

## **RADIATION PROTECTION RESEARCH ACTIVITIES IN CIEMAT (SPAIN)**

### **R&T activities:**

#### **1. Radiation protection of the public and the environment in planned, existing and emergency exposure situations:**

- Radiological impact of artificial and natural radiation sources, including NORM (Naturally Occurring Radioactive Materials) industries.
- Development, implementation and validation of tools and models for dose estimation in humans and biota, under planned and existing exposure situations.
- Development of new conceptual and mathematical models to study the behaviour of radionuclides, studying processes and parameters for modelling transport of pollutants by environmental components (terrestrial and aquatic).
- Use of predictive models to evaluate the radiological and non-radiological consequences of a nuclear or radiological accident and any remediation or restoration response.
- Implantation, demonstration and training of decision-making assistance systems in outside emergencies, basically for management of the last stages and environmental restoration.

#### **2. Radiation dosimetry.**

- Mathematical methods and models applied to radiation dosimetry. Use of Monte Carlo methods to simulate transport of photons, electrons and neutrons. Development of mathematical models to represent complex geometries that enable dose calculations in human organs.
- Internal dosimetry. Includes the Internal Personnel Dosimetry Service. Development of new dose measurement and calculation capacities which improve the existing infrastructure to cover the needs of the CIEMAT itself and also to assist with internal dosimetry nationwide.
- External dosimetry. Includes the External Personnel Dosimetry Service, the Environmental Dosimetry Service. Developments in neutronic dosimetry: dose measurements in mixed neutron-gamma fields applied to personal and area dosimetry.
- Retrospective dosimetry. Thermoluminescence and Optically Stimulated Luminescent (OSL) techniques are applied to estimate the dose in nuclear/radiological emergencies, to detect irradiated food, for dating, for spatial dosimetry, among other applications.

#### **3. Environmental radioactivity and radiation surveillance**

- Determination and control of environmental radioactivity levels in Spain
- Development of new methodologies and measurement systems to increase their sensitivity and adjust to the goals of surveillance networks.

### **Infrastructures:**

- Facility to perform internal and external dosimetry in humans
- Facility to measure radioactivity on different environment compartments
- Facility for chemical characterizations
- Facility for supercomputation
- Tools and models: CROM, ERICA, JRODOS, CROM

## Information - research interests and infrastructures

University of Gothenburg (UGOT) – Department of radiation physics

CONCERT information day 2017-01-27

- Infrastructures – equipment and measurements
  - External dosimetry, including personal dosimetry
  - Internal dosimetry: 2 whole body counters (NaI scanning bed, plastic scintillators), thyroid uptake meter
  - Stationary and mobile gamma spectrometry (HPGe): man-made radionuclides and NORM
  - *In situ* gamma spectrometry
  - Sample changers (NaI)
  - Liquid scintillator
  - Dose rate meters and handheld spectrometers
  - Sampling equipment and facility for sample preparation of various environmental samples
  - Alpha spectrometry with liquid/sediment/soil/organic matrices (inorganic refractory matrices (from industries) can be treated via alkali fusion technique to total dissolution): U isotopes (238, 235, 234), Th isotopes (232, 230, 228) Pu isotopes (238, 239+240), <sup>241</sup>Am and <sup>210</sup>Po.
  - Animal models (mouse, rat) in specialized facilities
  - Access to various cell lines and experimental equipment for cell proliferation studies and studies of gene expressions
  - Various software for environmental modelling and internal dosimetry
- Competences, research experience and networks
  - Emergency preparedness planning
  - Cell proliferation and gene expression
  - Animal model studies
  - Alpha, beta and gamma spectrometry
  - Radioecology
  - External and internal dosimetry
  - 3 professors, 10 senior researchers, 2 post doc, about 25 PhD students, laboratory personnel
  - Collaboration with about 30 MD:s
- Research interests
  - Radiometrical characterization, by alpha and gamma spectrometry, of materials as a previous step to its radiological risk assessment. The framework would be Environment and NORM industries.
  - Reducing uncertainties in assessment of internal dose from accidental intake of radionuclides
  - Measurements of radionuclides in soil at reference sites to establish time series and to study models for long-term migration in soil.

## CONCERT Partnering Event, 27 January 2016

### Research partner:

**Federal Office for Radiation Protection (BfS)**

**Department Radiation Protection and the Environment**

### Topic for the partnering event:

Topic 2: Reducing uncertainties in human and ecosystem radiological risk assessment and management in nuclear emergencies and existing exposure situations, including NORM.

### Research interests:

A key issue in the radioecological research at BfS is to reduce the predictive uncertainty of radioecological models by identifying and explicitly modelling key processes. Here, the focus is on replacing highly uncertain empirical parameters by robust radioecological sub-models. BfS is primarily interested in predicting the contamination levels of environmental media and foodstuff and the resulting dose to humans. In view of the implementation of the Euratom Basic Safety Standards, BfS aims at decreasing the degree of conservatism in generic assessment models, thus avoiding unjustified restrictions in licensing procedures, especially of NORM industries. BfS builds upon an extensive expertise in characterization, risk assessment and clean-up strategies of NORM legacy sites that resulted from uranium mining in Eastern Germany.

### Infrastructure (selection):

- High-resolution gamma spectrometers
- Alpha spectrometers
- Liquid scintillation spectrometers
- Proportional counter systems
- In-situ measurement systems (transportable, vehicle-based and helicopter-based high-resolution gamma spectrometers)
- In-vivo measurement systems (whole body and partial body counters)
- Atomic absorption spectrometer
- Ion chromatography system
- Equipment for sample preparation and digestion (cabinet dryer, microwave digestion system, muffle furnace etc.)
- Laboratory for the calibration of measurement devices for Rn-222 and short-lived progenies in air
- Facility for gamma dose rate probe inter-calibration
- Sample archives

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**Research interests and infrastructure from the NRPA and potential contribution to CONCERT topic 2. Reducing uncertainties in human and ecosystem radiological risk assessment & management in nuclear emergencies and existing exposure situations, including NORM.**

The Norwegian Radiation Protection Authority (NRPA) is the competent national authority in the area of radiation protection and nuclear safety in Norway, for humans and the environment. For the Concert call we are interested in research in the fields of:

- emergency preparedness, crisis management and recovery situations.
- radioecology
- radiation protection in general

Our research interests comprise:

- tools for crisis management including prognostic models for various ecosystems;
- analyses of hazard, risk and vulnerability;
- strategies for mobile measurements and data transfer and communication;
- technical, social, economic and ethical considerations for mitigating actions;
- societal consequences of nuclear accidents; stakeholder dialogue and participation methods
- radioecology model developments including parameter updating
- ecosystem transfer of radionuclides (incl. NORM) – aquatic and terrestrial environments

Available infrastructure include:

- decision support system ARGOS, crisis communication tools,
- other tools/models (e.g. ERICA)
- systems for mobile measurements (WBC, in-situ gamma measurements, detectors on cars, helicopters, planes and drones).
- Radiochemistry laboratories alpha/beta
- Facility for whole body counting
- Isotopic laboratory, type C
- Radon track-edge laboratory
- Radon calibration room
- Low-background whole body counting laboratory
- Large amount of data concerning the Chernobyl accident

Contact:

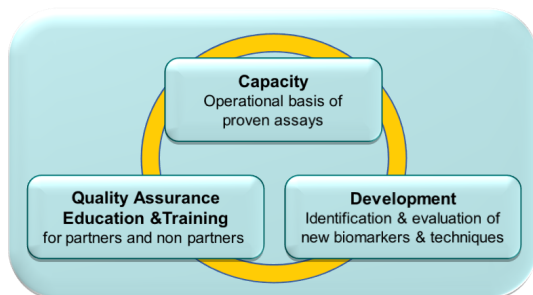
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# Analytical platforms

## RENEB

### A network for emergency preparedness and scientific research

**R**ENEB is a European Biodosimetry Network, able to perform large scale rapid biodosimetric dose estimation. Specialized to handle a large number of samples, RENEB contributes to radiological emergency preparedness and large scale research projects. The network infrastructure is based on reliable assays and techniques combined with high performance standards. To enhance the effectiveness of the network, RENEB is linked to global emergency preparedness and response systems as well as to the European radiation research area.



The network was initiated in January 2012 with 23 partners from 16 European countries with the support of the EC (EURATOM FP7, GA 295513). At this time the focus was on emergency preparedness with the aim to significantly increase dose reconstruction capacities in case of large-scale radiological scenarios. Individual dose estimation based on biological samples and/or inert personalized devices has been optimized to support the rapid categorization of many victims according to the received dose. Communication and cross-border collaboration was standardized and cooperation with national and international emergency and preparedness organizations such as IAEA and WHO were initiated.

The value of RENEB to support topics also outside emergency preparedness is now evident. With established strategies to guarantee consistent performance between the partner laboratories, the network has the ability and capacity to contribute to large scale research projects with the analysis of exposure biomarkers. This includes studies on the effects of low doses, group related radiation sensitivity, contribution to non-cancer diseases, and epidemiological studies where sampling and handling of bioprobes is included. RENEB also drives the development and evaluation of new exposure markers with special view to their applicability for addressing acute or protracted exposures as well as exposures dating back years or decades.

