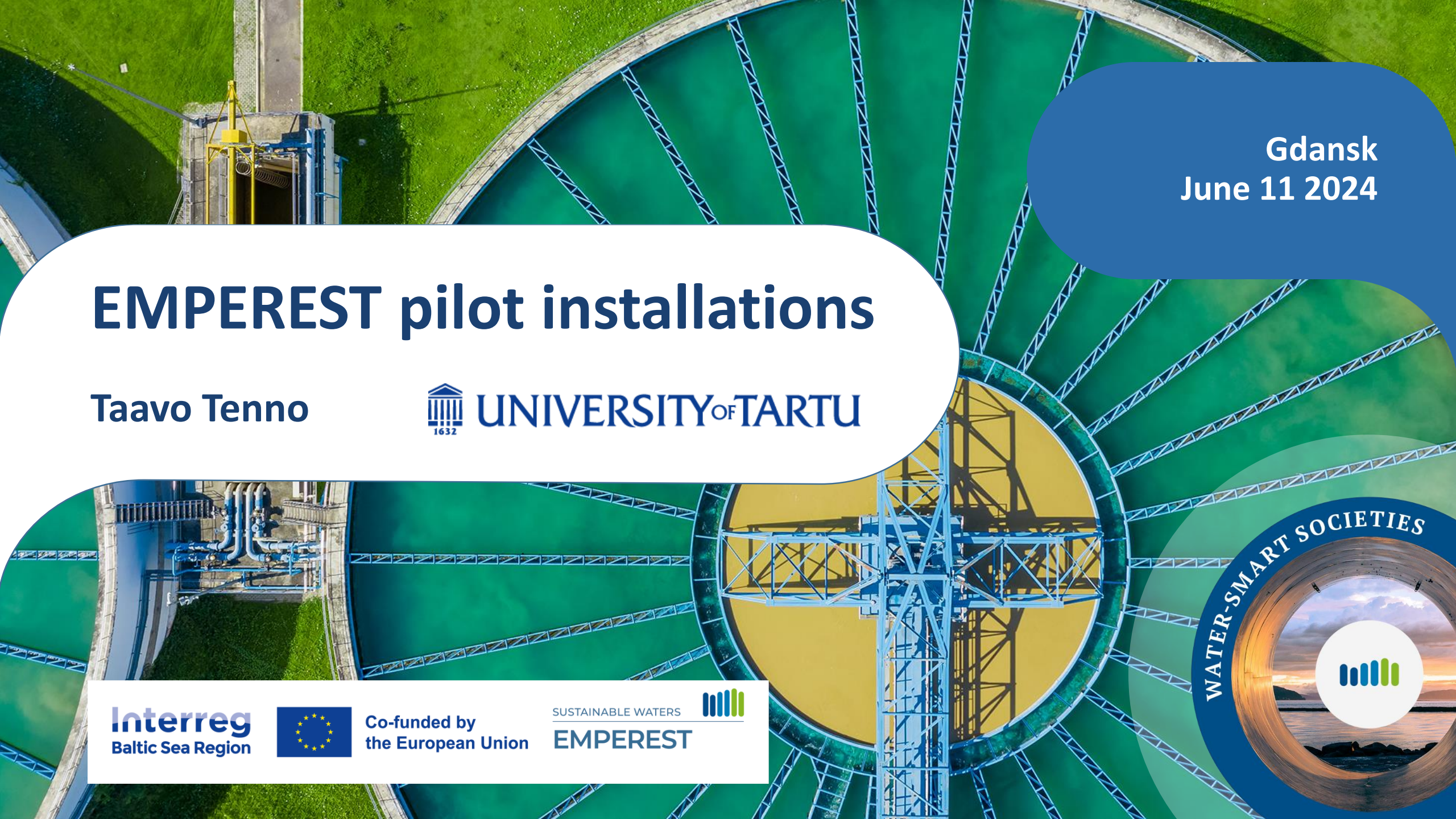


Gdansk
June 11 2024

EMPEREST pilot installations

Taavo Tenno

UNIVERSITY OF TARTU
1632

Interreg
Baltic Sea Region

Co-funded by
the European Union

SUSTAINABLE WATERS
EMPEREST

WATER-SMART SOCIETIES

Planning

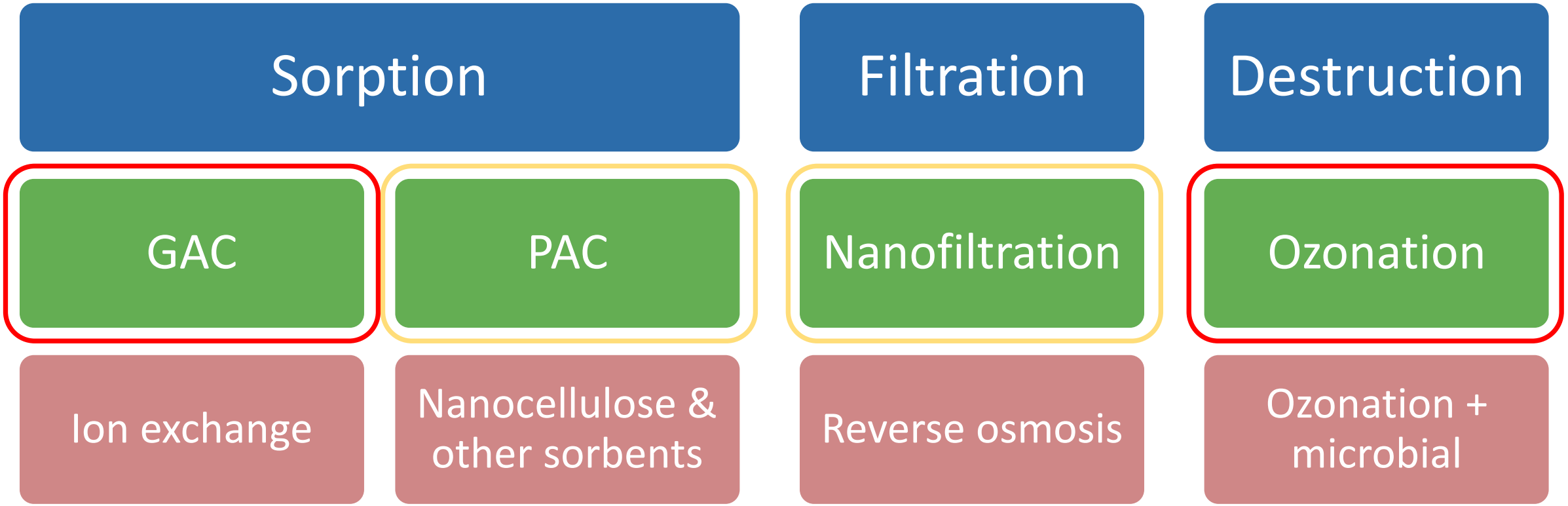
- Problem definition and planning
  - Interreg SEED 2020-2021
    - En-masse Mapping of PFAS In Wastewater Treatment Plant Effluents for REuse STrategies in the Baltic Sea Region
  - EMPEREST 2023-2025
- Definition of gaps of knowledge for WWTP-s - EMERGING POLLUTANTS
- New developments needed for WWTP-s – quaternary treatment
  - Persistent Organic Pollutants
  - PFAS
- Technologies – no clear grounds for decision making
- What can be done and what investments should be planned

Technologies

- The concept of quaternary treatment for municipal WWTP-s has been available for almost two decades
- Lots of experiences with full scale plants
- Major stiving force has been the anthropogenic contamination
  - Microplastics
  - Organic persistent pollutants – pharmaceuticals
- Although the key values for CAPEX and OPEX are available, the market is changing

- New micropollutants in focus (EU UWD)
- Technologies are continuously evolving and adapting

Technologies



Premature: foam fractionation, thermochemical, photocatalytic
Not considered: biological, constructed wetlands

Project planning

- 6 (7) interested water companies
  - Gdansk (PL), Szczecin (PL), Kaunas (LT)
  - Tartu (EE), Tallinn (EE), Turku (FI)

  } Riga (LV)
- Mobile test units
- Containerized pilot plants
  - Transportation,
  - Semi-industrial pilots (1-3m^3/h)
- Multiple technologies
  - Sorption – GAC
  - Destruction – Ozonation, UV

