NEWSLETTER

EDITORIAL

The kick-off meeting for the seven projects, recommended for funding following the 2013 Water JPI Pilot Call on Emerging Contaminants, will take place on the 11th March 2015 in Brussels. We are very pleased to start this new year in our collaboration on water research and innovation, enlarging our circle of people and institutions to the consortia of the projects FRAME, METAWATER, MOTREM, PERSIST, PROMOTE, StARE and TRACE.

This January newsletter provides details on the consortia, activities and expected results of these projects. The theme of our first Joint call on "*Emerging water contaminants – anthropogenic pollutants and pathogens*" was selected for its relevance to water quality and to impacts on water systems safety and risks to the societal wellbeing, according to our Strategic Research and Innovation Agenda SRIA. We had a large response to our first call supported by eleven Water JPI funding institutions: 106 applications submitted involving 595 partners. After a first eligibility check 64 proposals were evaluated by a panel of 12 international experts. The projects FRAME, METAWATER, MOTREM, PERSIST, PROMOTE, StARE and TRACE were recommended for funding for their scientific quality, the competence of the researchers involved, the societal impact of their activities. These seven projects which represent a research investment of more than 9 million Euros will produce new scientific and technological knowledge on the effects of emerging freshwater contaminants on human health, develop more efficient solutions to manage these substances, as well as assess their behaviour in the aquatic environment.

A warm thank must be addressed to the German Ministry for Research BMBF, the Spanish Ministry for Competitiveness MINECO, the Academy of Finland AKA, the French Agency for Water ONEMA, the Norwegian Research Council RCN, the Danish Innovation Foundation, the Italian Ministry for Research (MIUR), the Portuguese Foundation for Science and Technology FCT, the Irish Environmental Protection Agency EPA, the Spanish Centre for Technological and Industrial Development CDTI and the Research Promotion Foundation RPF of Cyprus, which will financially support the respective national researchers involved in the projects activities.

NEWSLETTER

FRAME: A novel FRamework to Assess and Manage contaminants of Emerging concern in indirect potable reuse

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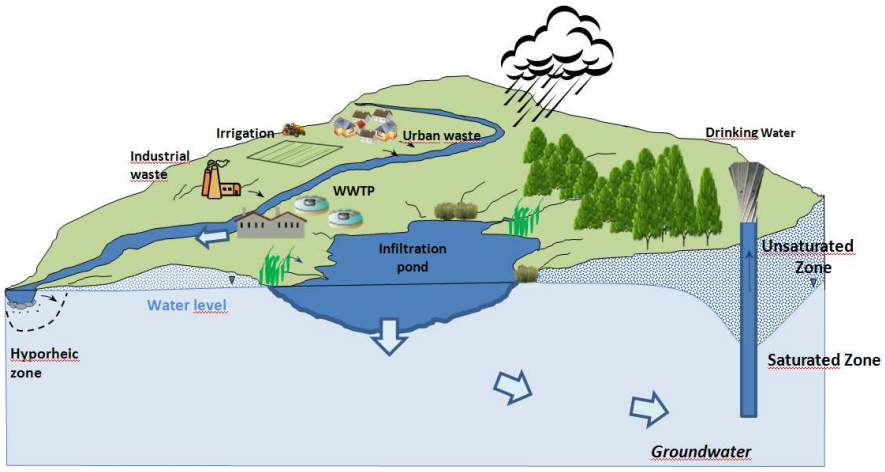
Emerging contaminants (e.g., pharmaceuticals, household chemicals), pathogens and antibiotic-resistant bacteria/genes are either continuously discharged by WWTPs into European rivers and streams or they are transferred to soils and groundwater by irrigation and groundwater recharge. Although impacts on aquatic and soil organisms have not been comprehensively elucidated so far, potential adverse effects on human health cannot be excluded if surface water or groundwater serves as a resource to augment downstream drinking water supply.

