

**STOWA WORKSHOP –
BEATING MICROPOLLUTANTS
Wastewater Treatment Plants**

Full scale plants and research THE NETHERLANDS

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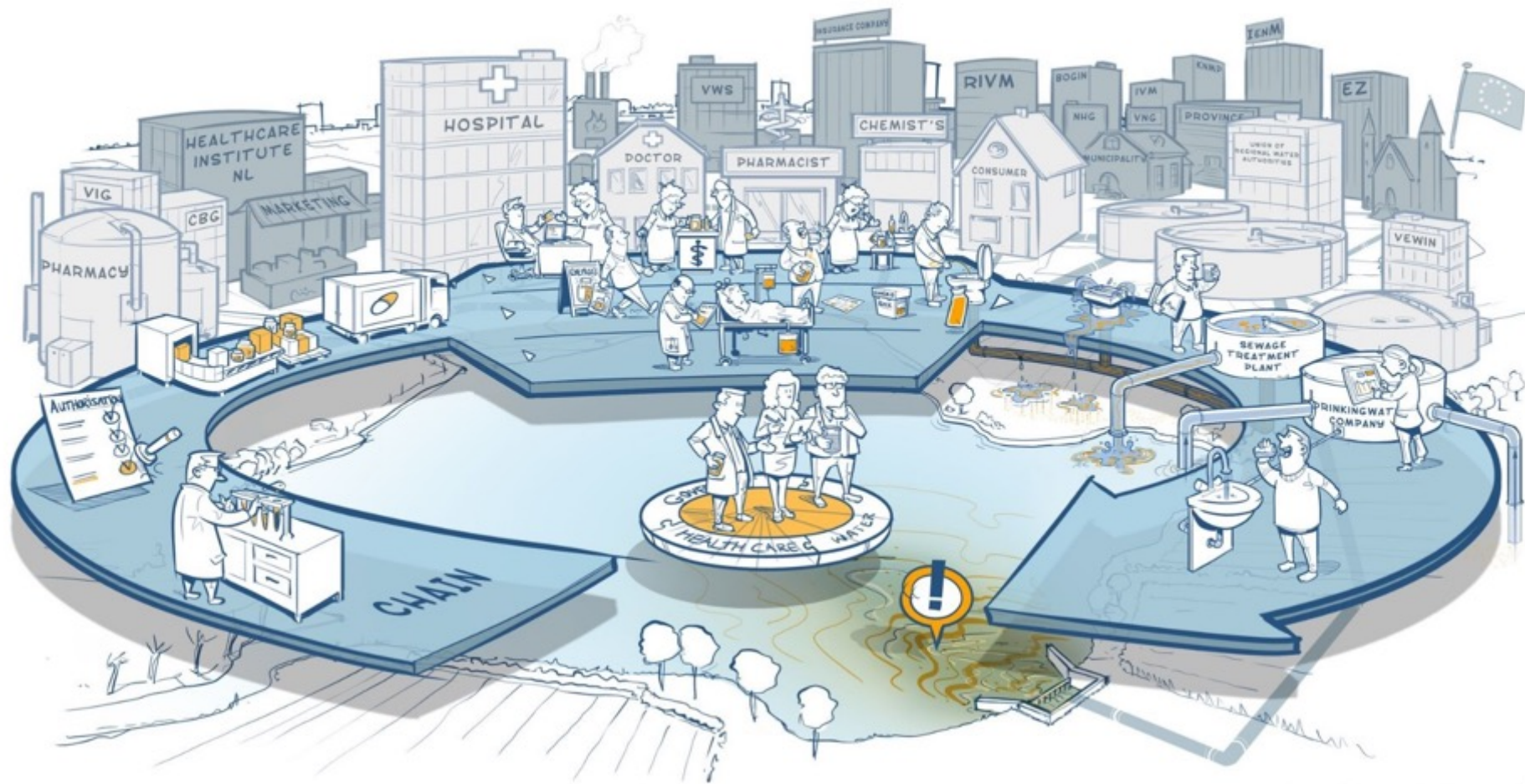
- 1 Noorderzijvest
- 2 Fryslân
- 3 Hunze en Aa's
- 4 Drents Overijsselse Delta
- 5 Vechtstromen
- 6 Vallei en Veluwe
- 7 Rijn en IJssel
- 8 De Stichtse Rijnlanden
- 9 Amstel, Gooi en Vecht
- 10 Hollands Noorderkwartier
- 11 Rijnland
- 12 Delfland
- 13 Schieland & Krimpenerwaard
- 14 Rivierenland
- 15 Hollandse Delta
- 16 Scheldestromen
- 17 Brabantse Delta
- 18 De Dommel
- 19 Aa en Maas
- 20 Limburg
- 21 Zuiderzeeland