Pilots

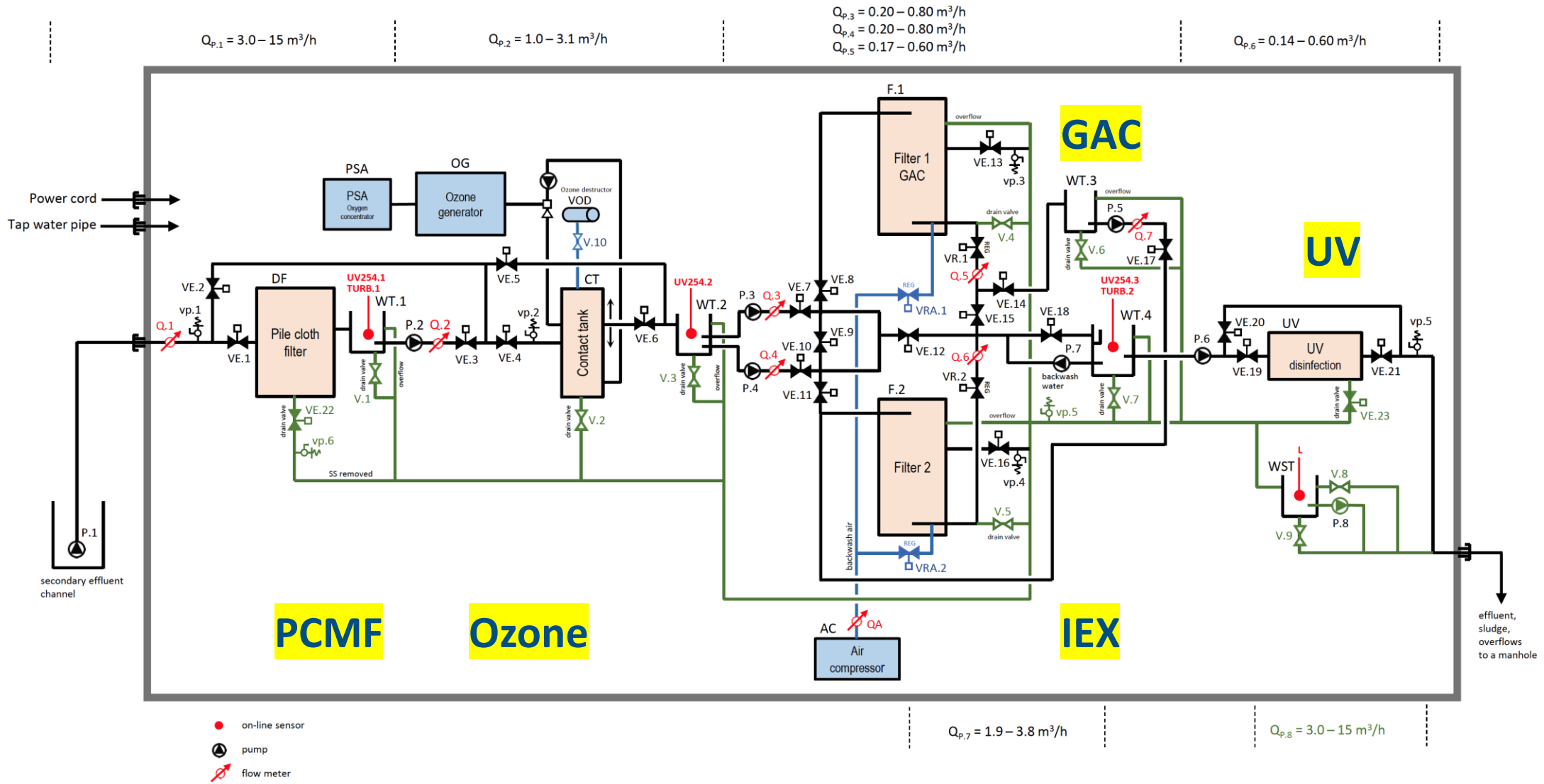
- 2 mobile pilots were planned

- Pilot Gdansk – investment by Gdansk
  - Route – Gdansk -> Szczecin -> Kaunas
- Pilot Tartu – investment by Tartu
  - Route – Tartu -> Tallinn -> Turku

