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### Blueprint of the European Radioecology ALLIANCE functioning

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## Executive Summary

Blueprint of the European Radioecology ALLIANCE functioning describes the outline for functioning and interaction mechanisms of the European Radioecology ALLIANCE suggested by the COMET project and further developed in close consultation with the ALLIANCE. Interaction mechanisms include not only internal interaction with ALLIANCE partners, but also interaction with other research organisations and universities working in the field of radioecology and in other disciplines, as well as with national competent authorities, stakeholders, international interest organisations as well as with European platforms, mainly related with radiation protection research.

The SRA/Roadmap working group with the different topical roadmap working groups, the Observatory Sites considered as important infrastructure for in situ long-term research, our education and training programme and workshop series and our website with repository are considered as important mechanisms for science progression, sustainability and continued visibility.

# 1 Introduction

The EC 6<sup>th</sup> Framework project Futurae ('A Future for Radioecology in Europe', 2006-2008<sup>1</sup>) was launched to produce an analysis of the state of radioecology in Europe. It observed a considerable decrease in the amount of funding allocated within the various Member States as the Framework Programmes for Research and Development (R&D) have been in progress, as well as fragmentation of research teams, problems in coordinating the different business strategies and R&D programmes of the Member States, and a threat of some organisations' facilities being closed after the retirement of experts. To face these challenges and avoid further fragmentation, eight European organizations signed a Memorandum of Understanding (MoU) in 2009 with the intention to bring together, in a step-by-step approach and with an aspiration of sustainability, part of their respective R&D programmes into an integrated transnational programme that would: 1) maintain and enhance radioecological competences and experimental infrastructures in Europe, with an international perspective, and 2) address scientific and educational challenges related to the assessment of the impact of radioactive substances on humans and the environment. This was the basis for the European Radioecology Alliance (ALLIANCE<sup>2</sup>).

The first joint action of the ALLIANCE was to submit a proposal to the EC 7<sup>th</sup> Framework Programme call to get funds to establish the Network of Excellence in radioecology, called STAR (Strategic Network for Integrating Radioecology<sup>3</sup>). The goal was to efficiently integrate important organisations, infrastructures, and research efforts into a sustainable network that contributed to a European Research Area in radioecology. To achieve this, a Joint Programme of Activities was implemented covering integration and sharing of infrastructures; training, education and mobility; knowledge management and dissemination; as well as three key research themes (integrating human and non-human radiological risk assessments; radiation protection in a multi-contaminant context and ecologically relevant low-dose effects).

STAR consortium and ALLIANCE members recognised that their shared radioecological research could be enhanced by prioritising group efforts along common themes of mutual interest. A major step in this prioritisation process was to develop a Strategic Research Agenda (SRA). The SRA outlines a suggested prioritisation of research topics in radioecology, with the goal of improving research efficiency and more rapidly advancing the science. The Joint Programme of Activities continued under COMET (Coordination and iMplementation of a pan-European instrument for radioecology, EC 7<sup>th</sup> Framework<sup>4</sup>) launched in 2013. COMET in its turn strengthened the pan-European research initiative on the impact of radiation on man and the environment by facilitating the integration of radioecological research. In close association with the ALLIANCE, COMET took forward the Strategic Research Agenda as the basis for developing innovative mechanisms for joint programming and implementation (JPI) of radioecological research. To facilitate and foster future integration under a common federating structure, research activities developed within COMET were targeted at

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<sup>1</sup> <http://www.radioecology-exchange.org/content/education-training-and-cross-cutting-studies#FUTURAE>

<sup>2</sup> <http://www.er-alliance.eu/>

<sup>3</sup> <http://www.radioecology-exchange.org/content/star>

<sup>4</sup> <http://www.radioecology-exchange.org/content/comet>

radioecological research needs that were synergistic with the priorities of the other platforms within the area of radiation protection, namely NERIS (European Platform on preparedness for nuclear and radiological emergency response and recovery<sup>5</sup>), MELODI (Multidisciplinary European Low Dose Initiative<sup>6</sup>) and EURADOS (the European dosimetry group<sup>7</sup>). Furthermore, COMET maintained and developed strong mechanisms for knowledge exchange, dissemination and training to enhance and maintain European capacity, competence and skills in radioecology.

Based on experience under STAR and COMET, and through interaction with the radiation protection platforms mentioned above, mostly via the ALLIANCE, that signed a MoU with these three European platforms, and with the other EC-funded projects such as OPERRA (Open Project for European Radiation Research Area<sup>8</sup>) and EJP CONCERT (European Joint Programme for the Integration of Radiation Protection Research<sup>9</sup>), COMET suggested an outline for functioning and interaction mechanisms of the ALLIANCE which was further developed in close consultation with the ALLIANCE members. Interaction include not only internal interaction within ALLIANCE, but also interaction with research organisations, universities working in the field of radioecology and in other environment-related disciplines, as well as with national competent authorities, stakeholders, international interest organisations as well as other European platforms, mainly related with radiation protection research.

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<sup>5</sup> NERIS: European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery, <http://www.eu-neris.net>

<sup>6</sup> MELODI: Multidisciplinary European Low Dose Initiative, <http://www.melodi-online.eu>

<sup>7</sup> EURADOS: European Dosimetry Group, <http://www.eurados.org>

<sup>8</sup> OPERRA: Open Project for the European Radiation Research Area, <http://www.melodi-online.eu/operra.html>

<sup>9</sup> CONCERT: European Joint Programme for the Integration of Radiation Protection Research, <http://www.concert-h2020.eu>

## 2 Internal interaction

### 2.1 Basis of the European Radioecology ALLIANCE

The European Radioecology Alliance was officially registered in 2012 as an Association “loi 1901” under the French law. The main purpose of the ALLIANCE is to coordinate and promote European research on radioecology. The ALLIANCE is a Research Platform, in accordance with relevant European Union policies, that aims to contribute not only to the definition of priority objectives in the European radioecology research, by identifying research programmes and resources to be implemented, but also to the promotion of communication on these issues between the various actors and parties involved and to education and training.

The ALLIANCE is composed of Founding members, Subscribing members and Honorary members. The admission of new Members is recommended by the Board of Directors to the General Assembly, which approves or rejects the admission after examining the proposed candidatures. The candidates for admission as subscribing members must send a statement of support for the ALLIANCE, signed by the responsible of the organization, which template is available in the ALLIANCE webpage (<http://www.er-alliance.org/>)

The Governance bodies of the ALLIANCE are the Board of Directors, the Bureau (composed of a president; a vice president; a secretary and a treasurer) which is chosen by the Board of directors; and the General Assembly in which all the ALLIANCE members are represented. The functioning structure of the ALLIANCE is described in detail in its Statutes which are publicly available in the ALLIANCE webpage.

The ALLIANCE is open to other organisations that have similar missions or interests in the field of radioecology and that are willing and capable to contribute to the goals of the ALLIANCE. Since its creation, the ALLIANCE has progressively grown, going from the 8 founding members in 2012 to 27 members, from 14 countries, in April 2017.

The activities of the ALLIANCE are organized within working groups, in which any interested member can participate. These working groups provide input to promote ALLIANCE functioning, strengthen integration and sustainability and provide also input to the CONCERT EJP project. At present, the active WGs are:

- SRA and Roadmap, which also hoes the Topical Roadmap working groups
- Marine radioecology
- Human food chains
- Naturally-Occurring Radioactive Materials (NORM)
- Atmospheric radionuclides in transfer processes
- Transgenerational effects and species radiosensitivity
- Infrastructures an sustainability
- Education and training
- Stakeholder involvement



In 2017, the ALLIANCE Bureau launched a mechanism to fosters integration and collaboration between its members, by funding the organisation of workshops, meetings of the topical roadmaps working groups, among other activities. In January 2017 a 1<sup>st</sup> call was launched to fund small research projects. The proposed activity had to be in line with the Strategic Research Agenda of the ALLIANCE and to contribute significantly to one of the topical roadmaps developed, or to progress an existing tool or database of interest for radioecology (ERICA, CROMERICA, FREDERICA, WTD). The proposals should involve a minimum of two ALLIANCE partners and have a maximum duration of 1 year.

After analysing the results of this 1<sup>st</sup> Call, ALLIANCE realised that not all their members could apply to this call, due to administrative restrictions of their organizations to receive money from the association. Therefore, in the ALLIANCE General Assembly in April 2017 it was decided that this was not a cost effective and equal way to use the ALLIANCE's money. It was proposed that the Board of Directors should define a mechanism to fund activities related with mobility of researchers – especially young researchers, organization of workshops, participation of the members in the meeting of the topical roadmap working groups, etc. The new mechanism will be available by July 2017.

The ALLIANCE has a webpage (<http://www.er-alliance.org/>), with information on its members, the rules to join the association and other news directly related activities of the Association. In its General Assembly of 2016, the ALLIANCE decided to sustain The Radioecology Exchange, developed during the STAR and COMET projects, recognising that this page is a reference in the radioecology community, since offers the most updated information on research, infrastructures, education & training, news and events in the field of radioecology and related disciplines (<http://www.radioecology-exchange.org/>).

In addition, ALLIANCE has a workspace, restricted to its members, where the work documents are stored: Meetings and General Assembly agenda, minutes, working documents on the topical roadmap, information on the ALLIANCE working groups created to give input to the EJP CONCERT<sup>10</sup> project, etc.

## **2.2 The Strategic Research Agenda and roadmap**

The ALLIANCE Strategic Research Agenda (SRA) devoted to Radioecology is a living document, initiated by the STAR Network of Excellence, defining a long-term vision (20

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<sup>10</sup> EJP-CONCERT: The [‘CONCERT-European Joint Programme for the Integration of Radiation Protection Research’](#) under Horizon 2020 is operating as an umbrella structure for the research initiatives jointly launched by the radiation protection research platforms MELODI, ALLIANCE, NERIS and EURADOS. CONCERT is a co-funded action that aims at attracting and pooling national research efforts with European ones in order to make better use of public R&D resources and to tackle common European challenges in radiation protection more effectively by joint research efforts in key areas.