The aim of FRAME is to develop an overall evaluation procedure enabling a comprehensive assessment of efficient and cost-effective indirect potable reuse (INPR) measures to minimize the risks associated with emerging chemicals and microbial contaminants, while closing local and regional water cycles. This innovative framework goes well beyond traditional singular assessment strategies by providing an integrated tiered approach.

This approach encompasses:
i) the removal efficiencies of water reclamation processes for suitable and representative (indicator) contaminants, including the formation of undesired transformation products,
ii) the inactivation of microbial contaminants,
iii) the removal of antibiotic-resistant bacteria/genes,
iv) the minimization of ecotoxicological and human health risks, as well as
v) costs and non-monetary benefits and drawbacks of selected INPR strategies.

For a comprehensive process evaluation, sound monitoring procedures at representative field sites practicing INPR, sensitive and accurate water quality characterization methods, reliable modelling approaches, and appropriate (eco)toxicological assessment strategies will be developed and validated.

The outcomes of this study will be embedded into a decision framework that can assist stakeholders and policy makers in selecting appropriate and cost-effective INPR applications, while minimizing ecological and human health risks.



NEWSLETTER

METAWATER: New METAgenomics and molecular based tools for european scale identification and control of emergent microbial contaminants in irrigation WATER

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Irrigation water may be the source of microbiological contamination of fresh vegetables and has been associated to important food-borne epidemics of gastroenteritis, acute hepatitis and other important diseases.

The proposed project will investigate what pathogenic microoganisms are contaminating irrigation water used in Europe, where are there they coming from, what treatments are more useful for removing microbial pathogens from reclaimed water and how to improve management of irrigation water and National and International regulations.
From a most scientific point of view, we will also use most advanced technologies for developing standard protocols for the simultaneous detection of microorganisms in water used for irrigation and will identify existing, emerging and new pathogens and microbial communities, including viruses, bacteria and antibiotic-resisting bacteria, protozoa and cyanobacterial toxins in water from rivers, ground water, wastewater and reclaimed water, and distribution water.

We will produce scientific information on pathogens excreted in the population of different geographical areas in Europe and bioinformatics tools and data bases for a better analysis of the information generated. The results are shared with water companies and regulatory agencies and will contribute to the reduction of the public health risk and to improve water and food safety in Europe.

NEWSLETTER

MOTREM: Integrated processes for MOnitoring and TReatment of EMerging contaminants for water reuse

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The MOTREM project focuses on the development of integrated processes for monitoring and treatment of emerging contaminants (ECs), improving the efficiency of the removal of these pollutants in urban wastewater treatment plants (WWTPs), especially for water reuse.

The project aims to provide new technologies for water treatment and/or improving the existing ones through the development of integrated processes for monitoring and treatment of ECs in the current waterline of municipal wastewater treatment plants, especially focusing on the aspect of water reuse. For this goal, the project combines cross- and multi-disciplinary expertise on water treatment processes design and engineering, analytical chemistry and ecotoxicology applied to ECs that guarantee the generation not only on new scientific knowledge but also of innovative commercial solutions to the market.

The general ideas behind MOTREM project are:

a) Develop new processes or modifications of the current biological and disinfection technologies in WWTPs by advanced oxidation and biooxidation processes to achieve the removal of ECs before water reuse or the discharge of the effluents to the environment.

b) Develop new technologies for the monitoring of the wastewater treatment plant operation regarding the removal of ECs, including analytical procedures and ecotoxicology assessment.

c) Bring together the “key enabling technologies (KET)” developed in steps a) and b) to be tested in an urban wastewater treatment plant.

The general goal of the project will be accomplished through specific research objectives:

1.- To develop biooxidation processes with higher efficiency in the degradation of ECs, evaluating their feasibility in continuous non-sterile operation conditions.