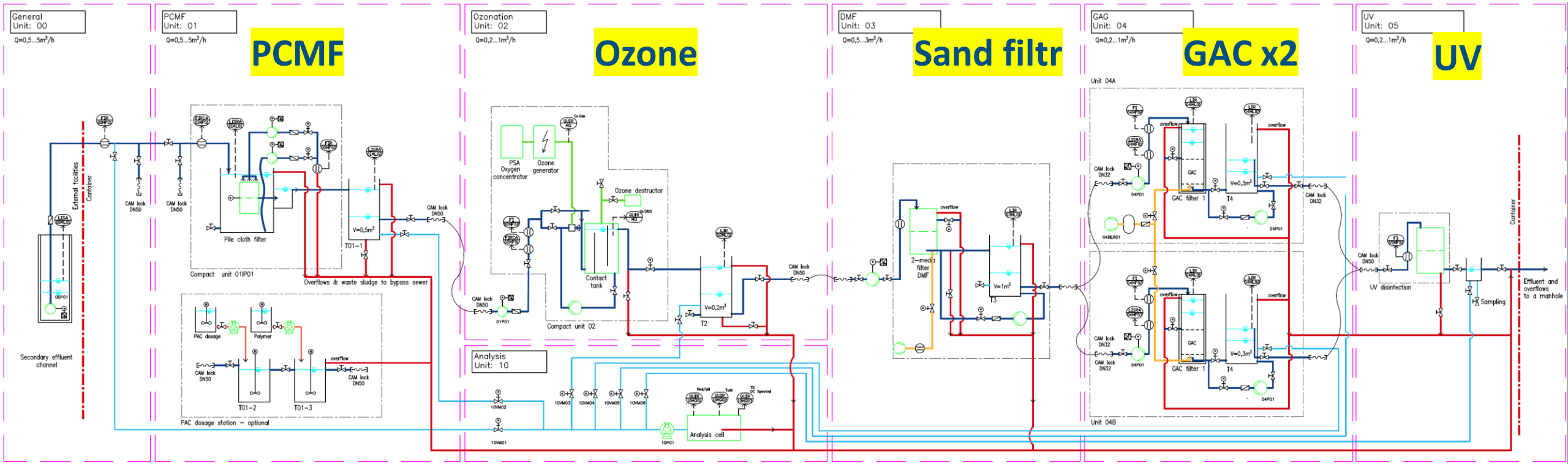
- Same major technologies



Design – Pilot Gdansk

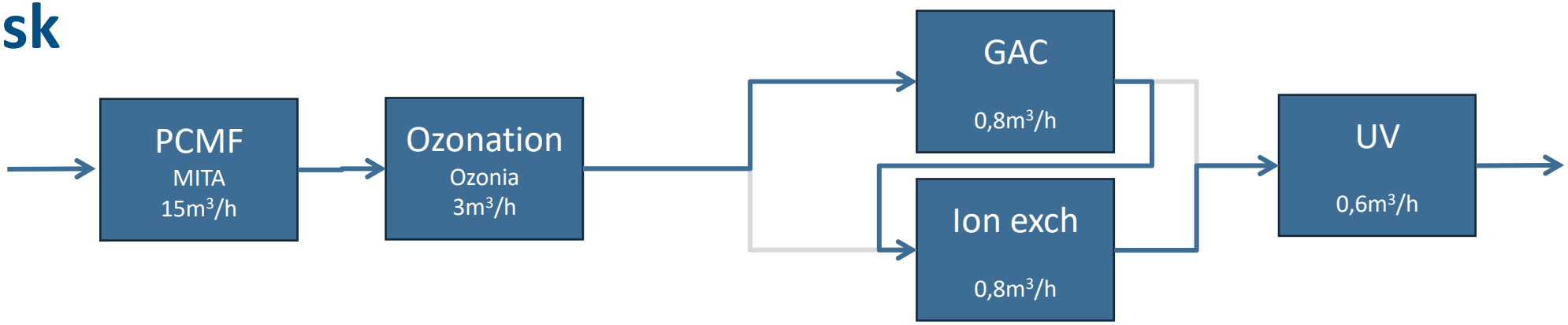


Design – Pilot Tartu

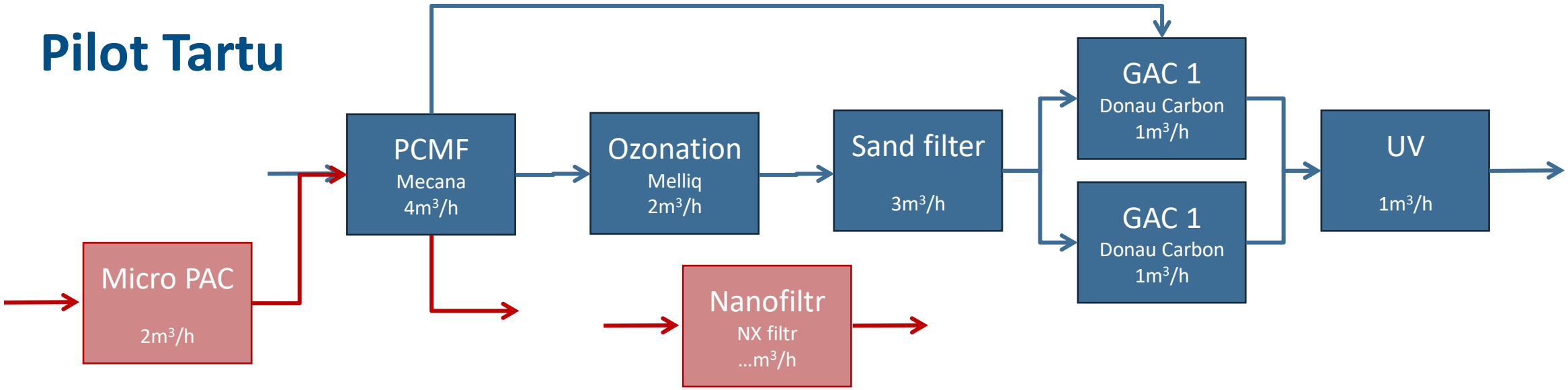


Design

Pilot Gdansk



Pilot Tartu



Pilot Gdansk



Pilot Gdansk



PCMF



Ozone



GAC

IEX

Pilot Tartu


MOBILE ADVANCED TECHNOLOGY
FOR MICROPOLLUTANT REMOVAL
FROM WATER

Pilot Tartu



PCMF



Sand filter

GAC

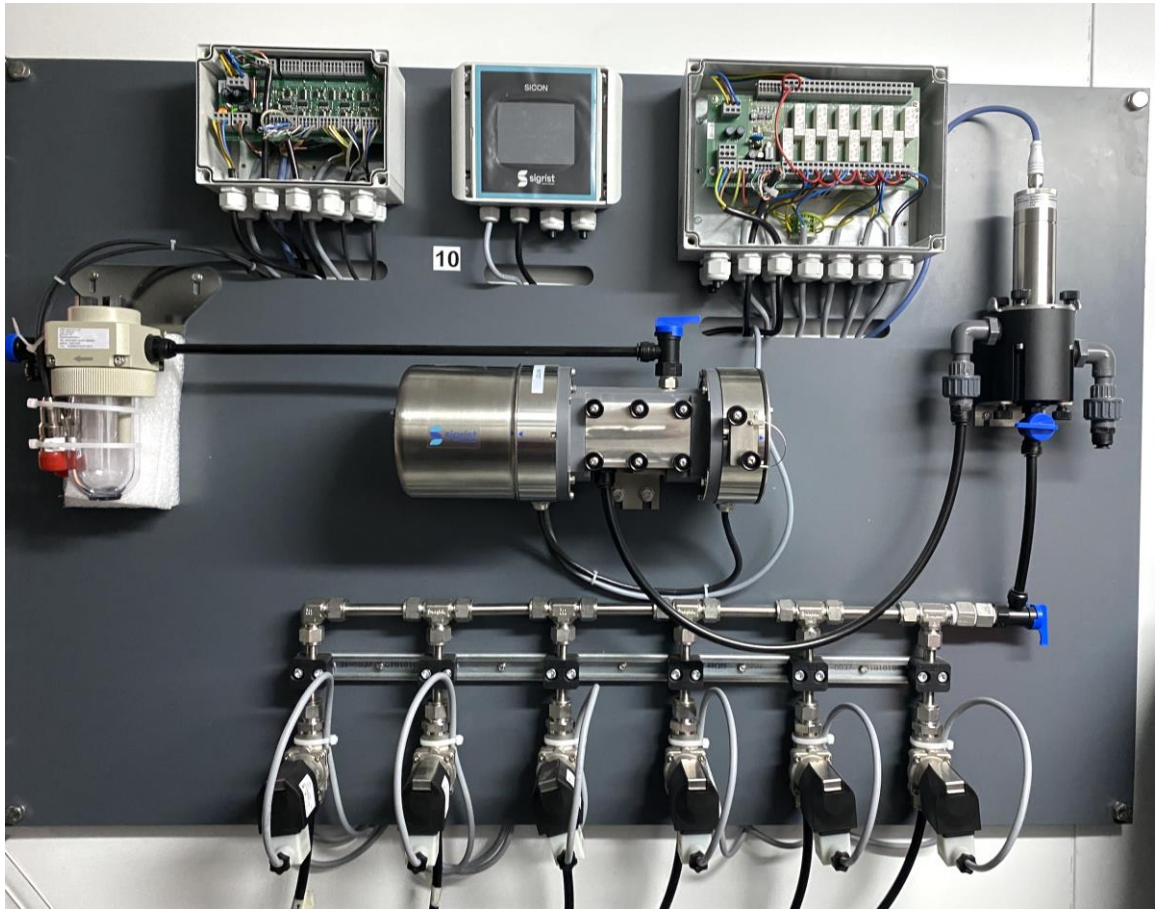


Ozone

Monitoring

Three levels of monitoring

- Online monitoring
  - Flow, turbidity, absorbance 254nm, pH, ozone, redox
- Laboratory monitoring
  - COD, DOC, SS, Bromide
- Micropollutant analyses
  - 24 PFAS + EU directive list
  - Initial analyses essential to save cost



Monitoring

Priority Class A[1]	Priority Class B[2]	Priority Class C[3]	Priority Class D[4]