As such, RENEB as an analysis platform is of special interest for the Emergency Preparedness Platform NERIS by adding preparedness in the field of individual dose estimation. Moreover it benefits MELODI and EURADOS by providing capacity for radiation research and specialized biomarker development. Concerning the latter, the radioecological Platform ALLIANCE will also profit from RENEB. Last but not least, RENEB provides intercomparisons, specialized courses and seminars open also to laboratories outside the network, thus being of relevance for E&T in the CONCERT-EJP.



Ulrike Kulka

RENEB was never meant to be a “time limited or closed club” and strategies were developed to identify “candidates” and integrate them as solid partners. Currently, RENEB comprises 22 partners and 7 candidates from 17 European countries. 16 have already signed a MoU, and thus form the nucleus of a unique growing infrastructure, combining high quality standards in the application and validation of biomarkers and maintenance and advancement of scientific and technical competence.

**RENEB Consortium:** BfS\* Germany, BIR Germany, CEA France, ENEA Italy, HMGU Germany, ICHTJ Poland, INSP\* Romania, IRSN France, ISS Italy, IST\* Portugal, LAFE\* Spain, NCRRP\* Bulgaria, NCSR Greece, OKK-OSSKI Hungary, NRPA\* Norway, PHE\* United Kingdom, SERMAS\* Spain, STUK Finland, SU-CRPR\* Sweden, UAB\* Spain, UGent\* Belgium, UNITUS\* Italy

**RENEB candidate:** AMVRC\* Italy, DIT\* Ireland, FZ Jülich Germany, INFN Italy, RPC\* Lithuania, SCK•CEN\* Belgium, US Spain

\*MoU signed



#### ID Card:

**Analytical platform type:**  
biodosimetry, markers of exposure, retrospective dosimetry on biological and inert samples

**Main techniques proposed:**  
panel of cytogenetic assays, gene expression assay, gamma H2AX assay, EPR/OSL dosimetry

**Capacity:**  
emergency situation: up to 1000 samples per week, depending on assay;  
research: up to 500 samples per week for several weeks, depending on assay;

**Delay to start:**  
Emergency situation: immediately, no delay;  
Research: dependent on the project

**Intercomparison exercise options:**  
possible for all network assays and techniques

**Training options:**  
possible for all network assays and techniques

**Access:**  
Emergency situation: regulated by national authorities;  
Research: selection by members

**Internet link:**  
<http://reneb.eu>

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**Related to:**  
Emergency preparedness: NERIS, Research: EURADOS, MELODI, ALLIANCE, medical associations

## Environmental Protection Agency, Office of Radiological Protection, Ireland

The Environmental Protection Agency's Office of Radiological Protection <http://www.epa.ie/radiation> is responsible for ensuring that people and the environment in Ireland are protected from the harmful effects of ionising radiation. The Office of Radiological Protection is a successor to the Radiological Protection Institute of Ireland which merged with the Environmental Protection Agency in 2014.

The Office of Radiological Protection fulfils its remit by providing strong and effective regulation of all those who use radiation sources and by working in partnership with other organisations and regulatory authorities. The ORP monitors radiation levels in Ireland. In addition, it provides advice to the public and the Government on radiation sources, on their management and on the corresponding risks. The ORP has a central role in ensuring Ireland's emergency preparedness in the event of a nuclear accident abroad and is responsible for monitoring developments in relation to nuclear installations abroad.

The Office of Radiological Protection is committed to scientific excellence, and its advice is based on internationally agreed standards and on peer-reviewed research.

### Research Interests

The main areas of research in which Office of Radiological Protection has been active include: radioecology, radon, food/agricultural countermeasures and environmental assessment. To date the successful research programme undertaken by Office of Radiological Protection has included a mix



of research undertaken directly by staff, research undertaken through collaboration with other agencies and fully funded outsourced research.

The Office of Radiological Protection has over many years been involved in marine radioecology research. Much of this research has been linked to the marine monitoring programme, which is undertaken to assess the radiological impact of radionuclides present in the Irish marine environment primarily as a result of discharges from the UK's Sellafield nuclear

reprocessing plant.

In the years following the Chernobyl accident the Office of Radiological Protection was involved in a wide range research projects concerned both with the impact of the Chernobyl accident and more generally with the environmental behaviour of radionuclides released into the environment as a result of any major nuclear accident. Much of this research was focused on the development of agricultural and food chain countermeasures and many of these projects were undertaken within the framework of both national and international collaborations.

More recently the Office of Radiological Protection undertook an assessment of the potential implications for Ireland of the proposed new nuclear build in the UK. This assessment included extensive modelling of the consequences of radioactive releases to the air and sea, from ongoing operations and a range of postulated nuclear accidents.

In recent years research activities were linked to strategy and in the main focussed on filling knowledge gaps that were identified as critical to delivery on core radiation protection functions e.g,



study of potential radiological implications for Ireland of proposed nuclear power plants in the UK, assessment of natural radioactivity in ground water, bottled water and in food, an assessment of radiation doses to the Irish population from all sources, studies of public response to radon campaigns, review of effectiveness of radon remediation, the effect of building regulations on the national average indoor radon levels

### **Laboratory Facilities**



The radio-analytical laboratory consists of a radiochemistry laboratory, a radiometric laboratory (counting facility) and a sample preparation laboratory. The Office of Radiological Protection has capacity to carry out modelling of radioactive releases to air and sea. The laboratory equipment includes gamma and alpha spectroscopy, liquid scintillation and gas proportional counting.

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UNIVERSITY OF TARTU

**Proposal to form consortium** in response to CONCERT 1st call for proposals, **4.1.2 Reducing uncertainties in human and ecosystem radiological risk assessment & management in nuclear emergencies and existing exposure situations, including NORM.**

**TOPIC: Addressing issues related to uncertainties and “data caps” in human and ecosystem radiological risk assessments and modelling**

**CONTACT: Dr. Alan Tkaczyk, [alan@ut.ee](mailto:alan@ut.ee), mobile +372 537 26 111**

Mathematical models that are used to estimate the transfer of radionuclides through various parts of the environment need to account the uncertainties related to input parameters. In order to use these models for impact assessments of releases of radionuclides from nuclear or NORM industry, the quality of the input data has to be assured to actually represent radionuclide transfer through different parts of the environment. Site specific and measured data has clear advantages over information obtained from general databases. Although collected data from the ambient environment is more time consuming and costly, it provides more precise parameters to conduct such risk assessments.

**To improve the representativeness of the data collected from available databases, conducting “case-study” format modelling and risk assessments from the radiological point of view will provide additional data to the regional database.** Initial steps include:

- Mapping current exposure situations and determining “data caps” for assessments;
- Conducting site specific measurements to improve input data;
- Improve the uncertainties accompanied with modelling and risk assessments.

This “case-study” format will be directed to the possible exposure situations of humans and biota to radiation originating from industrial activities in a defined region, such as:

- Nuclear installations;
- Fossil fuel power plants as sources of naturally occurring radionuclides to the environment;
- Waste repositories.

Currently NORM issues are often overlooked when making estimations of exposure situations to ionizing radiation. One of the aims will be determining the scale of the industrial installations in the defined region that count as sources of additional doses to the surroundings. This creates additional need to collect input data for the used models for providing more accurate predictions of radionuclide transport mechanisms. The suitability of available models can be tested and necessary improvements can be determined. NORM related topics will be an integral part of all European Member States in order to implement the requirements from the new BSS.

Expected outputs:

- More site specific input data will be collected to improve the representativeness of the models;
- Addressing current gaps in unknown data regarding radionuclide transport factors; distribution coefficients;
- Integration of NORM industries and defining necessary parameters needed to improve risk assessment quality and describing exposure situations;
- Providing quality input data for future risk assessments in order to improve decision making processes;
- Additions to the current reference databases.



## LABORATORY OF RADIOCHEMISTRY, UNIVERSITY OF HELSINKI, FINLAND

Laboratory of Radiochemistry, University of Helsinki, is the only general radiochemistry unit within Finnish universities and with the number of 40 researchers and doctoral students one of the largest academic radiochemistry units internationally. Laboratory educates both MSc's (8 graduated in 2015) and PhD's (17 doctoral students, 2 graduated in 2015). The laboratory has four major research fields:

- behavior (sorption and diffusion) of radionuclides originated from spent nuclear fuel in geosphere (bedrock and overburden)
- selective separation of radionuclides from nuclear waste effluents
- radiopharmaceutical chemistry
- environmental radioactivity / radioecology

of which the latter is most relevant with respect to the scope of the CONCERT call. The research carried in the framework of the first topic has, however, a direct link to environmental radioactivity studies since many of the radionuclides are in both cases the same and their basic transfer processes are mostly identical.