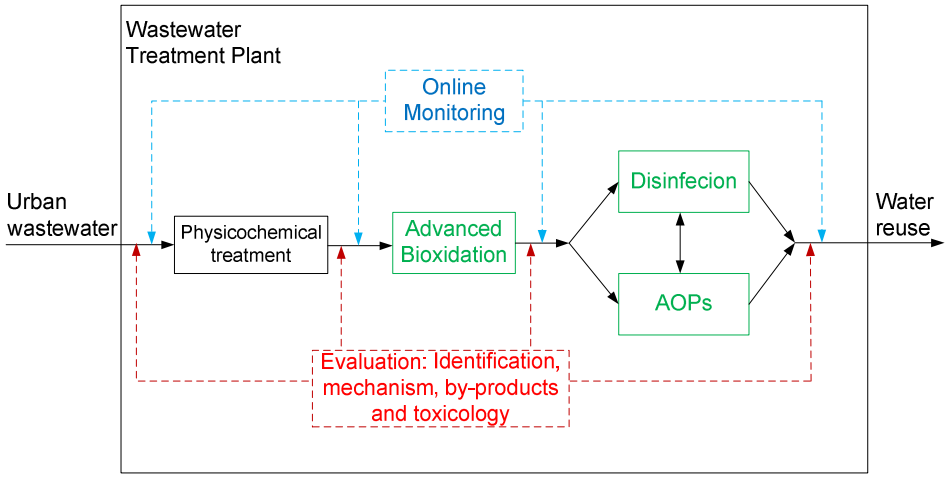
2.- To increase the catalytic efficiency of TiO2 materials by novel preparation and immobilization methods, evaluating their performance, lifetime and stability under long-term operation using solar light

3.- To develop photo-Fenton processes operating at near-neutral pH values for the simultaneous inactivation of microorganisms and removal of ECs, engineering the process for a successful scaling-up.

4.- To identify the ECs more refractory to the water treatment processes to be used as indicators of the wastewater plant operation efficiency, developing new sampling and analytical methodologies for their monitoring, making possible the link with the control strategies.

5.- To establish the mechanism of degradation of the ECs, including the identification of the transformation products and the assessment of their ecotoxicological and estrogenic impact.

The figure shows a scheme of the main concept behind MOTREM project, showing in green the water treatment processes in waterline of the wastewater treatment plant, in blue the monitoring activity and in red the analytical evaluation of ECs and their degradation mechanism.



MOTREM Project conceptual diagram

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PERSIST: Fate and PERSISTence of emerging contaminants ar MRB in a continuum of surface water groundwater from th laboratory scale to the regional scale

C. Le Gal La Salle

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Emerging organic contaminants (EOCs), such as pharmaceutical compounds, and mutli-resistant bacteria (MRB) represent a growing public health concern. Residual pharmaceutical products in the environment may arise from wastewater effluent outlets and intensive cattle grazing activities, while MRB may results from both direct release of wastewater to the environment and in-situ development due to the occurrence of residual antibiotics. However fate and transfer of EOCs and MRB in both surface water and groundwater bodies are yet not well known.

In this context, the PERSIST project aims to increase our knowledge on the behavior of a selection of targeted pharmaceutical products and multi resistant bacteria in both surface water and groundwater bodies. The study will be carried out at two complementary hydrogeological field sites, in Spain, the Empordà basin, and in France, the Vistrenque basin, chosen for their complementarities.

The investigation will be carried out at the catchment scale, in a surface water/groundwater continuum. To better constrain the sources and transfer processes of these compounds, their occurrence will be correlated to environmental tracers to define the origin and residence time of water.

Complementary column experiments will allow to evaluate transport parameters and these results will be up-scaled with the aim to model the fate and migration of EOCs at the catchment scale. Finally, relating the factors that control the hydrological system and contaminant movement with potentially contaminating land-uses will allow identifying areas of vulnerability. Hence results will be useful to delineate guidelines for groundwater pollution prevention and aquifer restoration, contributing to the development and implementation of EU directives for EOCs occurrence in water bodies.

