III Jornada técnica

ASPECTOS SANITARIOS DEL AGUA DE CONSUMO

Càtedra ATL de l'aigua potable

Universitat de Girona · ATL · Generalitat de Catalunya

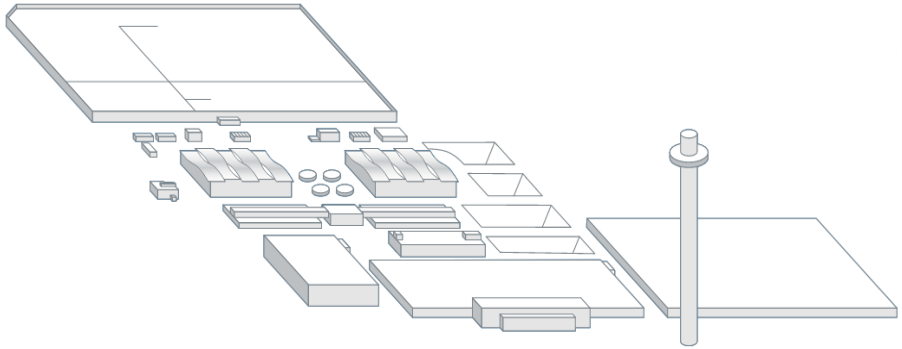
Consorci d'Aigües de Tarragona

SafeCREW Project

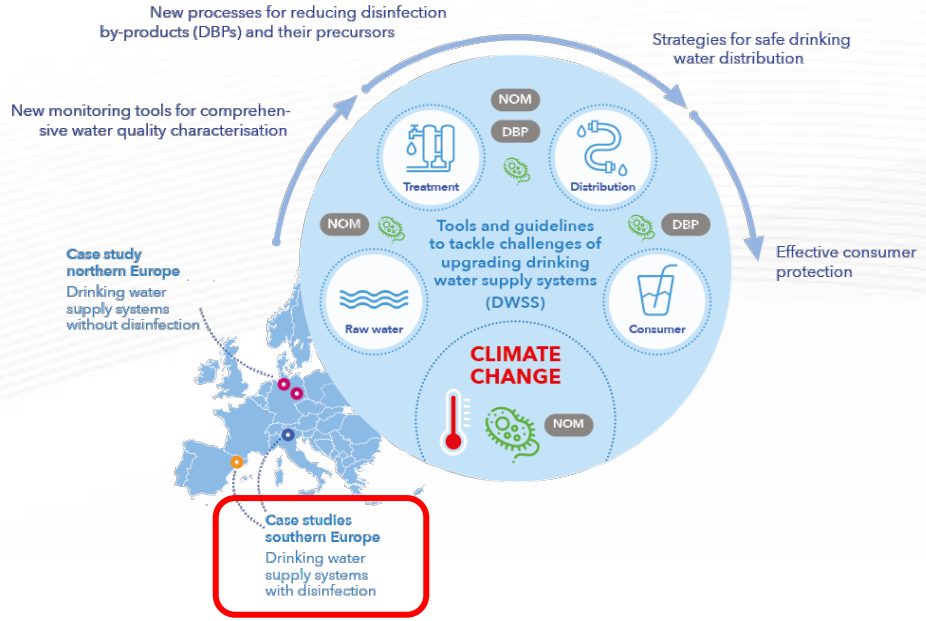
Climate **RE**silient management for safe disinfected and non-disinfected **W**ater supply systems

safe CREW

- SafeCREW Project
- CAT Introduction
- SafeCrew Tasks at CAT
- Conclusions



SafeCREW Project



- European project that aims to prepare the water sector for supplying high-quality drinking water as a challenge due to the **climate change**
- CAT represents a Southern Europe Case Study as a **drinking water supply system with disinfection**

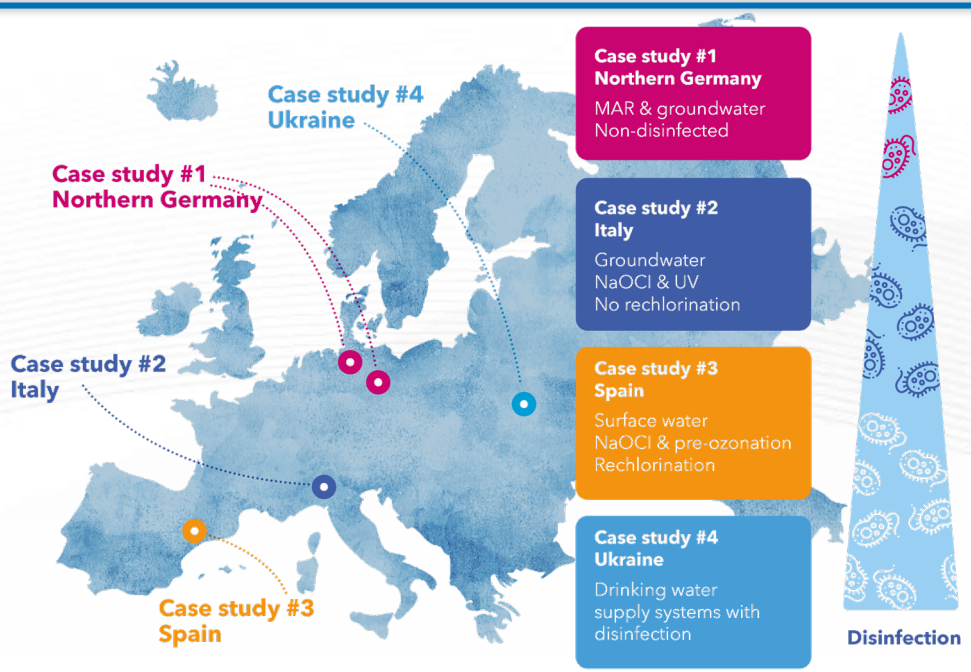
PROJECT WEBSITE

Consorci d'Aigües de Tarragona

safe CREW

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SafeCREW Project



TUTECH · Umwelt Bundesamt · KWB Kompetenzzentrum Wasser Berlin · DVGW · BDS BioDetection Systems · multisensor systems · Consorci d'Aigües de Tarragona

eurecat · Politecnico di Milano · UFZ Helmholtz Zentrum für Umweltforschung · MM Metropolitana Milanese SPA

