



EUROPEAN  
COMMISSION

Community research

## DELIVERABLE (D-N°5.7)

### COMET WP5

# Training activities during COMET - Successes, lessons learned and suggestions for the future

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Reporting period:

Date of issue of this report: 16/05/17

Start date of project: 01/06/2013

Duration: 48 Months



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Project co-funded by the European Commission under the Seventh Euratom Framework Programme for Nuclear Research & Training Activities		
Dissemination Level		
<b>PU</b>	Public	PU
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## Executive Summary

The 2014 Strategic Research Agenda for Radioecology (STAR D2.5) identified that the key challenge in Education and Training (E&T) was “To maintain and develop a skilled workforce in Europe and world-wide, through university candidates and professionals trained within radioecology” since “Scientific research in radioecology and application of that knowledge in the radiation protection of man and the environment requires scientists and workers with adequate competence and appropriate skills.”

The people in need of E&T in radioecology are both students and professionals within research, industry and radiation protection. Radioecology is a multidisciplinary science, requiring teachers from many fields, who need to reach out to students with a range of backgrounds. Being a relatively small science, teachers and students are widely scattered geographically, which leads to the need for intensive courses to minimize costs, and/or online E&T. In order to address these needs, COMET has developed an E&T web platform and arranged a number of courses and workshops for students and professionals. COMET has given refresher courses in conjunction with conferences, field-courses, hands-on training courses and full PhD and MSc courses for international audiences. The most important contribution from COMET is that the courses can draw on expertise from the COMET partner organisations to assemble relevant experts to teach courses as COMET holds the best expertise within radioecology topics.

In addition, COMET has been engaged in discussions with stakeholders for more long-term solutions to maintain the sustainability of radioecology E&T after the end of the project. A list of all the courses given by STAR, COMET and the MSc in radioecology is to be found at the Radioecology Exchange website. Despite progress in some areas, many of the challenges outlined in the 2014 SRA unfortunately remain, mainly due to the lack of sustainable dedicated funding. For example, increasing student and teacher mobility, development of web-based learning tools and distance courses all require sustainable funding mechanisms. Development and implementation of e-learning tools also requires the engagement of experts in digital learning, which has not been possible in COMET due to lack of dedicated resources. Future plans within the ALLIANCE and OPERRA must urgently address this lack of sustainability if radioecological competence is to be maintained in Europe.

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## 1. Introduction

The 2014 Strategic Research Agenda for Radioecology (STAR D2.5) identified that the key challenge in education and training (E&T) was “To maintain and develop a skilled workforce in Europe and world-wide, through university candidates and professionals trained within radioecology” since “Scientific research in radioecology and application of that knowledge in the radiation protection of man and the environment requires scientists and workers with adequate competence and appropriate skills.”

Those in need of E&T in radioecology are both students and professionals within research, industry and radiation protection. At university level, radioecology is a ‘minority’ subject that is often not provided as part of the curriculum, and students are often not aware of its existence. NMBU is the only university giving a full MSc programme in Radioecology, but radioecology courses could easily be given as part of radiochemistry, radiobiology or other close disciplines. In addition, radioecology is a multidisciplinary science, requiring teachers from many fields, and needing to reach out to students with a range of backgrounds. Being a relatively small science, teachers and learners are widely scattered geographically, which leads to the need for intensive courses to minimize costs, and/or a requirement for online E&T.

Consultation with users (including industry and regulators) at two workshops during the STAR project (STAR Deliverable 6.1), highlighted that recruitment of people with knowledge of radioecology would be needed well into the future and identified training requirements with respect to radioecology. Those of particular relevance to COMET, and included in the COMET Description of Work, were:

- Informed application of models and tools
- Laboratory courses that provide hands-on instrumental training.
- Field studies that provide opportunities for different disciplines to work together

## 2. Objectives of COMET E&T

The overarching objective of the ‘Knowledge Exchange’ work package (WP5) in the COMET DoW 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”. Education and training was included as Task 5.3 in this work package (and also within Task 5.1 –development of the E&T pages on Radioecology Exchange website, and Task 5.3 - Maintaining and enhancing competence (workshops))

