

ECORITME “*ECOTOXICOLOGY OF IONISING RADIATION & TRACE METALS*” IRSN/Cadarache

Scope: The **ECORITME** platform constitutes the French contribution to an emergent European platform named “ERA: European Radioecology Alliance” launched in June 2011 by 8 European organisations. **ECORITME** is specialized in the field of “**ECOTOXICOLOGY OF METALS AND IONISING RADIATION**”. It comprises several research lines and combined to analytical, modeling developments also with advanced statistics. **ECORITME** offers all potentially needed skills for performing and improving predictive ecological risk assessments for chronic exposure to low doses of ionising radiation and/or metals, in isolation or in mixtures. It is part of a French south-east emerging node (Languedoc-Roussillon & Provence Alpes Côte d’Azur region) where complementarities are yet existing for used biological models and for studying complex toxicants exposure (from the external media to the molecular targets including dynamic transformations, biokinetics, and interactions in mixtures) through the development of advanced and innovative *in vitro* models and analytical methods (e.g., nanovectors).

Platform specificities: **ECORITME** offers supports as follows:

- (i) modeling skills and tools: speciation-bioavailability relationships, dose-effects relationships, mixture exposure and effects models, PBPK models, individual to population extrapolation, ecological risk;
- (ii) an integrated technical plateau (analytical equipments, organisms husbandry, exposure laboratories). This plateau allows to perform experiments under controlled conditions for various biological models while using (or not) radioactive tracers and/or ionising radiation, and/or any chemical elements such as metals.
- (iii) a unique tool with the **MICADOLab** equipment (chronic external gamma irradiator). The latter allows investigating external gamma dose(rate) / effects relationships covering 6 orders of magnitude of dose rates in a large-scale experimental hall (50x7 m²). An innovative field of application of such equipment is to perfectly control the delivered energy. One application is to manipulate the red-ox status of any biological object.

Brief description of the exposure laboratories: **ECORITME** allows the controlled exposure of experimental units from micro- to large-scales, to external gamma irradiation and/or internal contamination with alpha- or beta-radionuclides alone or in combination with metals or organic compounds. It offers the possibility to use various biological models such as unicellular algae, plants, invertebrates, fish. Two biological models are preferred for the mechanistic research lines and are widely used in the field of human toxicology (the nematode *C.elegans* and the fish *D. rerio*). A phytotron and growth-chambers complements the platform for the research on plants and experiments with contaminated soils. **ECORITME** includes 1200m² of laboratories (+ 1600 m² of associated technical zones and radioactive waste/effluent treatment). The laboratories are allowed to host experiments using a wide spectrum of radionuclides (82 radioisotopes among which H³, C¹⁴, P³², Cs¹³⁷, Cd¹⁰⁹, Ag^{110m}, Am²⁴¹, Cr⁵¹, Fe⁵⁵, Hg²⁰³, isotopes of Pu, Am, U, Np) in compliance with the actual regulation.

ECORITME analytical equipments: **ECORITME** is equipped to develop and perform analytical (bio)chemical characterization in various sample types with multi-element metrology, radioactive metrology, biochemical/genotoxicity characterization, histology/imager. As far as possible analyses are miniaturized *via* the use of microplates devices. The main equipments are listed below:

- **quantification of trace and major elements (including metals):** ICP-AES (Autosampler Optima 4300DV), Atomic absorption oven and FIAS (cold vapor and hydride generation system) ; ICPMS Agilent 7500 Cx + hydrogen generation system ; Ionic chromatography (Dionex CI 3000) ; HPLC ; Total Organic carbon (TOC) 5000 ; Fluorimeter Molecular device Gemini XS and spectrophotometer spectramx 384 plus ; Capillary Electrophoresis



- **quantification of radionuclides and speciation in environmental and biological matrices:** 7 gamma spectrometry counters, 2 Quantulus low background liquid scintillation devices, a Flo-One system for on-line liquid scintillation detection, radiochemistry and sample preparation, HPLC coupled to ICP-MS, Time-Resolved fluorescence.
- **Cell biology:** 2 Z2 Coulter-Counters for cell counting; VI-CELL XR viability analyzing system; Flow-cytometer for biomarkers of immunotoxicity, oxidative stress characterization.
- Biomarkers currently analysed: immunotoxicity (phagocytosis, apoptosis, lysosomes, ROS production), genotoxicity (comet assay, micronucleus assay, γ H2AX, DNApk), oxidative stress (GR, GPx, SOD, CAT, GSSG/GSH...), neurotoxicity (AChE), histopathology (optic and electronic microscopy).
- **Histology/Imagery of biological samples:** Epifluorescence Microscope (NIKON Eclipse 600 & 400), Transmission Electronic Microscope (Tecnai 12 G2 Bio-Twin) with EDAX probe for elementary analysis, ultramicrotome (UCT + EM-trim), cryomicrotome.

