

THE EUROPEAN PLATFORMS ON RADIATION PROTECTION: A COORDINATED EFFORT TO ENSURE THE SUSTAINABILITY OF THE RTD IN THIS FIELD

In the last decade, four platforms on radiation protection issues have been created in Europe: ALLIANCE (radioecology), EURADOS (dosimetry), MELODI (effects of low dose) and NERIS (emergency preparedness and management). The work done in close collaboration within the platforms is contributing to the sustainability of the RTD activities in radiation protection. The platforms have developed Strategic Research Agendas, defining long-term research priorities in their respective disciplines. The ultimate goal is to develop a joint Strategic Research Agenda for radiation protection in Europe.

In the last decade, stable platforms have been created by European members who do research in different areas of radiation protection. These platforms promote joint research activities between their members, set strategic priorities and cooperate to implement the research, through a better integration of national R&D programs within a European holistic approach.

At present the challenge is to address the main scientific questions that condition the improvement of the radiation protection practice in Europe and the world. Not only is it essential to improve the knowledge of various aspects related to ionizing radiation, but also to transfer and convert that knowledge into operational doctrines and tools that enable the management of issues such as those related to the behavior of radionuclides in the environment and the doses they cause to humans and biota, the effects and risks caused by such exposures, the response in radiological emergencies and the rehabilitation of contaminated areas. In order to confront and respond to this challenge, the ALLIANCE, EURADOS, MELODI and NERIS platforms were

founded to focus on different areas of radiation protection. ALLIANCE is devoted to research initiatives in radioecology, EURADOS focuses on subjects related to dosimetry, MELODI deals with the effects of low radiation doses and NERIS works on aspects related to the preparation and management of the response and recovery after a nuclear or radiological emergency.

Each platform has developed a Strategic Research Agenda for its corresponding areas of action, and the ultimate objective is to draw up a joint strategic agenda for research in radiation protection that will guarantee its sustainability.

Cooperation between the four platforms began under the European project OPERRA (Open Project for the European Radiation Research Area) of the 7th Framework Program. This cooperation intensified with the signature, in December 2013, of a Memorandum of Understanding between the four platforms, which included the joint commitment to promote and coordinate research in radiation protection.

The four platforms are members of the European Project EJP-CONCERT

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(European Joint Programme for the Integration of Radiation Protection Research) of the EC Horizon2020 program, which was launched in June 2015. The purpose of CONCERT is to contribute to the sustainable integration of the European and national radiation protection research programs. In the framework of the EJP-CONCERT, the four European platforms will maintain and update their Strategic Research Agendas, in a coordinated way. These Agendas will help to define the R&D priorities in Europe and will explore joint interests in multidisciplinary and synergic research (<http://www.concert-h2020.eu>) (Figure 1).

ALLIANCE: EUROPEAN RADIOECOLOGY ALLIANCE



Radioecology is the discipline that studies radionuclides as contaminants and radiation as a stress factor. Radioecology studies provide the basis for estimating exposures, doses and consequences of radioactive contamination in the environment, including the risks to people. To mention only some examples, a knowledge of radioecology is necessary to assess the risks posed by the nuclear fuel cycle, including the storage of nuclear wastes, to estimate the effects of chronic exposures at low doses and to respond to emergencies in which radioactive materials are involved.

The ALLIANCE was created in 2009 with the firm conviction of the eight European founding organizations, that the radioecology capabilities in Europe could only improve by joining forces. The main objective of ALLIANCE is to strengthen coordination and integration of radioecology research at the national, European and international levels.

In 2012, the ALLIANCE was constituted as a legal European Association under French law. The Association currently has 26 members from 13 countries. Spain is well represented with the participation of the CIE-MAT (founding member) and the Universities of Barcelona, Extremadura, Basque Country and Granada.