EJP: The European Joint Programme ('EJP') under Horizon 2020 is a co-funded action designed to support coordinated national research and innovation programmes. The EJP aims at attracting and pooling a critical mass of national resources on objectives and challenges of Horizon 2020 and at achieving significant economies of scales by adding related Horizon 2020 resources to a joint effort.

years) on the needs and implementation of research in radioecology (SRA available at <https://wiki.ceh.ac.uk/x/YoFsD> ). Perfectly integrated in the research strategy implemented by the COMET consortium, this SRA constitutes the reference document shared by stakeholders and researchers. Moreover, it was produced to serve as an input to those responsible for defining EU research call topics. The current reference document is the second version released in September 2013, taking account of input from stakeholders collected during an international workshop (Paris, November 2012) and a wide on-line consultation led during summer 2012.

The first short-term (5-y) scientific roadmap for Radioecology, released as a COMET deliverable in September 2013 (COMET D2.1, Vandenhove et al., 2013), was a first transitional implementation plan to structure and enhance interactions between the ALLIANCE and two existing European research platforms, namely NERIS and MELODI. These two documents, the SRA and the first transitional roadmap, have constituted two of the essential elements for preparing the scientific programme for radioecology in harmonisation with MELODI, NERIS and EURADOS, performed within the EJP CONCERT project. Some of the research areas for radioecology are also relevant for post-emergency management and low-dose effect research and provide a powerful catalyst to further develop collaboration between the four platforms of radiation protection, ALLIANCE, NERIS, MELODI and EURADOS.

The EJP CONCERT, where ALLIANCE is a partner next to the other research platforms (MELODI, NERIS, EURADOS and more recently EURAMED<sup>11</sup> for the medical field), was launched in June 2015. A new mechanism has been adopted to assist the definition of the research priorities needed for the two calls for proposals managed by CONCERT: this mechanism consists in requesting annually each platform to rank and justify a limited number of priorities extracted from their respective SRA consistently with the major outcomes from recent and ongoing projects. From the beginning of CONCERT, the ALLIANCE has produced 2 annual SRA statements (2015 and 2016).

Following COMET, under the EJP-CONCERT, a Joint Roadmap based on research lines resulting from the Strategic Research Agendas of each of the existing platforms (i.e. ALLIANCE, MELODI, NERIS, EURADOS and SHINE (Social Sciences and Humanities in Ionizing Radiation Research, under preparation) and EURAMED (The European alliance for medical radiation protection research)) will be produced. The Joint Roadmap is needed to establish a consensus based taxonomy of priority research goals at European level, based on societal needs, to help structure efficiently future Euratom (and other) calls, ensure synergies between platforms, and secure medium/long term funding for priority objectives. The joint roadmap should give an understandable link between the societal concerns with ionizing radiation exposure and the science needed. In addition to preparing a joint roadmap, each platform's roadmap should be reviewed by the others in order to recognize where platforms can enhance each other's research through collaboration. The ALLIANCE contribution to the Joint Roadmap reinforces the cross-cutting characteristics of radioecology and

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<sup>11</sup> EURAMED – The European alliance for medical radiation protection research, <http://www.eibir.org/scientific-activities/joint-initiatives/european-alliance-for-medical-radiation-protection-research-euramed/>

environmental issues. The Radioecology SRA has clearly supported the need for joint research by showing the best direction to take and how to optimally use our resources.

The ALLIANCE SRA will be updated under CONCERT and a new version released in 2019, similarly to the other platforms. This update will make use of the outcomes from a stakeholder meeting dedicated to radioecology as a satellite event of the ICRP-ERPW<sup>12</sup> event in Paris (10-12 October 2017). One important driver for the SRA update is to integrate the progress accomplished by funded projects to finish some priority research lines, add some new ones and/or reformulate some others. The evaluation phase of the progress done will assist the justification underlying the global roadmap of the ALLIANCE, the latter encompassing the topical roadmaps outcomes. The consultation phase in Paris to help the update, will be implemented for the global and topical roadmaps on one hand and the drivers of the SRA on the other hand.

Such a consultation mechanism could be regularly done, e.g. every 3 to 5 years, preferably in a coordinated way among all the research platforms.

## **2.3 Mechanisms of sustainable cooperation**

### **2.3.1 The topical roadmap working groups**

The SRA and its annual statement are being complemented by topical roadmaps that have been initiated by the EC-funded COMET project, with the help and endorsement of the ALLIANCE. The roadmap working groups were established to develop a context to advance in the challenges and priorities put forward in the SRA in a structured way and in large part realised through own funding by the participating partners.

The topical roadmap working groups are in principle powerful tools for progressing in science on complex issues which require to be addressed by several partners, for fostering integration and contribute to European Joint Programming. The intention is that through the shared effort of the participating organisations advances in science can be made, partially or largely based on own research funds. This is only possible when the participating institutes also partially angle their research priorities to the priorities of the global European radioecology research community as identified in the SRA and endorsed by stakeholders.

A prioritization process was developed to select among the research lines identified in the SRA. Those criteria in turn, should emerge from the overall strategy. The strategy underlying the roadmap development is driven by the need for improvement of mechanistic understanding across radioecology such that we can provide fit-for-purpose human and environmental impact/risk assessment in support of protection of man and the environment in interaction with society (connecting science, communication, economy) and considering the three exposure situations defined by the International Commission on Radiological Protection, ICRP (*i.e.*, planned, existing and emergency).

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<sup>12</sup> The 4<sup>th</sup> International Symposium on the System of radiological Protection of INTERNATIONAL Commission on Radiological Protection, ICRP and for the 2<sup>nd</sup> European Radiation Protection Research Week of the European research platforms.

A list of research prioritisation criteria was established and the 4 following criteria were retained: IMPACT, ACHIEVABLE, RELEVANCE AND PUBLIC PERCEPTION, GOOD SCIENCE (for details, please see Annex 1). Secondary (explanatory) criteria were developed which can be used as guidance when applying the primary criteria.

Several topical working groups, each dealing with specific scientific areas and/or complex environmental issues, were launched under COMET or ALLIANCE and have defined a 5-y topical roadmap:

- 1) Marine radioecology
- 2) Human food chain
- 3) Naturally Occurring Radioactive Materials (NORM)
- 4) Transgenerational effects and species radiosensitivity
- 5) Atmospheric radionuclides in transfer processes.

On a yearly basis, topical roadmaps will be presented and discussed/evaluated by the ALLIANCE BoD and the SRA-WG. Roadmap working groups can be discontinued on request of the roadmap WG or after discussion at the ALLIANCE GA.

New topical roadmaps can also be introduced . Topical Roadmap working groups are launched via a two-step process. The 'roadmap initiation template' (for details, please see Annex 2) asks for input on title/acronym, leadership and/or initiating partner(s), topical area, Broad Objectives, Justification based on answers to the criteria for prioritisation of research, question(s) to be addressed, Related challenge(s) and research line(s) in the Radioecology SRA, potential collaborators. These roadmap initiation templates will be discussed at the level of the ALLIANCE Board of Directors (BoD) and the ALLIANCE SRA working group. Topics that are considered relevant based on the criteria specified and for which there is enough critical mass to perform the activity will be asked to be further developed in a second template (see Annex 2) where input is asked on intended activities and work plan, which implies planned research activities and time scale, resources (committed by partners, requested funds and targeted calls, major elements of the communication plan, links with other activities identified at the national and the international levels.

A new topical roadmap WG will be established on hot particle research. This WG will interact with the IAEA –CRP on particles.

### 2.3.2 The Observatory Sites Working Groups

Radioecological Observatories are contaminated field sites that provide a focus for long term joint field investigations. The development of a pooled, consolidated effort maximises the sharing of data and resources as well as providing training and educational sites. Four contaminated sites have been selected under the STAR NoE and COMET: the Chernobyl Exclusion Zone, the aquatic environment of current and previous coal mining and processing sites in Poland, a forest in the Fukushima prefecture in Japan affected by the accident at the Fukushima Dai-ichi NPP and a Belgian phosphate industry waste landfill site "Kepkensberg".

More information on the Observatory Sites can be found on the [Radioecology Exchange website](#) and in Annex 3 of this document.

The Observatory WGs were formed under the COMET project to coordinate the RTD activities performed in the four Observatories selected:

- Chernobyl Exclusion Zone (CEZ): contact person Nick Beresford (CEH, UK)
- Fukushima exclusion Zone (FEZ): contact person Hirofumi Tsukada (Fukushima University, Japan)
- Aquatic ecosystem in the former mining and processing area in Poland: contact person Boguslaw Michalik (GIG, Poland)
- Belgian waste landfill from phosphate industry "Kepkensberg": contact person Nathalie Vanhoudt (SCK-CEN, Belgium)

New sites can be proposed, but their suitability should be evaluated based on a number of selection criteria as developed under STAR (MILESTONE 2.3: Selection criteria for the European Observatory sites). A need of a new, marine Observatory Site has been identified.

For the Observatories to be successful in the future there needs to be a willingness amongst ALLIANCE partners to:

- Inform each other of research plans and be willing to be flexible on timetabling, such that local collaborators are not put under undue pressure and resources are best utilised.
- Openly invite participation from ALLIANCE members.
- Consider jointly supervised PhD studentships as a mechanism of collaborating for comparatively little external funding.
- Make data openly available.

The Observatories need to be advertised to researchers and funders: what research opportunities do they present, what infrastructure is on site etc. The Observatories should not become a reason to conduct studies (i.e. 'we have got this Observatory we need to do something there') but rather they should be used in hypothesis driven research. The hypotheses should come from the SRA. Furthermore, the Observatories offer the opportunity to test and validate radioecological models.

The intensity of studies that will be possible at the Observatories is dependent upon funding. The ALLIANCE can act as a coordinator and help develop Observatory Sites (e.g. by making data available), but it cannot finance research at the sites. The ALLIANCE is evaluating possibilities to use EJP-CONCERT funding for infrastructures to further elaborate the Observatory Sites.

#### **2.4 The ALLIANCE Working Groups**

The ALLIANCE has formed in 2014-2015 four working groups on Strategic Research Agenda (SRA) & Roadmap, Infrastructures & Sustainability, Education & Training and Stakeholder involvement that will develop and promote the issues related to their topics in the future as

seen necessary. Integration will also be addressed and further deepened in the future through the EU project CONCERT.