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PROJECT WEBSITE

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Consorci
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de Tarragona

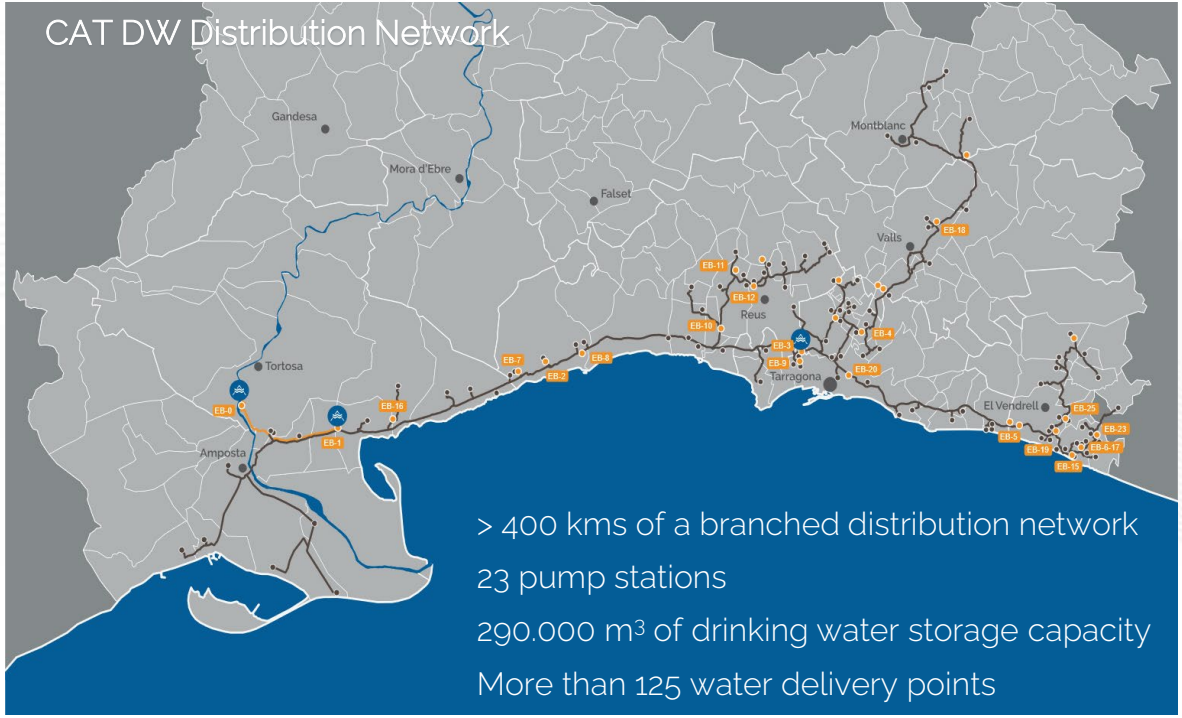
Tarragona Water Consortium (CAT)

Tarragona Water Consortium (CAT)

Consorci d'Aigües de Tarragona



Produces and distributes safe drinking water to the 86% of the Tarragona Province population (800k average / 1.5M max.)



Tarragona Water Consortium (CAT)



SURFACE RAW WATER MANAGEMENT

Since 1989, CAT can take up to 4.0 m^3/s of raw surface water from the Ebro river two irrigation channels



DRINKING WATER TREATMENT

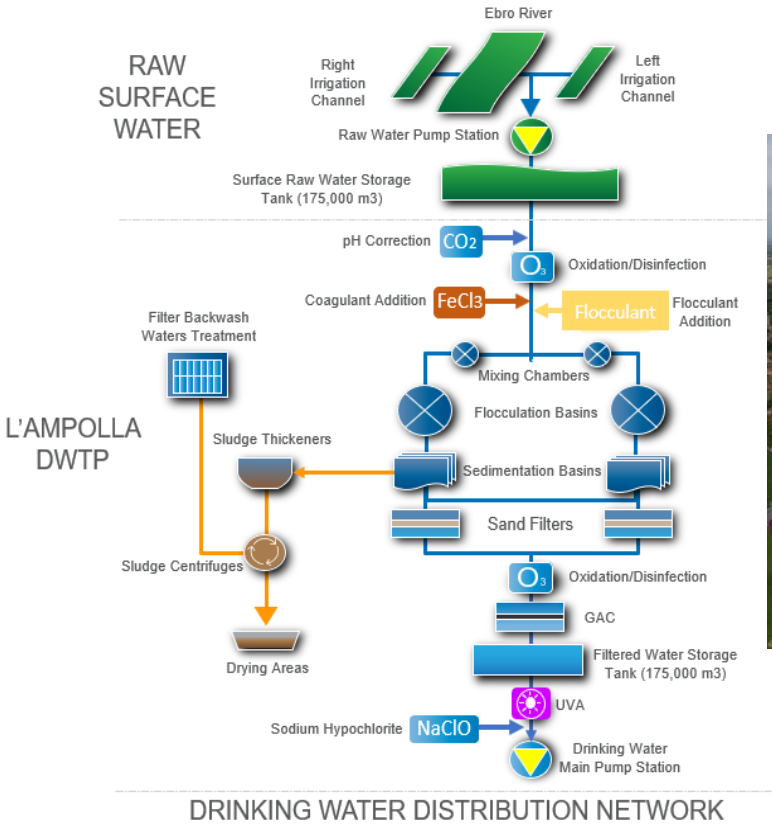
Water is treated by different physicochemical processes at the Ampolla



DISTRIBUTION NETWORK

Drinking water is distributed to 70 municipalities and 28 industries from the Tarragona Province

Ampolla DWTP





DWTP Evolution

Before 2000	2003	2008	2011	2018	2019	2022
						
Chlorine Gas	$KMnO_4$ + Chlorine Dioxide	GAC Filters	Basins + Filters Covers	Ozone + Sodium Hipochlorite	Distribution Network electro-chlorination	UV desin-fection

"These changes have been key to keep producing safe drinking water, reducing the chlorine disinfectants, the organic matter and consequently the DBPs."

