



# Dutch Innovation Programme Removal of Micropollutants

**Cora Uijterlinde STOWA**

**Tackling Micropollutants in Wastewater  
Approaches on Implementation and Innovation in Europe and The Netherlands**



Rijkswaterstaat  
Ministry of Infrastructure  
and Water Management

**November 3 and 4 2021 Aquatech Amsterdam**



# What is STOWA



Foundation for Applied Water Research

Budget: 7,5 – 10 M€ per year

Products: research reports, websites, seminars, newsletters, .....

8 employees + many other experts!

Focus areas:





# Innovation program micropollutants

Hosted by STOWA

Funded by Ministry, STOWA and regional water authorities  
(€11,7 mln; 2019-2023)

Focus on:

- Treatment technologies on the threshold of breaking through → TRL 7 in 2025
- Technologies should have an added value compared to existing techniques (removal rates, costs, sustainability or eco-toxicological risks)
- Feasibility studies (100.000 pe) and pilot plant research



	Unit	PACAS	Ozone+sand filter	GAC
CO <sub>2</sub> footprint	g CO <sub>2</sub> /m <sup>3</sup> <sup>(1)</sup>	116	119	325
Costs	€/m <sup>3</sup> <sup>(1)</sup>	0.05	0.17	0.26
Removal efficiency guide substances Ministry of Infrastructure and Water Management	% <sup>(2)</sup>	70-75%	80-85%	80-85%





# INNOVATION PROGRAM

✓ ARVIA

**BODAC (Emmen)**

**O3-STEP (Horstermeer)**

Continuous Upflow with micro GAC

Continuous GAK with oxygen

inventarisation natural systems



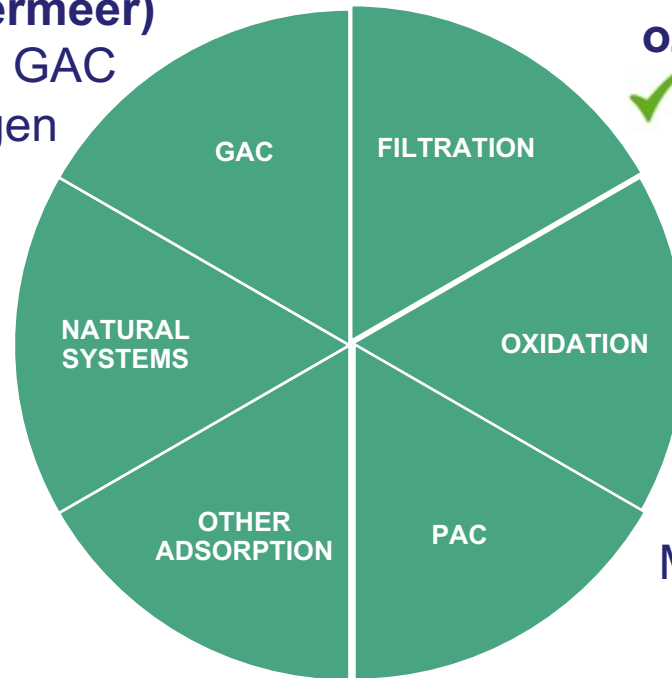
zeolites

bio-carbon

sandfiltration

cyclodextrines

**AdOx (Leiden)**



**pretreatment – nano filtration (Waterfactory Wilp)**

nano filtration effluent

**ozone with ceramic micro filtration (Wervershoof)**

✓ Pharem - enzymes



**Ultrasound and ozon (Winterswijk)**

**PACO3 (Leiden-Noord)**

✓ **UV (Aarle Rixtel)**

✓ **Ozone (Aarle Rixtel)**

B-O3-B (biological pretreatment and ozone)

Microforce (integrated ozone and biofilm reactor)



**PACAS + Fe**

**PACAS Nereda (Simpelveld)**

**PAC+cloth filtration (Vinkel)**





# What more

- Target substances

*benzotriazole, carbamazepine, diclofenac, irbesartan, gabapentine, metropolol, hydrochloorthiazide, mixture of 4- and 5-methylbenzotriazole, sotalol, trimethoprim and venlaflaxine.*

- Sampling

*Removal efficiency for a minimum of seven of the eleven selected guide substances in any 24-hour or 48-hour flow rates - or time-proportional sample, taking into account the residence time of the water in the wwtp*

- Chemical monitoring

- Biological effectmonitoring

- Designcriteria advanced treatment (dry wether flow and more)

- Desk study into the effects of oxidation products from effluent.