Environmental radioactivity is the oldest research field of the laboratory; it started in the beginning of 1960's with studies on the behavior of nuclear weapons test fallout radionuclides (Cs, Sr, Pu, Am etc) in the environment and food chains. After the Chernobyl accident the Laboratory has focused on the TRU's (Pu, Np, Am and Cm) in the Finnish environment. During the last twenty years more effort has been put to natural radionuclides (U, Ra, Po, Pb) eg. in drinking water, in forest soil and edible forest and plants and in mining waste. In the last five years the largest project related to NORM has been a study on the behavior of uranium series radionuclides at three mining sites in Finland. Please see the doctoral thesis at <https://helda.helsinki.fi/handle/10138/157882>.

In the context of final disposal of spent nuclear fuel, behavior of long-lived radionuclides (Cs, Se, I, Mo, Ag, Nb, Ni etc.) in the overburden (surface soil, mire lands and sediment) have been extensively studied. See for example a thesis on Cs, Se and I behavior in peat lands at <https://helda.helsinki.fi/handle/10138/156513>.

Laboratory has good laboratory spaces for the treatment of all relevant environmental and tracer radionuclides at low to intermediate levels. Laboratory has a good number of necessary equipment to measure alpha, beta and gamma radiation.

Contact person: Professor Jukka Lehto, [jukka.lehto@helsinki.fi](mailto:jukka.lehto@helsinki.fi), p. +358294150141

<http://www.helsinki.fi/kemia/radiokemia/english/>

**Główny Instytut Górnictwa, Śląskie Centrum Radiometrii Środowiskowej (GIG-SCRS),  
Katowice, Poland  
/Central Mining Institute, Silesian Centre for Environmental Radioactivity/**

GIG is located in Katowice, the administrative centre of Silesia, a mining and industrial region in southern Poland. GIG is research and development institute, working for mining industry, local authorities and environment protection business. The mission of the Institute is to create modern, energy-saving and clean technologies, technical solutions and undertake measures towards the creation of desired relationship: industry – environment – people. Number of topics related to waste management, water and air protection related to mining industry restructuring – there are current specific research areas of GIG. The tasks related to radioprotection and radioecology, mainly in the context of enhanced natural radioactivity (NORM) are run by the Silesian Centre for Environmental Radioactivity (SCRS), the modern, well equipped GIG's department. The SCRS' team has been involved in the problems caused by NORM at industrial and post-industrial areas for many years. It results in extensive experience in radiation measurements, occupational risk assessment and monitoring of the environmental impact related to the enhanced natural radioactivity. One of significant achievement of this team is the complete system of radioprotection, including all, measurement methods, risk evaluation and regulations implemented in all Polish underground mines in 1989. After the system had been enforced in mining industry the main scientific activity of SCRS was directed into protection widely comprehended environment against ionising radiation, including non-human biota, effects related to the simultaneous presence of other toxic metals and different environmental conditions or radon and radon progeny at homes. During the last few year SCRS participated in EU projects ERRICCA II, TENORM-HARM, WATERNORM, COMET, MetroNORM mainly focused on radiation protection and environmental effects related to an activity of a non-nuclear industry. SCRS cooperates with Faculty of Biology, Silesian University on the investigation of critical endpoints in plant cells exposed to enhanced natural radiation. Within COMET GIG is focused on initial research activity at areas contaminated by NORM due to discharge of radium rich brines from coal mines that had been selected in frame of STAR Network of Excellence as a long term observatory site. In MetroNORM project, in frame of EURAMET (the European Association of National Metrology Institutes), SCRS is involved in development of measurements techniques and reference materials applicable in NORM monitoring.

SCRS disposes almost all measurement techniques useful in radiation protection and radioecology (i.e. high resolution gamma spectrometry, alpha spectrometry, liquid scintillation spectrometry, radiochemical lab and TLD dosimetry). One SCRS's important field of activity is radon and radon progeny. The high volume (17 m<sup>3</sup>) full controlled radon (climatic) chamber coupled with fine (nano) aerosols generators and aerosols distribution analysers manufactured by TSI let SCRS develop radon risk models under various conditions. Due to recent investments the capabilities of SCRS were enhanced with the equipment allowing exposure to different radiation (X,  $\gamma$ ,  $\beta$  and neutrons) under controlled conditions in wide range of doses. All laboratories are located in an underground part of SCRS's new developed building.

Based on gathered experience and well equipped laboratories in 2013-2014 SCRS developed the methodology and then perform the complex study focused on the assessment of current environmental condition in the both assumed the first Polish NPP location regions before commissioning of the nuclear installation. The ambient radioactivity (including natural and artificial radionuclides) and occurrence of chemical pollution (organic and inorganic) in the atmosphere, hydrosphere, lithosphere and biota had been monitored. The data obtained are intended for use as a baseline in future investigations focused on determination the effects of the NPP installation. In this activity SCRS team was supported by other GIG's departments, ready to measure concentrations of non-radioactive constituents by ICP OES, ICP MS, XRF, XRD and classical chemical analyses.

SCRS has experience in training of industry operators in radiation protection and NORM waste management and can provide excellent condition for trainings and exercises focused on radiation protection and radioecology.

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## INFODAY CONCERT

Research interest Dan Galeriu, IFIN-HH, ROMANIA

Radiation protection, Radioecology, Life and Environmental Physics, Environmental Modelling for Radiation Safety

Radiological Impact Assessment for routine and accidental releases of tritium ( $^3\text{H}$ ) and  $^{14}\text{C}$

Process oriented dynamic modelling of  $^3\text{H}$  and  $^{14}\text{C}$  transfer in air-soil-plant-animal continuum, as well as for other radionuclides of interest for CANDU reactors

Formation of organically form of tritium (OBT) in plants; Buried tritium, exchangeable organically bound tritium (E-OBT), non-exchangeable OBT (NE-OBT); Monitoring and measurement errors

Metabolism of tritium and  $^{14}\text{C}$  in farm, laboratory, and wild animals

Human dosimetry of tritium, health consequences

Biota radioprotection for tritium and  $^{14}\text{C}$

Survey system for meteorology and radiation, interface with atmospheric transport models

Radon –outdoor and effects on external gamma dose

Accident management and decision support systems

Sources of uncertainties in Radiological impact assessment

Publications at

<http://www.nipne.ro/research/publications/64-publications.html>

## **RENEB network (Running the European Network for biological dosimetry and physical retrospective dosimetry)**

RENEB is a European Biodosimetry Network, able to perform large scale rapid biodosimetric dose estimation. Specialized to handle a large number of samples, **RENEB contributes to radiological emergency preparedness and large scale research projects**. The network infrastructure is based on reliable assays and techniques combined with high performance standards. To enhance the effectiveness of the network, RENEB is linked to global emergency preparedness and response systems as well as to the European radiation research area.

The network was initiated in January 2012 with the aim to significantly increase dose reconstruction capacities in case of **large-scale radiological scenarios**. Individual dose estimation based on biological samples and/or inert personalized devices has been optimized to support the rapid categorization of many victims according to the received dose. Communication and cross-border collaboration was standardized and cooperation with national and international emergency and preparedness organizations such as IAEA and WHO were initiated.

The value of RENEB to support topics also outside emergency preparedness is now evident. With established strategies to guarantee consistent performance between the partner laboratories, the network has the ability and capacity to **contribute to large scale research projects** with the analysis of exposure biomarkers and/or inert personalized devices. This also **includes studies on the effects of low doses, group related radiation sensitivity, contribution to non-cancer diseases, and epidemiological studies where sampling and handling of bioprobes or inert material is included**. RENEB also drives the development and evaluation of new exposure markers with special view to their applicability for addressing acute or protracted exposures as well as exposures dating back years or decades.

As such, RENEB as an analysis platform is of special interest for the Emergency Preparedness Platform NERIS by adding preparedness in the field of individual dose estimation. Moreover it benefits MELODI and EURADOS by providing capacity for radiation research and specialized biomarker development. Concerning the latter, the radioecological Platform ALLIANCE will also profit from RENEB.

Last but not least, RENEB provides intercomparisons, specialized courses and seminars open also to laboratories outside the network, thus being of relevance for **E&T** in the CONCERT-EJP.

At the moment the RENEB network comprises 25 partners who have signed a Memorandum of Understanding.

### **Contribution to the aims of the call are:**

- To support transnational research projects that combine innovative approaches in the field of radiation protection in line with the research priorities of CONCERT;
- To actively integrate E&T activities and collaboration with universities in multidisciplinary research projects;
- To make optimal use of research infrastructures

CONCERT Information Day on the 1st OPEN RTD CALL, 27th January 2016, Munich

**Participants from the University of Pavia:**

- **Andrea Ottolenghi**, andrea.ottolenghi@unipv.it
- **Giorgio Baiocco**, giorgio.baiocco@unipv.it
- **Gabriele Babini**, gabriele.babini@unipv.it
- **Jacopo Morini**, jacopo.morini@unipv.it

**Call topics:**

**Topic 1:** Improvement of health risk assessment associated with low dose/dose rate radiation

**Topic 2:** Reducing uncertainties in human and ecosystem radiological risk assessment and management in nuclear emergencies and existing exposure situations, including NORM.