#### 2.4.1 SRA & Roadmap

Under COMET, roadmap working groups developed topical roadmaps as explained above. One of the objectives under COMET was also an update of the SRA but after consultation with ALLIANCE members and the COMET Steering Committee, no actual need for adaption was identified. The ALLIANCE SRA and roadmap WG is now also working in interaction with EJP-CONCERT. More precisely EJP-CONCERT WP2 (Integration and SRA development in radiation protection research) and WP3 (Priority research and joint programming needs in the perspective of European integration). Additionally, a new mechanism was adopted to assist the definition of the research priorities for the two calls for proposals managed by EJP-CONCERT WP4 (Management of the Open RTD Calls). This mechanism consists of requesting annually that each platform ranks and justifies a limited number of priorities extracted from their respective SRA consistently with the major outcomes from recent and ongoing projects. From the beginning of EJP-CONCERT, the ALLIANCE has produced two annual SRA statements (2015 and 2016).

#### 2.4.2 Sustainability and infrastructure

There are a number of activities that will contribute to the overall sustainability of the ALLIANCE (e.g. education and training (E&T), and the ‘mobility funding’ initiative launched in 2017). However, these are considered elsewhere in this document, the focus of the Sustainability Working Group to date has been the future of Radioecology Exchange website (<http://www.radioecology-exchange.org/>) and it’s content.

In preparation for the end of the COMET project, the bespoke STAR ([www.star-radioecology.org](http://www.star-radioecology.org)) and COMET ([www.comet-radioecology.org](http://www.comet-radioecology.org)) websites have been incorporated into the Radioecology Exchange. The STAR and COMET web addresses now redirect to the Radioecology Exchange. NERC-CEH has purchased all three website addresses until at least 2022.

Subsequent to the COMET project finishing some of the pages on the Radioecology Exchange will be ‘frozen’ and no longer updated (e.g. those associated with the STAR and COMET projects). There is an intention to maintain and update other pages (see Annex 4 Table A.2) whilst the future of further pages is still being discussed at the time of writing.

During the course of the STAR and COMET projects the Radioecology Exchange has been maintained by NERC-CEH with the exception that Stockholm University has taken responsibility for the E&T pages. NERC-CEH have committed to providing some support to maintain the site until 2020 (of the order of five person days per year), subsequently this will be reviewed depending upon funding. However, the open source content-management platform (*Drupal*) used to build the Radioecology Exchange allows for people outside of NERC-CEH to contribute to editing the website.

For the Radioecology Exchange to be successfully maintained in the future:

- (i) ALLIANCE members must be willing to supply content;



- (ii) A core team of capable ALLIANCE members must contribute to editing the site.

Without the active inputs of ALLIANCE partners then maintaining the Radioecology Exchange in the future will be unsuccessful. At the time of writing, the E&T pages will continue to be maintained by those responsible for these activities with Barcelona University taking responsibility as the ALLIANCE E&T WG lead. There is a need to delineate between the Radioecology Exchange and the ALLIANCE (<http://www.er-alliance.org/>) websites and this is discussed further in *Dissemination and Communication* below.

### Infrastructure

An inventory of infrastructure covering equipment, methods, bioinformatic equipment and methods, sample archives, models, expertise and facilities for radioecological research was created under STAR NoE. The resultant listing of facilities available for others in the community to access, either as commercial services or through research collaboration, is on the Radioecology Exchange ([Virtual laboratory, Equipment and facilities](#)). The listing is largely restricted to STAR partners.

The infrastructure related work will continue under the CONCERT EJP work package 6. The four main objectives of WP 6 aim to increase the visibility of infrastructures: (i) prepare the criteria and to compile a list of infrastructures; (ii) prepare regular information about infrastructures; (iii) develop harmonised practices and protocols to strengthen and expand databases from past radiobiological experiments and from stored biological material; (iv) to develop strategies for facilitating access to infrastructures. A free web access infrastructure database, AIR<sup>2</sup>D<sup>2</sup>, has been created by CONCERT and is accessible via [www.concert-infrastructures.eu](http://www.concert-infrastructures.eu). It includes suitable infrastructures validated *a priori* by their frequent use in previous researches over the four CONCERT areas: low doses (MELODI), radioecology (ALLIANCE), nuclear accident management (NERIS) and dosimetry for radioprotection (EURADOS). The monthly CONCERT bulletin (AIR<sup>2</sup> “Access to Infrastructures for Radiation protection Research”) introduces infrastructures to the wider community and has already included radioecological infrastructures and databases (via input by COMET partners).

#### 2.4.3 Education and training

The overarching objective of the ‘Knowledge Exchange’ work package (WP5) in COMET was to “enhance and maintain European capacity and skills in radioecology by establishing a dynamic interaction promoting effective collaboration between researchers, tool developers, regulators and industry”. COMET has further developed the E&T web platform initiated by STAR and arranged a number of courses and workshops for students and professionals. Courses and workshops were as short and time-efficient as possible to allow the participation of professionals with high demands on their time. COMET has also given refresher courses in conjunction with conferences, and full PhD and MSc courses for an international audience. In addition, COMET has been engaged in discussions for more long-term solutions to maintain the sustainability of radioecology E&T after the end of COMET. In the future, education and training in radioecology will be led and promoted by the ALLIANCE with the E&T platform of the Radioecology Exchange being maintained by the E&T WG lead. An ALLIANCE E&T working group is already in place and currently comprises nine organisations (UB, NMBU, CEA, IST, IRSN, UP, HZDR, SCK·CEN, CIEMAT). This working group

also connects to E&T WP of CONCERT and to other platforms (e.g. MELODI), consortia and projects (e.g., PETRUS III).

The work will include continuing and building on existing activities (PhD and MSc courses, workshops, training courses, student networking and blogs etc.) started in COMET, as well as the introduction of new initiatives. Future activities should include:

- Maintaining the E&T Platform and updating it with more links to nuclear and radioactivity-related European E&T activities, including E&T activities from ALLIANCE organizations not participating in STAR and COMET.
- Continuation of the two COMET field courses to be held every second year. As part of the signed MoU agreements with NMBU, there is already agreement upon continuing both research and education cooperation post-COMET.
- Searching for common activities and agreements with E&T projects, networks and consortia, in which some ALLIANCE institutions are already participating.
- Further exploring the creation of a European MSc in Radioecology through the Erasmus Mundus Joint Master Degree mechanism. This would be a way to consolidate and secure the future of the European MSc programme currently hosted by NMBU, and developed within STAR and COMET. A survey of COMET partners in 2016 indicated that there was enough support (four universities and four non-universities) to form the basis for an application (COMET Milestone 25).
- Encouraging the establishment of Memoranda of Understanding, Cotutelle agreements and Erasmus PhD funding (see 2.5) to enable joint MSc or PhD students between organisations.
- Establishing the mechanisms to grant short stays of MSc and PhD students within institutes of the ALLIANCE, as well as the attendance at workshops and conferences.
- Having a consolidated offer of professional development courses (besides PhD and MSc programmes), combining ECTS and vocational (ECVET) credits.
- Initiating a mechanism by which students and future employers could make contact in order to arrange work placements, joint research projects, industrial MSc/PhD projects and summer jobs.

While some of these activities can, at least in part, be supported through the participating organizations and collaboration with existing initiatives and networks, their long term success is highly dependent on the procurement of sustainable dedicated funding. Increasing student and teacher mobility, field courses, development of web-based learning tools and distance courses (including the engagement of experts in digital learning) all require sustainable funding mechanisms. Future plans within the ALLIANCE must urgently address this lack of sustainability if radioecological competence is to be maintained in Europe.

#### 2.4.4 Stakeholder involvement

The stakeholder involvement of the ALLIANCE has been mainly limited to key stakeholders of the wider research community concerned with radiation protection of humans and wildlife and regulatory authorities. The web site of the European Radioecology Alliance is rather suited for giving information (i.e. featuring a FAQ site) than for getting information from the public. In 2014, however, the website hosted the OPERRA e-survey giving users the chance to prioritize further research in radiation protection. Besides the ALLIANCE, also the



platforms of MELODI, NERIS and EURADOS were involved in that concerted action. The European Radioecology Alliance had thereby received high scores for all of their 15 research goals, acknowledging them as being relevant for improving radiation protection.

For a broader stakeholder involvement, however, the ALLIANCE is realizing that it would be essential to seek input from social sciences and humanities. Such bridging activities could facilitate the communication with non-expert stakeholders and the wider public, for instance by:

- making scientific results easier to understand without concealing residual uncertainties;
- improving risk communication;
- decreasing prejudices;
- increasing trust and credibility;
- inciting stakeholders to get involved and giving feed-back on their information needs.

As an active partner of the CONCERT stakeholder working-group, the European Radioecology Alliance is presently profiting by a very lively interexchange with social science and humanities. Interaction of the ALLIANCE with the Social Sciences and Humanities (SSH) has been described (see Annex 5). The European Radioecology Alliance has been contributing to the CONCERT Deliverable on “stakeholder involvement and communication in radiation research” and made sure that the radiation protection goals will not only target on humans but also on conserving the biodiversity of wildlife and that environmentalists will be part of the future CONCERT stakeholder group. European Radioecology Alliance is also participating in developing a new questionnaire for getting response from the wide public on radiation protection issues. This questionnaire will be distributed this year. The results will stimulate discussions within the European Radioecology Alliance. The cooperation between the European Radioecology Alliance and CONCERT in the field of stakeholder involvement is very fruitful for both sides.

Roadmapping is of major importance in terms of European research governance. Regarding the roadmaps dedicated to radioecology, the ALLIANCE will coordinate, when relevant, a stakeholders consultation phase and will guarantee the wide dissemination of the outcomes in a spirit openness. Next event, planned during the ICRP-ERPW joint event in 2017 (10-12 October, Paris) will be a “Stakeholder-ALLIANCE interaction” meeting to get the external feedback on the ALLIANCE topical roadmaps, the global roadmap and the drivers of the SRA.

