Working Group 4 Presentation

Digital sciences, modelling and decision support systems for REUSE

WG4 - Overview

- This working group (WG) aims to support the Water4REUSE by applying **the methodologies and the tools of quantitative chemical and microbiological risk assessment** for evaluating **the health and environmental risks** associated with the reuse of reclaimed wastewater for different applications.

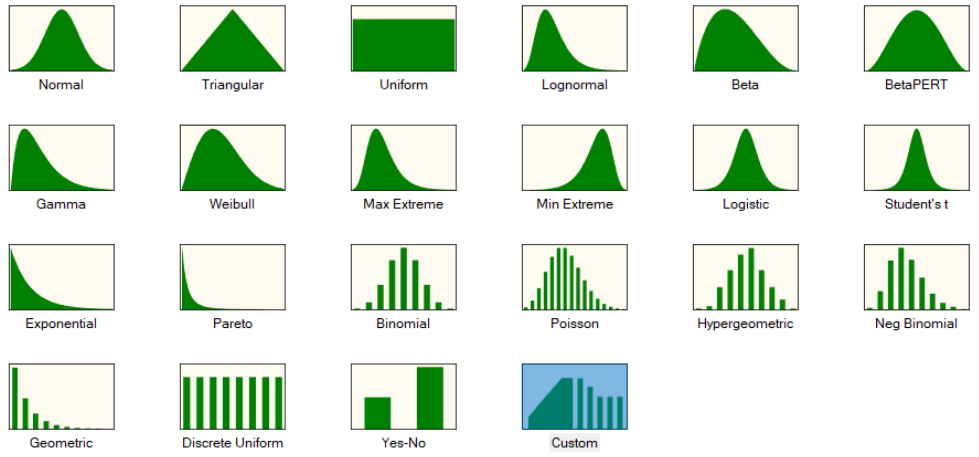
- WG4 also aims to support associated **risk management** by providing **decision support tools** for assessing:
  - Different wastewater treatment processes and barriers
  - Different water reuse scenarios (agricultural, landscape irrigation, industrial uses, aquifer recharge etc.)
  - Other quantitative tasks related with the risks from the water reuse concept (i.e. pollutant dose – response relationships)

Task 4.1

- **Review of State of the Art of current models**
  - Deterministic models (Provide the basic concepts)
  - Stochastic models (Support uncertainty and variability of the model parameters)

- **Compilation of criteria and measures of impacts**
  - Annual risk of infection
  - Annual risk of illness
  - Disability adjusted life years (DALYs) per person per year

- **Review of modelling and data analysis methods for risk assessment**
  - Probability Density Functions
  - Monte Carlo simulation
  - Parametric uncertainty analysis



Task 4.1

- **Compilation of treatment systems**
  - Disinfection (Chlorination, UV treatment)
  - Filtration (Sand filtration)
  - Membrane technologies (Reverse Osmosis)
  - Adsorption technologies (Carbon based advanced treatment i.e. GAC, PAC)
  - Advanced oxidation processes (Ozonation, Photo Fenton)
- **Models and available simulation platforms**
  - Oracle Crystal Ball (https://www.oracle.com/applications/crystalball/)
  - @Risk (https://lumivero.com/products/at-risk/)
  - Python, R
  - Matlab, Wolfram Mathematica

Task 4.2

- **Inventorize the set of available sensing and monitoring devices and methods** to be able to apply any new control of the whole wastewater/water treatment chain in “closed-loop”.

- **Propose at least one international benchmark** for investigating the water for demand concept putting forward the flexibility of treatment processes for water REUSE

WG4 - Actions

- Activity A4.1 Joint seminar with WG1, WG2 and WG3 to build a common framework for the Water4REUSE Action reference scenarios.
- For the first year it is useful to diffuse among the members of the cost action (CA) the methodologies of quantitative risk assessment **by reviewing the literature** and presenting the methods and tools through relative activities such as:
  - Preparation of tutorials in the form of webinars concerning specific methodologies (i.e. Monte Carlo simulation)
  - Tutorials on specific risk assessment software (i.e. Crystal Ball) or general purpose software (i.e. Matlab, Mathematica, etc.) in topics related with modeling of risk assessment.