NEWSLETTER

PROMOTE: PROtecting water resources from MObile TracE chemicals

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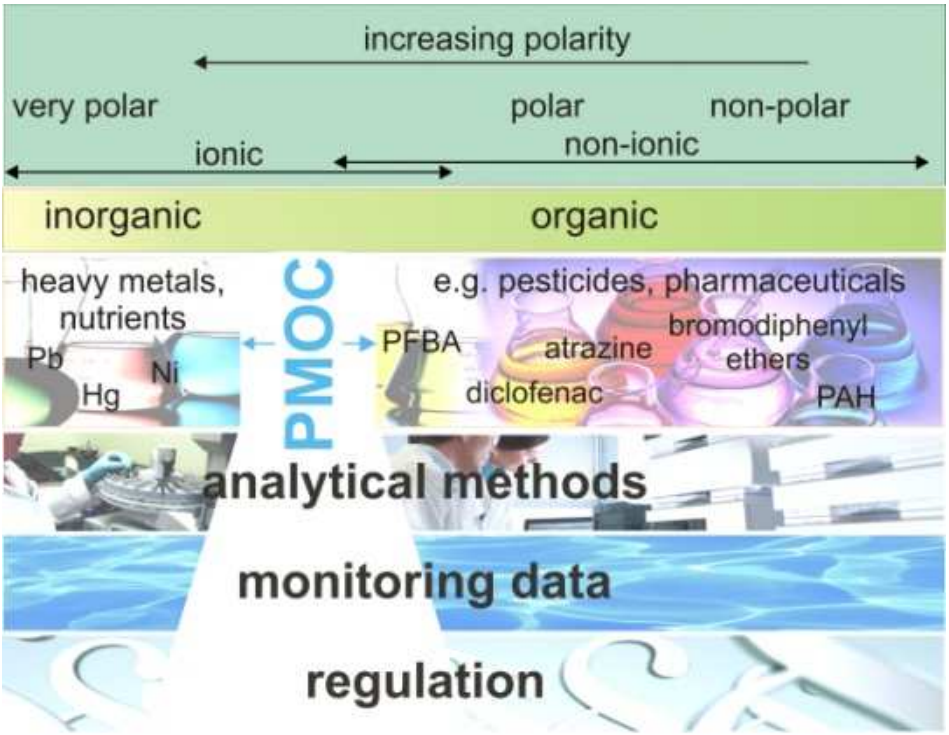
PROMOTE focuses on persistent, mobile organic contaminants (PMOC). PMOC are highly polar compounds and as such likely to occur in the water cycle and in raw waters used for drinking water production. At the same time their physico-chemical properties make them very challenging to analyze. Consequently, analytical methods are insufficiently developed and little is known upon their occurrence in environmental and drinking waters. PROMOTE follows two strategies to identify and monitor PMOC: (a) developing and applying analytical methods for screening of water samples for PMOC and (b) selection and prioritization of candidate substances based on REACH data and developing analytical methods for their quantitative analysis.

The developed analytical methods will be applied to representative samples from five European river basins, to WWTP effluents, to groundwater samples and to raw waters used for drinking water production.

For PMOC occurring in raw waters or likely to occur in such waters PROMOTE will study the potential of different drinking water treatment strategies to remove PMOC. PMOC will be prioritized in terms of their emission sources and removal options and adequate mitigation methods at reasonable effort will be proposed. This will include improved treatment processes for compounds emitted only locally, changes in the use profile and regulation within the REACH legislation.

Widely distributed PMOC of environmental or health concern may also be candidates for the watch list of the WFD.



