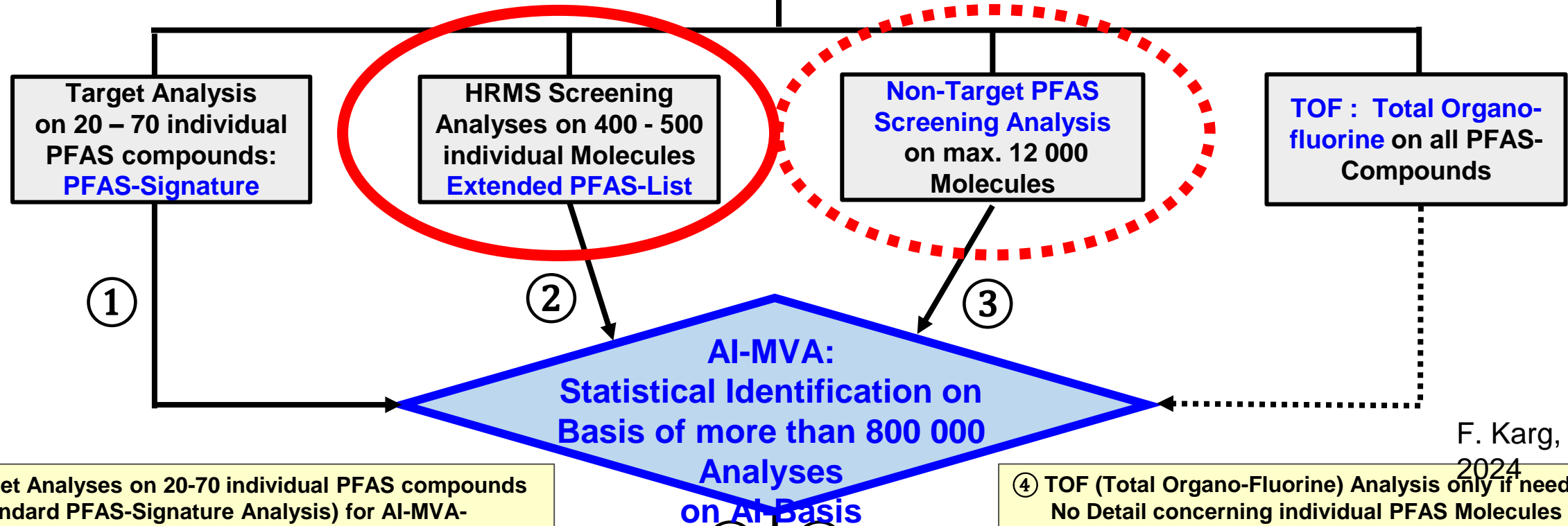
NTA: Non-Target Analysis = Semi-quantitative Identification of up to
12 000 Compounds: PFAS Monomers

QTA: Quantitative Target
Analysis = up to 20-700 Com-
pounds: PFAS Monomers

QTA+TA; after TOP Assay (20-
200 Compounds: PFCA including
transformed polyfluorinated PFAS)

Environmental Samplings (soil, groundwater, surface waters) / **Registering of Standards**

F. Karg,
2023



F. Karg,
2024

- ① Target Analyses on 20-70 individual PFAS compounds (standard PFAS-Signature Analysis) for AI-MVA-Procedure
- ② Extended PFAS List Analysis for AI-MVA – Data Bank.
- ③ Registering of individual PFAS Compounds Spectrums from Commercial PFAS Products and degraded Commercial Products after long term Lysimeter & Percolation Tests with Bacteria for bio-transformation of poly-fluorinated PFAS to per-fluorinated PFAS

Identification of commercial PFAS-Products and Pollution Sources de pollution in Standard Environmental Soil and Water Analyses via polytopic AI-MVA

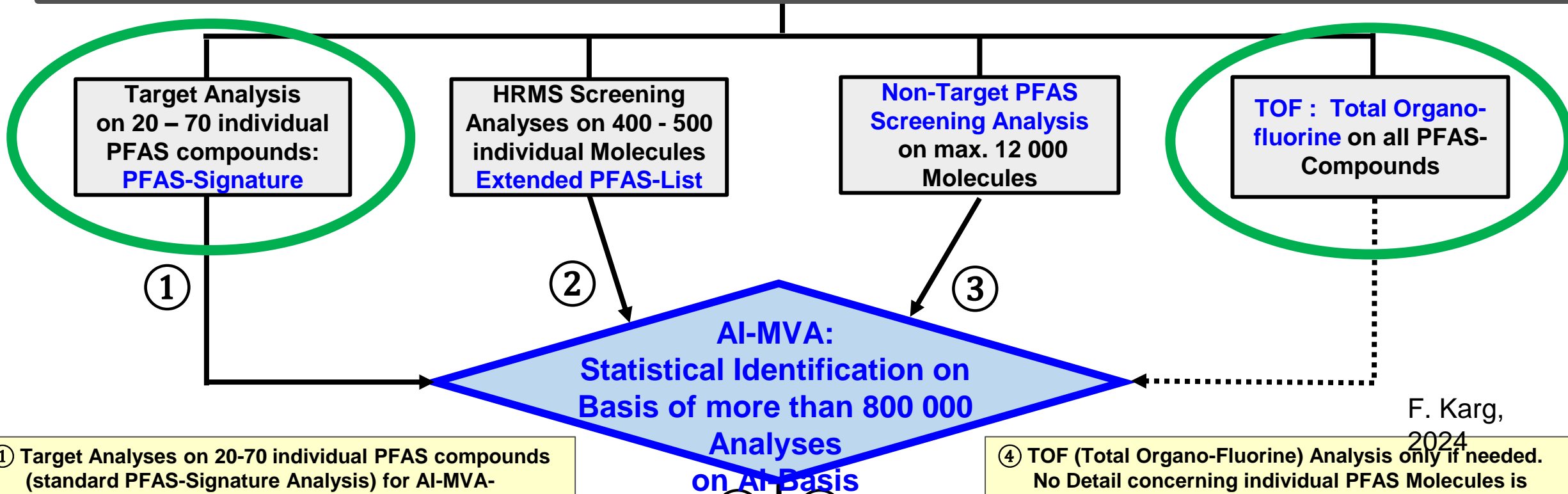
- ④ TOF (Total Organo-Fluorine) Analysis only if needed. No Detail concerning individual PFAS Molecules is obtained.
- ⑤ Identification of commercial PFAS Products based on the Extended PFAS-List Spectrums of HPC INTERNATIONAL's Data Bank.
- ⑥ Identification on Experiences Basis on more than 800 000 PFAS Analyses and registered statistical Polytopic PFAS Parameters.



PFAS-Source Identification and Differentiation Tools by use of PFAS Data Bank on Commercial Products and AI-MVA-Tool (Artificial Intelligence

Multi-Vector-Analysis)

Environmental Samplings (soil, groundwater, surface waters): **Routine Analysis (+ Top Assay)**



① Target Analyses on 20-70 individual PFAS compounds (standard PFAS-Signature Analysis) for AI-MVA-Procedure

② Extended PFAS List Analysis for AI-MVA – Data Bank.

③ Registering of individual PFAS Compounds Spectrums from Commercial PFAS Products and degraded Commercial Products after long term Lysimeter & Percolation Tests with Bacteria for bio-transformation of poly-fluorinated PFAS to per-fluorinated PFAS

Identification of commercial PFAS-Products and Pollution Sources de pollution in Standard Environmental Soil and Water Analyses via polytopic AI-MVA

④ TOF (Total Organo-Fluorine) Analysis only if needed. No Detail concerning individual PFAS Molecules is obtained.

⑤ Identification of commercial PFAS Products based on the Extended PFAS-List Spectrums of HPC INTERNATIONAL's Data Bank.

⑥ Identification on Experiences Basis on more than 800 000 PFAS Analyses and registered statistical Polytopic PFAS Parameters.

F. Karg,
2024

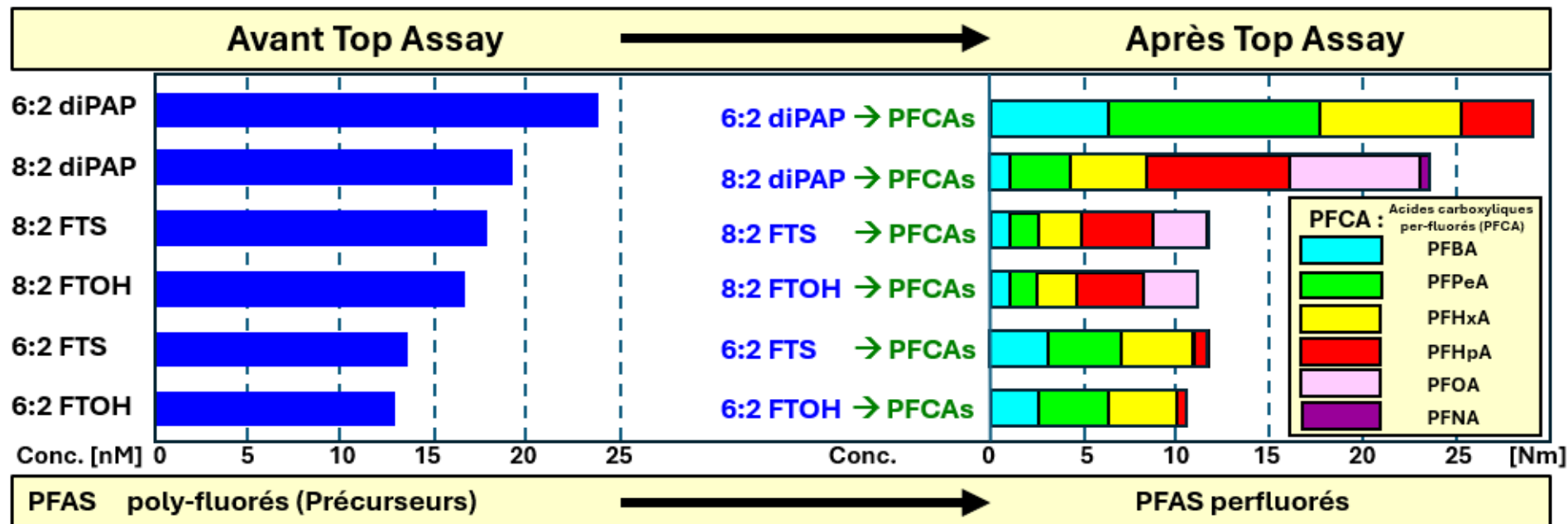
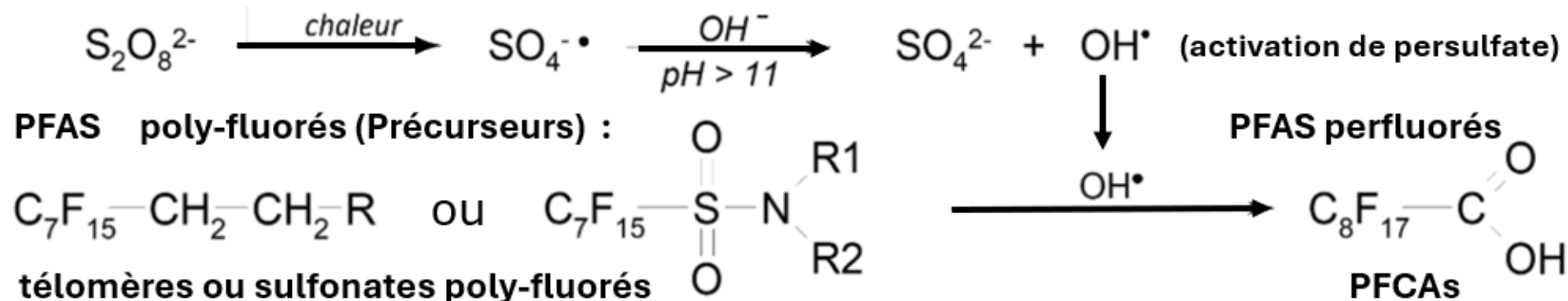
PFAS	LQ	CAS	VTR	Dir. CE EP2020/ 2184	AM 20/06/23 France
PFBA (acide perfluorobutanoïque)	ng/l	1	375-22-4		
PFPeA (acide perfluoropentanoïque)	ng/l	5	2706-90-3		
PFHxA (acide perfluorohexanoïque)	ng/l	1	307-24-4		
PFHpA (acide perfluoroheptanoïque)	ng/l	1	375-85-9		
PFOA linéaire (acide perfluorooctanoïque)	ng/l	1	335-67-1		
PFOA ramifié (acide perfluorooctanoïque)	ng/l	1	335-67-1		
PFOA totale (acide perfluorooctanoïque)	ng/l	1	335-67-1		
PFNA (acide perfluorononanoïque)	ng/l	1	375-95-1		
PFDA (acide perfluorodécanoïque)	ng/l	1	335-76-2		
PFUnDA (acide perfluoroundécanoïque)	ng/l	1	2058-94-8		
PFDODA (acide perfluorododécanoïque)	ng/l	2	307-55-1		
PFTTrDA (acide perfluorotridecane)	ng/l	1	72629-94-8		
PFTeDA (acide perfluorotétradécane)	ng/l	1	376-06-7		
PFHxDA (acide perfluorohexadécane)	ng/l	2	67905-19-5		
PFODA (acide perfluorooctadécane)	ng/l	1	16517-11-6		
PFBS (acide perfluorobutane sulfonique)	ng/l	1	375-73-5		
PFPeS (acide perfluoropentane sulfonique)	ng/l	1	2706-91-4		
PFHxS linéaire (acide perfluorohexane sulfonique)	ng/l	1	355-46-4		
PFHxS ramifié (acide perfluorohexane sulfonique)	ng/l	1	355-46-4		
PFHxS totale	ng/l	1	355-46-4		
PFHpS (acide perfluoroheptane sulfonique)	ng/l	1	375-92-8		
PFOS linéaire (acide perfluorooctane sulfonique)	ng/l	1	1763-23-1		
PFOS ramifié (acide perfluorooctane sulfonique)	ng/l	1	1763-23-1		
PFOS totale (acide perfluorooctane sulfonique)	ng/l	1	1763-23-1		
PFDS (acide perfluorodécane sulfonique)	ng/l	1	335-77-3		
4:2 FTS (acide 4:2 fluorotélomère sulfonique) H4-PFOS	ng/l	1	757124-72-4		
6:2 FTS (acide 6:2 fluorotélomère sulfonique)	ng/l	1	27619-97-2		
8:2 FTS (acide 8:2 fluorotélomère sulfonique)	ng/l	1	39108-34-4		
10:2 FTS (acide 10:2 fluorotélomère sulfonique)	ng/l	1	120226-60-0		
MePFOSAA (acide N-méthylperfluorooctane sulfonamide acétique)	ng/l	1	2355-31-9		
EtFOSAA (acide N-éthylperfluorooctane sulfonamide acétique)	ng/l	1	2991-50-6		
PFOSA linéaire (perfluoro-n-octanesulfonamide)	ng/l	2	754-91-6		
PFOSA ramifié (perfluoro-n-octanesulfonamide)	ng/l	2	754-91-6		
PFOSA totale (perfluoro-n-octanesulfonamide)	ng/l	2	754-91-6		
MeFOSA linéaire (N-méthylperfluorooctanesulfonamide) (MePFOSA)	ng/l	1	31506-32-8		
6:2-FTAB (6 :2 fluorotélomère sulfonamide propyl betaine) Capstone B	ng/l	10	34455-29-3		