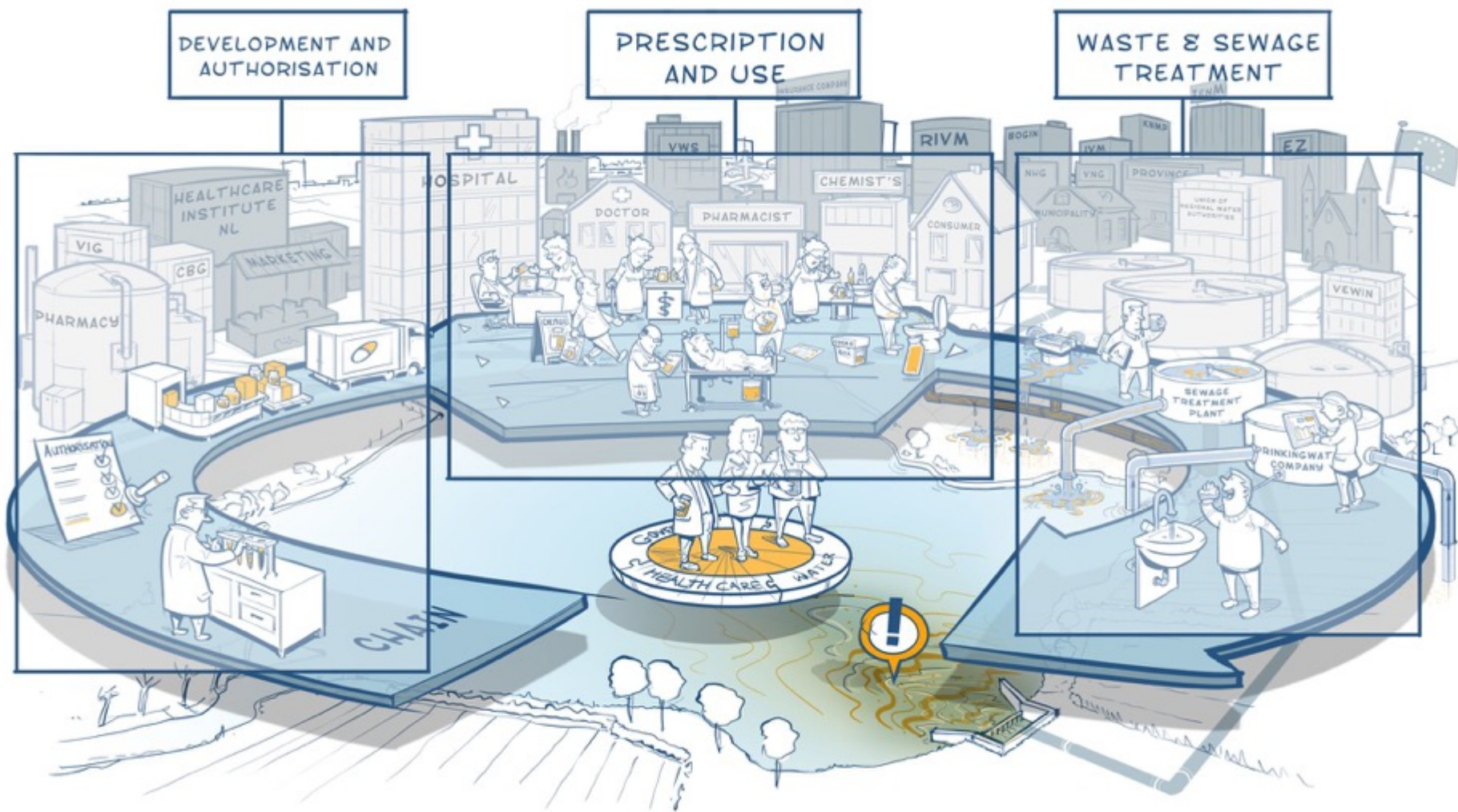


Research

- Report National Institute for Public Health and the Environment:
- At least 140 tonnes pharmaceutical residues emitted into surface water in the Netherlands
- Effects:
 - Tissue damage
 - Endocrine disruption
 - Behavioural impacts
- Routing: 95% via normal use and excretion by patients
- 10% emitted at hospitals and care centres, 90% emitted at home







End-of-pipe measures

1. Implementing existing technologies in NL
2. Innovation programme
3. Supportive projects



Impact analysis micro pollutants surface water

- 314 sewage treatment plants in NL
- 2017: analysis of 'hot spots'
- Impacts:
 - Increase of concentration
 - Watercourses affected
 - Drinking water intakes
- ± 100 STP's need improvement?



Funding full scale projects

- € 60mln for stimulating implementation
- € 0,07/m³ (based on Dutch pilots & experiences in DE and CH)