But these will be enough?¿?



Climate Change Scenarios

Surface Water Quality Changes
Severe Scenarios –
Uncontrolled water quality

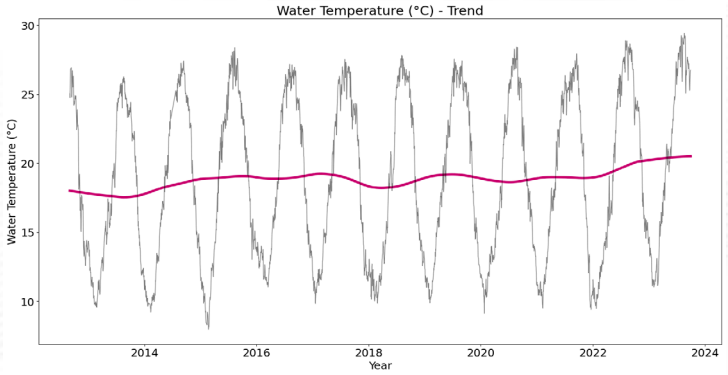
Climate Change effects on CAT:

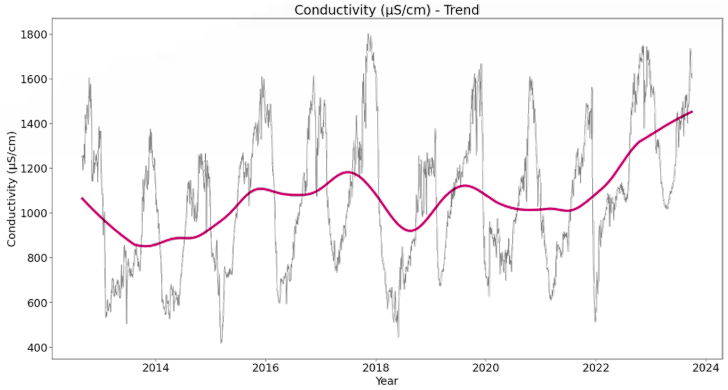
- Worse Surface Water Quality – higher temperatures and conductivities
- Algae Blooms
- Treatment difficulties
- Decrease of chlorine in the network
- More DBPs generation

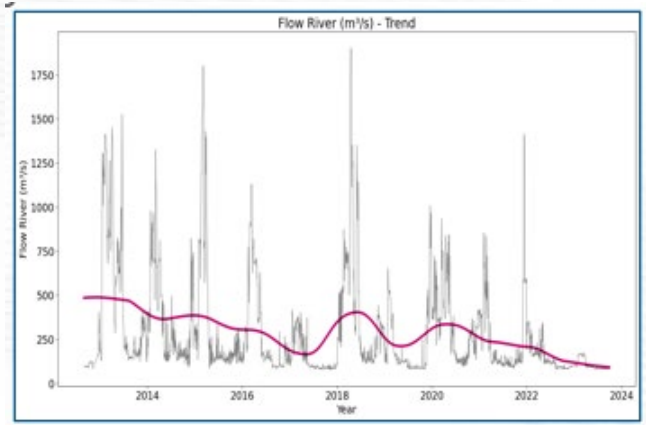
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Ebro River Surface Raw Water Quality Evolution

From our water quality data, it is clearly observed a trend towards an increment in salts and temperature in our raw water from the final section of the Ebro River







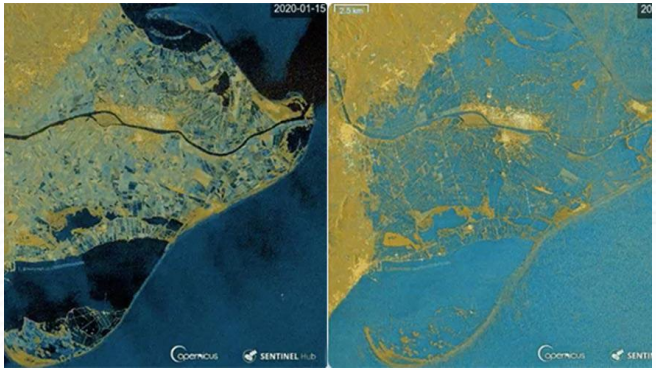
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In addition, climate change is already providing severe climate scenarios

GLORIA STORM 2020



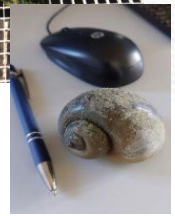


EXTREME DROUGHT 2022 - 2023









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SafeCREW at CAT

SafeCREW Project at CAT

CAT is involved in the following Project Tasks:

Task 2.3. Testing materials to improve **NOM absorption** through activated carbon (AC)

Task 2.5. Characterization of NOM and quantification of its removal. Automatic control for NOM removal in flocculation and filtration systems

Task 3.2. Monitoring DWDN for model development. Real–Time Microbiological concentration **using flow cytometry**

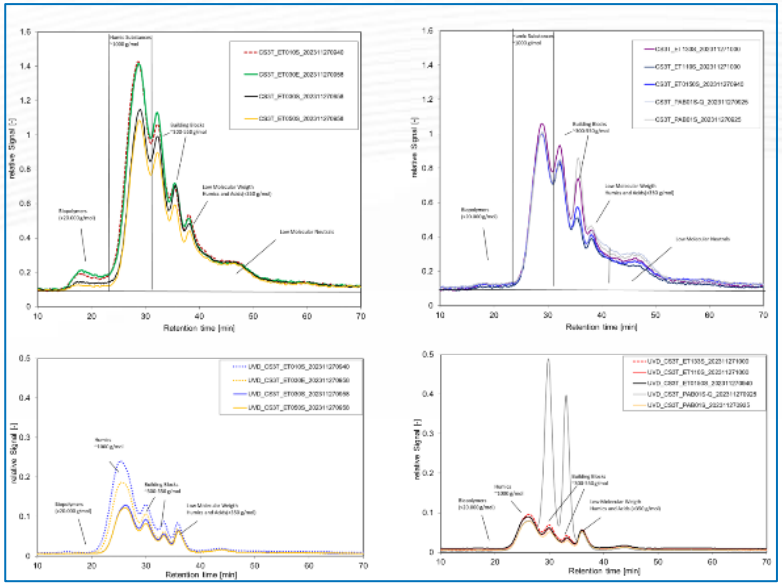
CAT also has on trial a reagent-free **THM sensor for online monitoring of the four main THMs** and a **Passive sampler for effective microbial monitoring for early warning (Task 1.5)**.