- Study: the release of micropollutants in sludge digestion

- Resource recovery and water factories



## RESEARCH THEMES

- I EFFECT DIRECTED MONITORING
- II SUSTAINABLE TREATMENT TECHNOLOGY FOR MUNICIPAL EFFLUENTS
- III EFFECTIVE CONTROL



## contaminants<sup>of</sup> emerging concern

a partnership in water technology

## PARTNERS



## PROJECTS

### EMERCHE # 15760

**Description**  
Effect-directed monitoring tools to assess ecological and human health risk of chemicals of emerging concern in the water cycle

**Participating institutes**  
Wageningen University & Research,  
Utrecht University



### RoutinEDA # 15747

**Description**  
Expanding the scope and downscaling the format of high throughput Effect-Directed Analysis for routine water cycle monitoring and effective control

**Participating institute**  
Vrije Universiteit Amsterdam



### CER-CEC # 15759

**Description**  
Cost-efficient removal of Contaminants of Emerging Concern in urban Waste Water Treatment Plants

**Participating institute**  
Radboud University Nijmegen



### AdoX # 15756

**Description**  
A next generation adsorption-oxidation process for removal of CECs from municipal wastewater

**Participating institute**  
Technical University Delft



### SUSPECT # 15763

**Description**  
Decision support tool for risk-based prioritization and control of Contaminants of Emerging Concern

**Participating institutes**  
Radboud University Nijmegen,  
Wageningen University & Research



# Progress full scale plants

Inventarisation Hotspots (2017)

Ministerial Action Plan 60 M€ (2021-2027)

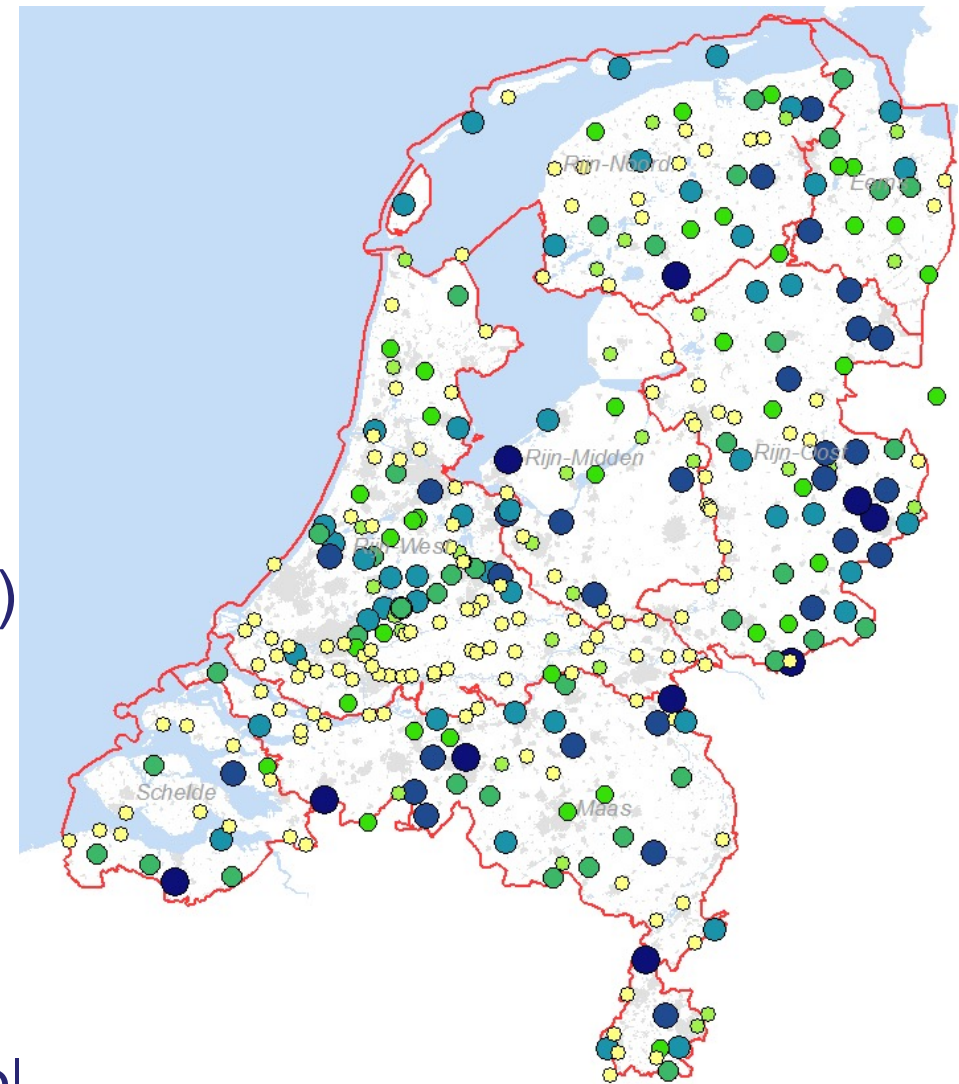
Efficiency of 70 % list guide substances