- Monitoring of guide substances
- Biological effect monitoring
- > 10 year in operation

carbamazepine, propranolol, trimethoprim,
metoprolol, benzotriazol, mengsel van 4-
methylbenzotriazol / 5-methylbenzotriazol,
hydrochloorthiazide, sulfamethoxazol, diclofenac,
clarithromycine, sotalol



experiences

- Visit Switzerland and Germany (2015)
- Technology Overview (2017)
- PACAS (2018)
- Groote Lucht pilot ozone (2018)



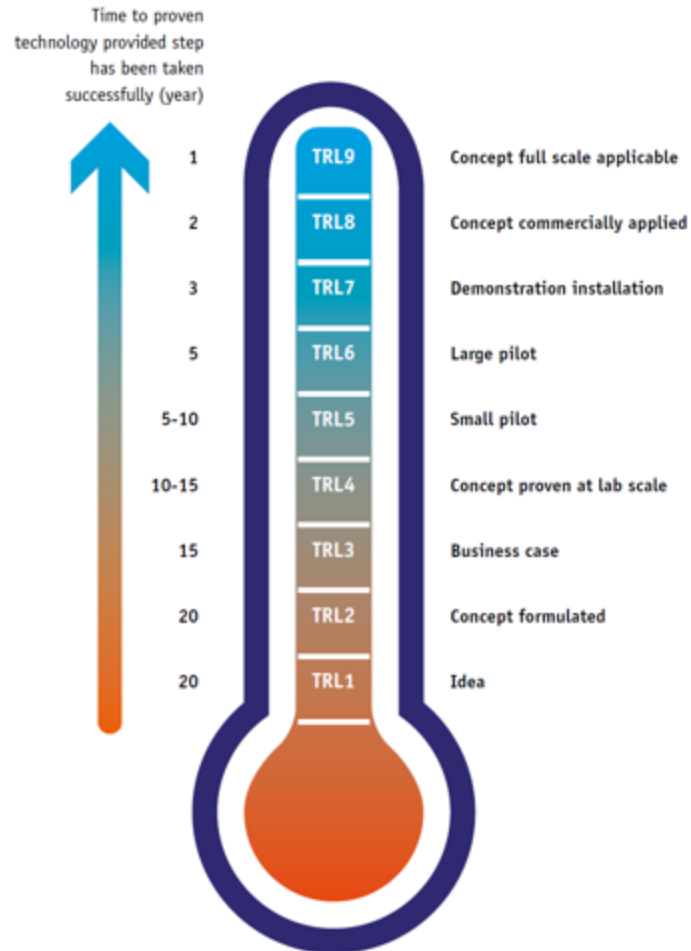
Innovation programme micro-pollutants

- Hosted by STOWA
- Funded by Ministry, STOWA and regional water authorities (€11,7 mln during 5 years)
- Focus on:
 - Treatment technologies on the threshold of breaking through
 - Optimisation of existing technologies
 - Technologies should have an added value compared to existing techniques (removal rates, costs, sustainability or eco-toxicological risks)
- Fundamental research in academic programme