PFAS	LQ	CAS	VTR	Dir. CE EP2020/ 2184	AM 20/06/23 France
MeFOSA ramifié (N-méthylperfluoro-n-octanesulfonamide) (MePFOSA)	ng/l	1	31506-32-8		
MeFOSA totale (N-méthylperfluoro-n-octanesulfonamide) (MePFOSA)	ng/l	1	31506-32-8		
8:2 DiPAP (8:2 polyfluoroalkyl phosphate diester)	ng/l	1	678-41-1		
HFPO-DA (acide hexafluoropropylèneoxy dimer) Gen X	ng/l	1	13252-13-6		
EtFOSA linéaire (N-éthylperfluorooctanesulfonamide) (EtPFOSA)	ng/l	1	4151-50-2		
EtFOSA ramifié (N-éthylperfluorooctanesulfonamide) (EtPFOSA)	ng/l	1	4151-50-2		
EtFOSA totale (N-éthylperfluorooctanesulfonamide) (EtPFOSA)	ng/l	1	4151-50-2		
MeFBSAA (perfluorobutanesulfonamide(N-méthyl)acetate)	ng/l	5	159381-10-9		
5:3-FTCA: 5:3 acide carboxylique fluorotélomère	ng/l	1	914637-49-3		
6:2-FTCA: 6:2 acide carboxylique fluorotélomère	ng/l	5	53826-12-3		
8:2 FTUCA (acide 2H-perfluoro-2-décène)	ng/l	1	70887-84-2		
DONA (acide 4,8-dioxa-3H-perfluorononanoïque)ADONA	ng/l	1	919005-14-4		
MeFBSA (n-méthylperfluorobutanesulfonamide)	ng/l	1	68298-12-4		
PFBSA (perfluorobutanesulfonamide)	ng/l	1	30334-69-1		
PFECHS (acide perfluoro-4-éthylcyclohexanesulfonique)	ng/l	1	646-83-3		
PFNS (acide perfluorononane sulfonique)	ng/l	1	68259-12-1		
PFDODS (acide perfluorododécane sulfonique)	ng/l	1	79780-39-5		
6:2 diester de phosphate fluorotélomérique. 6:2 diPAP	ng/l	10	57677-95-9		
6:2 8:2 diester de phosphate fluorotélomérique. 6:2 8:2 diPAP	ng/l	10	943913-15-3		
PFHxSA (perfluorohexanesulfonamide)	ng/l	1	41997-13-1		
PFUnDS (acide perfluoroundécane sulfonique)	ng/l	2	749786-16-1		
PFTTrDS (acide perfluorotridecane sulfonique)	ng/l	2	791563-89-8		
EtFOSE (2-(N-éthylperfluoro-1-octanesulfonamido)-ethanol)	ng/l	5	1691-99-2		
MeFOSE (2-(N-méthylperfluoro-1-octanesulfonamido)-ethanol)	ng/l	5	24448-09-7		
NFDHpA (Nonafluoro-3,6-dioxaheptanoïque acid)	ng/l	1	151772-58-6		
PFMPA (Perfluoro-3-méthoxypropanoïque acid)	ng/l	1	377-73-1		
PFMBA (perfluoro-4-méthoxybutanoïque acid)	ng/l	1	863090-89-5		
C6O4 (Perfluoro([5-méthoxy-1,3-dioxolan-4-yl]oxy)acetic acid)	ng/l	10	1190931-41-9		
6:2-FTOH (6:2 fluorotélomère alcool) FHET	ng/l	20	647-42-7		
8:2-FTOH (8:2 fluorotélomère alcool) FOET	ng/l	10	678-39-7		
PFAS Ultrashorts :					
TFA (trifluoroacetic acid)	ng/l	10			
PFPPrA (perfluoropropanoïque acid)	ng/l	10			
TFMS (trifluoromethanesulfonic acid)	ng/l	10			
PFES (perfluoroethanesulfonic acid)	ng/l	10			
PFPPrS (perfluoropropanesulfonic acid)	ng/l	10			

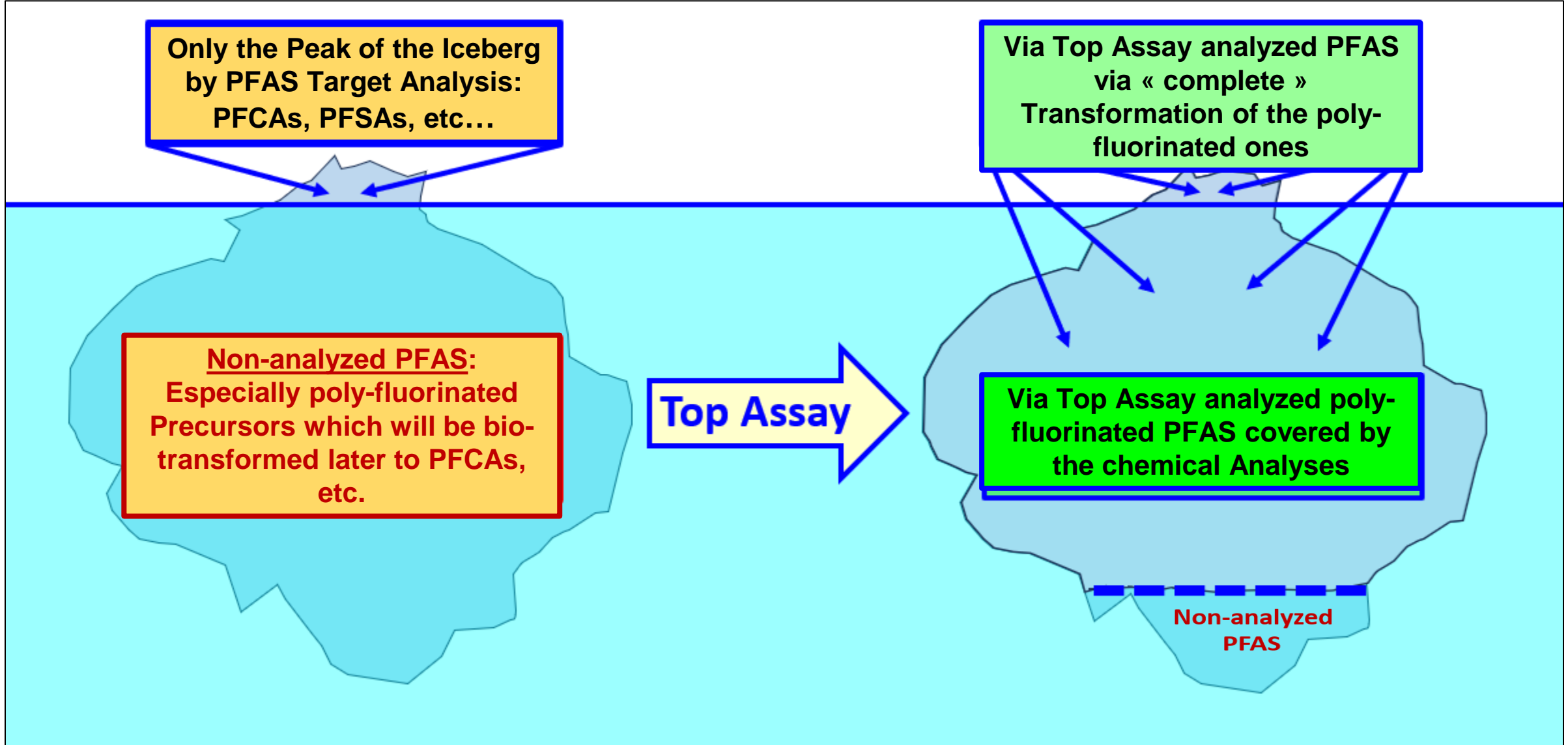
Considering of
 all
 poly-fluorinated
 PFAS as final
 per-fluorinated
 PFCAs