2020-2023 (13 WWTP's: 8 ozone + 5 PACAS)

2023- 2027 (~ 13 WWTP's)

Learning by doing (usergroups; community of practice etc)

Not only end-of-pipe measures: source control



Ministry of Infrastructure  
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# IMPLEMENTATION AT FULL SCALE (2020-2023)

## OZONE\*

**Wervershoof**  
(Hollands  
Noorderkwartier)

**Horstermeer**  
(Amstel Gooi en Vecht)

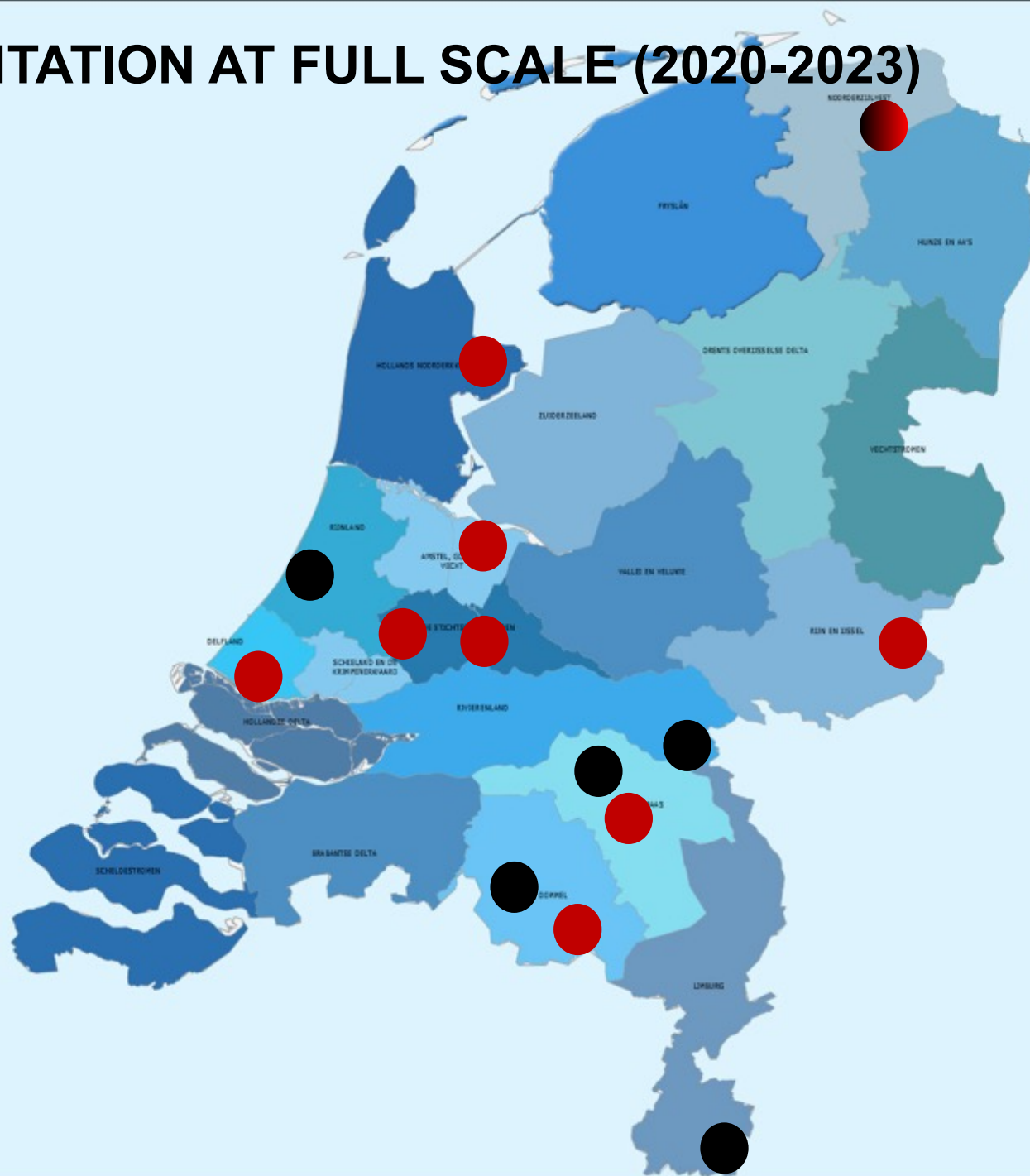
**Houten  
Woerden**  
(De Stichtse Rijnlanden)