## 3 Interactions with outside bodies

### 3.1 European and international platforms

Within this section we present with which European and international platforms ALLIANCE interacts, within the domain of radioecology and radiation protection or beyond, and the intended approach of the ALLIANCE for future interaction and collaboration.

We here present the view forward. In Annex 4 of this document, the reader can find more context and information about some of the international platforms and the endeavours to establish interaction or co-operation.

### **3.2 Radiation Protection Platforms and Organizations**

#### **3.2.1 Radiation Protection platforms in Europe and EJPs**

Through COMET, OPERRA and CONCERT the Radiation Protection platforms in Europe (ALLIANCE, MELODI, NERIS, EURADOS) and recently EURAMED, have consolidated their interaction. This increased interaction, certainly through EJP CONCERT which intends to establish an umbrella structure for radiation protection research in Europe, also reinforces the position of radiation protection within Euratom. The interaction of ALLIANCE (radioecology) with the other European radiation protection platforms is important and should be continued. Today and in the coming years this is mostly mediated through EJP CONCERT where the platforms, as ALLIANCE, interact for updating SRAs and roadmaps, infrastructure, education and training, stakeholder involvement, the organisation of the Radiation Protection Week.

Within EJP CONCERT, ALLIANCE with the other 4 European radiation protection research platforms as advisory consortium members, represent the wider scientific community, and are responsible for the integrative activities: SRA's and Roadmaps, science direction, call preparation dialogue, interaction with partners outside Europe, interaction with the social sciences and humanities community and with stakeholders at European level, etc. This important task will be continued and ALLIANCE Bureau members and Working Group leaders play an important role. With the other platforms ALLIANCE will continue to organise the annual Radiation Protection Week.

ALLIANCE will also liaise and interact with all radioecology related Euratom projects and evaluate with the respective project coordinators how this interaction is best accomplished in order that radioecology related and relevant project outcome is not again dispersed but centred and consolidated by the ALLIANCE.

#### **3.2.2 ICRP**

Since 2016, ALLIANCE is Liaison Organisation of the ICRP and the ALLIANCE president will be invited to participate at the annual ICRP Liaison Organisation meeting and to take part in discussions of global interest. The ALLIANCE will continue to participate and these Liaison meetings and invite ICRP to our events. ICRP members are also invited to join the ALLIANCE roadmap Working Groups (WG).

#### **3.2.3 IUR and the FORUM**

The International Union on Radioecology (IUR) and the ALLIANCE have signed a Memorandum of Understanding (November 2013). At that time the objectives of co-operation were (1) Promoting the creation of a common strategy and implementation plans for research; (2) Conducting joint activities and participating in joint task groups; (3) Promoting the conduct of sound research into all aspects of environmental radioactivity and

radioecology; (4) Promoting the exchange of scientific information; (5) Authoring joint publications and presentations.

The most straightforward way of interaction between IUR and ALLIANCE seems through common organisation of events, common E&T projects, contribution to each other's working groups. The ALLIANCE continues to look for other opportunities also.

An initiative based on an initial set of 15 networks, now called the IUR FORUM, was launched in June 2014. The IUR Forum agreed to build a framework for improved coordination of scientific knowledge, integration and consensus development relative to environmental radioactivity. Three objectives have been collectively assigned to the IUR FORUM: (1) coordination, (2) global integration and construction of consensus and (3) maintenance of expertise. ALLIANCE is member of the Forum and will continue its interaction.

#### 3.2.4 IAEA

The International Atomic Energy Agency (IAEA) MODARIA programmes provide a venue for interaction between the ALLIANCE members and the IAEA. The working groups on Effects on the environment, NORM, Site remediation, Model development, Waste and disposal have links with the radioecology SRA. There is no formal collaboration between ALLIANCE and IAEA, however many ALLIANCE members actively contribute to these IAEA projects (including as working group leaders). This interaction should continue in the future, but the ALLIANCE needs to evaluate how we can better promote our SRA priorities to be taken up in the IAEA programmes.

#### 3.2.5 European platforms with links to Radiation Protection and Radioecology

There are several platforms which have more distant links to radioecology and the ALLIANCE:

NUGENIA (Nuclear Generation II and III Association) is an international non-profit Association devoted to R&D on fission technology of Generation II and III. NUGENIA wants to promote a better liaison and synergy between the Nuclear Safety and Radiation protection communities. Potential mutual interest domains are: Reducing the uncertainty on environmental impact assessments, improving the emergency preparedness and response and Public and environmental radiological protection for core and reactor operation .

IGD-TP's (Implementing Geological Disposal of Radioactive Waste Technology Platform) core scope is with implementation-oriented R&D activities on all remaining key aspects of deep geological disposal of spent fuel and long-lived radioactive waste. Topics of potential common interest are most likely in the IGD-TP key topics 1: Safety case; 5: Safety of construction and operations; 6: Monitoring; 7: Governance and stakeholder involvement.

EURAMET's (The European Association of National Metrology Institutes) mission is to develop and disseminate an integrated, cost effective and internationally competitive measurement infrastructure for Europe. ALLIANCE can, through some of its members, participate at the calls launched by EURAMET. The fact that participants to projects must from now on be assigned designated labs, it will be very difficult for ALLIANCE (partners) to

participate in projects. Nevertheless, regular interaction between the radiation protection community on one hand, and the metrology on the other hand is important. For EURAMET it is a win to have direct contact with the radiation protection community as stakeholder / end user of metrology, whereas input from metrology into radiation protection research can result in reduced uncertainties in risk assessment.

So far, effective interaction and collaboration with these platforms was not yet accomplished but ALLIANCE will keep eyes open for opportunities.

### 3.2.6 Conclusions for the interaction with outside bodies

- Continue involvement in EJP-CONCERT and similar future EJPs.
- Within EJP or similar structure, represent the wider scientific community, and be responsible for the integrative activities: SRA's and Roadmaps, science direction, call preparation.
- Interact with European projects linked with radioecology (e.g. TERRITORIES<sup>13</sup>, CONFIDENCE<sup>14</sup>) to take up, disseminate and consolidate advances in radioecology R&D.
- Continued interaction with international RP organisations with link with radioecology (ICRP, IAEA, IUR, ) and develop mechanisms and scope of effective collaboration. Follow-up evolution in European platforms with link with radioecology (IGD-TP, EURAMET, NUGENIA) and be open for interaction

### 3.2.7 Other European projects

The emergence of sustainable research platforms MELODI, ALLIANCE, NERIS and EURADOS operating through joint research agendas made it possible to bring together all these platforms under one umbrella structure, addressing research on radiation protection. Within the OPERRA project (Open Project for European Radiation Research Area), the MELODI Association took the lead in establishing the necessary structures able to manage the long-term European research programmes in radiation protection. Whilst in fields adjacent to low-dose risk research (radioecology, nuclear emergency management) scientific issues would continue to be hosted by the sister associations, ALLIANCE and NERIS, these associations were encouraged to join MELODI to establish an umbrella structure as equal partners, as were other relevant associations, e.g. EURADOS - the European Dosimetry Group.

The EJP-CONCERT (European Joint Programme for the Integration of Radiation Protection Research) proposal sent to H2020 European Joint Programme (EJP) call in Sep 2014 was accepted. The research platforms ALLIANCE, MELODI, NERIS and EURADOS are partners in the consortium. CONCERT aims to develop a sustainable structure for promoting and

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<sup>13</sup> TERRITORIES = To Enhance uncertainties Reduction and stakeholders Involvement TOwards integrated and graded Risk management of humans and wildlife In long-lasting radiological Exposure Situations <http://territories.eu>

<sup>14</sup> CONFIDENCE - COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCIes - <https://portal.iket.kit.edu/CONFIDENCE>

administration of joint programming and open research calls in the field of radiation protection research for Europe. Activities of the CONCERT consortium will focus on (i) the aspects of support to develop an integrated landscape for radiation protection research in Europe and (ii) to directly fund coordinated research projects in an open, fair and transparent manner dedicated to state of the art science and tailored to the radiation protection needs of the society, authorities and stakeholders. Integration of education and training in the research agenda as well as optimal use of research infrastructures in Europe and even beyond are essential for the consortium. National programmes are represented by national Program Owners or Programme Managers nominated by them.

The ALLIANCE has made a statement on its role in project proposals and projects. The statement puts into context the role of the ALLIANCE in preparation of project proposals answering national<sup>15</sup>, European or international calls:

1. The ALLIANCE affirms its role to coordinate, integrate and promote radioecology research and related technological applications in Europe. Relevant activities include to: develop a Strategic Research Agenda, road maps and associated implementation plan, recommend research priorities; function as an information exchange and communication platform; promote education and training and; elaborate new funding mechanisms.
2. Given this, the ALLIANCE states the following position regarding its potential involvement in national, European or international projects:
  - If the project deals with governance of research and joint programming (such as a NoE, EJP), the ALLIANCE can be actively involved. The ALLIANCE if invited to be part of the consortium would represent the European radioecological community, fulfilling its role as described above (The ALLIANCE currently participates in the CONCERT EJP in this role).
  - For specific research projects the ALLIANCE could be a member of the project's scientific or steering committee if invited.
  - Where appropriate the ALLIANCE may issue 'letters of support' for a given proposal if it is deemed to further our SRA and associated roadmaps.
3. The ALLIANCE Board of Directors will decide on a case by case basis (two-third majority vote for decision) if the ALLIANCE will join a proposal/project based on three criteria: maintaining its impartiality, relevance (added value for ALLIANCE and its members), scope of requested involvement).
4. All members of the ALLIANCE are free to join any research consortia.

### **3.3 Dissemination and communication**

Dissemination activities in the STAR NoE were carried out via a range of activities, the most important of which was the development of the Radioecology Exchange, which has continued to be developed by COMET. The creation of [www.radioecology-exchange.org](http://www.radioecology-exchange.org) as the gateway to accessing on-line radioecological resources and news items, was a major step

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<sup>15</sup> "national" refers to states of the ALLIANCE members.

forward in providing a wide range of information on environmental radioactivity in a single web site. The portal has pages on Training and Education, Information Exchange, the SRA, the Virtual Laboratory, Workshops and Observatories, and a News blog. The Virtual Laboratory provides access to methods, procedures and protocols; facts, figures and data useful to radioecology. The [Information Exchange](#) provides access to STAR and COMET partner publications, publication catalogues, newsletters, FAQ's and links to other websites of interest to radioecology.