The specific objectives for WP5 were to:

- Establish an interactive website for COMET including supporting materials for the user community providing informed and regular updates of developments. (Task 5.1)
- Develop training packages to maintain and enhance professional competence (Task 5.3)

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- Facilitate discussion of topical radioecological issues between students, researchers and users to support radiation protection in Europe (Task 5.2)

### 3. COMET contribution to radioecology E&T

In order to address these needs outlined above, COMET has developed an E&T [web platform](#) 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 many demands on their time. For the same reason, activities were arranged if possible to coincide with other meetings and conferences to save travel cost for participants. COMET has also given refresher courses in conjunction with conferences, field-courses, hands-on training courses and full PhD and MSc courses for an international audience. In addition, COMET has been engaged in discussions on more long-term solutions to maintain the sustainability of radioecology E&T after the end of the project.

#### 3.1 Platform (Radioecology exchange E&T website)

Within the Radioecology Exchange website, COMET has further developed the E&T platform (Task 2.5), a focal point for students and professionals interested in radioecology, linking education in different nuclear disciplines together. The platform presents an overview of education and training course modules within radioecology/environmental radioactivity presently offered by the COMET consortium and will be followed up by the Radioecology Alliance post-COMET. The ALLIANCE institutions within the E&T WG will explore to keep the platform updated, especially as a few institutions also participated in the COMET project. A platform-coordinator will be selected among ALLIANCE E&T WG partners. Information on course curricula and learning outcomes are provided, with recommended pathways to obtain academic merited education or training courses. The main focus of this, was to maintain the platform established under STAR and to further sustain and develop competence within radioecology, in collaboration with particularly the CINCH II, DoReMi/MELODI and ENETRAP II platforms. The joint information on courses, programmes and workshops on this platform, will implement training and educational solutions that will encourage the streamlining of the European education system in respect to the provision of radioecology and allied discipline courses at post-graduate level, and will encourage the move towards the creation of a standardized certification system for postgraduate qualifications throughout the EU. This, in turn, will enable the identification, by employers, of personnel with the specific skills that meet their needs. This will maximize the use of disparate existing resources through the sharing of personnel and facilities. The project will reduce the duplication of expensive course modules and encourage optimisation of resources (human resources, tools, investments). It will also encourage collaboration and increased utilisation of joint resources with other training and education providers such as IAEA and ENEN.

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The ultimate aim of the E&T platform is to ensure a sustainable workforce in radioecology by giving the possibility to network, take courses and interact with the radioecology community. This platform holds information on different courses within radioecology ranging from MSc and PhD courses to workshops and professional development, it also provides links to other E&T platforms, such as those within Radiochemistry, Radiobiology and Radiation Protection (DoReMi, CINCH II, etc). This is an important outreach mechanism for the Radioecology E&T platform, as – for example – many of the basic course modules within radioecology are also relevant for other nuclear science students, and vice versa. For the future it is important to link to E&T within CONCERT and CONCERT funded projects (Territories, Confidence).

Information on the Radioecology PhD Network is also available on E&T platform (see section 2.3). The Radioecology PhD network is a virtual forum intended to promote networking and interaction between students and scientists and the rest of the radioecology community.

### **3.2 E&T courses given during COMET**

During COMET, several courses were held. Ongoing MSc and PhD courses were revised during COMET, given as intensive courses making it possible for international students to attend. These courses utilised experts from the COMET consortium as lecturers. Two new field courses were developed, designed and held during COMET, with teachers from several of the COMET partner organisations: “Naturally occurring radioactive material (NORM) in the environment” in Katowice, Poland, 2015; and “Chernobyl fallout in the environment” in Kiev, Ukraine, 2016. All course materials are freely available on the Radioecology Exchange (<http://www.radioecology-exchange.org/content/training-courses>). Both courses had more applicants than available places and received very positive feedback from the participants. ALLIANCE intends to take these or similar courses further after the end of COMET. The continuation of the courses will be explored among the ALLIANCE partners participating in the E&T WG.