**Radiobiology and Radiation Biophysics Group (lead by Andrea Ottolenghi, Physics Department, University of Pavia, Pavia, Italy)**

The group carries on experimental and theoretical studies on ionizing radiation effects (particularly after low doses), with applications in the clinical use of radiation for diagnostics and therapy (including the risk of complications and secondary tumours), and radiation protection, also for manned missions in deep space. The general objectives are:

i) to understand the mechanisms and to develop mathematical models of the action of different qualities of radiation on biological systems, from physical interactions to biological effects at the sub-cellular and cellular level, which can further drive effects at the tissue, organ and systemic level (e. g. cancer and non-cancer, including cardiovascular effects). The research focuses on radiation-induced DNA damage and repair processes, intra- and extra- cellular signalling perturbation, and their anti- and pro-carcinogenesis implications. Radiation is studied as a perturbing agent of complex systems that alters the complex behaviours and feedback phenomena, and may end up with either the recovery of a homeostatic equilibrium or with pathological conditions. Classical reductionist studies are combined with system, multi-scale approaches (systems radiation biology), also to integrate datasets on different radiation effects (e.g. pro-inflammatory responses, cell senescence);

ii) to use radiation as a probe to study the response of biological systems to external stimuli, e.g. for individual sensitivity studies, also for patients with (rare) genetic diseases.

**Involvement of the group in Research and Training EURATOM Programmes in the 7th Framework and in HORIZON 2020**

Local (UniPv) scientific management of the EURATOM projects CONCERT (with coordination of the WP on E&T), OPERRA, EUTEMPE-RX, ANNETTE, DoReMi (with coordination of the WP on E&T), EPIRADBIO. EU coordination of the EURATOM projects ANDANTE and ALLEGRO.

**Reference people for different research activities/expertise**

**Andrea Ottolenghi, physicist, head of the Radiobiology and Radiation Biophysics Group:** research on the effects of low doses of different qualities and on risk assessment, with applications to radiation protection and medical use of radiation.

**Giorgio Baiocco physicist:** theoretical models and simulations of radiation transport and effects on biological structures (from the macroscopic to the cellular/sub-cellular scale, with track structure modeling).

**Gabriele Babini physicist:** experimental and theoretical studies on intra-/extra-cellular signaling, bioinformatic analysis of high throughput datasets and modeling of radiation action with a systems radiation biology approach.

**Jacopo Morini, biologist:** experimental and theoretical studies on intra-/extra-cellular signaling, individual radiosensitivity (also with applications to rare diseases) and DNA damage response to ionizing radiation.

## Information sheet Biosphere Impact Studies for the CONCERT information day, 27th of January, 2016

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Biosphere Impact Studies  
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- Nathalie Vanhoudt [nathalie.vanhoudt@sckcen.be](mailto:nathalie.vanhoudt@sckcen.be)

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### Research interests:

- Studying the behaviour of radionuclides in the biosphere
  - Studying mechanisms and processes to better understand and predict radionuclide behaviour in the terrestrial, freshwater and marine environment
  - By using dedicated laboratory set-ups, greenhouse experiments and field studies as well as developing modelling tools calibrated and validated with the data sets thus developed
  - Infrastructure/tools: NORM observatory site, soil collection (European and Japanese soils), greenhouse, controlled lab environment, relevant lab equipment, etc.
- Development of a groundwater-soil-vegetation-atmosphere (SVAT) interaction model
  - To assess the transport and accumulation of bioavailable contaminants in a terrestrial ecosystem which can be applicable e.g. for long-term assessment of radioactive waste entering the surface biosphere from below-ground
  - To link radionuclides to water, carbon and nutrient fluxes in vegetation in order to represent cycling by trees experiencing climate variation
  - Infrastructure/tools: monitoring station in pine forest, etc.
- Biological effects induced in plants after exposure to external radiation, uptake of radionuclides or mixed stressor conditions
  - To study dose response relationships and to identify mechanisms that can explain the effects observed
  - By studying endpoints of different levels of biological complexity: molecular (gene expression, epigenetic mechanisms), cellular (enzymes and metabolites), individual (mortality, morbidity, reproduction, mutation) and population (mortality, reproduction)
  - Infrastructure/tools: radiation facilities, genomic platform, plant growth chambers, controlled lab environment, etc.
- Human and environmental risk assessment
  - To assess the human and environmental impact of routine and accidental releases of radioactivity
  - By developing mathematical models to predict the distribution and transport of radionuclides in the terrestrial and aquatic environments and the resulting health impact on man and environment

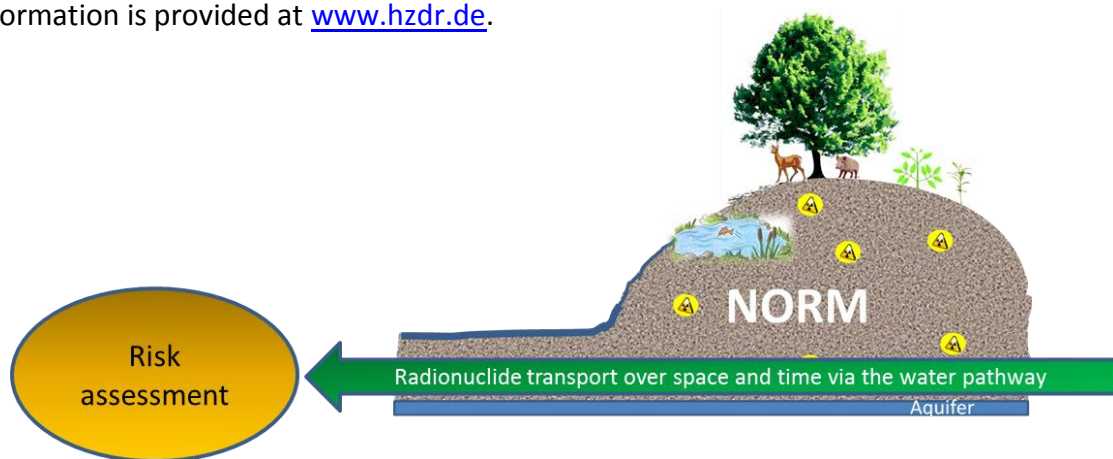


**Thuro Arnold and Susanne Sachs**

**Helmholtz-Zentrum Dresden Rossendorf e.V., Institute of Resource Ecology**

The Institute of Resource Ecology (IRE) is part of the Helmholtz-Zentrum Dresden-Rossendorf (HZDR), which is situated in Dresden, Germany. Research activities of the IRE are focused on the assessment and reduction of risks related to the nuclear fuel cycle and the migration of radionuclides in natural environments, based on a profound knowledge of molecular processes at the interface between geo- and biosystems. The IRE combines earth sciences, biochemistry, chemistry, and biology.

IRE has ample experience with the characterization of environmental problems. These activities include low level nuclear radiation measurements, application of sophisticated spectroscopic and analytical techniques, modelling of thermodynamic equilibria and migration processes, interactions of microbes or plants with radionuclides, sorption phenomena, colloid chemistry, and solubility and speciation studies. IRE combines state-of-the-art spectroscopic, microscopic, and biological methods in controlled areas (radiochemistry labs) allowing studies that can only be performed at a few places in Europe. IRE runs the X-Ray absorption spectroscopy station for radiochemistry, the Rossendorf Beamline, at the European Synchrotron Radiation Facility in Grenoble (France). More information is provided at [www.hzdr.de](http://www.hzdr.de).



Thuro Arnold and Susanne Sachs are the leaders of the ALLIANCE/Comet Roadmap WG NORM. With regard to the first open CONCERT call, we are interested in NORM related research. In particular, we are interested in the identification and quantification of key processes that play an important role in the transfer/migration of radionuclides in the environment. Fields of NORM applications are e.g. uranium mining sites, phosphate industry, and geothermic work places. This includes, for instance, studies on the interaction and mobility of radionuclides at the interface between geo- and biosystems. For this the uptake of radionuclides by microorganisms and plants on a molecular level is studied to identify and parametrize key processes and use them for more reliable modelling of the radionuclide transfer in the environment.

**Information sheet of  
Hungarian Academy of Sciences Centre for Energy Research (MTA-EK)  
(Partner 16 of CONCERT Consortium)  
for the 1st CONCERT Call**

Address: 29-33 Konkoly-Thege Miklós út, 1121 Budapest, Hungary

**Main research interests:**

**Quantification of the spatial dose distributions of inhaled radionuclides.** We are experienced in quantifying the heterogeneous radioaerosol deposition in the respiratory system and its microdosimetric consequences in terms of tracks, cellular hits and dose distributions (1, 2). We are interested in applying the elaborated models to find correlations between macroscopic exposure parameters and microscopic doses. These models can be used e.g. to estimate doses from biomarkers in lung tissue samples which can provide aid for dose determination in epidemiological studies in case of internal emitters.

*E-mail: imre.balashazy@energia.mta.hu*

**Radiation effects on tissue kinetics and its consequences on mutation induction and carcinogenesis.** We have developed computational models for mutation induction considering the changes of cell turnover due to radiation exposure (3). We applied this model for estimating initiation and promotion rates upon radon exposure (4). We are interested in the role of tissue kinetics in radiation effects on mutagenesis and carcinogenesis.

