Finanziato dall'Unione europea NextGenerationEU | Ministero dell'Università e della Ricerca | Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA

multi-Risk sciEnce for resilienT commUnities undeR a changiNgclimate

Codice progetto MUR: **PE00000005** – CUP LEAD PARTNER

Deliverable title: Improved methodologies for contaminant monitoring

Deliverable ID: DV 4.3.1

Due date: February 29th, 2024

Submission date: February 29th, 2024

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1 Technical references

Project Acronym	RETURN
Project Title	multi-Risk sciEnce for resilienT commUnities undeR a changiNg climate
Project Coordinator	Domenico Calcaterra UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II domcalca@unina.it
Project Duration	December 2022 – November 2025 (36 months)

Deliverable No.	DV 4.3.1
Dissemination level*	PU, CO
Work Package	WP3 (VS4) - Enhancing capability to observe, model, and assess environmental hazards
Task	T 4.3.1 - Contaminant fate and transport models in water, groundwater and soils; innovative approaches to monitoring environmental pollution and quantification and reduction of uncertainty
Lead beneficiary	POLIMI/UNIFI
Contributing beneficiary/ies	POLIMI, UNIFI, UNINA, UNIPA, UNIPD, UNIROMA1

* PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

1.1 Document history

Version	Date	Lead contributor	Description
0.1	05.02.2024-19.02.2024	All partners	Individual contributions to first draft
0.2	19.02.2024	Alessandra Polettini (task coordinator) (UNIROMA1)	First draft
0.3	21.02.2024–24.02.2024	All partners	Edits for approval
0.4	26.02.204	Manuela Antonelli (WP coordinator) (POLIMI)	Revision
1.0	29.02.2024	Alessandra Polettini (task coordinator) (UNIROMA1)	Final version

2 ABSTRACT

The present document provides details on the results/products of the activities conducted until month 15 in the framework of WP4.3 ("Enhancing capability to observe, model, and assess environmental hazards"), task T4.3.1 ("Contaminant fate and transport models in water, groundwater and soils; innovative approaches to monitoring environmental pollution and quantification and reduction of uncertainty").
In compliance with the executive working plan of the whole project, T4.3.1 involves using innovative techniques to detect and measure contaminants in different environmental compartments as well as in animal and plant organisms to provide the framework for risk assessment of anthropic activities. Target contaminants include microplastics (from both conventional plastics and bioplastics), elongated mineral particles (EMP), hydrocarbons, heavy metals, antibiotics, drugs, pesticides, and other contaminants of emerging concern (CECs). A range of methods including advanced analytical determination, lab-scale study, full-scale monitoring, modelling of transport and transformation mechanisms as well as uncertainty evaluation, are developed and used at different time/space scales to determine the evolution and transformation of contaminants in terrestrial water ecosystems, groundwater, and soils. The task is also complementary to the companion task T4.3.2 that focuses on the same issues for marine ecosystems.
The products of the investigation activities delivered at this stage of the project are grouped based on three main thematic areas:

1. **Development, application and validation of methods and protocols for the detection and quantification of contaminants in the environment:**
   i. advanced methodologies for microplastics and micro-bioplastics sampling and detection in biotic and abiotic samples (UNIFI, UNIROMA1);
   ii. advanced characterization of the interactions of hazardous (asbestos, erionite) and potentially hazardous (antigorite) mineral fibres with biological fluids of humans (UNIROMA1).
2. **Development, application and validation of methods for advanced environmental monitoring:**
   i. monitoring of microplastics in wastewater, groundwater and environmental compartments (UNIFI);
   ii. implementation of a hydrogeological database and field data collection for the detection of contamination and marine intrusion phenomena in coastal aquifers (UNINA);
   iii. development of advanced methods for the estimation of characteristics parameters in porous systems, streams and rivers for subsequent use in modelling (POLIMI, UNIPD);
   iv. development of advanced methods for holistic contaminant monitoring in urban water systems (including wastewater treatment plants, receiving water bodies, irrigation systems, soil, crops and humans) (POLIMI).
3. **Data analysis and modelling of transport, diffusion, transformation, degradation of contaminants as well as prediction of their effects on human health, flora, fauna and environment quality:**
   i. assessment of the impact of microplastics on plants, crops and stygofauna (UNIFI);
   ii. application of methods (based on statistical approaches, sensitivity analysis, uncertainty estimation) for the analysis of environmental data (UNINA, POLIMI);
   iii. development and validation of geochemical and hydraulic models describing reactive transport processes of contaminants in porous systems, streams and rivers (POLIMI, UNIPD);
   iv. risk-based modelling for the identification of the main sources and exposure routes of micropollutants released by combined sewer overflows or associated to the reuse of reclaimed wastewater in agriculture (POLIMI).

Efforts to efficiently integrate the multiple competences of the participants to T4.3.1 (encompassing the fields of chemistry, geology/mineralogy, hydrogeology, fluid mechanics, biology/botanic, civil and environmental engineering) have been made in order to attain the main target of WP4.3, involving the development of advanced methodologies and tools to observe, model and assess environmental hazards as thoroughly and comprehensively as possible. Taking further advantage from synergistic interactions among the multiple expertise involved will be the target of the future activities within the task that will lead to the final deliverable due at month 36 (DV 4.3.2 – "Multiscale modelling framework for contaminants transport and reaction with uncertainty quantification").