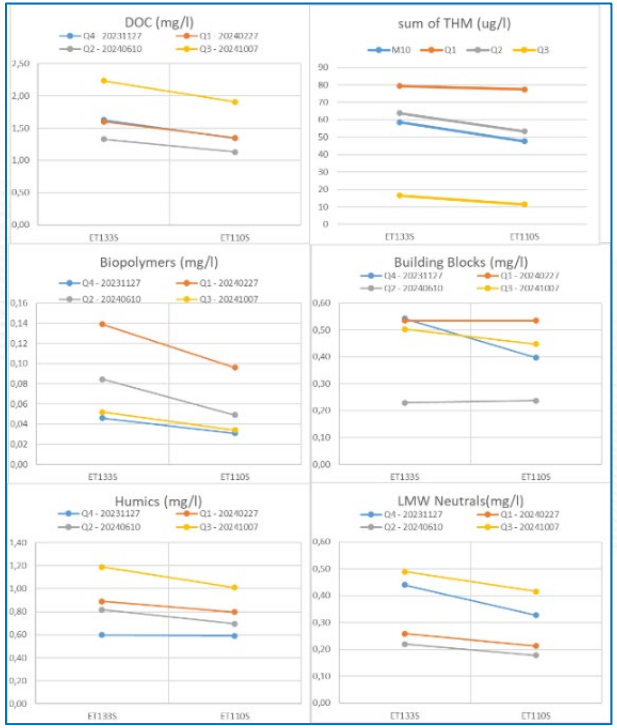
Task 2.3 - Adsorption-based processes to minimize DBP formation

Full-year sampling campaign to evaluate:

- effect on DBP formation of actual GAC filters

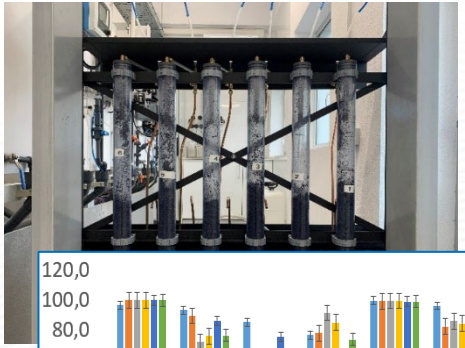
– NOM fraction vs DBPs reduction

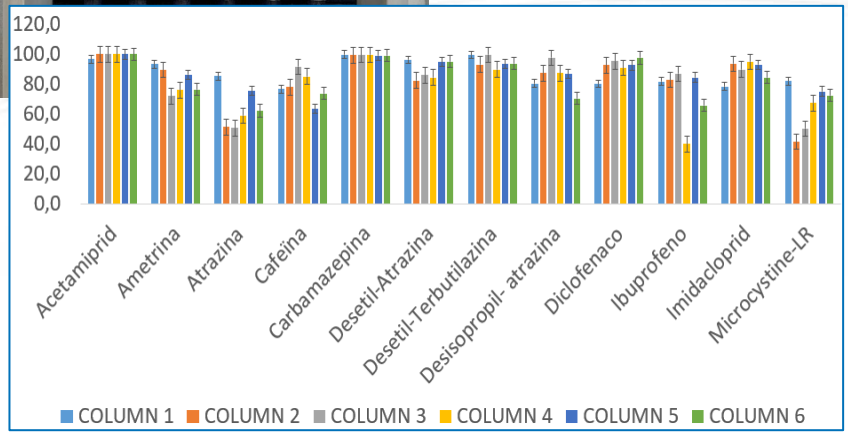




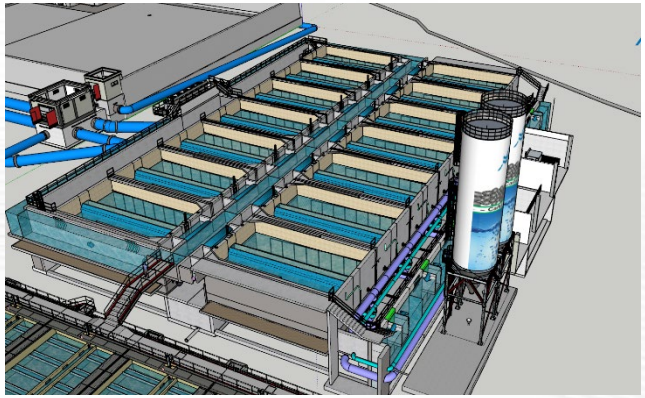
Task 2.3 - Adsorption-based processes to minimize DBP formation

Lab Pilot Testing of different GACs on contaminants removal





GAC RENEWAL PLAN 2022-25 (2,240 m³ of GAC)