**Course on “Naturally Occurring Radioactive Material (NORM) in the Environment”**, held at the Silesian Centre for Environmental Radioactivity, Central Mining Institute (GIG), Katowice, Poland, 7th – 10th September 2015.

The intensive (4 day) course was aimed at both students and professionals, and focused on most aspects of environmental radiation impact and risks associated with enhanced natural radioactivity released from different NORM industries and accumulated in the environment. Key processes controlling the behaviour of naturally occurring radionuclides in different ecosystems were outlined in the light of recent radioecology research, including basic concepts, variables/parameters and kinetics needed for modelling purposes. Application of

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appropriate methods, for assessing the radiation impact and risk in the context of the complex suite of natural radionuclides were discussed and then practiced during field exercises. Lectures and exercises covered the whole impact assessment process starting with sampling strategies and protocol preparation, sampling campaign, sample pre-treatment and preparation, the use of state-of-the-art measurement techniques and ending with the use of Environmental Risk Assessment models (ERICA tool). Two-days of field exercises were carried out at sites contaminated by NORM due to former and current industrial coal mining activities in the Upper Silesian Coal Basin.

Course evaluation: average score of 4.4/5 for the 15 questions asked. The practical field and lab aspects, as well as the diversity of participants and the range of expertise of the teachers were particularly appreciated.

**“Chernobyl fallout in the environment”**, held at National University of Life and Environmental Sciences of Ukraine (NUBiP of Ukraine) and Ukrainian Institute of Agricultural Radiology (UIAR) in Kiev, Ukraine, 5-8 September 2016.

This intensive (4 day) course was aimed at PhD and Masters students and focused on the impact and risks associated with enhanced radioactivity in the environment due to the Chernobyl accident fallout. The course covered key processes controlling the behaviour of radionuclides in different ecosystems, including basic concepts, variables/parameters and kinetics needed for modelling purposes. There was a strong focus on selecting and applying appropriate sampling strategies and methods for assessing radiation impact and risk in the context of the complex suite of radionuclides present in the environment. The course included theory (lectures) and training in the laboratory (radiochemistry and radiation measurements) and one day in the field, within the Chernobyl 10km zone, which was heavily contaminated during the accident in 1986.

Course evaluation: average score of 4/5 for the 15 questions asked. 83% of participants indicated that the course should be held again. The vast majority of students highly appreciated the chance to visit and take samples in the CEZ.

**Radiological Protection of the Environment** (training course) held at CEH Lancaster, UK, 15-17 March 2017.

This course covered a number of aspects of environmental (non-human biota) radiological assessment, including application of the ERICA tool, radionuclide transfer, dosimetry, effects, benchmarks, dispersion and how to model atmospheric noble gases. The course (the ninth in a series) is aimed at students and professionals who want to: obtain a basic understanding of radionuclide transfer, dosimetry and radiation effects; become more familiar with radiological

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assessment objectives and tools; be able to interpret the results provided by these tools and understand the implications of how the tools are used.

### **Intensive courses (some as part of European Radioecology Masters Programme).**

COMET partners have also continued to develop and participate in the European Masters Programme in Radioecology, held at NMBU, Norway. Several COMET experts have been teaching in the different course modules within this programme. This programme is important in promoting radioecology as an academic discipline and in providing E&T for students and professionals. Modules of this programme (e.g. Radioecology and Environmental Radioactivity MSc course in October 2015 and Environmental Radiobiology PhD course in June 2015), as well as separate courses held at individual COMET organisations (e.g. Radiobiology course at SCK•CEN, 2015) have also benefited from collaboration and co-financing from other platforms such as DOREMI and CINCH II. Students from all over Europe participate in these intensive courses.

COMET also held two **refresher courses** at the International Conference on Radioecology and Environmental Radioactivity in Barcelona, 2014. These were on a) revisions to the ERICA Tool and b) assessment of noble gases for wildlife, and attracted 30-50 scientists. NERC-CEH also gave a short session entitled 'Protection of biota: Methodologies and assessment tools' at the 14<sup>th</sup> Congress of the International Radiation Protection Association, Cape Town, South Africa in May 2016 as part of their refresher course programme.

