# Intention for launching Radioecology research working group *(December I 2014)*

**Title and acronym:** **Marine Radioecology**

**Leadership**

Céline Duffa (IRSN, France)

**Topical area** (ca. 10-line description)

The Fukushima accident in 2011 has refocused the vision for marine radioecology by highlighting the importance of post-accidental marine issues and the limited knowledge that we have in that area. It constituted the most important accidental release of artificial radionuclides to the marine environment that has ever occurred. Contamination of every marine component (water, sediment and biota) has been observed. The understanding of contamination levels and radionuclide distributions in the environment, along with prediction of their future evolution requires analyses of detailed monitoring data and the use of modelling tools. In the aftermath of an accidental situation where radioisotopes in the different marine compartments have not equilibrated, time-dependent radioecological models of transfer are required. Such situations offer the opportunity to validate and improve models that are, or have the potential to be, included in decision support systems (DSS) for emergency situations. This post-accidental situation also shows the necessity to develop research on more realistic (and sophisticated) models taking into account trophic transfer process related to pelagic or benthic organisms. To set up such tools implies to improve our knowledge on marine trophic chain description and functioning.

**Broad Objectives** (up to 5 lines)

- To develop research and studies based on experimental or *in-situ* measurements to improve knowledge on transfer processes for benthic and pelagic organisms
- To improve knowledge on radioecological marine transfers in non-equilibrium situation.
- To consolidate or develop prediction tools usable to characterize and model transport, transfers, ultimate fate and radiation exposure for man and marine wildlife of accidental releases of radioactivity to the marine environment.
- To provide dynamic models incorporating spatial and temporal processes, for the early- to midterm period after release, before more stable conditions tending to equilibrium are reached (COMET D2.1).

Within COMET WP3, the marine group proposes to focus the IRA on radioecological transfer modelling to biota and sediments and plans to use existing models as a basis for the work with a view to improving some of them to achieve more sophisticated models, e.g. trophic transfer modelling, and by combining transfer modelling with sediment modelling.

The FRAME project will investigate the sources, fate, transport, bioaccumulation and associated impact of radionuclides from the Fukushima Dai-ichi NPP accident in the water column, seafloor and marine biota. The concentrations of a suite of contaminant radionuclides ($^{137}$Cs, $^{134}$Cs, $^{90}$Sr, plutonium isotopes, $^{236}$U and $^{129}$I) will be determined and the transfer to marine biota (including fish, macroalgae and plankton) will be assessed. This will be accompanied by measurements of other natural radionuclides

(i.e. $^{234}$Th, $^{210}$Pb, Ra isotopes) in order to quantify groundwater fluxes, residence times in the ocean and accumulation and mixing rates in bottom sediments.

FRAME project and other different National projects working on Fukushima shall allow addressing questions such as: *i*) What is the fate of the contamination in the ocean, what fraction of the total releases is stored in marine sediments and what is the spatial extent of the contamination in the seafloor; *ii*) How much radioactivity is still leaking from the Fukushima Dai-ichi site and what are the mechanisms that govern the releases to the ocean, such as the role of submarine groundwater discharge; *iii*) To what extent have the concentrations of contaminants in the ocean changed since 2011; and iv) What are the current impacts on marine biota.

**Justification based on answers to the criteria for prioritization of research, question(s) to be addressed** (up to 20 lines)

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

- Understand the long-term behavior and fate of radionuclides released from Fukushima, e.g. sustained concentrations due to ongoing discharges and land runoff.
- Compare and test robust 'first-generation' dynamic models, and develop a 'second generation' of models incorporating foodweb processes.
- Look at stochastic modelling for biokinetic processes to provide more complete information about bioaccumulation processes in different trophic levels. This approach can be used for evaluation of reliability of submodel predictions and for testing of Monte-Carlo approach simulations.
- Begin to fill the many data and knowledge gaps, especially concerning benthic organisms and their interplay with sediment compartments.
- Explore potential relationships between biological half-lives in laboratory experiments and ecological half-lives observed in the field
- Couple biological transfer models with ocean transport and dispersion models (e.g. PREPARE project, STERNE model).

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

The work to be done in this WG is highly relevant to the SRA Challenge 1 (*To predict human and wildlife exposure in a robust way by quantifying key processes that influence radionuclide transfers and exposure*). In particular, it is relevant to RL1 (*Identify and mathematically represent key processes that make significant contributions to the environmental transfers of radionuclides and resultant exposures of humans and wildlife*), 3 (*Develop transfer and exposure models that incorporate physical, chemical and biological interactions, and enable predictions to be made spatially and temporally*) and 4 (*Represent radionuclide transfer and exposure at a landscape or global environmental level with an indication of the associated uncertainty*).
It also relates to Challenge 3 (*To improve human and environmental protection by integrating radioecology'*) and in particular to its RL1 (*Integrate uncertainty and variability from transfer modelling, exposure assessment, and effects characterisation into risk characterisation)*.
The research is also of relevance to NERIS, particularly within their Key Topics 2 (Aquatic dispersion modelling) and 3 (Improvement of Existing Decision Support Systems). NERIS is interested in contamination of (marine) foodstuffs, consequences of contamination for fisheries, economic impacts, likely duration of a contamination problems, and whether any countermeasures are feasible.