First common seminar between the INRAE REUSE network and the COST Action CA23104 Water4Reuse

Quantitative Microbial Risk Assessment (QMRA): a methodological framework for estimating health risks associated with the reuse of treated wastewater

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Connection link: **https://inrae-fr.zoom.us/j/8838174385?pwd=Jj0Ob1wL1gOz0TrxENmI6AYa5we0pp.1&omn=96204483690**

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Abstract: Quantitative Microbial Risk Assessment (QMRA) provides a robust methodological framework for evaluating the health risks associated with the reuse of treated wastewater. By integrating scientific data and statistical models, it facilitates developing safe strategies for water management. In QMRA a structured four-step process is followed: *hazard identification*, *exposure assessment*, *dose-response modelling* and *risk characterization. Uncertainty* and *variability* are intrinsic to QMRA, influencing risk estimates and decision-making. Uncertainty originates from knowledge gaps, while variability reflects natural heterogeneity. *Monte Carlo* simulations address these challenges by probabilistically modelling inputs through probability density functions (PDFs), which quantify the likelihood of different parameter values. These simulations perform thousands of iterations, propagating uncertainty/variability through the QMRA framework to generate a risk distribution. Sensitivity analyses then identify dominant contributors indicating critical parameters. PDFs for dose-response models (e.g., exponential vs. beta-Poisson) further capture interspecies or interindividual variability in host-pathogen interactions. By integrating stochasticity, Monte Carlo outputs provide percentile-based risk estimates (e.g., 95th percentile risk), offering regulators a probabilistic understanding of compliance with safety targets. This lecture will enable the audience to consider all these aspects and understand how QMRA empowers policy-makers to balance water recycling strategies and public health protection ensuring sustainable use of water resources in an era of increasing water demand and climate change.

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Dr. Artin Hatzikioseyian is Assistant Professor for Environmental Engineering at the School of Mining and Metallurgical Engineering at NTUA, Greece. His main research interest is related with process modelling and technology development for the microbially-mediated treatment of municipal, industrial, and hazardous wastewater. He has authored research papers on the biosorption/bioprecipitation of metal ions by microbial biomass as well as on the modelling of adsorption columns for the sequestering of metal ions from wastewater. Artin is leading the fourth working group (WG4) within Water4Reuse (Cost Action 23104) offering work on the quantitative assessment of microbial and chemical risks by applying risk analysis tools in various water reuse scenarios. He is an experienced user of Wolfram Mathematica, Aquasim, COMSOL Multiphysics, JMP, and Oracle Crystal Ball. In this seminar, he will present the basic principles of QMRA for assessing the health risks associated with the reuse of treated wastewater.

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