In 2011, the STAR (Strategy for Allied Radioecology) Network of Ex-

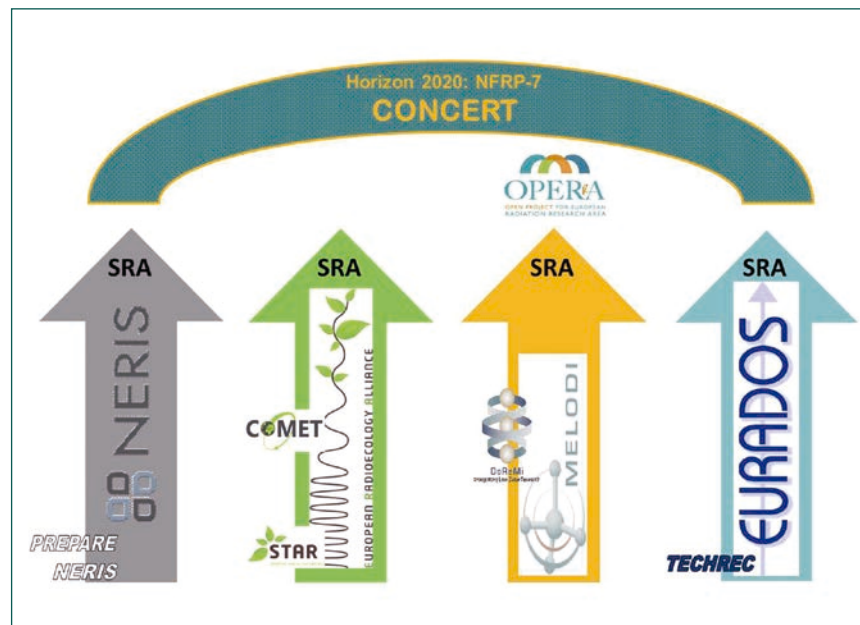


Figure 1. European radiation protection platforms and R&D projects in which they participate.

cellence in Radioecology was created, in the framework of the ALLIANCE and with the financial support of the EC FP7. In June 2013, the project COMET (COordination and iMplementation of a pan-European instrument for Radioecology), also financed by the CE, was launched with the general objective of strengthening the pan-European research initiative on the impact of radiation on humans and the environment and supporting the integration of radioecology R&D activities.

In 2012, the ALLIANCE, in close collaboration with STAR, developed the first Strategic Research Agenda in Radioecology, which identified three main challenges: (1) More robustly predict the exposure of humans and biota by quantifying the key processes that influence radionuclide transfers and exposure; (2) Determine the ecological consequences under realistic exposure conditions; and (3) Improve human and environmental protection by integrating radioecology. In relation to these three challenges, 15 lines of research were identified. After a public consultation in which scientists, regulators, industry and other stakeholders participated, and after taking the comments and suggestions received into account, a second version of the Strategic Agenda was drawn up in

2013 (www.radioecology-exchange.org).

Recently, the ALLIANCE, in collaboration with the COMET project, has started to prepare a short-term (5-year) roadmap to implement the strategic agenda, focusing on five specific topics: atmospheric transfer of radionuclides, marine radioecology, human food chain, naturally occurring radioactive materials (NORM), transgenerational effects and radiosensitivity of species.

In addition to collaborating with the other European radiation protection platforms, the ALLIANCE closely collaborates with the International Union of Radioecology (IUR), e.g. in the organization of the international radioecology and environmental radioactivity conference (ICRER) that is held every three years. The ALLIANCE has recently formalized its relation with Committee 5 of the International Commission on Radiological Protection (ICRP) in charge of the radiation protection of the environment, and at present is an official Liaison Organization of the ICRP.

The ALLIANCE is an open association that welcomes all groups from around the world that do research in areas related to radioecology. All information on how to join the ALLIANCE is available on its website: <http://www.er-alliance.org/>.

MELODI: MULTIDISCIPLINARY EUROPEAN LOW DOSE INITIATIVE



Although the health risks of exposures at high doses of ionizing radiation are well known and effectively treated by current radiation protection measures, there are still uncertainties today about the biological effects of low radiation doses. To answer these questions, the EC and five of the EU Member States that take part in the EURATOM Program established a High Level Experts Group (HLEG) in 2008 in order to identify the research needs and propose improved integration of the European efforts in the field of protection against low radiation doses. In 2009, the HLEG proposed the creation of a European platform devoted to the research of the health risks of exposure at low doses, MELODI (Multidisciplinary European Low Dose Initiative). In 2010, MELODI was registered as an association with 15 founding members, among them the UAM and the URV. Since then, the number of members in MELODI has increased to 30 with the incorporation of other institutions, including CREAL and UAB of Spain.

