

The Strategic Research Agenda in Radioecology: the seed for integration

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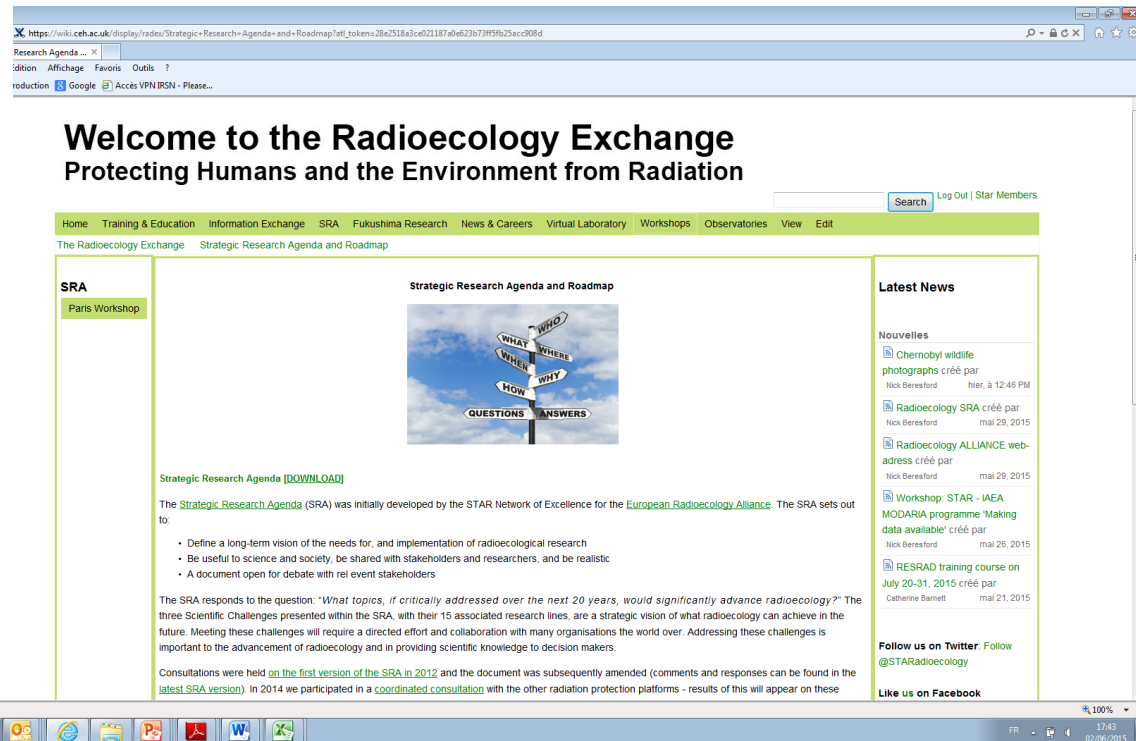
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The different components of the SRA for Radioecology – the vision for...

- the science to be developed (*this talk*)
- the infrastructures and knowledge management
- radioecological observatory sites
- education and training

The SRA for Radioecology: a key document to guide the research strategy

- The SRA in radioecology expresses the priority research lines and expected advances for the next 15-20 years. The SRA is the key document to guide the research strategy for radioecology in Europe.
- STAR initiated this exercise for radioecology, delivered the first version of the SRA for Radioecology (May, 2012), and updated it (Jan 2014) on the basis of an open consultation (e-questionnaire) combined with a consensus workshop organised by STAR-ALLIANCE (Nov 2012, Paris).
- *ca.* 100 various items from a comprehensive panel of stakeholders were incorporated in the present version



The screenshot shows a web browser window displaying the 'Radioecology Exchange' website. The page title is 'Welcome to the Radioecology Exchange Protecting Humans and the Environment from Radiation'. The main content area is titled 'Strategic Research Agenda and Roadmap' and features a central image of a signpost with arrows pointing in various directions labeled 'WHO?', 'WHERE?', 'WHEN?', 'HOW?', 'QUESTIONS', and 'ANSWERS'. Below the image, there is a section for the 'Strategic Research Agenda' with a 'DOWNLOAD' link. The text describes the SRA as a long-term vision document developed by the STAR Network of Excellence for the European Radioecology Alliance. It lists three key goals: defining a long-term vision, being useful to science and society, and being open for debate. The page also includes a 'Latest News' sidebar with several articles, a search bar, and navigation links like 'Home', 'Training & Education', and 'Information Exchange'. The browser's address bar shows the URL: https://wiki.ceh.ac.uk/display/radev/Strategic+Research+Agenda+and+Roadmap.

The SRA for Radioecology: What were the key drivers?

- The multiple lessons learnt from the Fukushima and the Chernobyl accidents
- The evolvement of policy in the field of radiological protection at the European and international level
- The need for improving communication with stakeholders and to better interact with society
- The need for filling gaps of knowledge and/or reduce uncertainties in our science with a priority level consistent with the needs from users (NGOs, industry, regulators, international organisations)
- The ultimate goal of improving radioecological expertise for a variety of environmental situations dealing with the nuclear fuel cycle, NORMs, contaminated sites ... (planned, existing, emergency)

What do we expect from the SRA ?