Top Assay Total Oxidizable Precursor

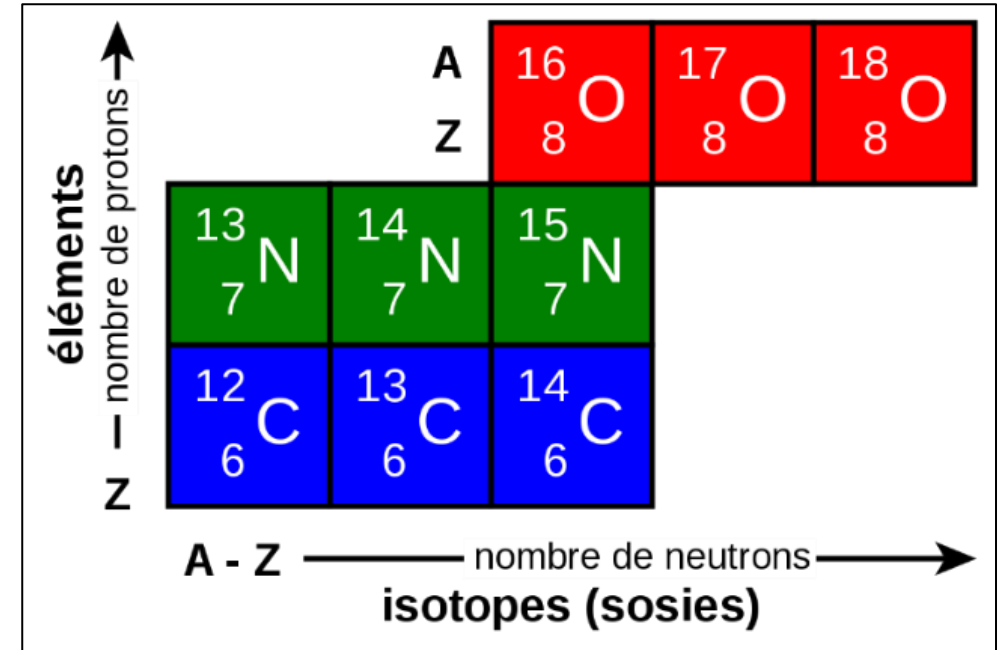
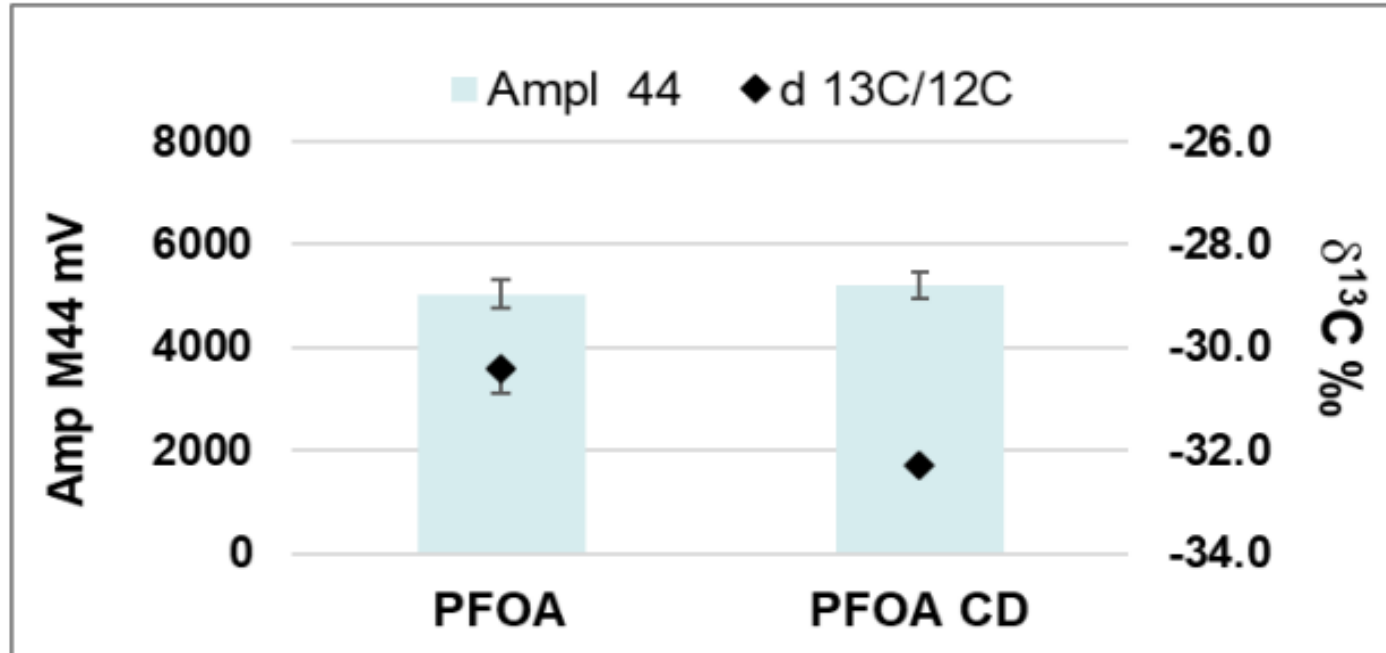
Frank KARG 2024



Analyses PFAS sans et avec Top Assay



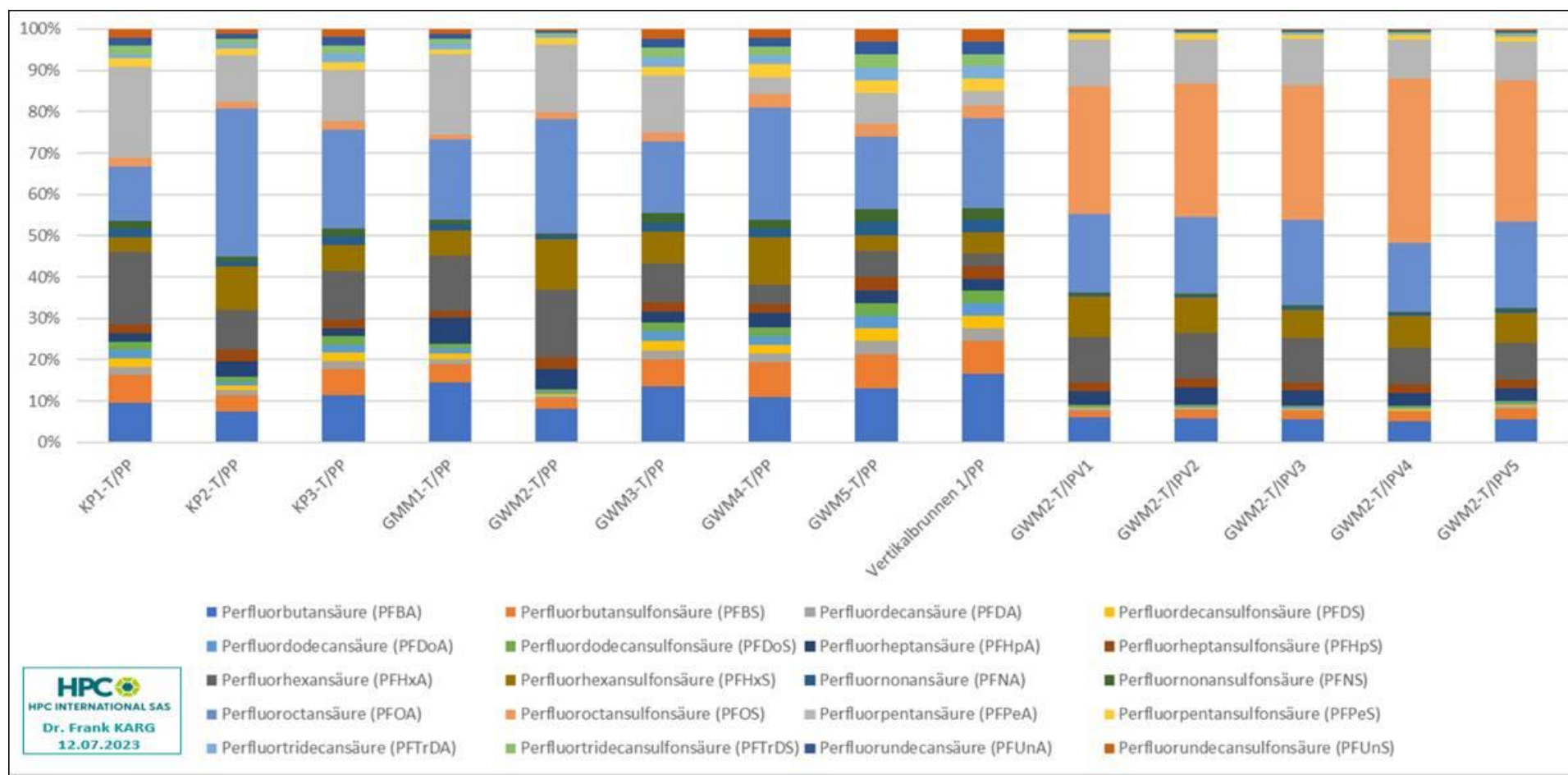
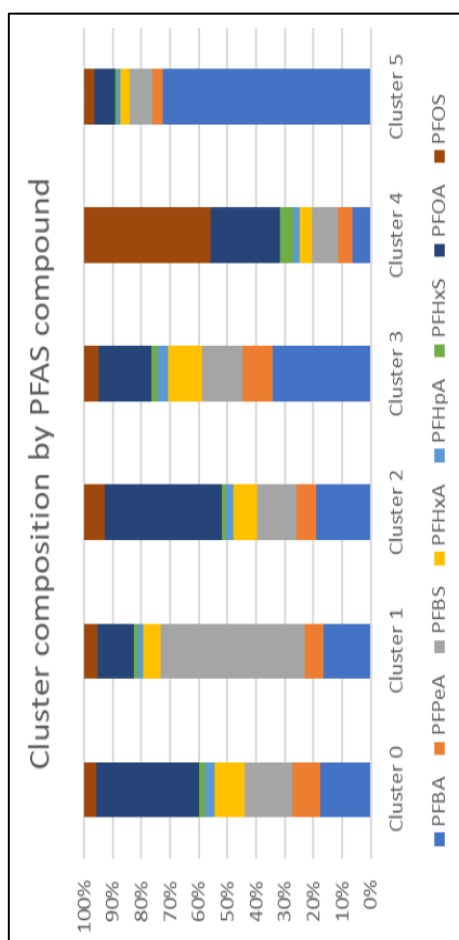
PFAS-Source-Identification via Isotope Ratios ($^{13}\text{C}/^{12}\text{C}$) :



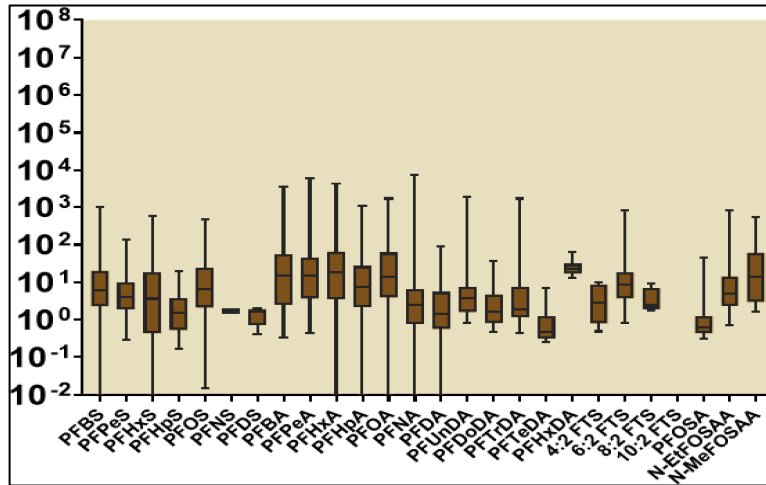
Application $^{13}\text{C}/^{12}\text{C}$ Ratios for identification of PFAS Sources: Example of PFOA (Kuntze 2023).
PFAS Source Identifications with Sulfur-Isotopes for PFOS, etc. is in development.