### **3.4 Radioecology Exchange and social media**

The Radioecology Exchange will remain as a mechanism for ALLIANCE members communicating their activities (see above). The ability to post news items, studentships or vacancies will be retained on the site.

The @RadioXchange *Twitter* account will also continue to be used to communicate with a wider audience; the *Twitter* feed automatically links to the *facebook* page <https://www.facebook.com/radioecology/> which is currently managed by NMBU. Whilst access details for the @RadioXchange account were given to all STAR project partners (all of whom are involved in the COMET project) it is only actively used by NERC-CEH, though some ALLIANCE members do occasionally request postings. To best use these social media resources ALLIANCE members in the future need to ensure that they use them to promote for instance, new papers, new projects, conferences etc.

## **4 Conclusions**

The actions jointly taken by various European organisations have been able to slow down the gradual deterioration of expertise and knowledge in the field of radioecology and enhance collaboration.

The ALLIANCE platform has a solid basis, having expanded from the initial eight founding members to 25 members from 14 countries (Belgium, Croatia, Finland, France, Germany, Greece, Ireland, Kazakhstan, Norway, Poland, Portugal, Spain, Sweden and United Kingdom) in 2017. The ALLIANCE is not a project with an end date, depending on external funding, but an association with members committed to sustainable cooperation. However, the funding available under COMET (and previously STAR) has helped the ALLIANCE develop its structural basis. The cascade funding (research calls within the projects) in COMET, OPERRA and EJP-CONCERT has also allowed to quickly react to emerging needs, such as research related to Fukushima.

The work to promote radioecology will continue under the Euratom EJP-CONCERT (2015-2020). EJP-CONCERT aims to develop a sustainable structure for promoting and administering joint programming and open research calls in the field of radiation protection research for Europe. Activities of the EJP-CONCERT consortium focus on (i) supporting the development of an integrated landscape for radiation protection research in Europe and (ii) directly funding coordinated research projects in an open, fair and transparent manner, with that research based on state-of-the-art science and tailored to the radiation protection needs of society, authorities and other stakeholders. Integration of education and training in

the research agenda as well as optimal use of research infrastructures in Europe, and beyond, are essential to CONCERT.

The integration of programmes involving research and development into health and safety issues relating to ionising radiations will be partly achieved by bringing ALLIANCE, MELODI, NERIS, EURADOS, EURAMED and SHINE into a single framework under CONCERT. However, a single framework does not necessarily imply an integrated programme and there remains a need to identify where the various component programmes are complementary and can enhance each other's research through collaboration. It is worth considering cross-cutting themes that are relevant across the different radiation protection programmes. Identification of common requirements in these areas could help in building bridges between the programmes. However, this should not exclude research which is not complementary from future funding as the platforms have their own research needs as defined by their SRAs. Integration with ecological and other environmental sciences also needs to be fostered. It is important to build on an ecocentric vision: Bring more ecology into radioecology and move from biological impact of radiation to ecological impact. There is an obvious need to find a balance between complementary and basic radioecological research.

Radioecology is largely an applied science and the research aims are often described in terms of evaluating actual or potential adverse impacts on human health or the environment. Although this is critical there is also the need to allow curiosity driven research.

Sustainability and further integration need continuing efforts and exploration of new modes of cooperation. The radioecological research community should continue to network and broaden the scope beyond nuclearized countries and beyond Europe. Cooperation with regional/topical scientific networks and sister organisations or networks dealing with non-radioactive stressors is encouraged. In addition, more intensive interaction with end users could be beneficial. A communications/dialogue strategy is needed to appropriately address stakeholder concerns.

There needs to be a strong emphasis on the education and training of the next generation of scientists and experts. External funding is required in order to be able to achieve this and also answer emerging research needs (to support the safe use of radioactivity within Europe).



## Annex 1 – Criteria for research prioritization and development of topical roadmap

### Final List of Criteria for Research Prioritization

Broad Area	Specific criterion	Comments
<b>Impact</b>	<i>Substantial enhancement of knowledge</i>	Required to give confidence to stakeholders and provide an improved capability giving greater confidence in decision making.
	<i>Addresses major unresolved issues relevant to radiological protection</i>	Ensures that the overall enhancement of knowledge is directed to the specific requirements of the radiological protection community.
	<i>Practical applicability</i>	Results can be used directly or readily adapted for use by legislators, regulators, operators and other interested parties
	<i>Public relevance</i>	Seen to be addressing issues of public interest or concern.
<b>Achievability</b>	<i>Realistic on a five-year timescale</i>	Or at least feasible to undertake in stages, so that well-defined interim goals can be achieved and demonstrated within five years.
	<i>Sufficient guaranteed capacity</i>	Sufficient internal resources within the ALLIANCE to deliver a useful product even in the absence of external funding.
	<i>Adequate basis in current knowledge and experience</i>	Builds on existing knowledge and makes use of experience and facilities that are available within the research community.
	<i>Appropriate level of risk of failure</i>	Suitable balance between high risk and low risk components, i.e. there is a need to ensure that some useful outcome is delivered, but this should not stifle the need to undertake speculative work that could lead to a high return if it is successful.
<b>Relevance &amp; public perception</b>	<i>High relevance for protection of humans</i>	Implies a focus on the radionuclides and pathways that contribute most to doses to humans in a variety of assessment contexts.
	<i>High relevance for the protection of wildlife</i>	Includes consideration of biodiversity, ecosystem performance and health, sustainability and protection of endangered species. Again, implies a focus on key radionuclides and pathways in a variety of assessment contexts.
	<i>Relevant to research initiatives in areas outside radioecology</i>	These research initiatives include studies on the effects of low doses, developments in emergency planning and preparedness and dosimetry .
	<i>Addresses major unresolved issues relevant to radiological protection</i>	Duplicates the corresponding item under impact, so could be deleted in one or the other instance.
	<i>Important and relevant</i>	Are the results to be obtained of importance from a public perspective (irrespective of their significance for radiological protection? Are results of relevance to an issue of great public interest. Will results be of direct relevance to members of the public in enhancing their understanding of a given situation and informing their decision making.
	<i>Convincing</i>	Has provision been made to demonstrate why a member of the public should place credence in the results to be obtained, e.g. by explaining the background to the work in appropriate language and showing how it fits within a broader body of scientific knowledge?
<b>Good science</b>	<i>Logical development</i>	Builds on existing understanding and addresses a generally recognised deficiency in that understanding (e.g. due to lack of data or an appropriate conceptual model of the processes and mechanisms of relevance).
	<i>Hypothesis driven</i>	The research should be targeted to support or refute one or more hypotheses of importance for understanding the issue being considered.
	<i>Innovative</i>	In so far as innovation enhances our ability to answer the key questions posed by the research topic.



## Annex 2 – Templates for initiating and launching a Topical Roadmap Working Group



### Template 1 Intention for launching Radioecology Research Working Group

**Title and acronym**

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**Leadership and/or initiating partner(s)**

.....

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

.....

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

.....

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

.....

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

.....

**Interested parties**

.....



## Template 2

### Terms of Reference for Radioecology WG *(in a second stage)*

#### Title and acronym

.....

#### Topical area (reminder)

.....

#### Leadership

.....

#### Partners with a brief description of their assigned role

.....

#### Intended activities (task, approach, steps to accomplish, expected outcomes)

.....

#### Starting date and estimated duration of the WG to accomplish its plan

.....

#### Work plan

- **Planned research activities and time scale:** tasks, responsibilities, participants, use of observatory sites, use of large scale facilities, milestones, deliverables, resources committed by partners (estimated man.months, indoor funds), requested funds and targeted calls (EC Call, other calls)
- **Major elements of the communication plan** (workshops, publications, guidance documents...)
- **Links with other activities** identified at the national and the international levels
- **Potential problems, gaps/lack of knowledge**, etc. that might prevent the accomplishment of the research

## Annex 3 – Short descriptions of the four radioecological Observatory Sites

### ***Chernobyl Exclusion Zone Observatory***

COMET partners have collaborated to conduct studies on radionuclide transfer to wildlife and agricultural products, and also radiation effects to a range of wildlife species (frogs, earthworms, plants). During this time there has been co-ordination between COMET activities and national programmes of the partners to avoid overloading local partners and also to make the most use of our combined resources.

It is likely that papers from the COMET studies will continue to be published over the next 1-2 years. Authors should be encouraged to make all of their data available (e.g. through the CONCERT supported STORE database (<http://www.storedb.org>)); this was a key recommendation of a COMET sponsored workshop focused on research in the CEZ (Barnett et al. 2016). Currently there are plans to make available (by end of 2017): (i) the NuBIP 'PROBA' database of spatial datasets for the CEZ via STORE; (ii) datasets on animals transfer held by NERC-CEH and Chornobyl Center via the NERC Environmental Informatics Data Centre (EIDC); (iii) dataset on soil biological activity from studies conducted by NERC-CEH, Chornobyl Center and University of Salford via the EIDC.

ALLIANCE partners have plans for conducting collaborative studies within the CEZ until at least the end of 2019:

- 1) Studies on the effects of radiation on birds (focusing on corticosterone in feathers as a non-invasive biomarker) – a PhD studentship co-supervised by NERC-CEH, IRSN and the University of Stirling (with the Chornobyl Center collaborating);
- 2) CONFIDENCE project (funded under H2020 via the CONCERT project; see <http://bit.ly/2l41n4h>) – CONFIDENCE will use the CEZ in studies of hot particles and to validate Sr models. ALLIANCE members are NERC-CEH (work package leader), NMBU, NRPA, SCK-CEN and the University of Extremadura (with NUBIP collaborating);
- 3) RED FIRE (funded by the UK Natural Environmental Research Council; see <http://bit.ly/2kiMLMK>) – RED FIRE is focused on the aftermath of the July 2016 Red Forest fire investigating the effects of radiation on ecosystem recovery and the effect of fire on radionuclide mobility. The project is led by ALLIANCE member NERC-CEH with NMBU collaborating along with the universities of Salford and Nottingham, NUBIP and Chornobyl Center.