MELODI has three fundamental objectives: (i) give priority to, promote and coordinate research into the risk of low doses in Europe with an open, integrating approach and adopting a strategic research plan; (ii) create a space for dialogue with national and European institutions, as well as with any party interested in this type of problem; and (iii) interconnect with international partners (e.g. the WHO, American and Japanese partners with responsibilities in the low dose field, etc.).

The purpose of MELODI is to coordinate and promote European research of the risks of exposure to low doses of ionizing radiation. To this end, its activities are aimed at defining the research priorities of the low dose risk and identifying research programs and resources to be implemented in order to achieve the proposed objectives. One of

the main activities of MELODI is to establish and update a Strategic Agenda of long-term research on the effects of low radiation doses. Its intention is to guide the priorities of national and European research programs with a view to implementing measures that improve the current radiation protection programs in Europe. The main scientific questions addressed in the Agenda are: (i) the shape of the dose-response curve in relation to the appearance of carcinogenic processes; (ii) individual sensitivity to radiation; and (iii) the impact of low doses on the appearance of diseases other than cancer. In addition, the Agenda considers issues of an inter-sectoral nature related to: (i) the quality of the radiation; (ii) tissue sensitivity; and (iii) internal emitters. The Agenda is regularly updated based on an open dialogue with the scientific community and the different stakeholders in workshops annually organized by MELODI. Another important activity is to ensure the availability of key infrastructures for the research activities regarding the risks of low radiation doses. Training and education are other no less important activities of MELODI, as it is essential to ensure an appropriate level of competence in research in the long term and the assessment of the health risks of exposure to low radiation doses.

At present the structure of MELODI basically consists of a Governing Body that directs the association and the General Assembly, which discusses the agenda of topics proposed by the Governing Body. In addition, there are work groups for specific topics that provide the necessary information to the Governing Body for undertaking the activities of MELODI (<http://www.melodi-online.eu/>).

EURADOS: EUROPEAN RADIATION DOSIMETRY GROUP



A radiation dose, in any of its definitions, is the essential parameter on which to base any activity in radiation protection, but it is also essential in the risk-benefit optimization in

medical radiation diagnosis. There are numerous fields of activity that require reliable radiation dose measurements and there is also a large collective of professionals involved in these measurements.

EURADOS (www.eurados.org) is a European Association registered in Germany as a non-profit Society that promotes coordinated research and development in the field of ionizing radiation dosimetry. It currently has 68 members (Voting Members) and more than 540 scientists (Associate Members) who participate in the different activities promoted by the organization: research projects, work groups, intercomparison activities, congresses and training actions. EURADOS is a self-sustaining platform whose sources of funding are the members' fees, European R&D calls and the activities organized by the work groups such as courses and intercomparisons. EURADOS includes experts in dosimetry, reference centers, regulators, R&D laboratories and dosimetry services. EURADOS is directed by the Council (CIEMAT is one of the members), which is presided over by the platform director. The Annual Meeting is organized once a year and consists of the General Assembly, Winter School, work group meetings and presentation of the results of intercomparison exercises. Every five years, EURADOS organizes the Individual Monitoring of Ionizing Radiations Congress to present the latest advances in personal internal and external dosimetry, ambient and retrospective dosimetry, implementation of quality systems in dosimetry, R&D actions and harmonization, application and development of Monte Carlo methods and computational models, and high energy and neutron dosimetry. EURADOS grants 1 short-term internship (€3,000) and two special prizes (€500 each) to young researchers who work in the field of ionizing radiation dosimetry.

EURADOS has developed a Strategic Research Agenda for ionizing radiation dosimetry that covers five visions and defines key research issues for the decades to come. The five visions of EURADOS are: (1) Toward fundamental updated dose and quantity concepts; (2) Toward improved estimates of the radiation risk, deduced from epidemiological cohorts; (3) Towards an effective dose assessment for radiological



emergencies; (4) Towards personalized dosimetry integrated into medical applications; (5) Towards improved radiation protection of workers and the public.