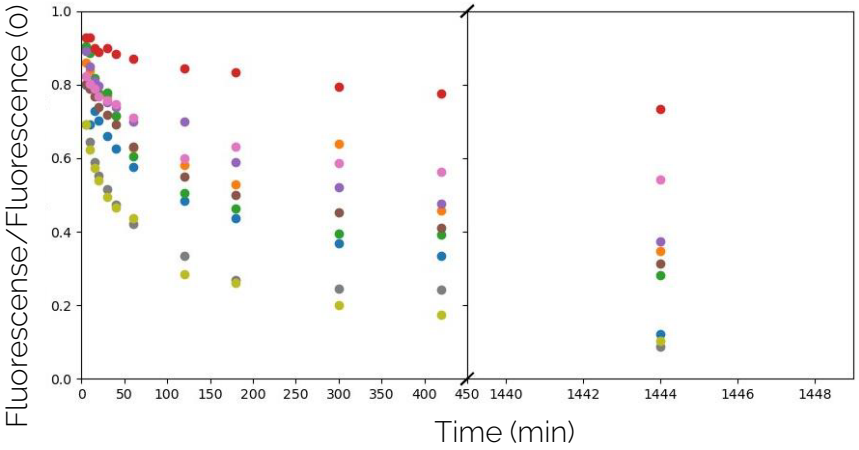


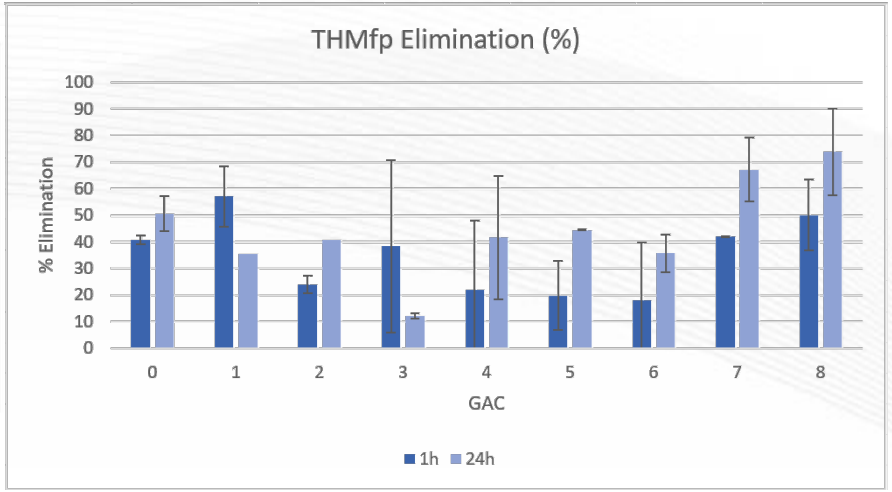
Main results:

- ✓ GAC reduces NOM fractions that decrease the formation of DBPs
- ✓ Its effectiveness depends on the water matrix and the type of GAC.
- ✓ Reactivation/renewal of GAC is key to maintaining its performance

Task 2.3 - Adsorption-based processes to minimize DBP formation

NOM/DBPs potential reduction results in batch tests for different GACs Fluorescence, Absorbance and THMfp analysed (UdG-LEQUIA collaboration)



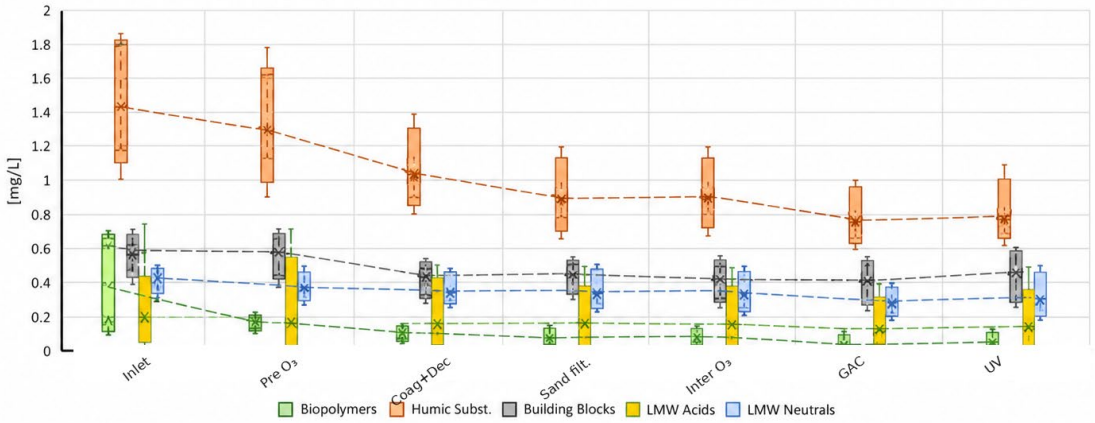


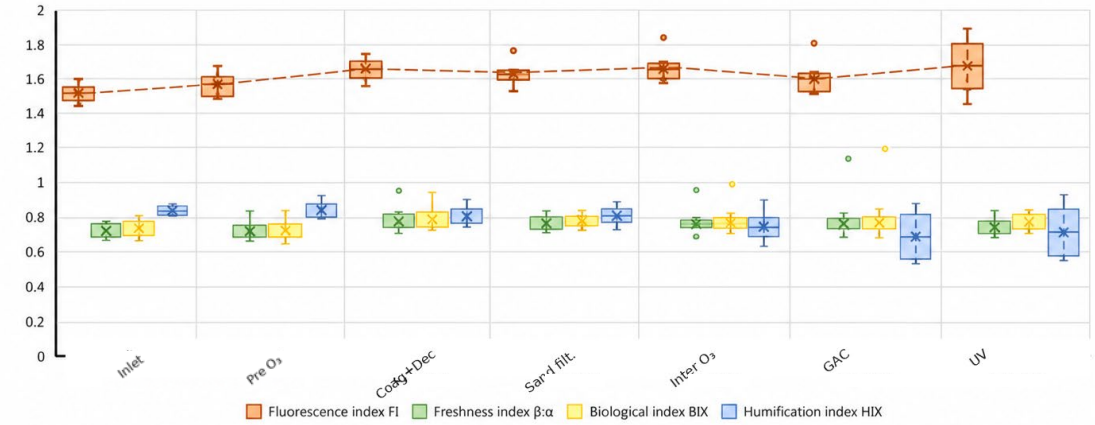
Chosen filter was GAC nº7
best absorption capacity-to-cost ratio

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NOM Characterization at Full scale

