

### Strategic Research Agenda a tool for structuring research efforts and sharing priorities

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### **European Radioecology ALLIANCE**

### Strategic Research Agenda a tool for structuring research efforts and sharing priorities

Rodolphe GILBIN *EPRI-NEA joint workshop on low-dose research co-ordination Paris, 26 June 2024* 









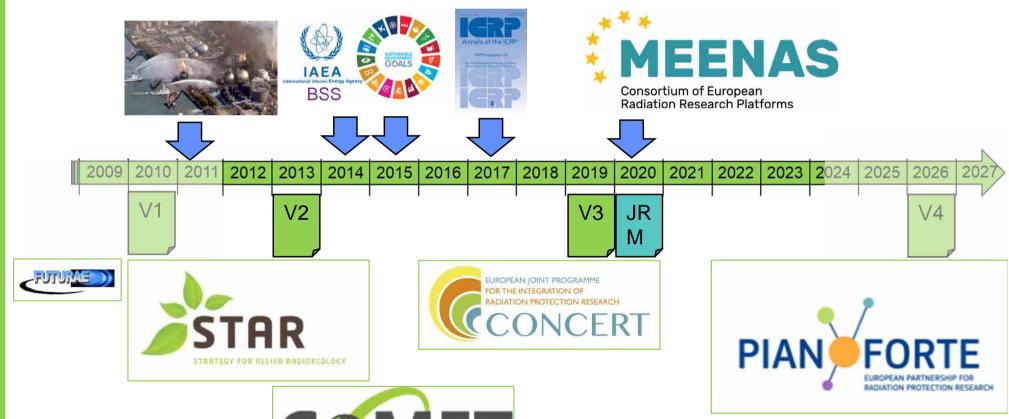
8 founding members (2009) Official status (2012) 32 members, 18 countries

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# **Strategic Research Agenda**A continuing story since 2009

An essential tool for defining priorities in scientific programming and maintaining the visibility of radioecology







### Strategic Research Agenda Strategy for its development

### **Objectives**

- 1. Maintain and develop the workforce (education and training)
- 2. Maintain and develop associated infrastructure
- 3. Defining a long-term vision (for the next 20 years) of the **research needs in radioecology** in Europe (3 Research Challenges)

### **Inputs**

- State of research in radioecology and, where relevant, related sciences
- Stakeholder's vision on research needs and data gaps

### **Expected Impact**

Confidence in and Credibility of the radiation protection of the public (environmental exposures) and the environment (e.g. robustness of 'no-effect' benchmark dose rates)



# 1/ Education and training to maintain and develop a skilled workforce

PIAN FORTE

- Increasing student and teacher/researcher mobility
- Funding early career researchers in funded projects

- ALLIANCE
  Small Calls

  Mobility
  programme
  (ECR/ECP)
- Joint EU MSc (Erasmus, European Universities) and links with other E&T programs in nuclear and environmental sciences
- Members initiatives
  MSc in Radioecology (NMBU)
  SCK•CEN Academy
  Stockholm University courses

- Providing courses and workshops for students, professionals and academics
- Offering refresher courses and seminars at conferences
- Organising summer schools, field training...

ALLIANCE
Refresher courses
(ICRER, ERPW)

**ALLIANCE** webinars

ALLIANCE Observatories



# 2/ Infrastructures and capabilities to maintain and develop the infrastructures

- Identify the requirements and create the partnerships of excellence that bring together the required infrastructures
- Maintain a web-based catalogue of infrastructures and capabilities
- Promote the visibility and joint use of existing infrastructures, encourage wider collaboration
- Further development of the <u>Radioecological</u> <u>Observatory sites</u> (Chernobyl Exclusion Zone, Fukushima Exclusion Zone, NORM-impacted sites in Belgium, Poland and France)

#### **CONCERT webHandbook D6.4**



#### **Exposure Platforms**

- FIGARO (Norway)
- PULEX-COSMIC (Italy)
- SCRS-GIG (Poland)
- Microtrol Lab (Czech Rep.)
- MICADO-Lab (France)
- SNAKE (Germany)
- Radon expo (Germany)
- BIO (Hungary)
- CIRIL/GANIL (France)
- SCK.CEN (Belgium)

#### **Observatory Sites**

- Chernobyl Obs. Site (Ukraine)
- Fukushima Obs. Site (Japan)
- NORM Obs. Site (Belgium)



# 3/ Research Challenges in the SRA main drivers

### Joint Roadmap @concert

 Identify research needs and develop tools that will further optimize the existing radiation protection system and advance radiation protection, considering the societal needs and concerns, and to plan such research

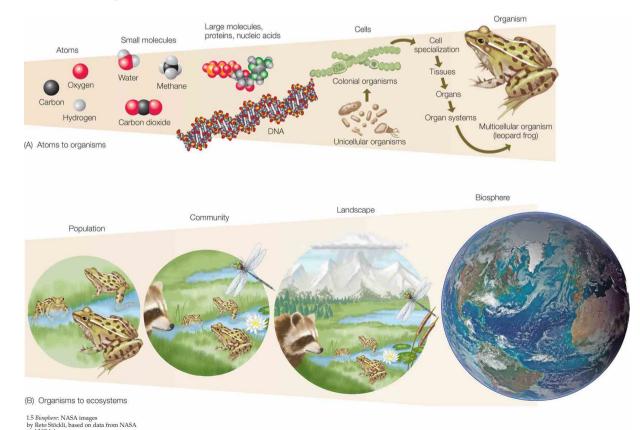
Need for improvement of mechanistic understanding across radioecological research

- Provision of scientific evidence and fit-for-purpose impact/risk assessments for human and wildlife (mechanistic modeling, improved parameterisation, improved databases)
- Support the evolution in policy making and guidance
- Qddressing of shortcomings linked to new technological developments and releases of radioactivity in the environment (e.g., SMRs, decommissioning, waste disposal, legacy sites, medical uses...)