Identification et différenciation des sources PFAS par analyses des Clusters

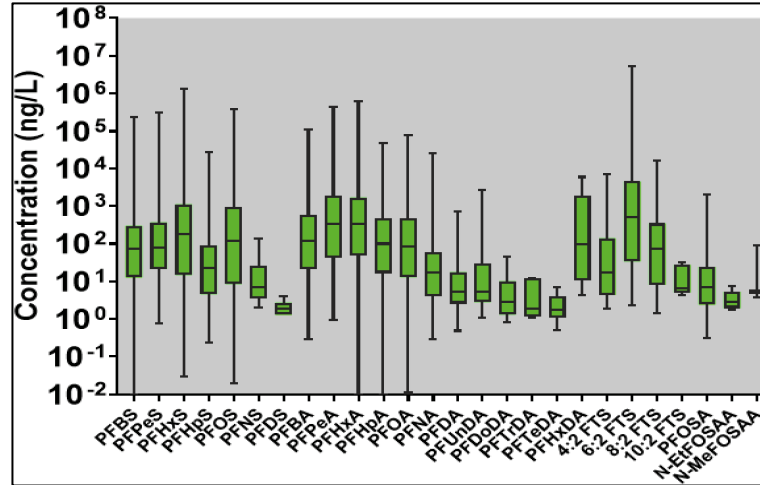
Des analyses de **Clusters PFAS** permettent d'**identifier les origines** des produits et industries ayant provoqué les pollutions environnementales



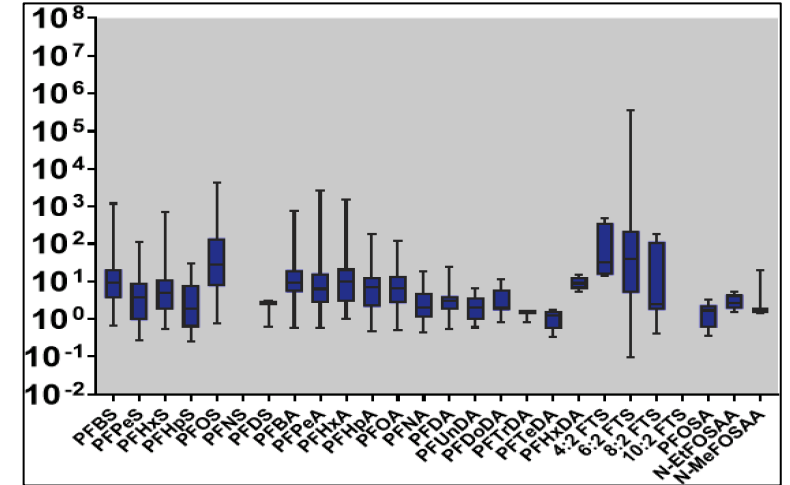
Exemples Statistiques basés sur plus que 800 000 Analyses Environnementales (NAS, 2023)



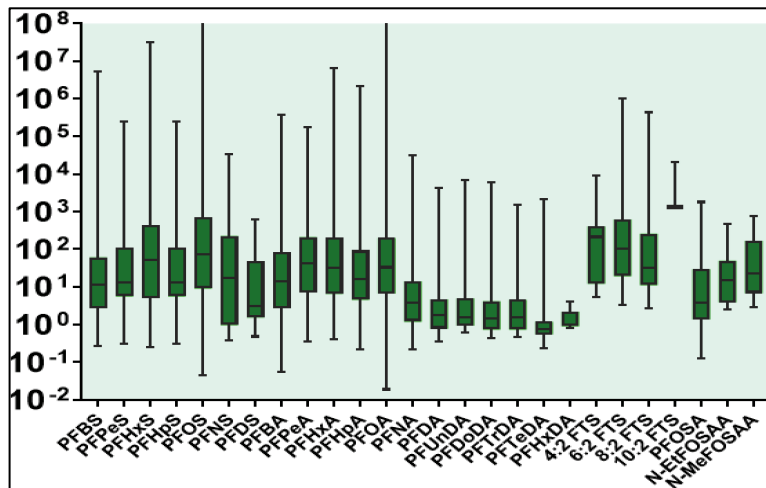
Household Landfills



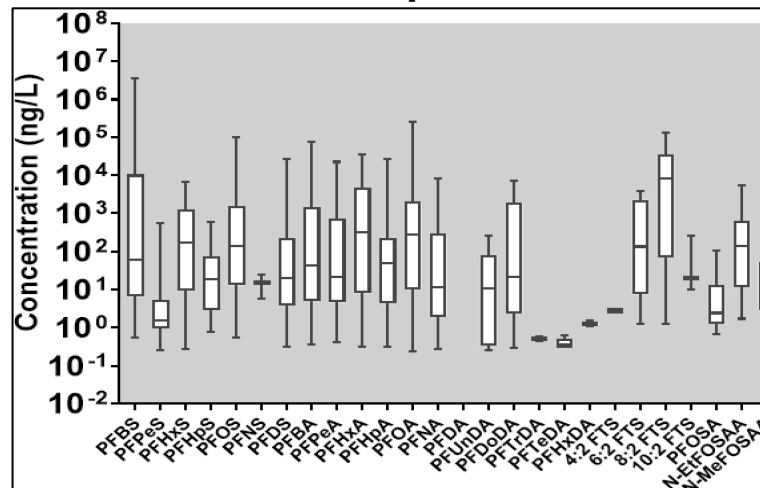
Civil Airports



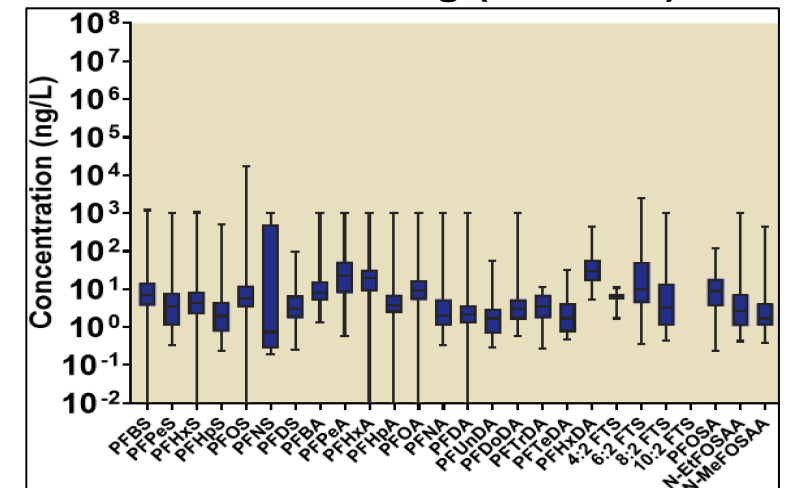
Chrome Plating (Galvanik)



Military Airports

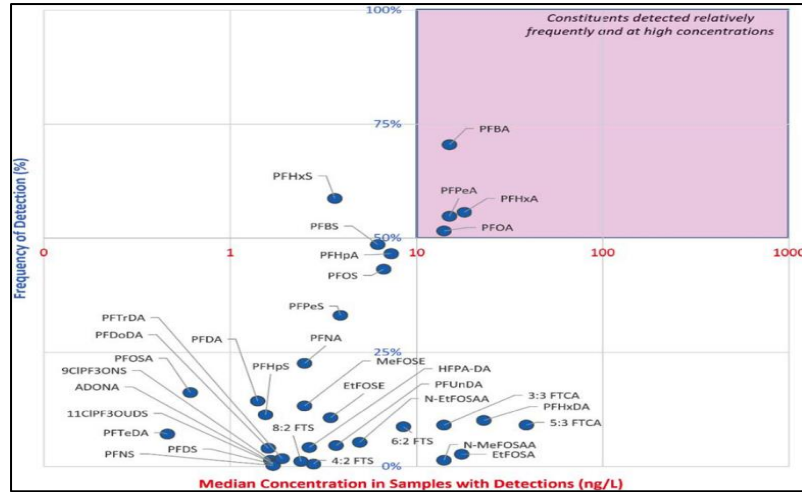


Industrial Sites (Polymers etc.)

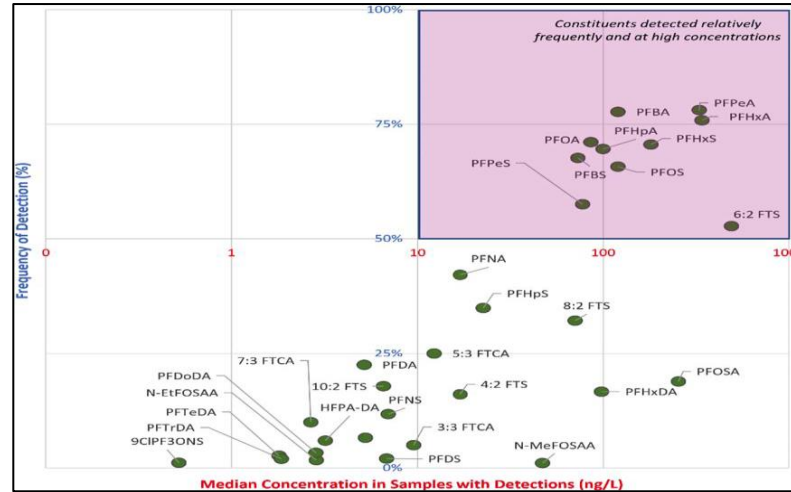


WWTPs (Wastewater & WWTP Sludge)

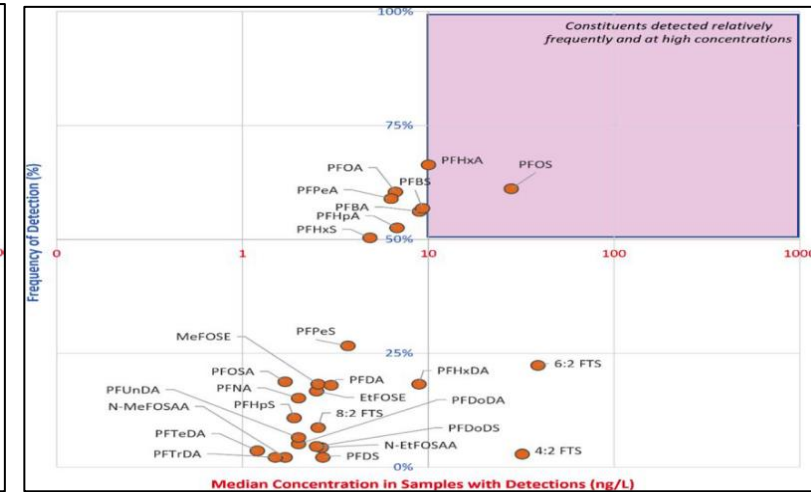
Exemples Statistiques basés sur plus que 800 000 Analyses Environnementales (NAS, 2023)