Chloroalkanes, C10-13	Amisulprid	Diuron	Other WFD Annex X substances and potential new substances proposed to be added there
Tributyltin compounds	Carbamazepine	Isoproturon	
Polychlorinated biphenyls (PCBs)	Citalopram	Naphthalene	
Hexabromocyclododecanes (HBCDD)	Clarithromycin	Tetrachloroethylene	
Phthalates (including DEHP)	Diclofenac	Polychlorinated dibenzofurans (PCDFs)	
	Hydrochlorothiazide	Terbutryn	
	Metoprolol	Silver (Ag)[5]	
	Venlafaxine	Hexachlorobenzene	
	Benzotriazole	Benzene	
	Candesartan		
	Irbesartan		
	Mixture of 4-methylbenzotriazole and 6-methylbenzotriazole		

previously detected in high concentrations

proposed in UWWTD proposal

detected in piloting WWTPs above LOQ

Timeline

Period		P2						P3						P4						P5						P6					
Year		2023						2024												2025											
Month	Partner	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Design and construction	PP06	x	x	x	x	x	x	x	x																						
Commissioning and startup	PP06									x																					
Piloting period 1	PP06										x	x	x	x	x																
Piloting period 2	PP07															x	x	x	x	x											
Piloting period 3	PP10																				x	x	x	x	x						
Piloting period 4	PP14																									x	x	x	x	x	

- Both pilots in operation
  - Gdansk – in full operation
  - Tartu – startup issues with PCMF and ozonation mostly solved
- Challenges
  - Decision making at the early stage
  - Tendering and time of analyses

What to expect

- Get understanding of the problem
- Focus on PFAS, organic POP
- Efficiencies of different technologies in the actual configuration of the WWTP
- Management of waste and concentrates
- Help on investment decisions

- No direct cost analysis
- No restrictions of new development



Thank you!