Additionally, it is likely that ALLIANCE partners will be involved in national studies (e.g. the UK project TREE (<http://tree.ceh.ac.uk/>) lead by NERC-CEH will be working in the CEZ until the autumn 2018).

For the other observatories access is in-effect 'controlled' by the ALLIANCE lead for each site and as such collaborations will be required if work is to be conducted at them. This is not the case for the CEZ as the ALLIANCE has no control over access. Consequently, the success or failure of the CEZ Observatory as an 'ALLIANCE infrastructure' is reliant on an enthusiasm of ALLIANCE members to collaborate. Given the scientific debate on effects within the CEZ for

us to usefully contribute, we **MUST** make our data openly available through repositories such as STORE (<https://www.storedb.org>).

### ***Fukushima exclusion Zone***

Yamakiya Observatory Site is located in approximately 35 km of north-west away from the Fukushima Daiichi Nuclear Power Station. The area is approximately 7 ha established by the Institute of Environmental Radioactivity (IER) at Fukushima University in 2014. The owner of the site is; Kawamata-town municipality. The use by IER is based on the contracts between town municipality / town-run public forestry corporation and IER. Plant and animal samples have been collected from Yamakiya and the aggregated transfer factor (Tag) for  $^{137}\text{Cs}$  and transfer factors (TF) of elements from surface soil to plant or animals have been calculated. The data are utilized for the transfer model in the ecosystems. Erosion factor of  $^{137}\text{Cs}$  has been determined in experimental fields of forest, uncultivated field and cultivated field in Yamakiya. Erosion after decontamination of surface soil has also been investigated. Other research institutes including University Tsukuba, Hiroshima University, IRSN, CEA, NMBU, and Institute for Nuclear Research of the National Academy of Sciences of Ukraine have also been studying in Yamakiya

Future plans:

- To understand the migration of radiocaesium in forest ecosystems
- Training for sampling and pre-treatment for graduate students
- Plan on joint usage in the contaminated site
- To share site specific data between COMET partner members to compare, improve and/or validate radioecological models
- To compare radionuclide behaviour at different Observatory Sites (Tsushima, Okuma, Chernobyl, etc.)

### ***Naturally Occurring Radioactive Materials (NORM) Observatory Sites***

NORM Observatory Sites differ significantly from contaminated zones in Chernobyl or Fukushima in physical properties as well as in formal accessibility. During the operation of the first NORM Observatory Site in Poland, it turned out that to satisfy the two main objectives of radioecological Observatory Sites (long-term shared field work and suitability for research prioritized in the SRA), many administrative obstacles and scientific problems must be solved. In the light of not well defined regulation concerning NORM Observatory Site owners are expecting negative consequences when information about NORM in their properties become widely available. This aspect may be a significant inconvenience especially severe in the case of Observatory Site established in a property of still acting industry.

After a more in depth analysis of the existing exposure situations at the Polish Observatory Site, weak points typical for Observatory Sites where no particular accident or incident has occurred, were revealed. Based on this, further needs and expectations were defined which could be covered by selecting a new set of NORM affected areas. These NORM Observatory

Sites should be selected in order to achieve a maximum efficiency on the SRA objectives using a limited number of them. It must be acknowledged that it is impossible to include everything emphasised in SRA in a single NORM Observatory Site. For that reason a research program must be adapted to each existing Observatory Site characteristics.

#### NORM site 1: Aquatic ecosystem in the former mining and processing area in Poland

Upper Silesia Coal Basin (USCB) in southern Poland is an area where, enhanced concentrations of natural radioactivity are observed as well as many other pollutants resulting from long term activity of heavy industry. Radium isotopes and their decay products are the major radionuclides and are observed near to coal mines due to radium rich formation water release.

The research in frame of the Initial Research Activities (IRA) for NORM in COMET, was focussing on: characterisation of the current state of the Rontok Wielki reservoir contaminated due to discharge of radium rich water and comparison of radionuclide ( $^{226}\text{Ra}$  and  $^{210}\text{Pb}$ ) spatial and vertical distribution in bottom sediments (1999-2016), assessing the  $K_d$  for  $^{228}\text{Ra}$ ,  $^{226}\text{Ra}$  and  $^{210}\text{Pb}$  Transfer Factors (TF) to selected biota and application of Features, Events and Processes (FEP) analysis and integration matrix approach for identification main processes determining radionuclides behaviour in contaminated fresh water lake ecosystem.

The Polish Observatory site provides the opportunity to investigate a variety of very specific research questions, e.g. different temporal stages of settling ponds (in operation, post-operational phase, after remediation measures). Despite recent significant limitation of coal mining activity, more than 400 MBq per day of both radium isotopes ( $^{226}\text{Ra}$  and  $^{228}\text{Ra}$ ) is still discharged into inland water with mine effluents. All of that creates excellent opportunity to observe the final fate of radium released into environment. Radium is a natural radionuclide as well as the decay product of uranium enclosed in spent nuclear fuel that will have become major risk agent after fissile product decayed. That is why this radionuclide is crucial from perspective of long-term forecast for a final spent fuel repository.

Future plans: investigation of radium decay product ( $^{210}\text{Po}$ ) migration in ecosystem, continuation of RAMSES project aimed at studying radionuclide transfers through the aqueous pathway in the vicinity of coal mining sites in order to identify radium source terms and mechanisms controlling its mobility (GIG & IRSN), use as an test field in TERRITORIES project (EU-CONCERT funded project), observation of cyto- and genotoxicity of contaminated soil based on local plant population.

#### NORM site 2: Belgian waste landfill from phosphate industry

The Belgian NORM site is a calcium difluoride sludge heap from the phosphate industry partly covered with vegetation such as pine trees, birch trees, grasses and shrubs. Radionuclides present at the site, are mainly  $^{238}\text{U}$  and its progeny which originate from the phosphate ores.

The Observatory Working Group related to the Belgian NORM site was created within the EC-project COMET to define common goals and establish joint research actions. As it was

only recently decided (2017) to perform research at this site, the initial activities that have been conducted at the site are limited to:

- Mapping of gamma-ray dose rate
- Sampling campaign of upper soil at nine locations to determine the spatial variability of contaminant concentrations
- Initial sampling campaign to determine the distribution of radionuclides between soil (at different depths), tree roots, needles, bark, grasses and moss
- Preparatory activities for on-site monitoring

ALLIANCE partners have further plans for conducting collaborative studies at the site such as:

- Understanding and modelling the long-term influence of vegetation on radionuclide dispersion in forest ecosystems. As part of the TERRITORIES project (EU-CONCERT funded project), it is intended to set up a plot within the pine trees with equipment to follow the cycling of naturally occurring radionuclides and other elements within the trees, integrated with monitoring of the energy and water cycles. Additionally, it is planned to monitor the radionuclide content within seasonal samples of soil, sludge, tree roots, bark, wood, branches, tree needles and litterfall.
- Additional sampling campaigns will be set up, using research funds of the partners, to further characterise the site in order to gain more in-depth knowledge of processes determining radionuclide mobility and bioavailability in soil and sludge, and to compare radionuclide behaviour at different NORM sites.
- The available and generated site specific data will be used to improve and/or validate radiological models.
- Gathered data and knowledge will be shared between partners ensuring efficiency, continuity and sustainability in radioecological research.

## Annex 4 Future intentions for pages currently on the Radioecology Exchange

Pages in bold are 'landing pages' other pages link to the landing page above them in the list.

Page	ALLIANCE volunteer to maintain content <sup>^</sup>	Maintain page post COMET	Archive page* post COMET
<b>Home</b>	NERC-CEH	Yes (minimal)	
<b>Training &amp; Education</b>	Barcelona University (with Stockholm University)	Yes (all pages)	
<b>Information Exchange</b>		Yes	
Radioecology data	NERC-CEH	Yes	
<i>Euratom project outputs</i>	n/a	No	Yes
<i>European platforms and Newsletters</i>	CIEMAT	Yes (minimal)	
<i>Links to other websites</i>	CIEMAT	Yes	
<i>Interactive links</i>	n/a	No	Yes
<i>Newsletters from other projects</i>	CIEMAT	Yes (minimal)	
<i>Publications catalogues</i>	n/a	No	Yes
<i>International organisations</i>	n/a	No	Yes
<i>Fukushima research</i>	n/a	No	Yes
<b>SRA</b>		Yes (minimal)	
<i>Paris workshop</i>	n/a	No	Yes
<b>News &amp; careers</b>	NERC-CEH	Yes (minimal)	
<b>Virtual Laboratory</b>		Yes	
<i>Methods &amp; procedures</i>		Under discussion	
<i>Facts, figures and data</i>		Radioecology data page only	All other pages
<i>Radioecology models</i>		Yes	
<b>Observatories</b>	NERC-CEH	Yes	
<i>Chernobyl</i>	NERC-CEH	Yes	
<i>Fukushima</i>		Yes	
<i>Tessengerlo</i>	SCK•CEN	Yes	
<i>Upper Silesian coal basin</i>	GIG	Yes	
<b>STAR</b>	n/a	No	Yes
<i>STAR publications</i>	IRSN	Yes (in short-term)	
<i>All other pages under STAR</i>	n/a	No	Yes

<b>COMET</b>	n/a	No	Yes
<i>COMET Publications</i>	NERC-CEH	Yes (in short-term)	
<i>All other pages under COMET</i>	n/a	No	Yes

<sup>^</sup> Where no organization is listed an ALLIANCE volunteer to maintain these pages has not been nominated at the time of writing (n/a: page being archived therefore volunteer not required); <sup>\*</sup> These pages will be retained on the website but not updated, their status will be clearly marked on the page



## Annex 5 - INTERACTION OF THE ALLIANCE WITH SOCIAL SCIENCES AND HUMANITIES (SSH)

**Link between Alliance and SSH** is at the point where the results of the assessment/modelling need to be turned into useful input for the stakeholders, but may also be at the level of the fundamental research (in order to reply to some fundamental request by society – do epigenetic changes play a role in long-term effects following a nuclear accident; what is an acceptable level of uncertainty and how can we attain it). There is a space between the scientist and the public that needs to be covered, that's where SSH can help.