## Low-dose research related priorities SRA (Challenge 2), Topical Roadmap, JRM (Challenge C)

- Radiation induced effects at multiple levels, from molecules to individuals
- Intra- and inter-species differences in radiosensitivity
- Multi-generational responses (e.g., hereditary effects, adaptive responses) and long-term biological effects of low radiation doses
- Interactions with other co-stressors
- Effects at higher levels
   of organization
   (population dynamics,
   trophic interactions,
   indirect effects at the
   community level,
   ecosystem functioning)





# Roadmap for radiation-related effects on non-human biota and ecosystems

#### Challenge C – Understanding radiation-related effects on non-human biota and ecosystems



The need for an explicit demonstration of the protection of the environment from radioactive releases is now recognized. However, the available knowledge is related to the risk to individual organisms, whereas populations, ecological function and Drivers /Exposure situations biodiversity are more relevant from a management perspective. There is still scientific disagreement on the actual extent of the radiation effects on wildlife populations in contaminated areas. Game changers Characterize the influence of exposures on populations in contaminated environments Re-interpretation of data · Multi-trans-generational

C1: Resolving the controversy with regard to the effects on wildlife reported in the Chernobyl and Fukushima exclusion zones

- on long-term ecological effects of radiation
- Field studies, transplant experiments
- effects experiments
- Comparison between field and lab studies
- · Understand hereditary & adaptation effects

#### Identify the key factors determining the variation in populations' sensitivity to radiation

- Variation due to genetic & metabolic factors
- Influence of species life-cycle specificities
- Population-effect benchmark derivation
- Variation due to environment & behavior
- Species Sensitivity Distribution update



#### Identify and validate biomarkers of exposure and effects that are relevant at the population's level

- Primary mode of action of IR Identify biomarkers
- Adverse Outcome Pathway and Systems Biology approach
  - · Biomarkers testing
- Biomarkers toolbox available for application

#### C2: Determine the effects of radiation on ecosystem functioning

- Effects at community level (micro- meso-cosmos) & exposure characterization under realistic conditions
- Ecological models for risk assessment
- Ecosystems dynamics modelling
- Impact on ecosystem services

Required science and technology

Science: field effect data, laboratory models to identify radiation effects at the population/community level, high-quality exposure assessment and dosimetry, application of omics and AOP for the identification and validation of biomarkers Technology: Well curated and shared datasets and sample collections from Chernobyl and Fukushima exclusion zones, Low dose/dose-rate exposure facilities, Advanced statistical methods

2020 2025 2030 2035 2040 4 ALLIANCE

### **Conclusion**

#### Success

- SRAs and joint roadmap evidence of increased integration
- Projects follow from collaboration
- PhDs mobility
- Strong pillar of MEENAS
- Growing membership











### Societal responsability

- Response to stakeholders concerns regarding presence of RNs in environment
- Responsible RD&I for improved radiation protection of human health and wildlife populations

### Coordination of research, infrastructures availability and E&T

- Build common goals and share resources among radioecology and with European radiation protection community (Joint Roadmap, PIANOFORTE)
- Promote hypothesis-driven research for the acquisition of new scientific knowledge, and model and tools optimization

### **Way forward**

### ICRP RP System adaptation for the Next Generation (in progress)

- IR effects on the Structure and Function of ecosystems
- Resilience and adaptation capacities of non-human biota and shifts between levels of organization (organisms and life stages, populations)
- IR effects with Other stressors (chemicals, climatic change...)

### New contexts & societal perspectives

- War situations (Ukraine) or natural disasters
- Novel nuclear technologies (SMRs, AMRs, fusion) and specific sitings (marine, urban, arctic, tropical...)
- Specific radionuclides of interest (e.g. medical applications)
- Waste and Spent Fuel Management and Decommissioning

### Incorporation of Advanced Technologies

- Artificial Intelligence, Data science, Computational modelling (e.g. Inverse environmental modelling)
- AOP approach to provide further insight in the effects of low doses(rates)
- High-throughput screening methods in Ecology (environmental DNA), remote sensing metrology...

### **Next steps**

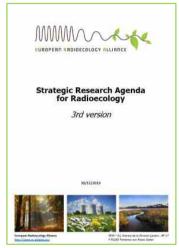
- Continued integration of environmental protection (environmental health, exposome)
- Links with larger considerations: UN Sustainable Development Goals (SDGs), preservation of biodiversity and ecosystem services
- Balanced approach against radiological impacts (social, environmental, economic)
- → Update of the Joint Roadmap ( PIAN FORTE WP2.2)
- Engagement with stakeholders and the public
- Taking into account scientific progress and evolution of societal needs



# Thank you for your attention!

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### More information:





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