Goal innovation program

implementing innovative technologies in 2025 on demo-scale (TRL 7)



Criteria innovation program

TABLE 1 Quantitative criteria Innovation Program Removal of Micropollutants at wwtps

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

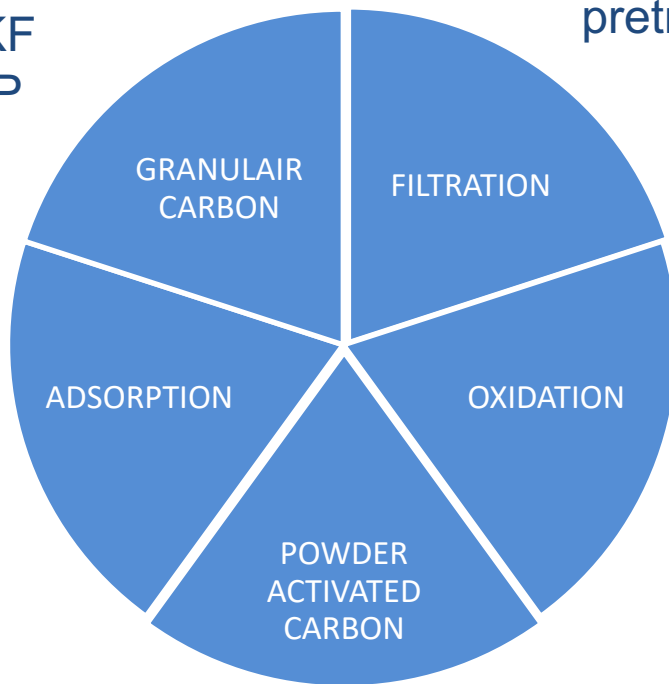
1) per treated m3 wastewater

carbamazepine, propranolol, trimethoprim, metoprolol, benzotriazol, mengsel van 4-methylbenzotriazol / 5-methylbenzotriazol, hydrochloorthiazide, sulfamethoxazol, diclofenac, clarithromycine, sotalol

INNOVATION PROGRAM 2019



ARVIA
BAKF
O3-STEP



ozone with ceramic microfiltration
pretreatment and nanofiltration
nanofiltration effluent
Pharem - enzymes



zeolieten
bio-activated carbon
sandfiltration
cyclodextrine

Usoniq
PAC4TOC
UV/H2O2 and ozone
transformation / residues



PACAS + Fe
PACAS Nereda
Cloth filtration AC
Effects on sludge treatment





contaminants^{of} emerging concern

a partnership in water technology

RESEARCH THEMES

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

PARTNERS



PROJECTS

EMERCHE I

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 I

15747

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

Participating institute
Vrije Universiteit Amsterdam



CER-CEC II

15759

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

Participating institute
Radboud University Nijmegen



AdoX II

15756

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

Participating institute
Technical University Delft



SUSPECT III

15763

Description
Decision support tool for risk-based prioritisation and Control of Contaminants of Emerging Concern

Participating institutes
Radboud University Nijmegen, Wageningen University & Research





Supportive projects

- › Harmonising analysing methods (incl. taking samples)
- › Biological effect monitoring
- › Knowledge exchange with neighbouring countries
- › research on micropollutants in rain weather flow and dry weather flow
- › developing tool for dimensioning hydraulic capacity

Knowledge exchange

- Regional water authorities discuss experiences
- Technical (performances of techniques)
- Monitoring (what protocols)
- Decision making process within organisation



Conclusions

- Ready to beat micropollutants at WWTP
- Implementation full scale
- Boost in innovative technologies at WWTP