**Credibility concerns:** Uncertainties and lack of predictive power in risk assessments are major contributors to the public's reduced credibility of radiological sciences, and thus a major driver for additional research to enhance knowledge. Credibility of assessment models is particularly important because their predictions are often key constituents in decisions made about emergency response, waste management, environmental remediation, and litigation. Some of these uncertainties originate from the exposure assessment, which is largely dependent on knowledge of the environmental behaviour of radionuclides. The acquisition of new scientific knowledge through research in radioecology is, therefore, a crucial element in improving human and environmental risk assessments, and thereby improving credibility with stakeholders. But SSH could help to evaluate true societal needs and how we can convey the message.

SSH could help direct our research and **direct our research method** so that the relevance for the public, stakeholders would increase and the research outcome would be more accepted.

SSH could help in developing systems of how we could **better communicate our results to stakeholders**. For example - Thematic maps of robust environmental exposure predictions at various scales, allowing advanced visualisation of the complex interactions between radionuclides and the various environmental properties and processes. SSH could assist in **proper communication and elimination of prejudices and biases**.

Acquiring new scientific results on which decisions are based is key to answering social concerns about (eco)toxic effects from ionising radiation. **Management decisions should be, in part, scientifically based**. The general public needs to trust decision makers. For example, the **divergent opinions** on the effects of the Chernobyl accident on human health and wildlife in the Chernobyl exclusion zone do not enhance public confidence and understanding. How could SSH help in this debate when faced with divergent opinions??

The methodologies for human and environmental assessments differ. Human and environmental assessments are not fully complementary in terms of how they are conducted. The differences cause difficulties for operators, stakeholders and regulators. An **integration of the two radiation protection systems** – both in terms of the underlying philosophy and the practical application via appropriate tools and systems – may offer

significant benefits on many levels. Can SSH help to define the importance of the integration and how it should best be done?

The risk assessment framework was first proposed for chemicals, before it was extended to radiation. Keeping and reinforcing the **consistency between frameworks for chemicals and radiation**, facilitates the mutual understanding between assessors and the exchange or mutualisation of methods and tools. In turn, this will help to facilitate stakeholders' understanding of risk from various sources, including radiation. Risk from radiation is never considered as one of the many stressors but is always dealt via a separate framework. Can SSH help to span the bridge?

In situations requiring **decisions to be taken dealing with radioactive contamination**, it is almost never the case that one criterion can be used in isolation when determining the actions to be taken. Radiological effectiveness and technical feasibility of the various management options, the acceptance of stakeholders and the public at large is at least as important. **Multi-criteria analysis** provides a suitable theoretical framework that can be used to combine quantitative and qualitative factors and to guide the decision process towards a satisfactory solution. Decision Support Systems are to a large extent the visible "face" of radioecology and constitute an important interface between radioecological research and stakeholders. SSH have a crucial role here to include the societal factor into the decision process and strengthen the interfacing.

SSH can also have input in the methodology by helping bring scrutiny into the dose assessment methodology: we encapsulate protection into a number, the concept of dose, but the methodology to calculate a dose may be questioned and the concept of dose limits at most gives an idea if a system is protected, but it does not in itself "protect" anything. Below an example:

- Non-human biota is the good example for this 'dose concept' problem. Our benchmarks, etc. cover the living environment, the NHB protection system of the ICRP, IAEA, UNSCEAR, EC-PROTECT do not include the ALARA principle as does the human system, it does not in itself protect.
- It is an open debate to see if the exposure assessment magnitudes (dose), benchmarks etc. are sufficient (and robust enough) to cover the value that mankind assigns to the environment and how it is affected by the presence of radiation. In other words, by focusing on grays and Sieverts, we lose the view of "contamination", what it means for an environment to be polluted.
- Social sciences could help in this debate by focusing on scientifically established understanding, factorising risk perceptions, human valuation of the environment.

## Annex 6: European and International Platforms – context

Within this section we present with which European and international platforms ALLIANCE interacts, within the domain of radioecology and radiation protection or beyond and the intended approach of the ALLIANCE for future interaction and collaboration.

### ***Radiation Protection Platforms***

#### Radiation Protection platforms in Europe and EJPs

Through COMET, OPERRA and CONCERT the Radiation Protection platforms in Europe (MELODI, NERIS, EURADOS) and recently the Medical platform, MEDIRAD, have consolidated their interaction. This increased interaction, certainly through EJP CONCERT which intends to establish an umbrella structure for radiation protection research in Europe, also reinforces the position of radiation protection within Euratom. The interaction of ALLIANCE (radioecology) with the other European radiation protection platforms is important and should be continued. Today and in the coming years this is mostly mediated through EJP CONCERT where the platforms, as ALLIANCE, interact for updating SRAs and roadmaps, infrastructure, education and training, stakeholder involvement, the organisation of the Radiation Protection Week.

Within EJP projects ALLIANCE with the other 4 European radiation protection research platforms as advisory consortium members, represent the wider scientific community, and are responsible for the integrative activities: SRA's and Roadmaps, science direction, call preparation dialogue, interaction with partners outside Europe, interaction with the social sciences and humanities community and with stakeholders at European level,...). This important task will be continued and ALLIANCE Bureau members and Working Group leaders play an important role here.

With the other platforms ALLIANCE will also continue to organise the annual Radiation Protection Week.

Although integration with other radiation protection disciplines is important, we should emphasize that radioecology itself is an important discipline in view of future challenges, e.g. final repositories for radioactive waste, uranium and NORM legacy, post-emergency contaminated land management, .... We should avoid the impression that radioecology is only a "tool" for other radiation protection disciplines. ALLIANCE should continue to interact strongly with its sister European radiation protection platforms without losing its entity.

#### ICRP

Since 2016 ALLIANCE is Liaison Organisation of ICRP and the ALLIANCE president will be invited to participate on an annual basis to the ICRP Liaison Organisation meeting where we are invited to take part in discussions of global interest. In 2016 the discussion was related to the role of optimisation of protection / reasonableness, and individual dose restrictions / tolerability, in the implementation of radiological protection or other fields related to protection of people and/or the environment.

## How could ALLIANCE co-operate with ICRP?

At R&D level, ALLIANCE could in principle contribute to one of the research priorities of ICRP 'Assessing risks to populations of non-human fauna and flora' and which is translated in the following considerations: That it is important to develop appropriate dosimetric models, understand dose-response relationships and account for differences in sensitivity between organisms and life stages. The focus of protection for non-human biota is on population viability and hence on tissue reactions, including gross impairment of reproductive capacity and effects on future generations. Further research is needed to understand exposures, doses and effects in relations to population viability for different species. Additionally, under COMET, monitoring and experiments at identified ICRP reference sites provide the data to derive more robust RAP transfer factors and a taxonomically based model of radionuclide transfer for wildlife independent of site-specific factors.

Other ways of collaboration/interaction are:

- ICRP members can join the ALLIANCE roadmap Working Groups (WG)
- Interact at the ICRP-Radiation Protection Week-2017, Nov 2017, Paris. As the other European platforms in Radiation Protection, ALLIANCE will co-organise the ICRP-Radiation Protection Week and have one common session organised with ICRP dealing with the topic of "Integrated Protection of People and the Environment".
- Comment on the ALLIANCE SRA and roadmap
- Participate at COMETs final workshop where ICRP (and other international organisations) is invited to attend the COMET/ALLIANCE final event and give their view on how important the progress made in COMET is for ICRP and what research directions radioecology should take in order to contribute to the ICRP objectives.

## IUR and the FORUM

Radioecological expertise is mandatory everywhere around the world given the current and foreseen development of nuclear activities worldwide. Its need is not restricted to nuclearized countries, because the human and environmental consequences from potential accidents with releases of radioactivity are not bound to physical and administrative frontiers. The radioecology scientific community is small and fragile. It will benefit, both in political recognition and ability to promote significant scientific progresses (in support of ensuring a safe use of nuclear energy), from gathering the community in as large a manner as possible on as wide consensus findings as possible.

## **MoU ALLIANCE – IUR**

Therefore, IUR and ALLIANCE have since more than 3 years signed a Memorandum of Understanding (13/11/2013). At that time the objectives of co-operation were:

- Promoting the creation of a common strategy and implementation plans for research paying especial attention to the development and sustainment of expertise across all scientific disciplines relevant to problems associated with radioactivity in the environment.
- Conducting joint activities and participating in joint task groups, duly acknowledged, or by any means or tool felt desirable (workshop, meeting, scientific mission, ...)

- Promoting the conduct of sound research into all aspects of environmental radioactivity and radioecology, and promoting its publication in the open scientific literature.
- Promoting the exchange of scientific information, whether through their respective web sites, their respective publications (e.g. reports, newsletters,...) or the scientific workshops and conferences that they may support, organize or promote.
- Authoring joint publications and presentations.

The suggested areas of cooperation were: Radiation ecology (including atmospheric, earth and ocean sciences), Radiation biology (environmental biology, molecular biology, biodiversity), Environmental modelling (including atmospheric, earth and ocean sciences), Emergency and post-emergency preparedness, Ecological risk assessment, Ecotoxicology, Urban radioecology, Environmental health physics, Tracer studies (to support understanding of biogeochemical cycles), Microbiology and biotechnology.

Despite all good intentions, no effective collaboration was so far established between IUR and ALLIANCE. The most straightforward way of interaction between IUR and ALLIANCE still seems through common organisation of events, common E&T projects, contribution to each other's working groups. The ALLIANCE should also continue to look for opportunities.

### ***The FORUM***

Radioecology needs to be tackled at worldwide scale irrespective of the local situations prevailing in terms of political trends, funding, and scientific development. IUR, as an independent, non-profit and non-governmental association is committed to this spirit of development since the very beginning, with all suitable actions susceptible to assemble the largest community acting in the field.