**De Groote Lucht**  
(Delfland)

**Winterswijk**  
(Rijn en IJssel)

**Dinther**  
(Aa en Maas)

**Soerendonk**  
(De Dommel)



## ACTIVATED CARBON

**Leiden Noord**  
(Rijnland)

**Groesbeek**  
(Rivierenland)

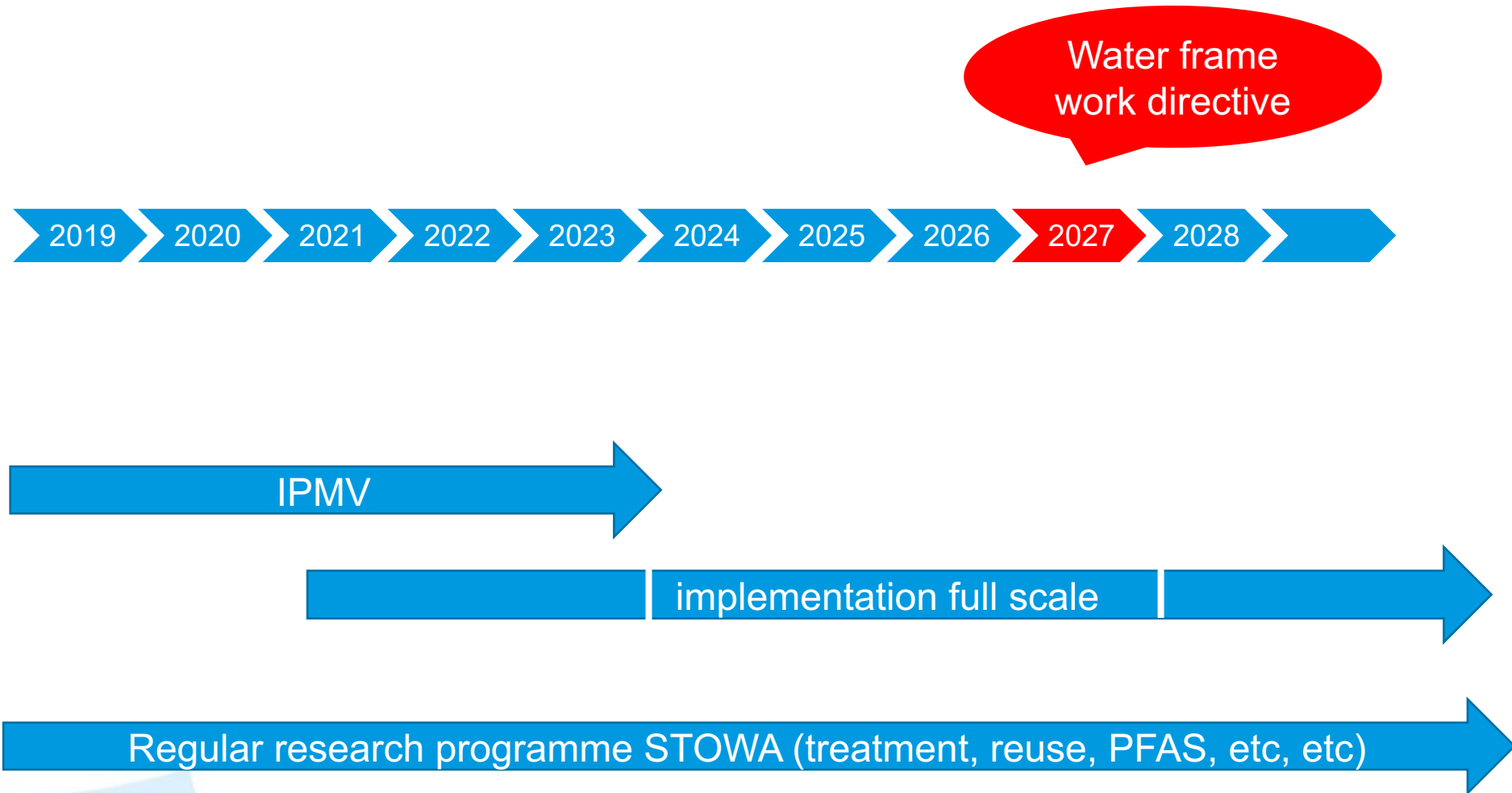
**Oijen**  
(Aa en Maas)

**Hapert**  
(De Dommel)

**Simpelveld**  
(Waterschap Limburg)

**Garmerwolde**  
(Waterschap Hunze en  
Aa's)





- [www.stowa.nl](http://www.stowa.nl)
- (search IPMV)
- Aquatech 2023?!





## More information

[www.stowa.nl](http://www.stowa.nl)

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