

## Intention for launching Radioecology research working group

### Title and acronym: **Naturally-Occurring Radioactive Materials (NORM)**

#### Leadership

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#### Topical area

The main issue in view of NORM is how we assess and regulate the management and clean-up of NORM-impacted sites, such as radium contaminated sites, uranium liabilities and wastes arising from industries processing or generating other kinds of NORM. This involves (1) the practical use of hydrogeological and hydrogeochemical mechanistic modelling together with a process-based understanding of the radionuclide migration in the abiotic environment, transfer into biota and finally into the human food chain; (2) projective modelling on timescales from years to millennia; (3) sampling strategies for characterization of NORM-contaminated sites. This is necessary so that science based advice can be provided on long-term effective remediation options. However, due to the complexity of NORM sites, which is characterized, for instance, by complex mixtures of different chemicals and minerals as well as disequilibria in radionuclide decay chains, difficulties arise not only from the lack of data but also from the inadequacy of existing model concepts. Therefore, a promising strategy is to identify and parameterize key processes that influence the radionuclide behaviour and to transfer this knowledge into a mechanistic model sufficiently complex to describe the radionuclide behaviour in the environment, however, simultaneously simple enough to be practical and transferable between different NORM sites. In view of potential hazards associated with radioactive source terms of NORM sites related to either former or current activities, as well as the need for developing preventive methods at different stages of a technological process in a NORM industry, this is an important area.

#### Broad Objectives

- Identification and molecular understanding of key processes relevant for the radionuclide transfer under NORM site conditions involving tailored experimental studies to acquire data necessary for the parameterization of key processes.
- Development and testing of tools to assess the radionuclide migration in the environment, their transfer into biota and into the human food chain based on a mechanistic understanding of relevant transfer processes in NORM impacted sites (including physico-geochemistry, disequilibria in decay chains, multi-stressors, etc.). This is a complex process that should proceed by achievable goals, i.e., identification of basic processes and interaction matrices, development of conceptual models and eventually of full models.
- Optimization of remedial options or methods preventing the radionuclide transfer.

For COMET WP3, the initial research activity (IRA) to be done on NORM modelling has the specific objective to acquire data necessary for the parameterization of key processes, to improve existing

models or develop models linking observed accumulation, mobility, and transfer with environmental parameters and processes.

### Justification based on answers to the criteria for prioritisation of research, question(s) to be addressed

The activities of this WG should contribute and/or allow to:

- Gain ability to robustly predict NORM behaviour based on mechanistic process understanding. This includes approaches for specific environments and scenarios, e.g., flooding and erosion, where NORM may create environmental pollution of, for instance, groundwater, surface water, and soil contamination.
- Gain ability to predict radionuclide concentrations in surroundings of NORM disposal sites and assess impact on human and biota exposure for timescales of tens to thousands of years.
- Contribute to the development of clearance levels (no-effect levels) under consideration of new Basic Safety Standards (BSS) by comprehensive impact studies, including bioassays.
- Propose remediation options and methods to prevent the radionuclide transfer into the environment, as well as identifying bioindicators for contamination.

### Related challenge(s) and research line(s) in the Radioecology SRA

Within the proposed NORM IRA (COMET D3.1), the objective is to contribute to Challenge 1 of the SRA, research lines 1 to 3, by (i) identification and parameterization of key processes relevant for the environmental transfers of naturally occurring radionuclides and resultant exposure of humans and wildlife, (ii) acquiring data necessary for the parameterization of key processes controlling the behaviour of radionuclides in the environment, and (iii) by improving existing models or developing parametric models linking observed accumulation, mobility ( $K_d$ ), and transfer (TF and fluxes) with environmental parameters and processes to enable spatial and temporal predictions. The resulting knowledge is required to explain the behaviour of natural radionuclides in environmental compartments including dynamic processes and to create a capability to assess resulting exposures of both non-human and human populations with substantially reduced uncertainty.