During the past decades, many specialised networks have formed to meet specific radioecological objectives, whether regional or sectorial (purpose-oriented). The IUR has therefore prompted a co-construction process aimed at improving worldwide harmonisation of radioecology networks. An initiative based on an initial set of 15 networks, now called the IUR FORUM, was launched in June 2014. The IUR Forum agreed to build a framework for improved coordination of scientific knowledge, integration and consensus development relative to environmental radioactivity. Three objectives have been collectively assigned to the IUR FORUM: (1) coordination, (2) global integration and construction of consensus and (3) maintenance of expertise. One particular achievement of the FORUM was an improved description and common understanding of the respective roles and functions of the various networks within the overall scene of radioecology R&D. It clarifies how the various networks assembled within the IUR FORUM interface with UNSCEAR and other international regulatory bodies (IAEA, ICRP), and how consensus on the assessment of risk is constructed. All these agencies interact with regional networks covering different geographical areas, and with other networks which address specific topics within radiation protection. After holding its first Consensus Symposium in 2015, examining the possible ecological impact of radiation from environmental contamination, the IUR FORUM continues its work towards improved radiation protection of humans and the environment.

ALLIANCE is member of the Forum and will continue its interaction.

## IAEA

The former EMRAS programmes of the IAEA and its more recent MODARIA programmes are venues of interaction of members of the ALLIANCE with IAEA. The IAEA MODARIA programme on Effects on the environmental, NORM, Site remediation, Model development, Waste and disposal has several links with the radioecology SRA. Though no formal collaboration between ALLIANCE and IAEA is set up so far, several ALLIANCE members actively contribute to these IAEA projects and contribute to the elaboration of the programme content. This interaction should continue in the future if not enforced and it should be envisaged if we cannot promote to a more important extent than is done today the inclusion of European RP priorities to be taken up in the IAEA (MODARIA) programme.

## ***European platforms with links to Radiation Protection and Radioecology***

### NUGENIA (Nuclear Generation II and III Association)

In March 2015 Hildegard Vandenhove was invited as coordinator of COMET and as member of the ALLIANCE by F Bréchnignac, JP van Dorsselaere and G Bruna, members of the ERMSAR Scientific Committee (ERMSAR - European Review Meeting on Severe Accident Research- of the SARNET (Severe Accident Research NETWORK of Excellence) network ) to give a keynote to present developments in the ALLIANCE and NERIS platforms which have a link with severe nuclear accidents and indicate venues for potential collaboration with the NUGENIA community.

NUGENIA is an international non-profit Association devoted to R&D on fission technology of Generation II and III. As a product demonstrating the success of the 3 networks (SNETP TWG Gen II&III, NULIFE and SARNET), NUGENIA is set up to be the starting point of a more ambitious and united community to advance the safe, reliable and efficient operation of nuclear power plants. NUGENIA provides, in a transparent and visible way, a scientific and technical basis by initiating and supporting international R&D projects and programmes. NUGENIA contributes to innovation and facilitates the implementation and dissemination of R&D results.

NUGENIA's scope of activities covers 8 main technical areas: 1. Plant safety and risk assessment; 2. Severe accidents; 3. Improved Reactor Operation; 4. Integrity assessment of Systems, Structures and Components; 5. Fuel Development, Waste and Spent Fuel Management and Decommissioning; 6. Innovative LWR design & technology; 7. Harmonisation; 8. In-service Inspection and Non Destructive Examination.

NUGENIA wants to promote a better liaison and synergy between the Nuclear Safety and Radiation protection communities, especially on cross-cutting issues such as those arising from severe accidents. The NUGENIA Roadmap therefore, under Technical Area 2 dealing with Severe Accidents, includes sub-topical areas on Reducing the uncertainty on environmental impact assessments and on Improving the emergency preparedness and response, both with potential areas of interaction with ALLIANCE.



Under Technical Area 3– Core and Reactor Operation there is a sub-topic on Radiation Protection with a sub-sub-topical area on Public and environmental radiological protection. NUGENIA strives for the reduction of the amounts of radioactive substances released periodically into environment under normal operational conditions and therefore aim (1) to develop of methods and tools for minimizing the release of radioactive substances into environment under normal operational conditions from NPPs and from other sources or radiation, and, (2) to develop platforms, methods, guidelines and tools necessary for realization of credible and useful PSA Level-3.

Despite several contacts, no collaboration programme was established.

In April 2016 OPERRA organised a meeting with NUGENIA. In a circular to the Radiation Protection Platforms (3 May 2016) they highlighted that NUGENIA addressed radiation protection issues within their roadmap under the 2 Technical Areas as follows:

- Technical area 2: *“The impact of severe accidents on the environment in the near-field around the NPP must be assessed as part of the NPP Environmental Impact Assessment (EIA). The objective is to reduce uncertainties on all phenomena (and on models and space/time discretization), either in-reactor or in near-field, leading to the atmospheric, on-ground and underground (liquid release) contamination of land from inside the plant to the near-field, including the impact of mitigation measures”.*
- Technical Area 3: *“One major challenge for radiation protection as tackled in NUGENIA area 3 “Core and Reactor Operation” is to promote a better synergy with nuclear safety issues since both are interdependent. Technological solutions taken for safety reasons are not all equal with respect to radiation protection.*

At the level 2 and level 3 PSA (Probabilistic Safety Assessment in the framework of nuclear applications), NUGENIA mentioned they would like to study emergency related radioecology/geology topics (we only refer to the domains interesting for the ALLIANCE). 1. Geological and ground water contamination during and/or after meltdown from on-site into underground and aquifer up to the freshwater and into the marine environment; (2) Mixture toxicity (industrial, environmental, habits and lifestyle)

A meeting between NUGENIA and the RP-community was proposed for fall 2016 but so far did not take place.

We think there is added value in increased interaction between the RP and the Nuclear Safety community and in that sense, the ALLIANCE should be open and continue to consider collaboration with NUGENIA.

#### IGD-TP (Implementing Geological Disposal of Radioactive Waste Technology Platform)

The European council has outlined that the emphasis in the Euratom research should be Implementation-oriented R&D activities on all remaining key aspects of deep geological disposal of spent fuel and long-lived radioactive waste. As appropriate, demonstration on the technologies and safety, and to underpin the development of a common European view on the main issues related to the management and disposal of waste are emphasised.

The ALLIANCE president and Nathalie Impens were invited to attend the annual IGD-TP Exchange Forum to present in a plenary keynote the recent developments in the European

radiation protection (RP) scene towards a European Joint Programming (EJP) instrument in RP and to present potential venues for collaboration between IGD-TP and the EC RP platforms based on the different SRAs and implementation plans.

Various topics of common interest were proposed, referring to the IGD-TP SRA, the IGD-TP Deployment plan and the SRAs of the abovementioned RP associations., such as: Potential links between radiation protection programs and IGD-TP are most likely in the IGD-TP key topics 1: Safety case; 5: Safety of construction and operations; 6: Monitoring; 7: Governance and stakeholder involvement.

It was agreed with Jacques Delay (Secretary IGD-TP) to set up a small working group with experts from the RP community on one hand and IGD-TP experts on the other hand, to select one or max. two topics of common interest. A fact sheet was to be developed on these subjects within one year (before end 2016). Then a pre-project should be worked out to be ready at the end of JOPRAD for the projects to be launched in 3 years from now. Jacques Delay was going to promote this approach at the IGD-TP Executive Committee meeting. Jacques Delay saw potential in a collaboration on monitoring and he supported the idea put forward to collaborate on uncertainty and sensitivity analysis. He recommended to discuss with Walter Steininger (KIT) and Lucy Bailey (RWM, UK) on uncertainty and sensitivity analysis and to Johan Bertrand (ANDRA, director of research) and Frederic Plas (ANDRA) on monitoring. We exchanged with Johan Bertrand. He would see monitoring in a broad sense, the large number of monitoring of waste and near-field compared to the too little monitoring and data collection in the biosphere, the same holding for the research. He would prefer to look in that area.

Lucy Bailey was interested to collaborate on uncertainty and sensitivity analysis – e.g. a structured process to derive uncertainty around key processes or key parameters in geosphere, biosphere/geosphere and geosphere modelling for safety assessment. After the IGD-TP Exchange Forum, contact persons and secretary were contacted and re-contacted but nothing effective evolved.

#### EURAMET - The European Association of National Metrology Institutes

The mission of EURAMET is to develop and disseminate an integrated, cost effective and internationally competitive measurement infrastructure for Europe. Two main tools to achieve these goals are the European Metrology Research Programme (EMRP) and the European Metrology Programme for Innovation and Research (EMPIR). EURAMET deals with 4 challenges: health, environment, energy and innovation.

In November 2015, a first meeting between the radiation protection community and EURAMET TC-IR was held (in the framework of OPERRA T2.1) to investigate potential common fields of interest. It was then decided to interact frequently to enhance collaboration where appropriate. As a consequence, Nathalie Impens (OPERRA T2.1 leader and CONCERT WP3 leader) and Hildegard Vandenhove (ALLIANCE chair) were invited to the meeting of the contact persons of the Technical Committee for Ionizing Radiation (TC-IR) of EURAMET (meeting held on a yearly basis which brings together the representatives of the ionizing radiation laboratories from all the national metrology institutes that are part of EURAMET).



The TC-IR deals with issues in three different sub-fields of ionizing radiations: (1) Development of the metrological infrastructure to underpin the development, operation and safety of advanced ionising radiation systems; (2) Underpinning metrology capability for nuclear and atomic data determination with significantly improved uncertainties; (3) A new quantity that describes the real biological effect of radiation, to complement or replace the current quantity “energy deposited per unit mass” dosimetry (radiotherapy and radioprotection), neutrons and radionuclides.

TC-IR has 3 working groups, on (1) Calibration and measurements capabilities (CMCs) in ionising radiation and quality assurance issues, (2) Healthcare and (3) Anthropogenic and Natural Radionuclides in Environment and Industry.

As a result of that interaction, ALLIANCE, through some of its members, participated at an EMPIR call and submitted the ENVIRONORM project, which was not selected.

The fact that participants to projects must from now on be assigned designated labs, it will be very difficult for ALLIANCE (partners) to participate in projects.

Nevertheless, regular interaction between the radiation protection community on one hand, and the metrology on the other hand is important. For EURAMET it is a win to have direct contact with the radiation protection community as stakeholder / end user of metrology, whereas input from metrology into radiation protection research can result in reduced uncertainties in risk assessment.

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