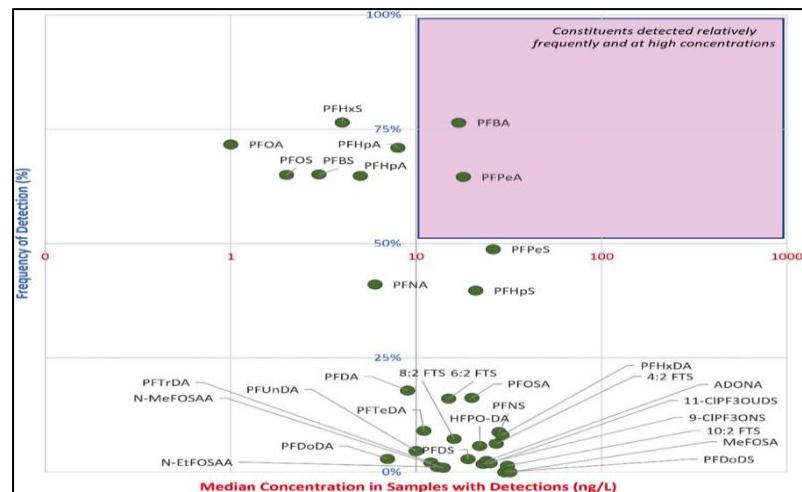
Household Landfills



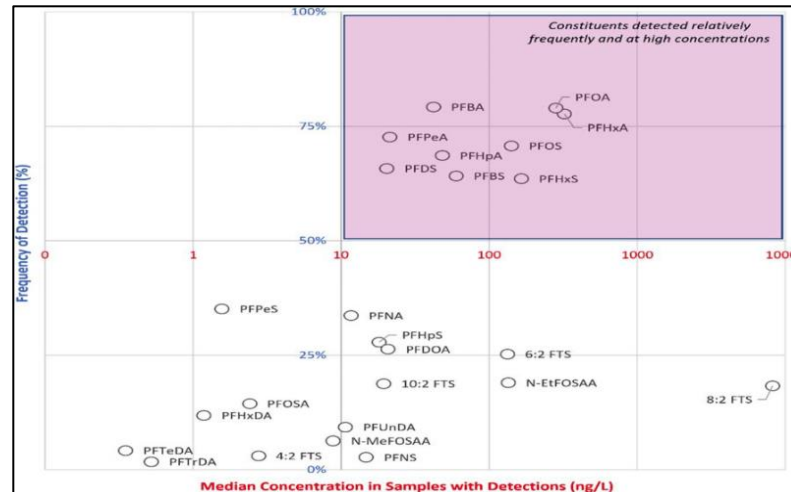
Civil Airports



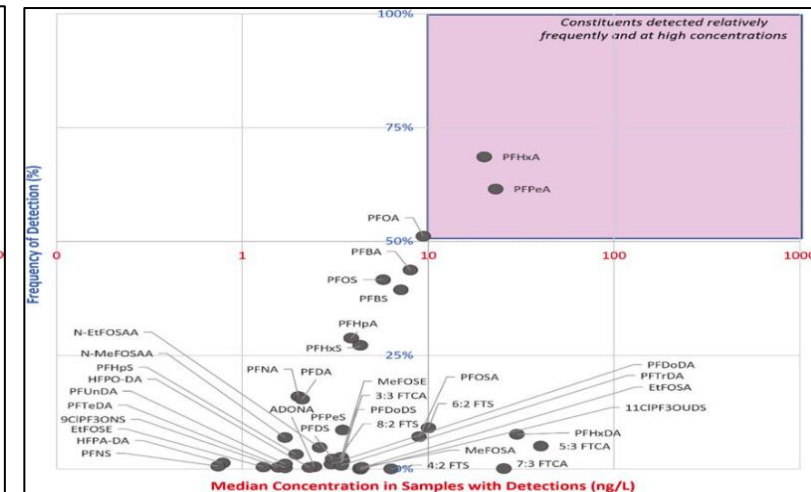
Chrome Plating (Galvanik)



Military Airports



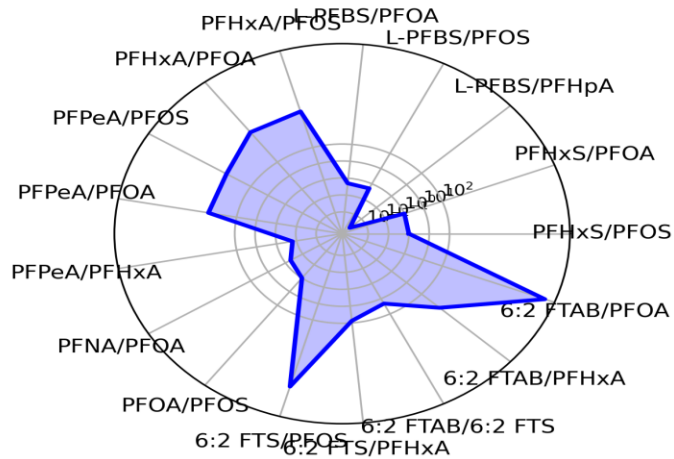
Industrial Sites (Polymers etc.)



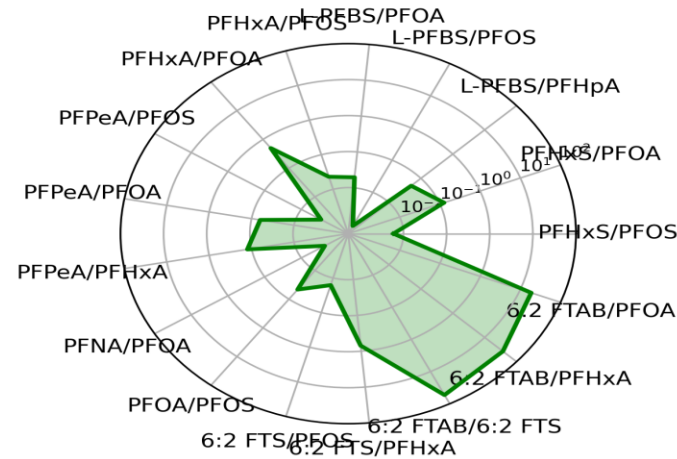
WWTPs (Wastewater & WWTP Sludge)