Task 2.5 – NOM Characterization at l'Ampolla DWTP



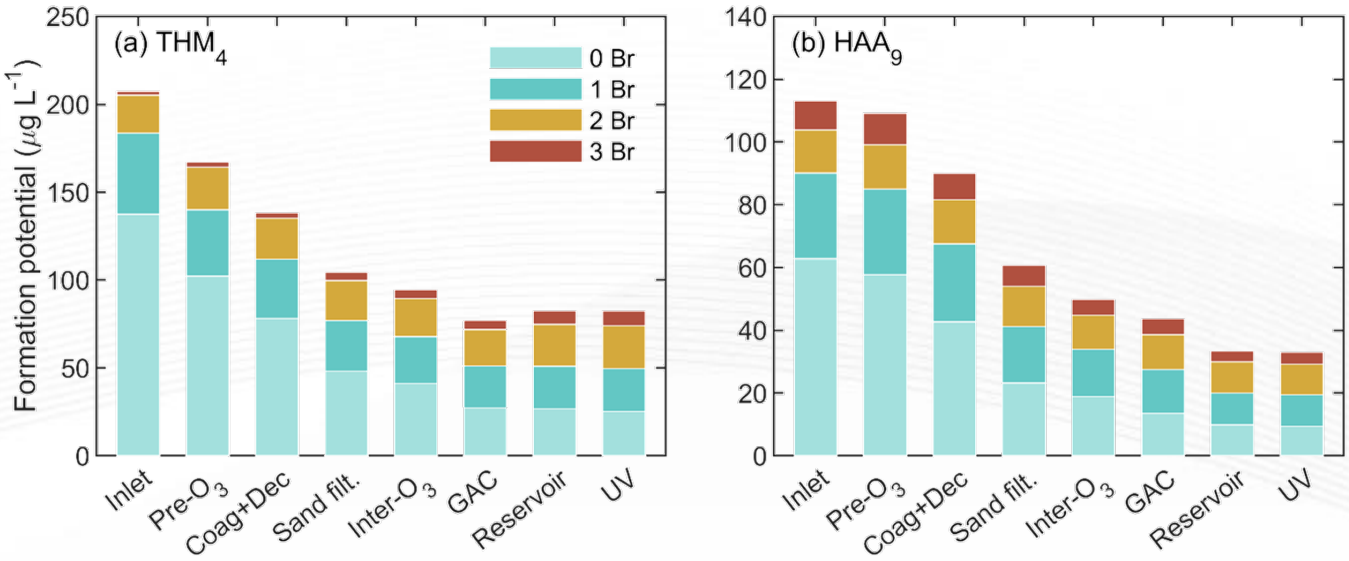


NOM fractions are differently removed by DWTP steps

Humic substances are key on the DBPs, but DWTP only eliminates them partially

Fluorescence Index (FI) remains high, indicating microbial-origin organic matter, more reactive with chlorine

Task 2.5 – NOM Characterization at DWTP vs. DBPs formation



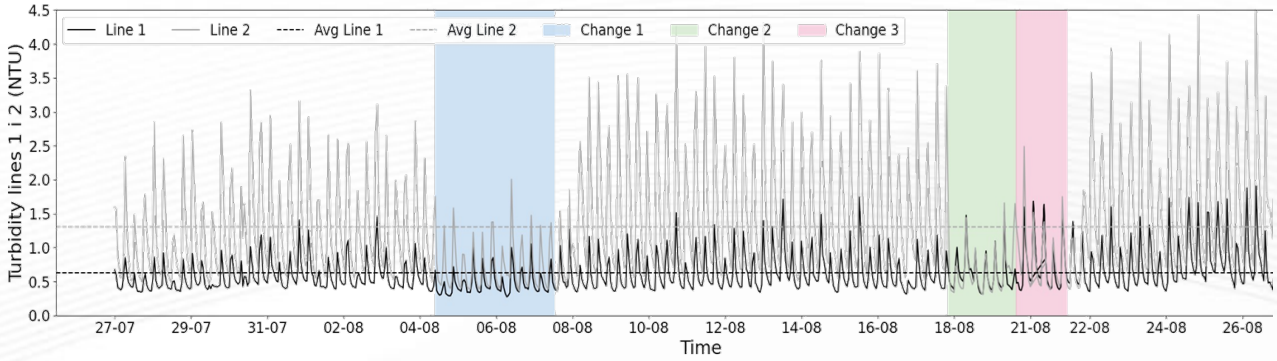
Better **understanding** of the performance of each **treatment process**

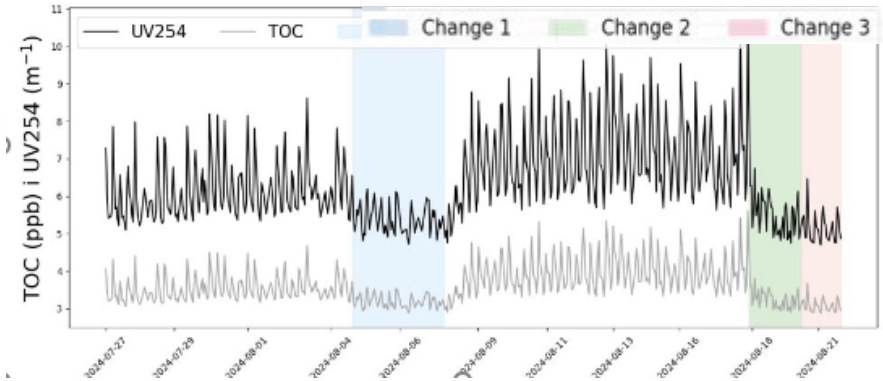
DBP-FP levels **decrease significantly** from raw water to GAC

The composition **shifts towards** more **brominated species**

Task 2.5 – NOM Characterization at l'Ampolla DWTP-

It is possible to **reduce the NOM** by modifying the **treatment parameters**





Operational Conditions

	Ozone	Floculant
Phase 1 Phase 2	0.8 ppm	1.1 ppm 1.5 ppm
Phase 1 Phase 2	0.8 ppm	1.1 ppm 2 ppm
Phase 1 Phase 2	0.5 ppm	1.1 ppm 2 ppm