*E-mail: balazs.madas@energia.mta.hu*

**Activity dispersion and dose calculation in atmospheric and aquatic environment, decision support systems.** We developed several models in the last decades not only for environmental impact assessment of normal operation and safety analysis for DBC (design basis conditions) and DEC (design extension conditions) scenarios which are applicable also for decision support systems for nuclear emergency response. New simplified *inverse algorithm* to calculate source term from environmental dose rate measurements has been developed. New methods for the determination of *uncertainties* of the results are under development for inclusion into the system.

Availability, accuracy and credibility of input data for calculations (meteorological database, source term) have been studied, effects of long-lasting releases were also taken into consideration.

Recommendations for the national monitoring system were elaborated by experts working in our research groups, new monitoring methods around nuclear facility were suggested.

We are involved in several national and international (e.g. IAEA, OECD NEA) cooperation on the fields of environmental consequences, emergency preparedness and response, radiation waste management and decommissioning.

*E-mail: tamas.pazmandi@energia.mta.hu*

**Infrastructures that we can provide for research partners:**

Gamma and neutron irradiation facilities for seeds, cells, small animals, electronic devices etc.

22 January 2016

*References:*

- (1) Farkas Á, Balásházy I. (2015) Development and application of a complex numerical model and software for the computation of dose conversion factors for radon progenies. *Rad Prot Dosim* 164, 278-290.
- (2) Szőke I., Farkas Á., Balásházy I., Hofmann W., Madas B.G., Szőke R. (2012) 3D-modeling of radon-induced cellular radiobiological effects in bronchial airway bifurcations: direct versus bystander effects. *Int J Radiat Biol* 88, 477-492.
- (3) Madas B.G., Balásházy I. (2011) Mutation induction by inhaled radon progeny modelled at the tissue level. *Radiat Environ Biophys* 50, 553–570.
- (4) Madas, B.G., Varga, K., 2014. Biophysical modelling of the effects of inhaled radon progeny on the bronchial epithelium for the estimation of the relationships applied in the two-stage clonal expansion model of carcinogenesis. *Radiat Prot Dosim* 159, 237–241.

## CONCERT INFORMATION SHEET

Linda Walsh

*[www.researchgate.net/profile/Linda\\_Walsh](http://www.researchgate.net/profile/Linda_Walsh)*

New affiliation: Medical Physics Group, University of Zurich, Switzerland.

E-mail: [lwalsh@bfs.de](mailto:lwalsh@bfs.de) (until May 2016), new e-mail: [linda.walsh@uzh.de](mailto:linda.walsh@uzh.de)

I am a specialist in radiation epidemiology and hold a higher doctorate (DSc) in radiation epidemiology and a doctorate (PhD) in physics from the University of Manchester, UK. My recent work has included involvement with the World Health Organisations expert group for assessing the radiation-related cancer risk in Japan after the 2011 nuclear accident at the Fukushima plant. Some of my past research includes: analyses of data from the Life Span Study cohort of Japanese survivors of the World War II atomic-bomb attacks; the development of epidemiological models for thyroid cancer risk in areas affected by the 1986 Chernobyl accident; and analyses of the mortality follow-up data from the German “Wismut” uranium miners.

My research interests include refining radiation risk models for various detrimental health outcomes (e.g., cancer), as used in health risk assessment and radiation protection, by applying novel techniques (e.g., to quantify and minimize the uncertainties in the analyses).

I am able to provide advice on and practical assistance with the analysis of radiation epidemiological and radiobiological data, meta-analyses, and health risk assessments involving calculations of radiation-related lifetime risks of detrimental health outcomes.

## Information Sheet of Weibo Li, HMGU

Application for

Participation in 27th of January, 2016 - Information Day on the 1st OPEN RTD CALL of the 'CONCERT - European Joint Programme for the Integration of Radiation Protection Research' under Horizon 2020

Applicant: Weibo Li

Research Unit Medical Radiation Physics and Diagnostics, Helmholtz Zentrum München— German Research Center for Environmental Health (GmbH), Neuherberg, Germany.

Tel: 0049 (0)89 3187 3314

Fax: 0049 (0)89 3187 2517

E-mail: [wli@helmholtz-muenchen.de](mailto:wli@helmholtz-muenchen.de)

My name is Weibo Li (Li is my surname). I have been working in Helmholtz Zentrum München, Neuherberg, Germany since 1997. Regarding to the first CONCERT Calls, my research interests can be divided into two areas: (1) Uncertainty in radiation protection and in medical dosimetry and (2) Nanodosimetry in radiation biological application. According to my competences, I would like to be a potential partner in the Topic 1 and Topic 2 announced in the CONCERT preliminary announcement.

(1) Uncertainty study in radiation protection and in medical dosimetry

In the last years, I developed a statistical approach for quantitative evaluation of uncertainties in biokinetic models and internal doses to the occupational workers and to the publics. Meanwhile, this method has been also applied and implemented into internal dose calculation to patients in nuclear medicine. This method can be used to analyze the overall uncertainty of internal dose to workers and to patients. Furthermore, this method can be used to identify the important parameters or factors in the procedure of the dose calculations. This method can also be extended to evaluate the uncertainty of dose to occupational workers in the epidemiological study.

(2) Nanodosimetry in radiation biological application.

I have a strong scientific background in using Monte Carlo radiation transport simulation programs (for example, PARTRAC in cooperation with Dr. Werner Friedland in HMGU and PENELOPE) for studying the physical track structures and chemical radicals and biological effects. Moreover, I am working on mathematical modeling of the cell survival based on the initial physical quantities and DNA damages.

In the following, a brief description of our organization - Helmholtz Zentrum München— German Research Center for Environmental Health (GmbH) for potential partners.

Helmholtz Zentrum München (HMGU) is the German Research Center for Environmental Health. It investigates important common diseases which develop from the interaction of lifestyle, environmental factors and personal genetic background. HMGU is a research institution of the Federal Republic of Germany and the Free State of Bavaria. It is a member of the Helmholtz Association of German Research Centers. The "Research Unit Medical Radiation Physics and Diagnostics" (AMSD) is a member of the "Department of Radiation Sciences" (DRS) in HMGU. The mission of AMSD is to contribute to the protection against man-made ionizing radiation, in particular by optimizing the performance of medical diagnostic procedures and developing innovative medical technologies. Other important research topics in AMSD aim at contributing to a better understanding of internal and external radiation exposures on humans. The AMSD gives advice to politics and stake-holders, cooperates with national and international partners and tries to commercialize own ideas and developments.

The French Institute for Radiological Protection and Nuclear Safety (IRSN) is the national public expert in nuclear and radiological risks. IRSN contributes to public policy-making concerning nuclear safety and health and environmental protection against ionizing radiation. IRSN groups together over 1 700 specialists: engineers, researchers, doctors, agronomists, vets and technicians, competent in the fields of nuclear safety, radiation protection and inspection of sensitive nuclear materials.

### IRSN objectives

- Optimizing our technical support to public authorities by getting the best out of our equipment and human resources to make an independent risk assessment.
- Targeting scientific excellence in our research activities by anticipating technological, economic and social developments.
- Opening our expertise to society needs to be recognized as a public reference cluster within a context of involvement of external experts.
- Contributing to convergence of technical practices of nuclear safety in Europe and throughout the world.

### Potential geosphere transfer research department of IRSN contribution to CONCERT

As part of the Nuclear Waste and Geosphere Division, our team of researchers focuses on the four following fields:

- Deep geological storage of radioactive waste
- Sites contaminated by nuclear accidents
- Sites contaminated by Naturally Occurring Radioactive Material
- Former uranium mines

The three last items are in accordance with the topic 2 of the EJP CONCERT.

Our research interest is to improve the mechanistic understanding of radionuclide (natural and artificial) transfer in the environment. On the CONCERT context we would like to focus on:

- water/sediment interface fluxes of U, Ra and Po in former mines catchment.
- Migration of radionuclides (mainly U, Ra, Po, Cs, Sr) from contaminated soils to underground water.

Our main skills are : Geochemistry, hydrology, metrology (ICP-MS, ICP-OES, ionic chromatography, carbon determination, porosity determination, specific surface, liquid scintillation, radon emanation,....)



## **Main interests**

**Development of tools, datasets and guidance to select and evaluate the effectiveness of different remediation strategies in existing exposure situations (e.g. radiological/nuclear accidents and/or NORM/TeNORM)**

- Identify and mathematically represent key processes that make significant contributions to the environmental transfers of radionuclides and resultant exposures to humans and wildlife;
- Acquire the data necessary for parametrisation of the key processes controlling the transfer of radionuclides;

**Environmental availability of radionuclides in the biosphere and their impact on wildlife and human food chain. Process-based model parameterization, characterization of variability, uncertainty assessment and communication**

- Identify and mathematically represent key processes that make significant contributions to the environmental transfers of radionuclides and resultant exposures to humans and wildlife;
- Develop transfer and exposure models that incorporate physical, chemical and biological interactions, and enable predictions to be made spatially and temporally.

José Corisco, IST, Portugal

James W Marsh

**Institute: Public Health England (PHE), Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon. OX11 0RQ, UK; PH (+44) 1235 831600; FAX (+44) 1235 833891;**

**E-mail: james.marsh@phe.gov.uk**

We are interested in participating in projects under topics 1 and 2.