Radar Plots of PFAS Relationships for several Commercial PFAS Products

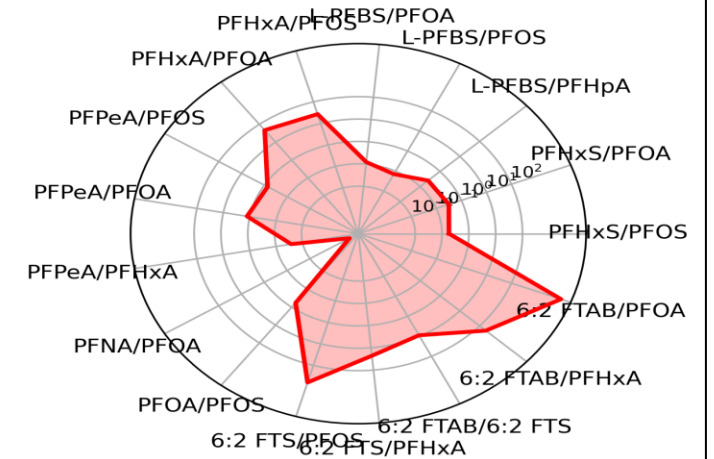
Pr1/Pr1bis



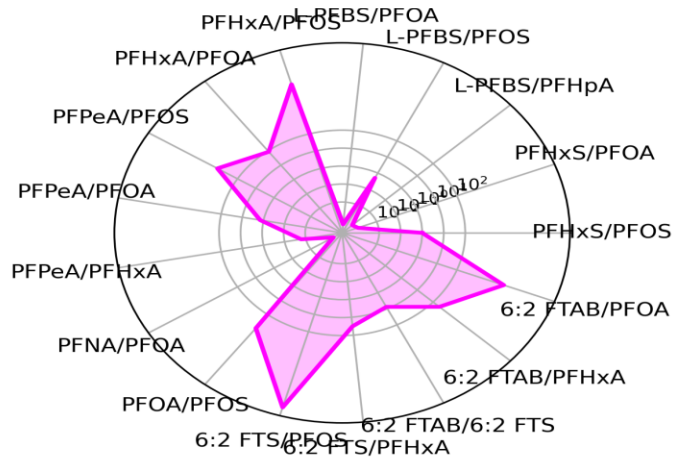
H4



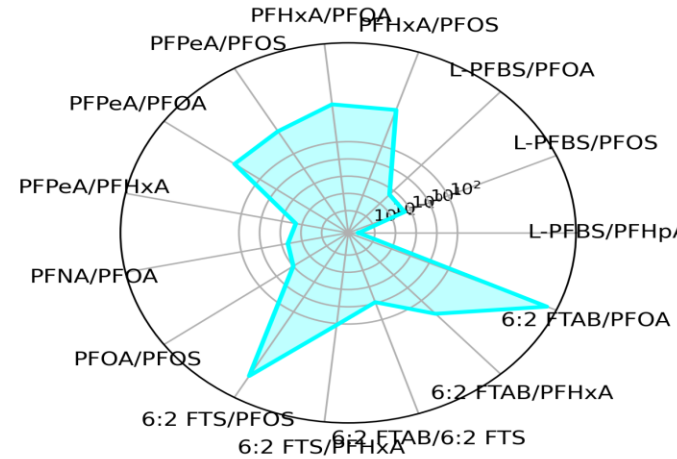
P1



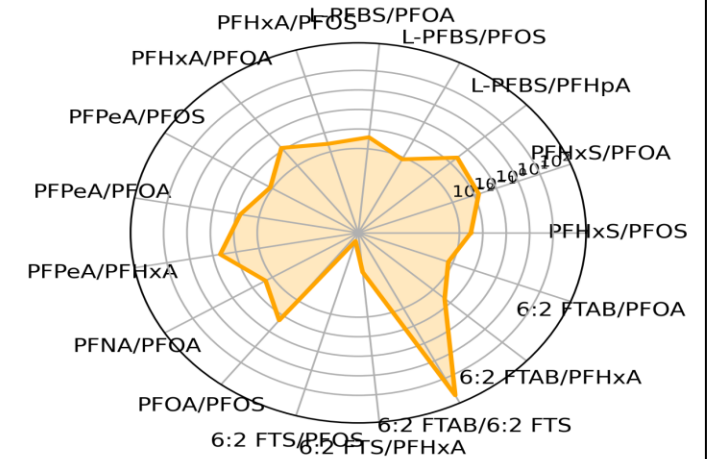
PF-CTE

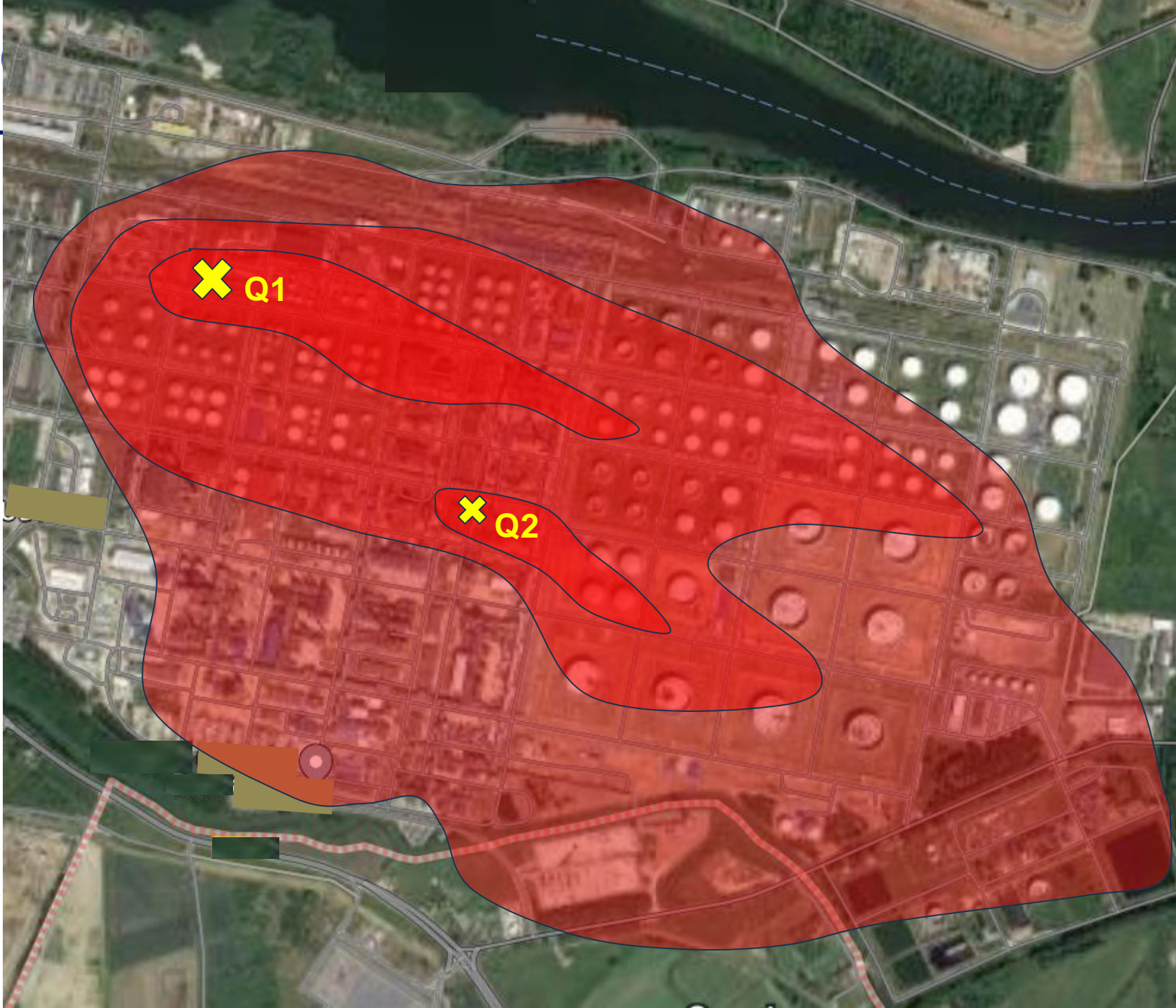


Pr2/Pr2bis



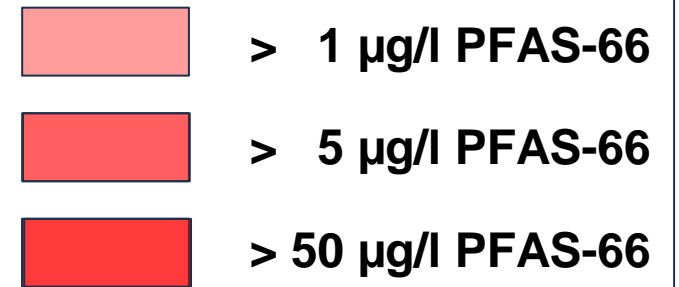
Scotchban FC 807





PFAS-66 total Presence in Groundwater

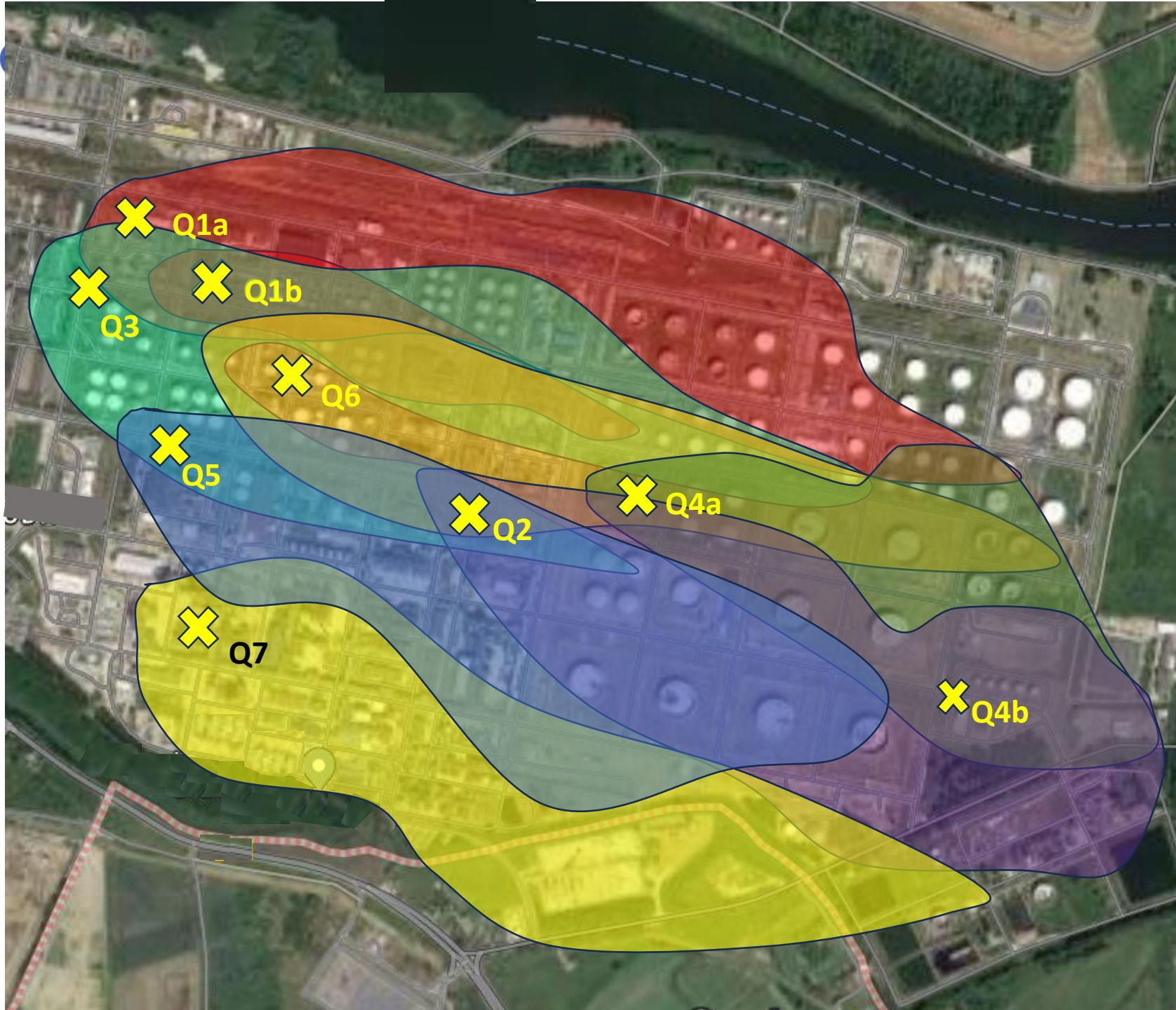
Identified PFAS
Sources S1 – S3





PFAS-Sources In Groundwater

**MVA-AI: Dominating Clusters:
Sources S1 – S9**



Q1ab: AFFF

6:2-FTAB, 6:2-FTS, 6:2-FTOH,
PFHxA, PFPeA, PFBA, PFOS.....

Q2: AFFF 2

6:2-FTS, 6:2-FTAB, 6:2-FTOH,
PFHxA, PFPeA, PFOA, PFHxS....

Q3: AFFF 3

6:2-FTS, 6:2-FTOH, PFHxA, PFPeA,
PFBA, PFHxS, PFBS, 4:2-FTS.....

Q4ab: Galv

PFHxA, PFPeA, PFOA, PFBA,
PFOS, PFBS, PFHpA, PFBS...

Q5: Landfill

PFBA, PFPeA, PFHxA, PFOA,
PFHpA, 8:2-FTOH, 5:3-FTCA....

Q6: Surfact

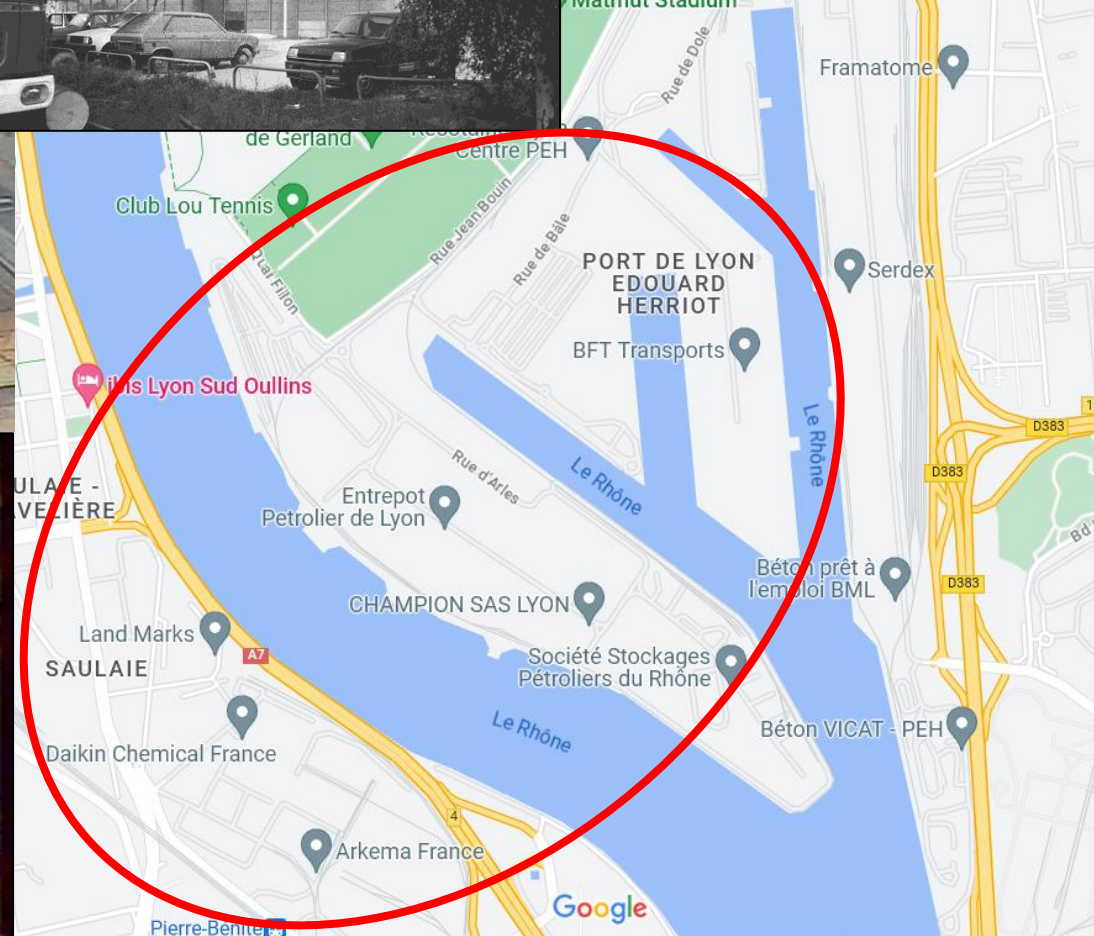
4:2-FTS, 6:2-FTS, PFHxS, PFBS, 6:2-
FTOH, PFHxA, PFPeA....

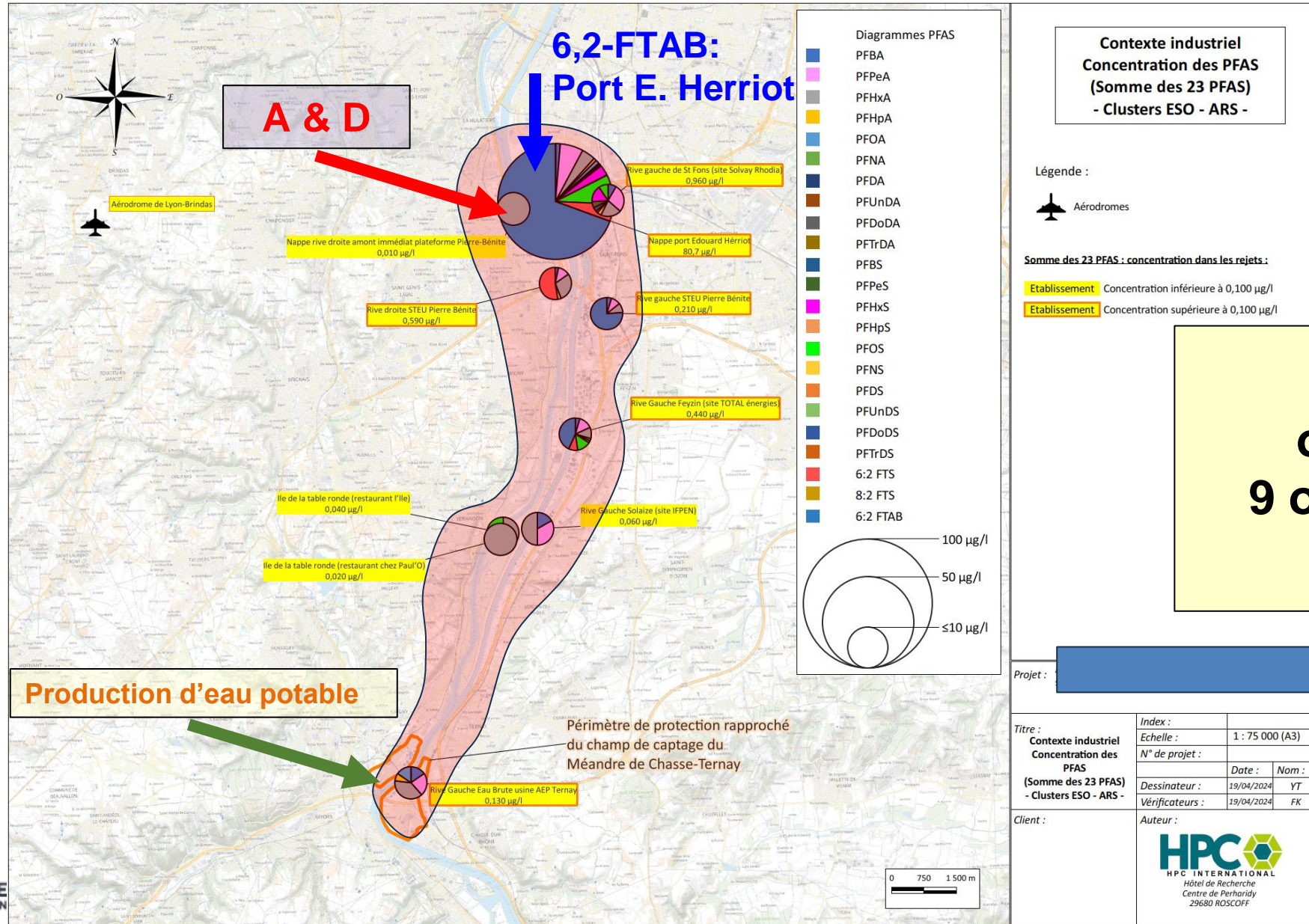
Q7: Surfact

6:2-FTS, PFHxS, PFBS, 6:2-FTOH,
PFHA, PFPeA, PFBA...