Initial results are promising, but further testing must be completed to verify these results with different raw water qualities

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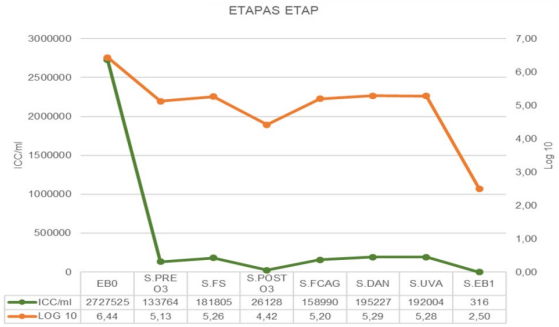
Drinking water monitoring for model development

Task 3.2 – Drinking water monitoring for model development

Flux Cytometer

DWTP processes cells reduction





	EB0	S.PRE O3	S.FS	S.POST O3	S.FCAG	S.DAN	S.UVA	S.EB1
ICC/ml	2727525	133764	181805	26128	158990	195227	192004	316
LOG 10	6,44	5,13	5,26	4,42	5,20	5,29	5,28	2,50

Efficiency of the UVA stage

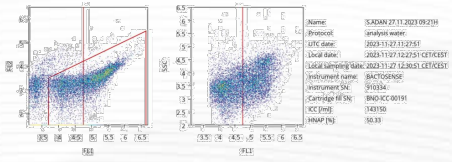


Gráfico 3: *Resultado del recuento de células Entrada UVA (S.DAN).*

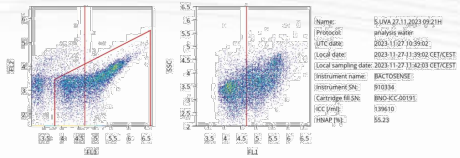
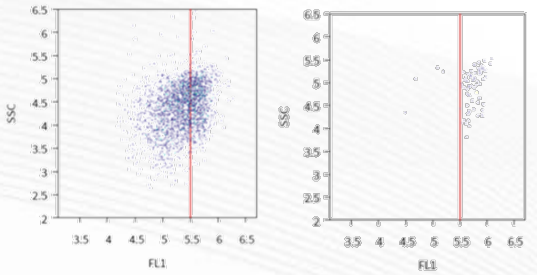


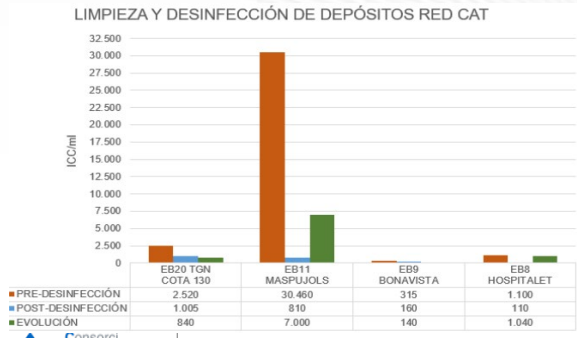
Gráfico 4: *Resultado del recuento de células Salida UVA (S.UVA).*



	0	24	48	72	96
S.DAN	273750	401240	445590	474755	472980
S.UVA	262680	253445	250885	280365	268610

Efficiency DW tanks cleaning





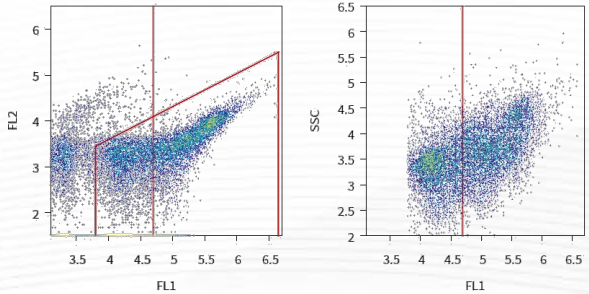
	EB20 TGN COTA 130	EB11 MASPUJOLS	EB9 BONAVISTA	EB8 HOSPITALET
PRE-DESINFECCIÓN	2.520	30.460	315	1.100
POST-DESINFECCIÓN	1.005	810	160	110
EVOLUCIÓN	840	7.000	140	1.040

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Task 3.2 – Drinking water monitoring for model development

Flux Cytometer for an online reading of the total cell number







25 minutes

1-3 days

≥ $3x10^4$ ICC/ml

PREALARM

≥ $3x10^5$ ICC/ml

ALARM





Possible Bacterial Contamination

Probable Bacterial Contamination water unfit for consumption

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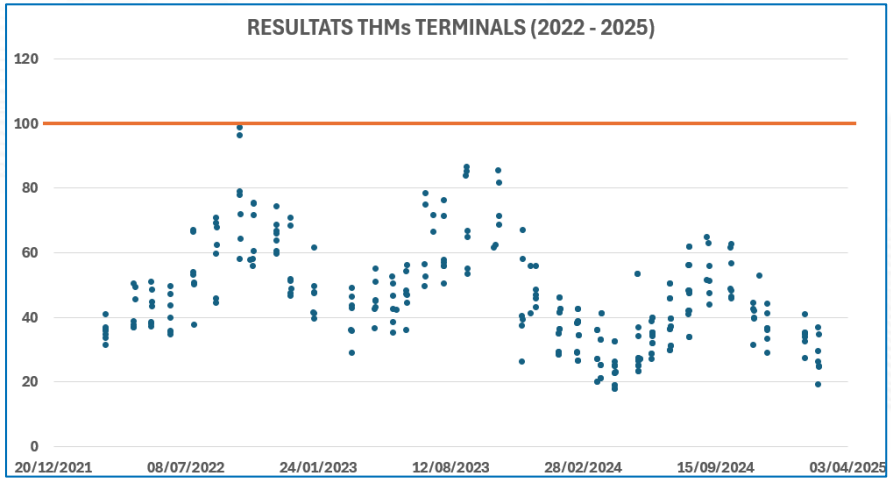
Other Tasks Collaborations