### **Topic 1**

We are interested in participating in epidemiological studies by calculating doses to worker cohorts. We have developed the internal dosimetry software PLEIADES, which has been used to calculate dose coefficients and bioassay quantities for the International Commission on Radiological Protection (Fell et al. 2007). As part of European projects (e.g. Alpha-Risk, SOUL, CURE) PHE has developed dosimetry protocols and calculated lung and organ doses to uranium miners and plutonium workers (Marsh et al., 2012; Puncher and Riddle, 2016).

### **Topic 2**

We are experts in internal dosimetry and emergency response. We have had experience in dealing with real emergencies (e.g. London Po-210 poisoning incident) and carrying out dose assessments (e.g. UNSCEAR's Fukushima worker assessment). Members of staff were also consortium members of the TMT Handbook project which produced a handbook on 'Triage, Monitoring and Treatment of people exposed to ionising radiation following a malevolent act' (Rojas-Palma, et al., 2009). We also have facilities and equipment for carrying out rapid screening measurements, personal in-vivo monitoring and urine measurements following an emergency.

### **References**

Fell TP, et al. The internal dosimetry code PLEIADES. Radiat Prot Dosim 2007; 124: 327-38

Marsh JW, et al. Dosimetric calculations for uranium miners for epidemiological studies. Radiat Prot Dosimetry. 2012; 149: 371-83.

Puncher and Riddle, 2016. A Bayesian analysis of plutonium exposures in Sellafield workers. J. Radiol. Prot. 36, 1-19

Rojas-Palma C, Liland A, Jerstad AN, Etherington G, Pérez M, Rahola T and Smith K (editors) 2009. TMT Handbook. Triage, Monitoring and Treatment of people exposed to ionising radiation following a malevolent act. ISBN 978-82-90362-27-5  
[www.tmthandbook.org](http://www.tmthandbook.org)

## MAIN RESEARCH INTERESTS

- 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;
- 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)

Maria José Madruga

Instituto Superior Técnico, Universidade de Lisboa, Portugal

18th January 2016

# Laboratory for Nuclear Technologies Applied to the Environment

University of Ferrara - National Institute of Nuclear Physics (INFN) – Italy

## RESEARCH INTERESTS

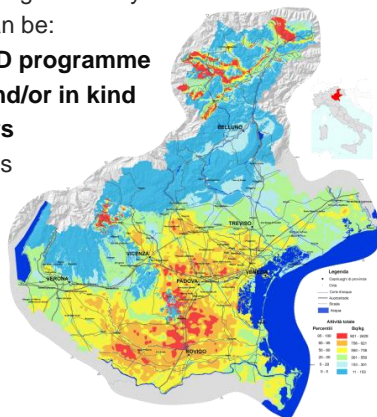
The **multidisciplinary team** is composed by 3 staff members, 3 post-docs and 3 graduate students with background in nuclear physics, neutrino physics, geophysics and engineering. The main research experiences cover the following topics:

- **environmental radioactivity mapping** through in-situ and airborne gamma-ray spectroscopy
- characterization of **NORMs** with HPGe
- numerical modeling of **reactor antineutrino** and **geoneutrino** signals and spectra
- optimization of **algorithms** and **software** for studying statistics, systematics and modeling **uncertainties**
- **hardware and software R&D** in collaboration with private companies
- organizer of **educational training programs** and **summer schools**

## ITALian RADioactivity project

The ITALRAD project, funded by the Italian Ministry of University and Research, is aimed at realizing the **natural radioactivity map of the Italian territory** by means of laboratory, in-situ and airborne gamma-ray measurements. Synergies with **CONCERT** can be:

- co-funding of **industrial PhD programme**
- **co-fund actions in cash and/or in kind**
- involvement of **stakeholders** from SME or public institutions
- **sharing** of database, equipments and know-how in radioecology, geophysics and geostatistics



## AIRBORNE SURVEY

The team designed and realized the Radgyro, an innovative ultralight aircraft dedicated to **multiparametric airborne surveys**. The Radgyro has exceptional potentiality for **applications in emergency and recovery preparedness and response**. It is equipped with an electronic system which allows for the **simultaneous acquisition** of:

- 5 NaI detectors in list mode for airborne gamma-ray survey
- 2 optical photogrammetric cameras
- 1 inertial navigation system
- 1 thermographic camera
- 1 infrared camera
- 5 GPS antenna
- 1 radar altimeter
- 1 P&T sensor



## INFRASTRUCTURES

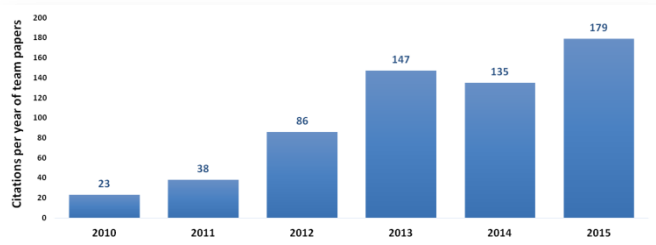
The laboratory is equipped with:

- a **fully automated** high-resolution gamma-ray spectrometer composed by two coupled **HPGe detectors** (Xhixha G. et al. – DOI: 10.1007/s10967-012-1791-1)
- **portable NaI scintillation detector** mounted in a backpack devoted to in-situ measurements (Xhixha M. et al. – DOI: 10.1080/17445647.2015.1115784)
- lightweight **collimated** gamma-ray spectrometer for **in-situ surveys**
- fully equipped **AlphaGUARD** for outdoor and indoor radon exhalation measurements



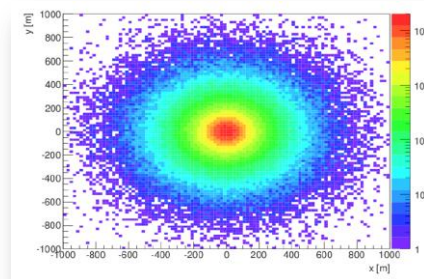
## RESEARCH RECORDS

- High-ranking **peer reviewed publications**
- **Invited talks** at international congresses
- Active and fruitful international **network of scientists**
- Successful **technology transfers** to private companies
- Development of **patents**
- Members of international **underground experiments** (Borexino; Jiangmen Underground Neutrino Observatory)



## NUMERICAL MODELING

- **Monte Carlo simulations** from initial physical events based on **GEANT4** for investigating detector sensitivity as well as for computational dosimetry studies
- **Geostatistical algorithms** for numerical cartography and for the estimation of models uncertainties
- **Custom software** designed for in-situ real time gamma-ray measurements analysis
- Sophisticated **treatment of uncertainties** for providing recommendations and for helping in **decision making**



## Information for potential partners - 1st RTD Open Call CONCERT

*UJV Rez, a. s., Hlavní 130, Rez, 25068 Husinec, Czech Republic*

UJV Rez, a. s. (in CONCERT: NRI), is a company providing a broad range of services, particularly applied research and engineering activities. The company's operation primarily involves putting research and development projects into practice. The company is a sought-after supplier in such fields and activities as safety analyses, modelling, thermohydraulic calculations, severe accident analyses and documents for technical changes in nuclear power plant projects, and designing in the sectors of conventional and nuclear energy. This also involves the creation of documentation as part of permitting processes, LTO projects and NPP power output enhancement projects, radioactive waste disposal, and more. Radiopharmaceuticals important for disease diagnostics are also produced in Rez.

Department of Diagnostics and Radiation Safety of Nuclear Safety and Reliability Division is deeply involved for many years in developing methods, tools, software and guidance for decision making in case of potential accident followed by inadmissible release of radioactive particles from nuclear power plant.

**We propose** research topics for 1st call of CONCERT, related to *Topic 2: Reducing uncertainties in human and ecosystem radiological risk assessment and management in nuclear emergencies and existing exposure situations, including NORM.*

1. Advanced methods and fast tools (including software development) for best estimate prediction of release of radioactive substances into environment and for radiological consequences in light of new approach of ICRP 103 recommendation and in the light of previous lessons learnt from Fukushima and Chernobyl accidents. Aiming for utilization under real terrain conditions by members of intervention teams.
2. Software for prediction of radioactive substances dispersion and deposition in urban condition after terrorists attacks with use of dirty bomb and/or dissemination of radioactive substances. Support for decision making of intervention teams during real threat.
3. Improvement of source term assessment using reverse modelling based on real measurement in terrain. Interactive and iterative improvement of source term assessed in ad-hoc situation without justified information on radioactive substances inventory in case of dirty bomb attacks.
4. Utilisation of drones (unmanned aerial and/or ground vehicles) for radiological reconnaissance in urban conditions (protection of crowded places). Proposal of hardware (sensors, vehicles, communication, control and data transfer), methods (procedures and guidance for reconnaissance) and software for evaluation of measurements and their integration into the dissemination model.