Port Edouard-Herriot

1987





**PFAS-66:
over 18 km:
9 other Sources
PFAS**

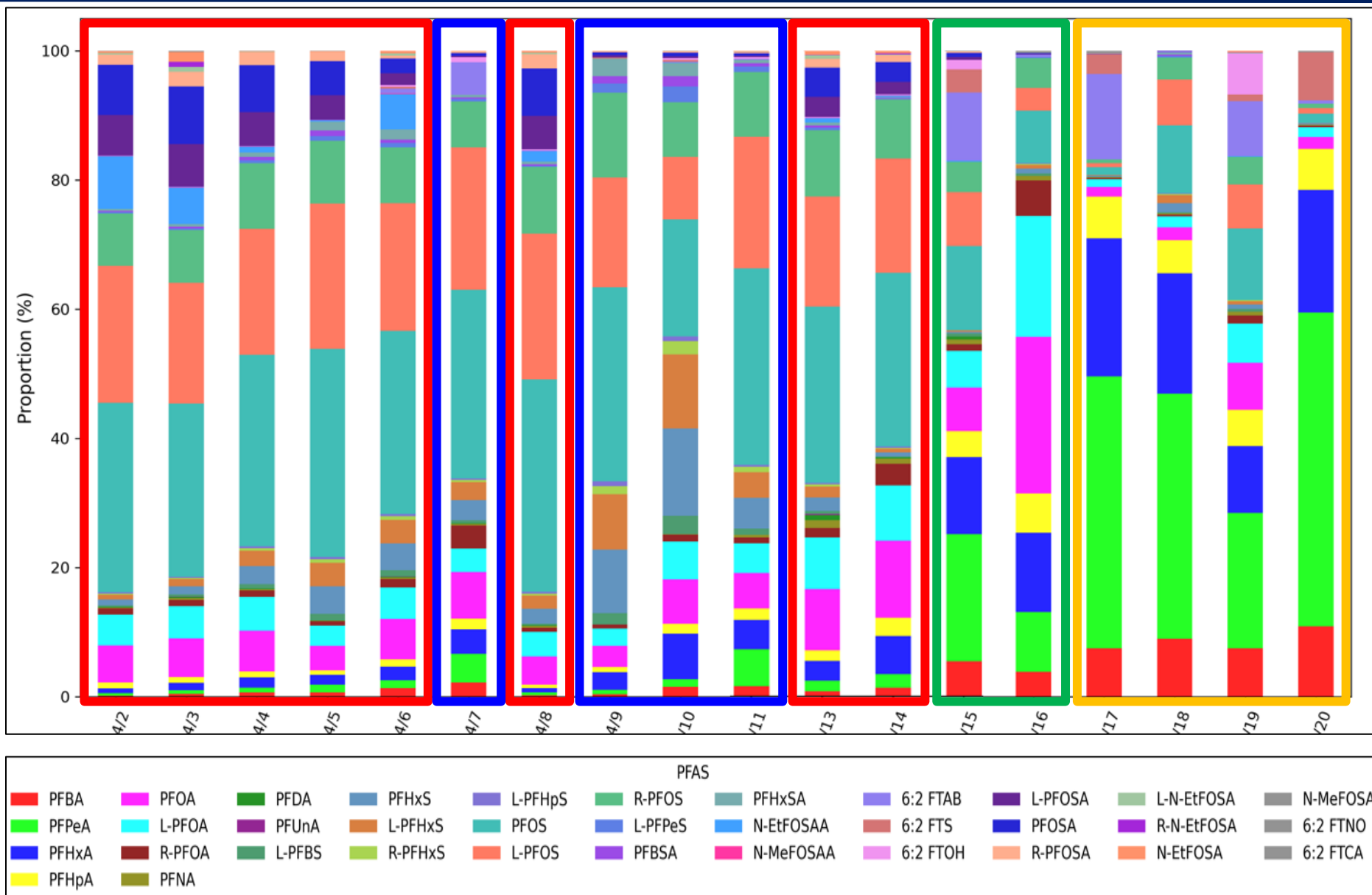
Site « C »:

Cluster 1: AFFF-A

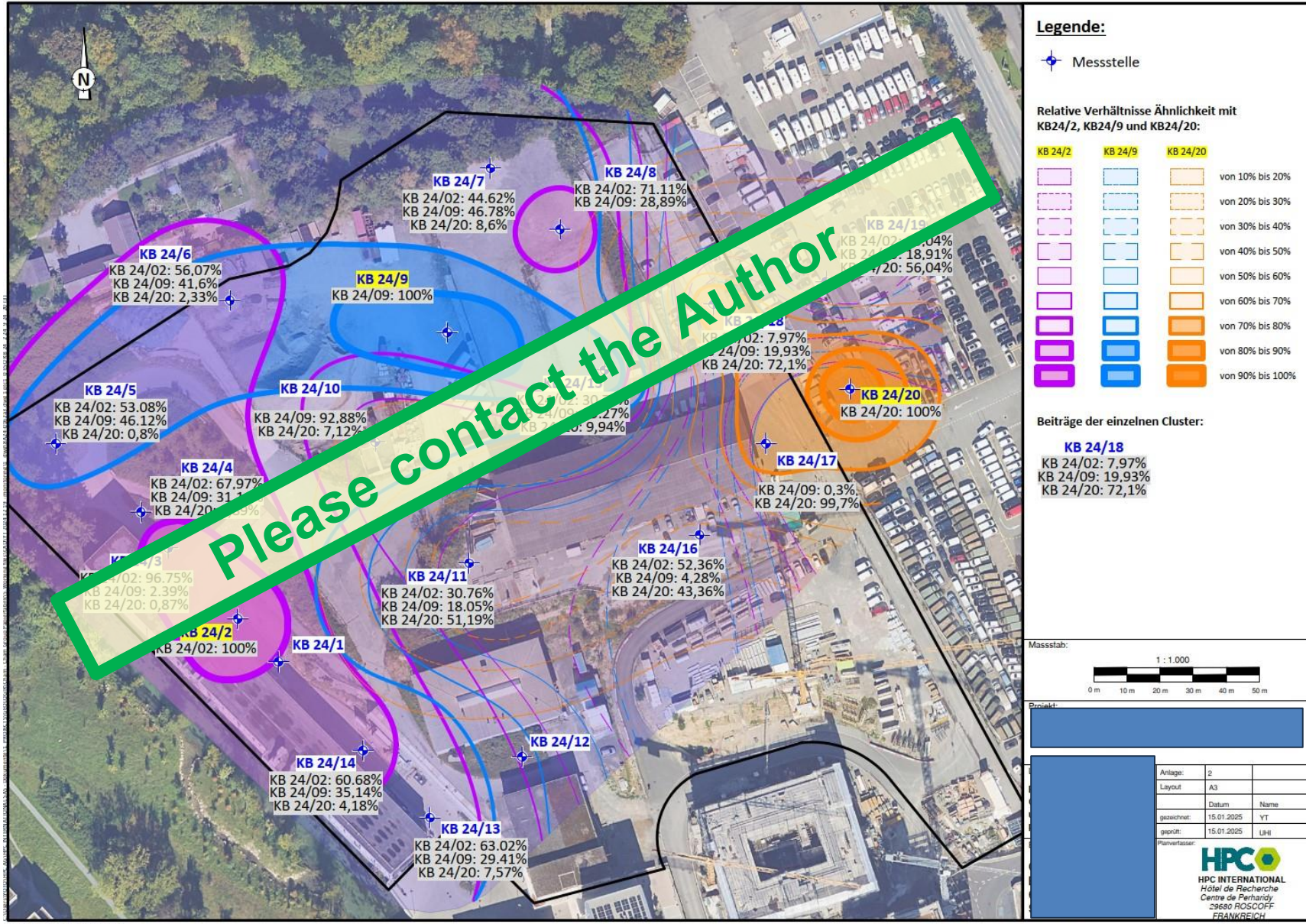
Cluster 2: SB FC807

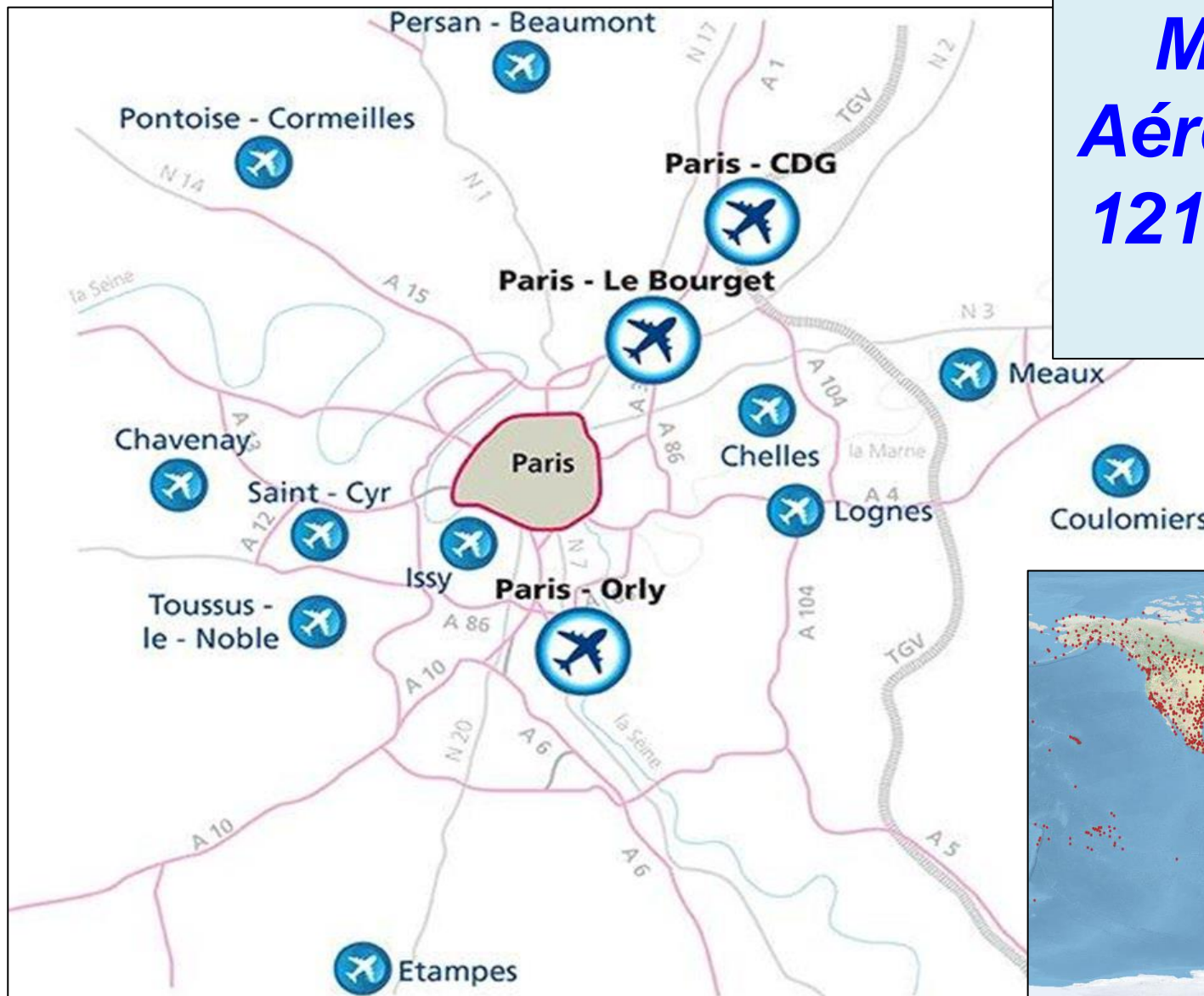
Cluster 3: AFFF-B

Cluster 4: Mix C1&2

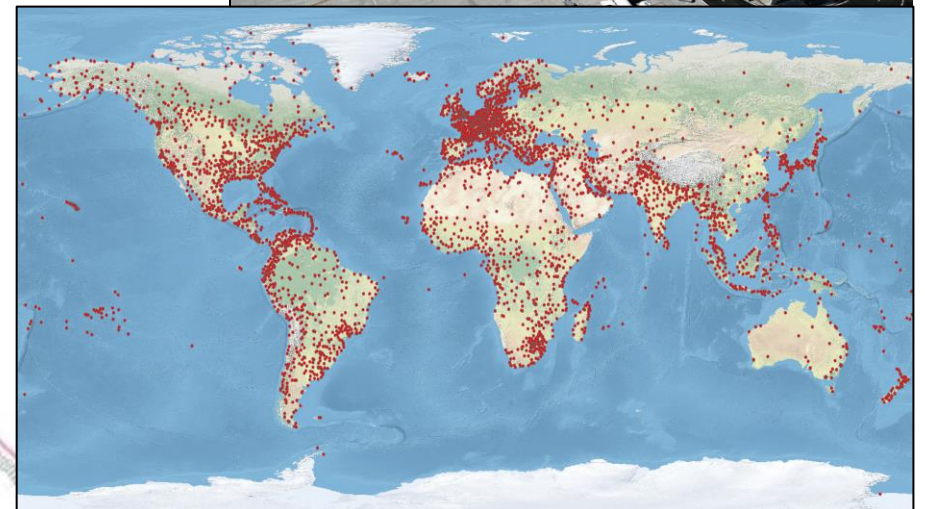
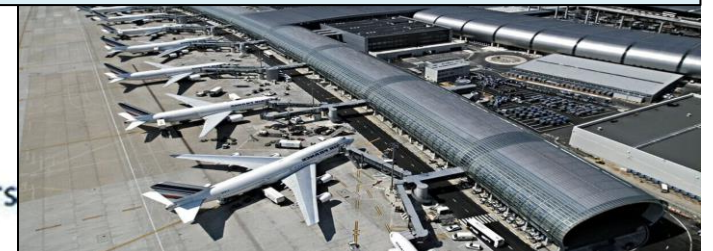


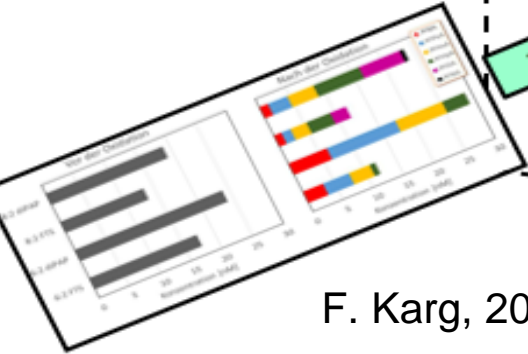
**PFAS-Sources
PFAS - Cluster
Overlapping
In Groundwater
and percentage of
Plume part**



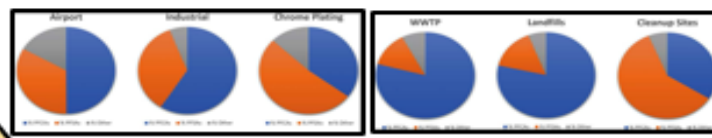
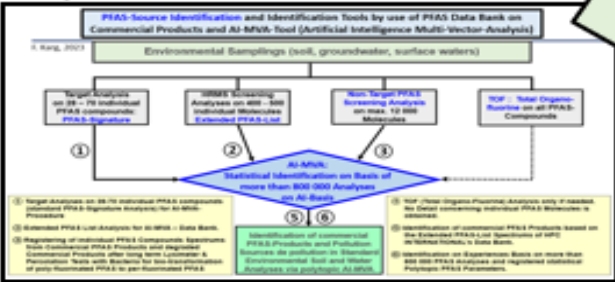


***MVA pour ADP:
Aéroports de Paris :
121 Aéroports dans
le monde***





F. Karg, 2024



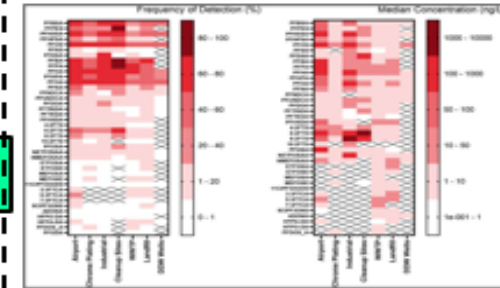
Circular PFAS Distributions

Non-Target Analysis: HRMS

Standard Analysis: PFAS 28

AI-MVA: Artificial Intelligence based Multi-Vector-Analysis for Identification & Differentiation of PFAS Sources

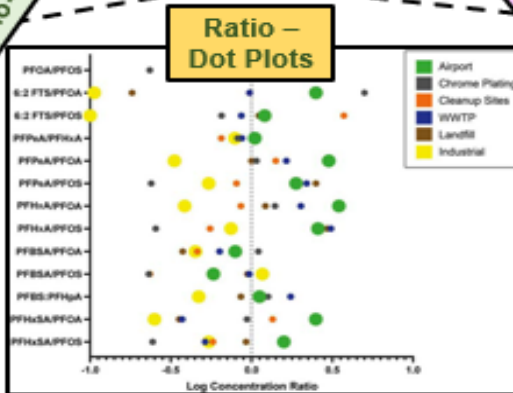
Forensic Analysis! Ramified PFAS, PFECHS, etc.



Isotope Ratios ($^{13}\text{C}/^{12}\text{C}$, $^{34}\text{S}/^{32}\text{S}$, etc.): IRMS

Ratio - Radial Plots

- Airport
- Chrome Plating
- Cleanup Sites
- WWTP
- Landfill



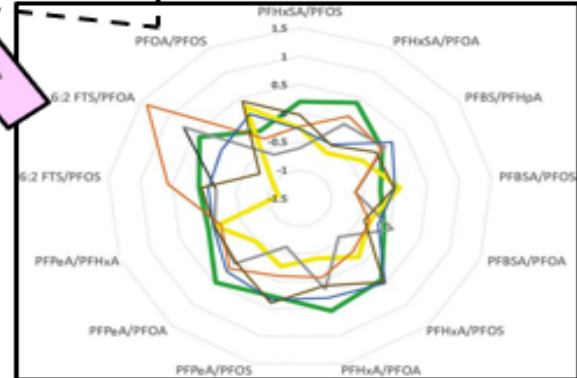
Box-Plots

Cross-Plots

Top Essay

**AOF or TOF:
Total Organo-fluorine**

Ratio – Dot Plots



AI-MVA

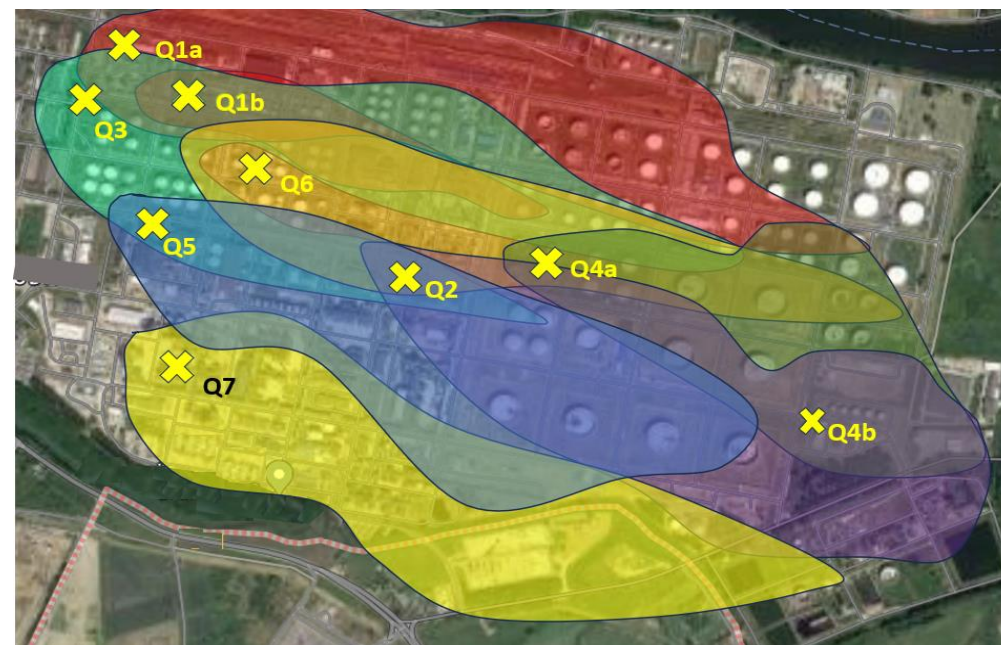
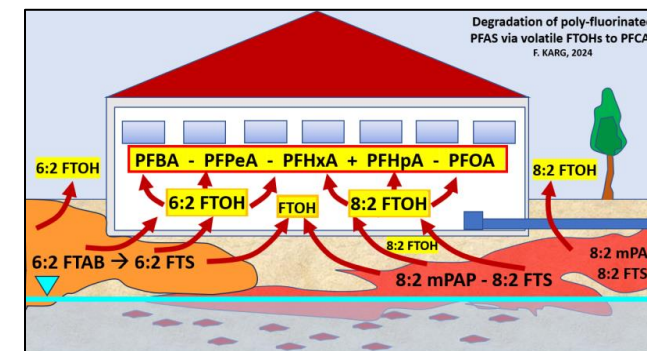
AI-MVA: Artificial Intelligence based Multi- Vector-Analysis for Identification & Differentiation of PFAS Sources

[illegible]

Conclusion :

- About 9000 – 15 000 PFAS exist
- In Groundwater Contamination Plumes and in Soil, Poly-PFAS-Sources are often responsible.
- PFAS Source Identification & Differentiation is possible via MVA-AI: Multi-Vector –Analysis, based on Artificial Intelligence.
- MVA-AI: is based on Statistics and on Clustering.
- Legal and Financial Responsibilities for environmental PFAS - Contaminations can be identified.
- The application is important for Industries, Authorities, Insurance Companies and for Court decisions and Cost Sharings !

Contact: frank.karg@hpc-international.com



Thank You / Merci !

Questions ? Remarks ?

Dr. (PhD) Frank Karg / Scientific Director of HPC-Group (INOGEN JV) and
CEO-President of HPC INTERNATIONAL / France, Germany, Hungary, Balkan, etc.

Email: frank.karg@hpc-international.com / Phone: +33 607 346 916