Few challenges concerning the quantitative risk analysis for reuse of reclaimed wastewater

- Variability in Reclaimed Water Quality
- Data Quality and Availability
- Uncertainty in Model Inputs
- Uncertainty of Dose-Response Models
- Exposure Pathways and Routes
- Modelling Pathogen Inactivation
- Accounting for Biofilm Formation
- Integrating Multiple Barriers
- Evaluating Long-Term Health Effects
- Ensuring Model Transparency and Validation

WG4 – Few numbers …

- **18** Participants have expressed so far their interest to contribute in WG4
- **1** Virtual mobility (VM) grant for the first year has been announced.

Name	Surname
Artin	Hatzikioseyian
Dalila	Serpa
Donka	Shopova
Emina	Petrovic
Fatma Özge	Özkök
Ibrahim	Ozturk
Ignasi	Rodriguez Roda
Jacek	Mąkinia
Jagan	Gorle
Jan-Frnatišek	Kubát
Jérôme	Harmand
Kamel	Jebreen
Klara	Ramm
Michela	Mulas
Özlem	Karahan Özgün
Pelin	Sertyesilisik
Quim	Comas
Veronica	Kiluva

Meeting of 30th January 2025

WG4 - Digital sciences, modelling and decision support systems for REUSE

			Task 4.1					Task 4.2	
			Review of State of the Art of current models *(Deterministic models, Stochastic models, other models i.e. CFD)*	**Compilation of criteria and measures of impacts** *(Annual risk of infection, Annual risk of illness, Disability adjusted life years (DALYs) per person per year)*	**Review of modelling and data analysis methods for risk assessment** *(Probability Density Functions Monte Carlo simulation Parametric uncertainty analysis)*	**Compilation of treatment systems** *Disinfection (Chlorination, UV treatment) Filtration (Sand filtration) Membrane technologies (Reverse Osmosis) Adsorption technologies (Carbon based advanced treatment i.e. GAC, PAC) Advanced oxidation processes (Ozonation, Photo Fenton)*	**Models and available simulation platforms** *Oracle Crystal Ball @Risk Python, R Matlab, Wolfram Mathematica*	**Inventorize the set of available sensing and monitoring devices and methods** *to be able to apply any new control of the whole wastewater/water treatment chain in "closed-loop".*	**Propose at least one international benchmark for investigating the water for demand concept putting forward the flexibility of treatment processes for water REUSE**
a/a	**Name**	**Surname**							
1	Artin	Hatzikioseyian	☑	☑	☑	☑	☑	☐	☐
2	Dalila	Serpa	☐	☐	☐	☐	☐	☐	☐
3	Donka	Shopova	☐	☐	☐	☐	☐	☐	☐
4	Emina	Petrovic	☐	☐	☐	☐	☐	☐	☐
5	Fatma Özge	Özkök	☐	☐	☐	☐	☐	☐	☐
6	Ibrahim	Ozturk	☐	☐	☐	☐	☐	☐	☐
7	Ignasi	Rodriguez Roda	☐	☐	☐	☐	☐	☐	☐
8	Jacek	Mąkinia	☐	☐	☐	☐	☐	☐	☐
9	Jagan	Gorle	☐	☐	☐	☐	☐	☐	☐
10	Jan-Frnatišek	Kubát	☐	☐	☐	☐	☐	☐	☐
11	Jérôme	Harmand	☐	☐	☐	☐	☐	☐	☐
12	Kamel	Jebreen	☐	☐	☐	☐	☐	☐	☐
13	Klara	Ramm	☐	☐	☐	☐	☐	☐	☐
14	Michela	Mulas	☐	☐	☐	☐	☐	☐	☐
15	Özlem	Karahan Özgün	☐	☐	☐	☐	☐	☐	☐
16	Pelin	Sertyesilisik	☐	☐	☐	☐	☐	☐	☐
17	Quim	Comas	☐	☐	☐	☐	☐	☐	☐
18	Veronica	Kiluva	☐	☐	☐	☐	☐	☐	☐

Acknowledgments

This presentation is based upon work from COST Action (Water4Reuse, CA23104) supported by COST (European Cooperation in Science and Technology)