In June 2016, the EURADOS Council organized a consultation of the dosimetry stakeholders in order to improve the strategic agenda based on the comments of ICRP, ICRU and up to 25 international entities and organizations related to radiation protection in general, and dosimetry in particular.

In addition to CONCERT, EURADOS currently participates in project TECHREC (EC-DG ENER, 2014-2016) as part of work group WP7-Internal Dosimetry (in which the CIEMAT takes part), to draw up the European Technical Recommendations in Internal Dosimetry. In the framework of OPERA (EURATOM FP7), projects SHAMISEN, "Nuclear Emergency Situations. Improvement of Medical and Health Surveillance" (coordinated by CREAL), and CATHYMARA, "Child and Adult Thyroid Monitoring After Reactor Accident", in which the CIEMAT participates, have been launched in January 2016.

A very important activity of EURADOS is the organization of laboratory intercomparisons. Three exercises have been announced for 2016, on: body dosimeters in photons and beta radiation fields, eye lens dosimetry and measurements and dose evaluation of radioiodine in thyroid, the latter in collaboration with the U.S. Lawrence Livermore National Laboratory.

NERIS: EUROPEAN PLATFORM ON PREPAREDNESS FOR NUCLEAR AND RADIOLOGICAL EMERGENCY RESPONSE AND RECOVERY



Nuclear safety and radiation protection have common objectives in the application of the defense in depth criterion (i.e., prevention, mitigation,

response and long-term recovery). Even though significant improvements have been achieved in the management of nuclear and radiological emergencies, a coordinated European approach is essential for emergency preparedness, in order to improve the efficiency of protection strategies, improve citizen protection and gain the trust of the public in the authorities and decision makers.

NERIS was created in 2010 with the mission of establishing a forum for dialogue and methodological development between the scientific community and all the European organizations and associations that take part in decision-making in emergency and post-emergency situations.

Since 2012, NERIS is registered as a legal European Association under French law. At present it has 59 members from 25 countries, which represent European authorities, professional, technical support and non-governmental organizations, research institutes and universities, and other national and local players and stakeholders. Of these 59 members, 28 support the legal association by helping to finance the Platform and, therefore, they are full members with decision-making powers in the General Assembly, Executive Committee and other governing bodies. The CIEMAT, with a representative on the R&D Committee, the UPM, with a representative on the Executive Committee, the University of Valencia and TECNATOM are the Spanish members of NERIS.

The objectives of NERIS are to improve the effectiveness of the current European, national and local approaches to preparedness for nuclear or radiological emergency response and recovery, to promote greater consistency and coordination of governmental actions in the European framework, to confront the present and future challenges in this field by identifying the deficiencies and needs for future developments, and to maintain and improve the technical experience and know-how acquired in Europe.

To achieve these objectives, NERIS undertakes different activities, basically through work groups and by organizing events and training courses. The RODOS Users Group exchanges experiences and ensures the operation and maintenance of the JRODOS (Real-time On-line Decision Support) system. The website (<http://www.eu-neris.net/>) and the periodic news bulletins report and publicize all these activities. Relationships and cooperation with other key networks and organizations (HERCA, AEN, IAEA and ICRP), in addition to taking advantage of past experiences – such as in the case of the Fukushima accident – for developing emergency preparedness and recovery in Europe, are other examples of the practical, focused nature of NERIS.

The scientific component of NERIS is developed through a Strategic Research Agenda, which distinguishes three key areas of action: (i) Improvement needs in Atmospheric and Aquatic Modeling; (ii) Improvement of dose assessments and support for decisions based on better knowledge; and (iii) Participation of the stakeholders and local preparedness and communication strategies. The Agenda identifies 7 priority lines of research, some of which have been developed in European projects such as NERIS-TP and PREPARE.

In view of the results obtained and in the framework of project CONCERT, it has been agreed to revise the Strategic Agenda. The priorities identified for future developments include the key role of the decision-making processes focused on the management of uncertainties in emergency response and recovery, robust decision making, strategies for preparing countermeasures and monitoring plans. To address these priorities, one of the main challenges will be to develop a highly multidisciplinary approach, including social and ethical aspects. ■