- Integrate skills, knowledge and tools from various partners in order to gain capabilities of answering complex and multidisciplinary issues
 - The SRA describes the basic research lines to be combined to answer high complexity issues and advance radiological protection
 - Questions raised by STAR are good examples: e.g., “are radiation protection benchmarks protective enough in a multiple stressor context?”
- Be the reference document for the roadmaps under construction where the sequence of research activities is planned:
 - Following the objectives of
 - (i) improving the level of expertise in ERA;
 - (ii) understanding the underlying mechanisms of major processes of transport, transfer and effects;
 - (iii) gaining the knowledge needed for
 - supporting policy changes,
 - enhancing public credibility,
 - managing issues at contaminated sites (e.g., Fukushima)
 - With prioritisation through the application of a set of criteria : impact, achievable, relevance and public perception, good science

The SRA overview in a nutshell

- Built around the three major components of the Risk Assessment for man and environment
 - from sources to exposure;
 - exposure (to dose) to effects;
 - risk characterisation, communication and management
- Articulated into 3 challenges (and 15 research lines)
 - Predict human and wildlife exposure in a robust way by quantifying key processes that influence radionuclide transfers and exposure
 - Determine ecological consequences under realistic exposure conditions
 - Improve human and environmental protection by integrating radioecology

- For enhancing its visibility worldwide, a short version has been published in a peer-reviewed journal



Short communication

An invitation to contribute to a strategic research agenda in radioecology

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CH 1 - To predict human and wildlife exposure more robustly

- **RL1 - Identify and mathematically represent key processes that make significant contributions to the environmental transfers of radionuclides and resultant exposures of humans and wildlife**
 - Help to (i) reduce uncertainty and understand variability, (ii) justify additional research required to parameterise dynamic-mechanistic models and (iii) identify the level of model complexity needed for specific exposure scenarios.
- **RL2 - Acquire the data necessary to parameterise the key processes that control the transfer of radionuclides**
 - Develop specific laboratory-based work and field studies or develop extrapolation methods
- **RL3 - Develop transfer and exposure models that incorporate physical, chemical and biological interactions, and enable predictions to be made spatially and temporally**
 - Describe processes at interfaces (e.g., atmosphere - water surfaces, geosphere - biosphere, oxic - anoxic, external media- biological membrane,..)
- **RL4 - Represent radionuclide transfer and exposure at a landscape or global environmental level with an indication of the associated uncertainty**
 - Incorporate process based model into a GIS tool in order to identify sensitive environmental areas

CH 2 - To Determine Ecological Consequences under Realistic Exposure Conditions

- **RL5 - Mechanistically understand how processes link radiation induced effects in wildlife from molecular to individual levels of biological complexity**
 - How may those elementary mechanisms result in adverse outcomes at the cellular and individual levels (e.g., reproduction, growth, survival, behaviour)?
- **RL6 - Understand what causes intra- and inter-species differences in radiosensitivity (among cell types, tissues, life stages, among contrasted life histories, influence of ecological characteristics including habitats, behaviour, feeding regimes)**
 - How do those findings, combined with a phylogeny/homology-type approach, support inter-species extrapolation?
- **RL7 - Understand the interactions between ionising radiation and other co-stressors**
 - What are the combinations of mixtures situations or co-contaminants that are likely to show interacting effects with radiation?
- **RL8 - In a broader ecological context, understand the mechanisms underlying multi-generational responses to long-term ecologically relevant exposures (maternal effects, hereditary effects, adaptive responses, genomic instability, and epigenetic processes)**
 - To what extent does multigenerational exposure make the consequences worse (or better)?
- **RL9 - Understand how radiation effects combine at higher levels of biological organisation (population dynamics, trophic interactions, indirect effects at the community level, and consequences for ecosystem functioning)**
 - How does ionising radiation affect the ecological integrity (structure, composition and function)?

CH 3 - To Improve Human and Environmental Protection by Integrating Radioecology

- **RL10 - Integrate uncertainty and variability from transfer modelling, exposure assessment and effects characterisation into risk characterisation**
 - Integrate over the period of interest for the risk assessment (from weeks to thousand years) the temporal variability of transfer, exposure and effects (from age-dependent differences to multigenerational responses)
- **RL11 - Integrate human and environmental protection frameworks**
 - Determine where harmonisation of approaches for man and environment is justifiable and beneficial
- **RL12 - Integrate the risk assessment frameworks for ionising radiation and chemicals**
 - Reinforce the consistency between risk assessment frameworks for chemical and for radiation and develop a risk assessment framework applicable for a mixture of stressors
- **RL13 - Provide a multi-criteria perspective in support of optimised decision-making**
 - Introduce MCDA to combine quantitative and qualitative factors and to guide the decision process
- **RL14 - Integrate ecosystem services, ecological economics and ecosystem approaches within radioecology**
 - To integrate the concept of sustainability, environmental indicators and sustainable use of resource into the definition of specific protection
- **RL15 - Integrate Decision Support Systems**
 - To develop DSS for integrated assessments of both man and environment

The SRA for radioecology needs to be...

- **A living document** (through the actions of COMET and the ALLIANCE) with regular update and regular stakeholders consultation to ensure research is fit-for-purpose and in adequation with the context for radiological protection in Europe and worldwide: the SRA «vitality» and «visibility» can be considered as markers of integration
- **A reference document** to inspire the development of the associated roadmaps which are objective-driven: Underpinning science for an enhanced basis for fit-for-purpose human and environmental impact assessment by mechanistic modelling, improved parametrization, improved databases
- **A must** to have in mind for being able to exchange with others (e.g., EJP CONCERT – update of SRA & roadmaps; focus on interactions)

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authorities, ministries,etc

For their valuable inputs into the present SRA.....

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