### References:

5. R&D Project MD (Ministry of Defence of Czech Republic) 0601 5 3040 S "Knowledge-based support for command and management of emergencies - reconnaissance optimization and model-based prediction of radiation and chemical situation with use of remotely controlled mobile vehicles"
6. R&D Project MD 0501 5 3020 "Advanced methods and tools for command and crisis management and simulation tools for specialists preparation and training"
7. R&D Project MD 0301 2 5555 S "Decision support system for commanding managers during state infrastructure endangerment"
8. R&D project MIT (Ministry of Industry and Trade of Czech Republic) FC-M/48"STRATEGY" – Application of nuclear methods for army and armament industry, including development of methods and tools for prediction of radiological consequences after release from low-potential sources (NPPs)
9. PHARE project PH11.07/97C „Crisis Centre Organisation and Equipment“, development of methods and tools to support decision making of crisis team on analysis and prediction of NPP accident course and consequences
10. R&D Project MIT FI-IM5/196 "Methods and tools for design, implementation and evaluation of advances form of complex technological process monitoring and control by new user interface displays generation"
11. R&D Project MIT FI-IM3/092 "Research of fuzzy neural modelling methods for non-destructive on-line monitoring and validation of technological process sensors"
12. R&D Project MIT FI-IM/061 "Augmented and Virtual Reality Tools for safety and effectiveness improvement of complex and/or risk classified human activities"

### Contact:

Mr. Vladimír Fiser, Head of Diagnostics and Radiation Safety Department

E-mail: vladimir.fiser@ujv.cz, phone: +420 266 172 446, mobile: +420 602 364 266



# Our aim: assess and prevent nuclear and radiological risks

## Who are we?

The French Institute for Radiological Protection and Nuclear Safety set up by law 2001-398 of 9 May 2001, under the statute of public authority of industrial and commercial nature (EPIC) is the national public expert in nuclear and radiological risks. IRSN contributes to public policy-making concerning nuclear safety and health and environmental protection against ionizing radiation. As a research and expert appraisal organization, IRSN works together with all the participants concerned by these policies while keeping an open mind.

IRSN has a budget of M€ 321 and groups together over 1 700 specialists: engineers, researchers, doctors, agronomists, vets and technicians, competent in the fields of nuclear safety, radiation protection and inspection of sensitive nuclear materials.

## Our remits

- We act as support for the public authorities competent in nuclear safety and radiation protection for civil and defense activities, and safety of nuclear facilities and materials within the framework of international treaties. In the event of emergency situations, the Institute has an emergency response center that can be called in at all times, together with field response teams.
- As we fulfill several other remits, we define and implement national and international research and study programs. We contribute to radiological monitoring of the national territory and workers exposed to ionizing radiation and to their training in radiation protection. We manage the national database on radioactive sources.
- We make our expertise available to numerous French and foreign partners and customers.
- We contribute to providing the public with information in the field of radiological and nuclear risks, especially with publication of reports, organization of exhibitions and our website.

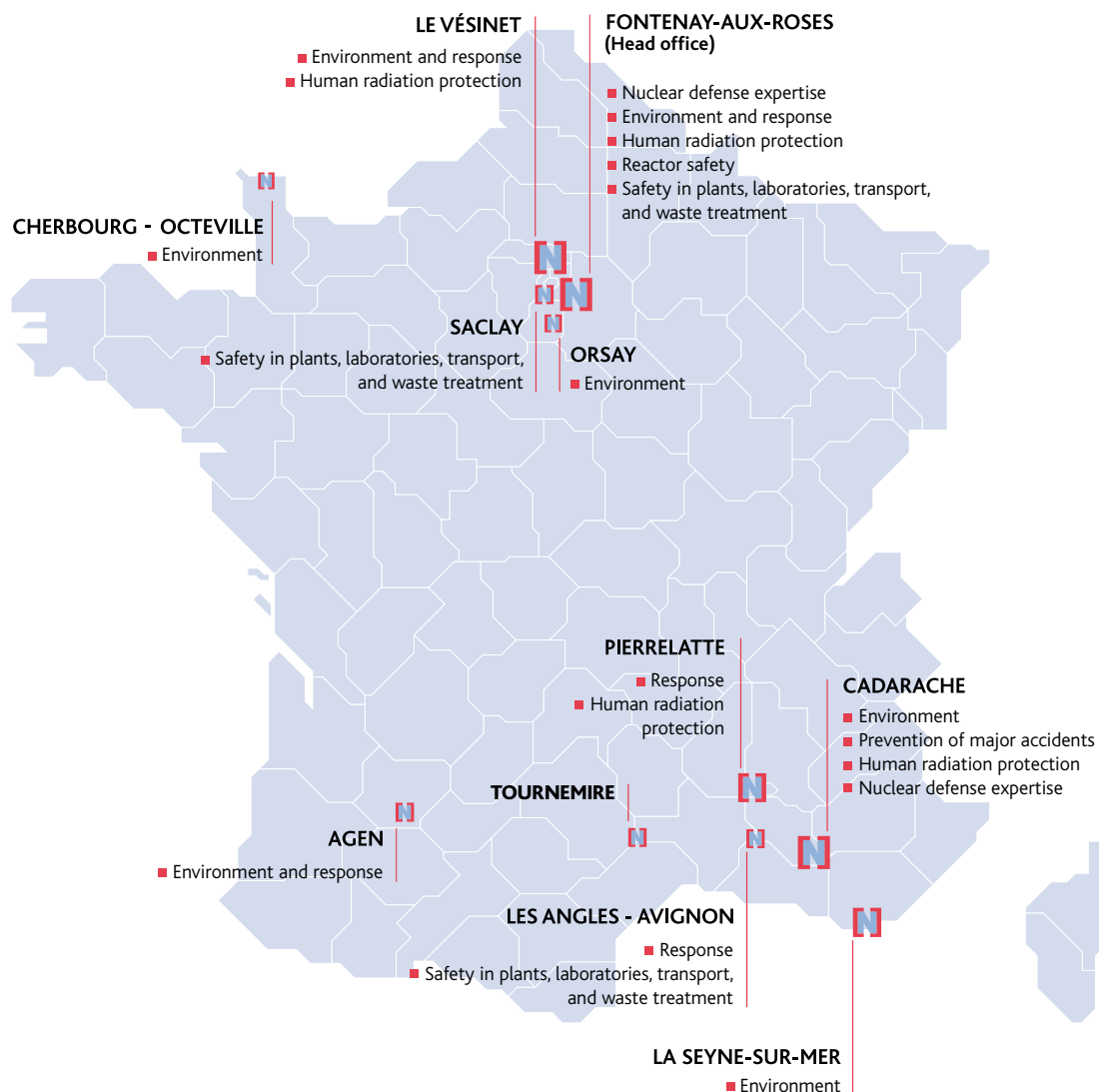
## Our objectives

- **Optimizing our technical support to public authorities** by getting the best out of our equipment and human resources to make an independent risk assessment, in-depth expert appraisal of facility compliance and ensure compliance of France's international commitments concerning nuclear non-proliferation.
- **Targeting scientific excellence in our research activities** by anticipating technological, economic and social developments, and cooperating with the world's best teams to strengthen our expert appraisal potential as and when technological developments occur.
- **Opening our expertise to society needs** to be recognized as a public reference cluster within a context of involvement of external experts.
- **Contributing to convergence of technical practices of nuclear safety in Europe and throughout the world**, by developing bilateral and multi-lateral research and expert appraisal collaboration with our counterparts, especially in Germany, the United States, Japan, China and Russia.





## Our main activities presented by site



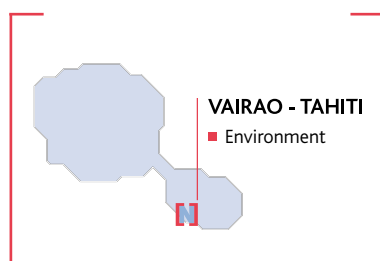
IRSN certified quality management system

### Correspondence

**Institut de radioprotection et de sûreté nucléaire**  
B.P. 17  
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Christelle ADAM-GUILLERMIN

Institut de Radioprotection et de Sûreté Nucléaire

Centre d'Etudes de Cadarache, Bâtiment 183, BP3

13115 Saint Paul Lez Durance cedex

France

Christelle.adam-guillermine@irsn.fr

Interest : Topic 1 but could also contribute to topic 2.

<u>Research interests :</u>	<u>Infrastructures :</u>
<ul style="list-style-type: none"><li>-Radioecology and ecotoxicology<ul style="list-style-type: none"><li>-Low doses/dose rates<ul style="list-style-type: none"><li>-Genotoxicity</li></ul></li><li>-DNAseq, RNAseq</li><li>-Proteomics</li></ul></li><li>-Protein carbonylation<ul style="list-style-type: none"><li>-Epigenetics</li><li>-Biomarkers</li><li>-zebrafish</li><li>-daphnids</li><li>-nematods</li><li>-cell culture</li></ul></li><li>-in situ experiments (Chernobyl, Fukushima)<ul style="list-style-type: none"><li>-DEBtox modelling</li></ul></li><li>-Population dynamic modelling</li></ul>	<ul style="list-style-type: none"><li>-Gamma irradiator (up to 50 mGy/h)</li><li>-Radioactive contamination facility (gamma, alpha and beta emitters)</li><li>-Microcosm experiments (aquatic/terrestrial compartments)<ul style="list-style-type: none"><li>-Cell culture laboratory</li></ul></li><li>-Microscopy (Transmission Electronic Microscope + EDAX probe ; apotome ; confocal microscope)<ul style="list-style-type: none"><li>-RT-qPCR</li></ul></li><li>-Flow cytometer</li><li>-Chemical analysis (ICP-MS/HPLC ; ICP-OES...)</li><li>-Gamma spectrometry/scintillation</li></ul>

## **Thünen Institute of Fisheries Ecology**

### **Radiation Ecology Research Interests and Infrastructures**

The Thünen Institute of Fisheries Ecology (TI-FI) is a German institute dedicated to explore and monitor the marine environment. We assess the actual status of radioactive substances in fish and their dispersion at sea on basis of regular surveys and seek to identify early changes and to assess their impacts on the use potential of living resources.