PROMOTE analytical method

NEWSLETTER

StARE: Stopping Antibiotic Resistance Evolution

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This project was designed based on the identification of the major gaps in knowledge and technology that impede successful measures to control antibiotic resistance in the environment. The research consortium assembles wastewater engineers, microbiologists, molecular biologists, and bioinformatics interested in antibiotic resistance evolution. The mobility of researchers within the consortium will enhance collaborative activities, mainly by the combination of fundamental and applied approaches. Major aims of this project include i) the establishment of standardized protocols, ii) the elucidation of the relationship between antibiotic residues and resistance genes in wastewater, iii) the comparison of antibiotic resistance prevalence in the effluents discharged by urban wastewater treatment in Northern and Southern European regions and the iv) the development of improved advanced wastewater treatment technologies and their effects on the microbiome and resistome. Major outcomes will be the formulation of harmonized protocols to measure antibiotic resistance in aquatic environments and the identification of critical factors (e.g. antimicrobial residues, heavy metals) coinciding with the highest antibiotic resistance prevalence. Advanced wastewater treatment technologies suitable to decontaminate effluents critical points (e.g., UWTP, hospital effluents) and capable of minimizing resistance acquisition will be improved. Since antibiotic resistance concerns the whole population, consortium members will actively promote educational, communication and dissemination activities directed to the public, stakeholders, policy makers, officials and students.

NEWSLETTER

TRACE: Tracking and assessing the Risk from Antibiotic resistant genes using Chip technology in surface water Ecosystems

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Given the serious public health threat posed by antimicrobial resistance, it is important to investigate the potential role of surface water in amplifying the emergence and spread of antimicrobial resistance and to assess the potential associated risk to human health.

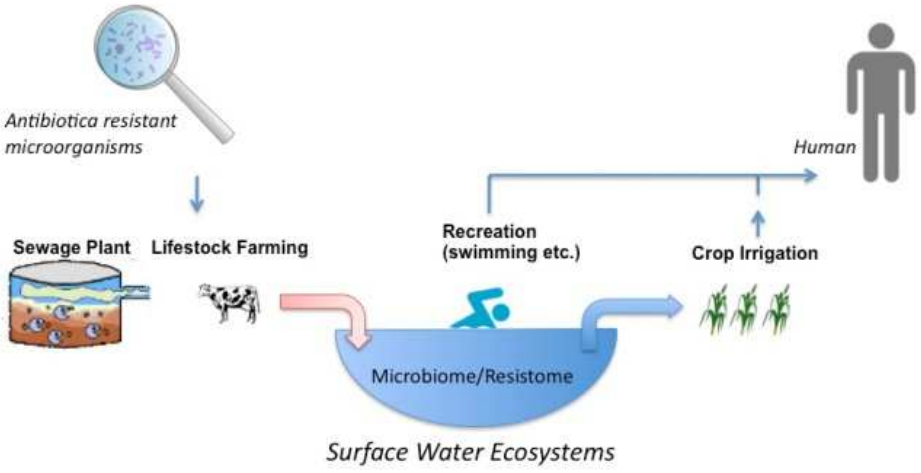
Research into the occurrence, fate, effect, and risk associated with the presence of antimicrobial resistant bacteria in such environments and the impact on human health is urgently needed for informed policy decisions.

TRACE will develop detection technologies that allow for a simpler on-site detection of antibiotic resistance, thereby enabling a much higher throughput and faster result-to-user turnaround.

This will allow for an increasing number of measuring points, as well as a higher frequency of measurements.

Extending this instrumental development for water system characterization, also fast and robust on-site tests will be developed in order to enable simple and timely testing. Despite current advances in the field of detection and portability, there is still a huge gap between bench and location when application and validation of these systems are concerned.

TRACE intends to bridge the gap and promote the effective translation of current laboratory technology to address real society problems. By doing so, TRACE will trigger further technology development and optimization that will strengthen current lines of research, whilst reinforcing current vectors of collaboration between partners.



Scheme of ecosystem addressed by TRACE: Antibiotic resistance in surface waters will be characterized using the newly developed detection technology.