Other Tasks Collaborations

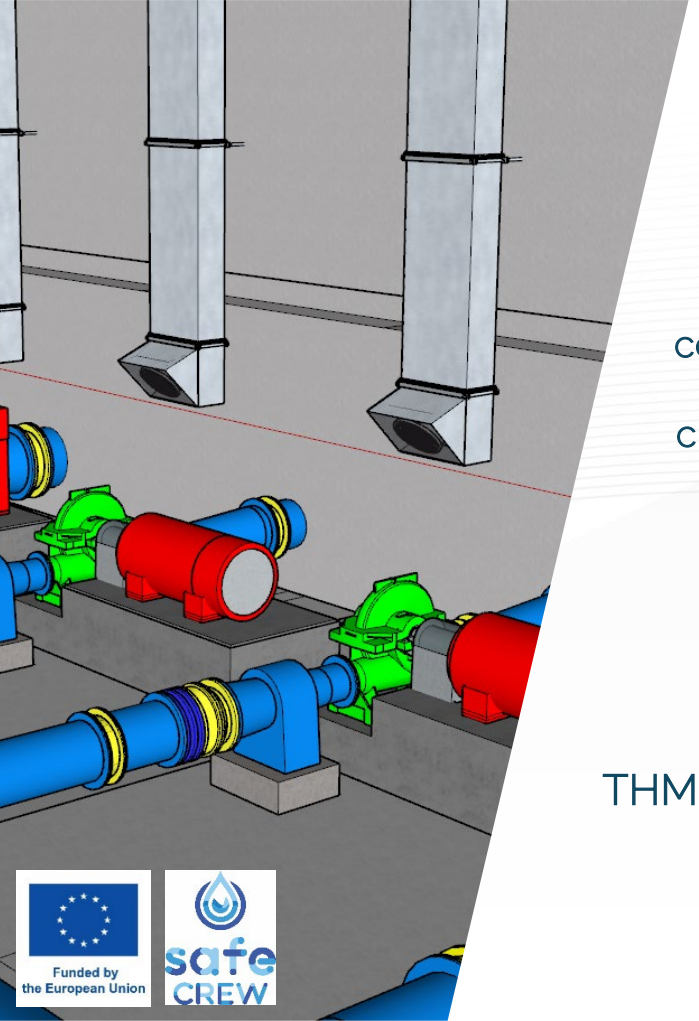
Reagent-free THMs online monitoring:



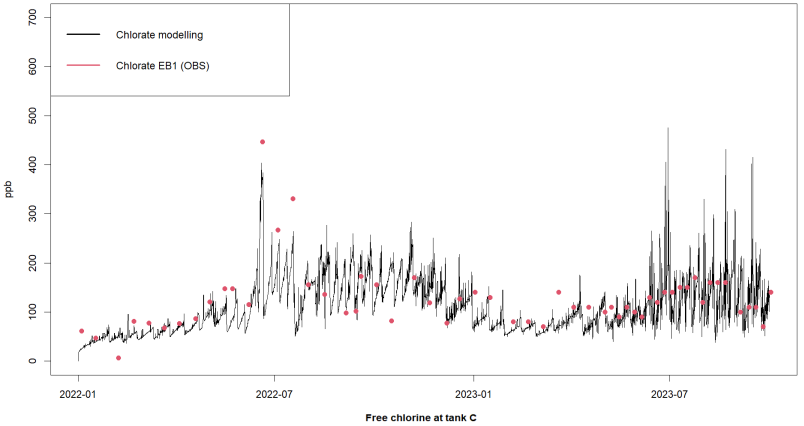




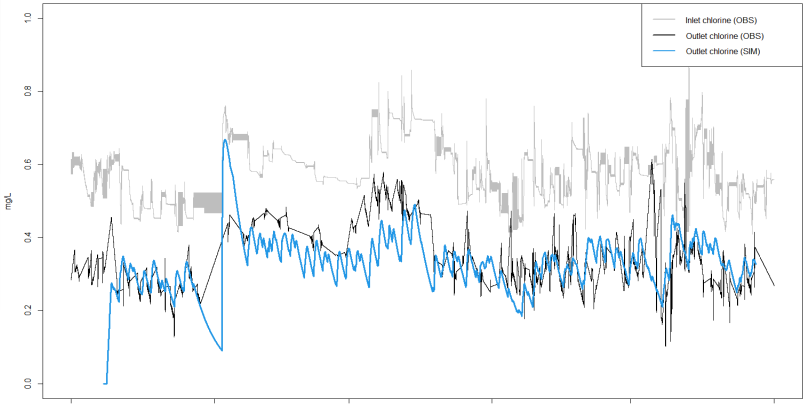
Water Quality Prediction Models in the Distribution Network for DBPs (eurecat)



Chlorates concentration model vs. chlorine dose



THMs formation



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Other Tasks Collaborations

Continuing sampling campaign for different project tasks.

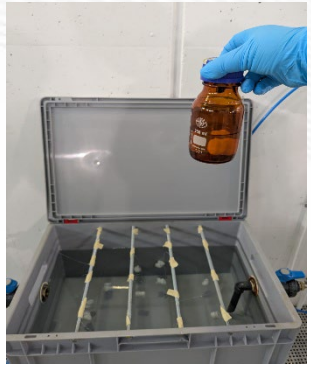
May 2025

Chlorophyll study to implement an **online chlorophyll detection** system in the Ebro River. Correlation study between laboratory data and equipment data. Collaboration with EureCAT in **Task 1.3**.



October 2025

Passive sampler installed at CAT DWTP for **continuous microbial monitoring** with the implementation conducted with Marco Matracchi (POLIMI) under **Task 1.5**, focusing on advanced sampling methodologies.



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Conclusions

Takeaways

- CAT is fully aware of the impact of the climate change to the source water quality.
- The **SafeCrew Project** has provided knowledge of **how to adapt our processes** to the future water quality conditions.
- SafeCrew Project helped CAT **understanding how NOM fractions are related to the DPBs generation**, and how to manage and evolve our treatment to minimize them.
- Research Projects like SafeCrew is key to design better tools to **ensure safe drinking water at all times.**





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Thank you for your attention