One of our research interests is the analysis of radiation effects in fish in environmental activities and concentrations. To achieve this goal we are interested in conducting laboratory experiments exposing fishes to ionizing radiation and other stressors that can modulate the radiation effects. Associated to this goal the finding of radiation specific biomarkers is a must.

We are also interested in field experiments to search for evidences of radiation effects in fish exposed to low dose radiation in the environment.

Computational modelling is also one of our strong. We are interested in the development of animal computational models to reduce the uncertainty in the exposure and dose assessment of the wildlife. Additionally, we wish to improve and develop models for radionuclide transport and transfer calculations in the Aquatic environment and the transference into the human food chain. We have in the past developed a Box compartment model able to model the radionuclides transferences in the Baltic Sea, North Sea and Greenland Sea. This computational model is also able to predict the transference to the human food chain and the resulting man-dose.

### **Infrastructures:**

Three ships that regularly conduct surveys of anthropogenic substances and fish diseases in the North Sea, Baltic Sea, Greenland Sea. Our flagship is the Walther Herwig III, a Stern trawler with 64 meters long, which contains 7 laboratories for analysis, sample preparation and hydrography measurements and can take a scientific crew up to 12 persons.

Alfa, Beta and Gamma low level spectrometers, for environmental samples.

One laboratory dedicated to genotoxic analysis (COMET Assay and Micronuclei).

Radiochemical laboratory for radionuclides chemical separation and sample preparation.

Several laboratories dedicated to Ultra-trace analysis of organic and inorganic anthropogenic pollutants (e.g. heavy metals, TNT, etc.).

Facilities for fish breeding and maintenance of several hundred zebrafish embryos, for the production of fish. Flow facility for maintenance and exposure of marine fish.

## **CONCERT INFO DAY participants from Istituto Superiore di Sanità (ISS)**

Cinzia De Angelis  
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### **Topic 1: Improvement of health risk assessment associated with low dose or dose rate radiation**

#### **Research interests**

1. investigation of the biological response to low doses/dose rate irradiation of cultured cells of different types and origin, including stem cells and cells with defects in the response to DNA damage, with special emphasis to the dependence on radiation quality
2. characterization of the effects of DNA damage on mitochondrial organization and dynamics by analysis of mitochondrial DNA damage, mitochondrial morphology, mitochondrial biogenesis and mitophagy
3. investigation of metabolic effects by Nuclear Magnetic Resonance spectroscopy: cell clustering based on metabolic fingerprints and identification of specific spectroscopic markers
4. methods of retrospective dosimetry in support to epidemiological studies
5. analysis of the relation of biophysical markers with internal contamination and radiation components (gamma and neutrons)
6. reducing uncertainties and increasing quality of measurements in retrospective dosimetry and dosimetry in medical field through participation to dosimetry networks (participation in EURADOS and RENEB)
7. communication with stakeholders on radiation protection research issues (in particular in the framework of the projects OPERRA and CONCERT)

### **Topic 2: Reducing uncertainties in human and ecosystem radiological risk assessment & management in nuclear emergencies and existing exposure situations, including NORM**

#### **Research interests**

1. NORM in building materials:
  - a. reducing uncertainties on Rn exhalation modeling to improve evaluation of Rn contribution from NORM containing building materials;
  - b. proving modeling reliability in controlled situations
2. NORM industry releases and residue landfills: improving environmental and human health impact assessment taking into account physical and chemical NORM characteristics and human habits
3. communication with stakeholders on dose levels (in particular in the framework of the project SHAMISEN)

**Infrastructures:*****Irradiation facilities***

At the ISS, besides the Gammacell 40 Exactor for acute gamma irradiation, there are irradiation facilities dedicated to continuous exposure of cultured cells in physiological condition, namely: the LIBIS gamma irradiation facility (dose rate range: 2 microGy/h - 20 mGy/h and the alpha particle irradiator (dose rates ranging from a hundred of microGy/h to few tens of Gy/h). Moreover, it is also available the PULEX-Cosmic Silence facility for exposure of biological samples in extremely low radiation background at the Underground Gran Sasso National Laboratory (LNGS) (for more information see AIR2- bulletin – Issue3).

***Other major research infrastructures:***

METAFER platform (for analysis of chromosome aberrations, micronuclei and DNA damage)

Nuclear magnetic resonance (9.4 T)

Magnetic resonance imaging and spectroscopy *in vivo* (4.7 T)

Electron paramagnetic resonance

Proteomics/Mass spectrometry

Mass cytometry

Confocal microscopy

APOTOME

Electronic microscopy (SEM, TEM)

Flow cytometry

## **VUJE, a.s. (VUJE, Slovak Republic)**

### **Organization**

VUJE was established in 1977 as a state research institute; in 1994, it was transformed into a joint stock company whose shares are owned by company employees and former employees. The change from the state-owned company into a private company meant also a change in company operations, i.e. a change from an originally research organization into an engineering company that presently implements large projects mainly in the field of nuclear power generation. The current scope of company operations includes all activities related to the preparation, implementation, operation and termination of operation mainly of energy installations. VUJE a.s. has an established integrated management system based on international standards and related national regulations aimed at improving the safety of nuclear facilities exploitation, the environment protection as well as occupational safety and health protection. It also applies requirements and recommendations of IAEA.

### **VUJE experience and research interests in Topic 2: Reducing uncertainties in human and ecosystem radiological risk assessment and management in nuclear emergencies and existing exposure situations, including NORM.**

VUJE in relation to the project topics is conducting research related to development and implementation of decision support systems, accident management and risk assessment, source term evaluation, atmospheric dispersion and dose modeling, uncertainty handling and sensitivity analyses, exercises preparation and conducting, training courses development and conducting, governance of hazardous activities and situations (including post-nuclear accident situations), stakeholder engagement processes and facilitation of multi-stakeholder processes.

### **Participation in the European research and expert projects**

VUJE has participated in numerous European research and expert projects [FP4, FP5, FP6 (EURANOS, COVERS, SARNET), FP7 (PREPARE, NERIS-TP, CATO, SARNET 2, CESAM, NUCL-EU, MMOTION, ADRIANA, SARGENIV, ALLIANCE), Inco Copernicus and PHARE] and has acted as a work package leader for some of these. VUJE is founding member of NERIS and NUGENIA. VUJE is also member of ETSON. VUJE has wider involvement in the OECD/NEA working groups nominated there by Nuclear Regulatory Authority of the Slovak Republic as their Technical Support Organization. VUJE has links to a wide range of stakeholders involved in radiation protection, emergency management and decision making including post-nuclear accident situations, nuclear safety and nuclear waste management.

### **Role in the CONCERT project**

VUJE is actively participating in the work of WP2, WP3, WP5 and WP7.

### **Key personnel**

**Ms. Tatiana Duranova** is mathematician and social worker, emergency planning expert, project manager, heads VUJE RODOS Team, working at VUJE since 1981. T. Duranova is Management Board Member of NERIS Platform Association since 2010, member of the WPNEM at NEA OECD, Deputy Chair of the RODOS Users Group. She was and is involved in a number EC-funded projects having been the Work Package leader in some of them and Coordinator of them within the Slovak Republic, currently involved in the EC-funded project PREPARE. Contact: [Tatiana.Duranova@vuje.sk](mailto:Tatiana.Duranova@vuje.sk)

**Ms Jarmila Bohunova** is mathematician, emergency planning expert, project manager and heads Group of radiological consequence analysis, working at VUJE since 1993. She is member of the NERIS R&D committee. She is involved in the EC-funded project PREPARE. Contact: [Jarmila.Bohunova@vuje.sk](mailto:Jarmila.Bohunova@vuje.sk)

**Dr. Juraj Duran** holds a Ph.D. in meteorology, theoretical physicist, emergency planning specialist, project manager, working at VUJE since 1990. He is leading and carrying out research and development of tools for accident analyses and decision support. He is involved in the EC-funded projects PREPARE and CATO. Contact: [Juraj.Duran@vuje.sk](mailto:Juraj.Duran@vuje.sk)

**Mr. Albert Bujan** is physicist, emergency planning expert, project manager, working at VUJE since 1981. He is responsible for environmental source term evaluation both during the severe accidents and design basic accidents, development of the computational models for European integral code ASTEC, He is involved in the EC-funded projects PREPARE and CESAM. Contact: [Albert.Bujan@vuje.sk](mailto:Albert.Bujan@vuje.sk)