

# ALLIANCE PRIORITY, CONCERT Call

**Biomarkers of exposure and effects in living organisms, as operational outcomes of a mechanistic understanding of intra- and inter-species variation of radiosensitivity under chronic low dose exposure situations**

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# Priority selection

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**Two priorities with impact expected mainly in terms of reduced uncertainty in exposure and dose assessment and increased human and wildlife radiation protection:**

- Environmental availability and impact of radionuclides in terrestrial and freshwater ecosystems (including human food chain) and their interactions with atmosphere, incorporating physical, chemical and/or biological processes. Validated process-based model parameterisation, characterisation of variability and uncertainty, and guidance for fit-for-purpose models (**ranked as priority 1**) *in 2015 for call 1 – changed into priority 2 in 2016 for call 2*
- Development of models/tools, and datasets for their calibration and validation and guidance to select and evaluate the effectiveness of different remediation strategies in long-lasting exposure situations (e.g. nuclear accidents and/or NORM/TeNORM) (**ranked as priority 3**)

**Two priorities with impact expected mainly in terms of reduced uncertainty in effect assessment and increased wildlife radiation protection:**

- Biomarkers of exposure and effects to living organisms as operational outcomes of a mechanistic understanding of intra- and inter-species variation of radiosensitivity to chronic low dose exposure situations (**ranked as priority 2**) *in 2015 for call 1 – changed into priority 1 in 2016 for call 2*
- Multiple stressors and modulation of radiation effects in living organisms (**ranked as priority 4**).

# Challenge

- Issue of biological effects of low doses of ionising radiation (environmentally relevant) is still of major concern for both human and environmental radiation protection, as highlighted after the Fukushima and Chernobyl accident.
- Not yet in position to quantify the risk to individual and population health at such low chronic doses/dose rates.
- ICRP aims for an integrated system of protection of both human and the environment urges to complement the knowledge and associated tools
- → explore mechanisms of intra- and inter-species radiosensitivity differences and quantify these differences by identifying and screening biomarkers of exposure & effects

## Scope Proposals should

- Identify primary mechanisms of radiation induced effects at the molecular level and their propagation to the individual level, including consequences for physiological functions (e.g. reproduction) with potential population level impact
- Establish dose-response relationships using a comprehensive (omics, system-biology) approach to link mechanisms with associated biomarkers of effects. Could include genetic & epigenetic changes as potential biomarkers for transgenerational effects.
- Assure accurate biodistribution and dosimetry as a prerequisite for any robust dose-response relationships
- Combine “lab-field-modelling”-approaches for selected exposure conditions and species

## Scope Proposals should

- Evaluate and identify suitable biomarkers of exposure and biomarkers of effects.
- Provide the basis for models to tackle the wide species diversity and useful for risk assessors by helping reducing uncertainty in predictions of exposure and/or effects (and ultimately risk).
- Address the implications of the research results on the perception and communication of risks from low doses of ionising radiation to environment and man
- The topic is relevant for any exposure situations where flora and fauna, and humans, may be chronically exposed to environmentally relevant levels of radionuclides

## Expected impact

- Will provide an answer to the major concern of long-term biological effects of low radiation doses and alleviate part of the controversy
- Identification robust biomarkers of exposure and effect and of basis for difference in radiation sensitivity → acquired knowledge will underbuilt the various extrapolations needed when assessing radiological risk to humans or non-human species, and will provide robustness in decision making
- By encouraging openness to other disciplines and innovative hypothesis-driven approaches to understand underlying mechanisms, this research topic will contribute to increasing acceptability of the radiation protection system and aid in risk prediction, management and communication.

## Expected impact and relevance

- Outcomes will support emerging policy in the field of radioprotection of the environment, mentioned in the EURATOM Basic Safety Standards through the statement that *"While the state of the environment can impact long-term human health, this calls for a policy protecting the environment against the harmful effects of ionising radiation. For the purpose of long-term human health protection, environmental criteria based on internationally recognised scientific data (...) should be taken into account"*.

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- Research and innovation action
  - Can address part of scope but always link with environment
  - Open to interaction with other platforms – Melodi, SSH