### ***3.3 Actions to promote/enhance networking of young scientists***

More than 30 PhD students and a large number of Masters students have been associated with COMET-related research and are part of the Radioecology PhD network, which is also open to non-COMET students. The Radioecology PhD network is an international networking forum aimed primarily at PhD students in radioecology and other relevant nuclear sciences. There is a full list of students, with their research topics and contact details on the Radioecology Exchange E&T Platform, giving students a forum to make contact with each other. Students in the network are also given priority on courses organised by COMET such as the PhD course in Environmental Radiobiology held at NMBU in collaboration with COMET.

An Early Career / Young Scientists Session was co-organised by COMET at the Radiation Protection Week in Oxford (Sept, 2016) (<https://www.phe-protectionservices.org.uk/rpw/>), to highlight research by early career scientists across the various EU platforms (e.g. MELODI, EURADOS, NERIS and ALLIANCE) and provide a meeting place for scientists at this stage of their career.

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### 3.4 Workshops

A number of workshops were held during COMET. Although not specifically designed as E&T activities, a number of students and professionals benefitted from the chance to participate and discuss scientific issues with international researchers and stakeholders. The freely available workshop reports (<http://www.radioecology-exchange.org/content/workshops-0>) also provide useful summaries of the discussions and ideas for future research and policy directions.

#### **Transgenerational and Epigenetic Mechanisms of Radiation Toxicity at Chronic Doses,**

Oxford, UK, 10<sup>th</sup> – 12<sup>th</sup> December 2014

The workshop was intended as an integrating activity between related research fields. The meeting focused on theoretical discussions on epigenetics and on the role of epigenetics in (eco) toxicology and radioecology, including biological processes such as development, aging and neurological diseases, adaptation and the use of epigenetic endpoints as generalized or even stressor-specific biomarkers. As well as a series of presentations, priority was given to two discussion sessions on ‘Epigenetics and transgenerational effects’ and ‘Epigenetics and systems biology’ to allow cross-fertilisation of ideas across disciplines. Outcomes of the discussions identified promising approaches and ideas to advance the field and fed into recommendations for future research priorities in the ALLIANCE.

#### **ICOBTE and Fukushima workshop,** Fukuoka and Fukushima, Japan, July 2015

The 2<sup>nd</sup> COMET workshop comprised three events in July 2015. There was a session in the 13<sup>th</sup> International Conference on the Biogeochemistry of Trace Elements (ICOBTE 2015), held at Fukuoka, an associated excursion with 26 participants to contaminated areas near the Fukushima Daiichi NPP and a COMET Fukushima Workshop was held at Iizaka. The Symposium was on “Understanding and mitigating the environmental behaviour of radiocaesium after the Fukushima accident”. There were 73 presentations, including 25 posters, from 9 countries. The COMET Fukushima workshop, organised by the Institute for Environmental Radioactivity, Fukushima University, had 42 participants from 6 countries. The speakers covered a wide range of topics and summarised current key findings and issues. Comparison with Chernobyl shows similarities and also differences which will need to be documented and incorporated into international literature, understanding and models.

#### **Modelling fit for purpose** workshop, Seville, Spain, 15<sup>th</sup> – 17<sup>th</sup> June 2016.

The objective of this 3<sup>rd</sup> COMET workshop was to discuss modelling as fit for purpose, by organising a dialogue and obtaining feedback from modellers, experimentalists and

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stakeholders on this subject. A key aspect of this workshop was to improve the interaction between modellers and experimentalists, since a closer cooperation is expected to create a better compatibility between model developments and experimental studies. In addition, the workshop provided guidance on the development of radioecological models for specific purposes, including the desired degree of conservatism, the acceptable level of uncertainty and the optimisation of model complexity. Developing strategies to minimize the overall predictive uncertainty of model output is one of the challenges. The benefits and limitations of process-based approaches and extrapolation methodologies to fill data gaps were addressed in this context. Approaches to the validation of radioecological models were reviewed and evaluated. The workshop initiated a dialogue that will improve the quality and robustness of radioecological models and make them more suitable for scientific applications and a broad range of assessment purposes, bridging to other radiation protection platforms and taking into account their specific needs.

**Thirty years after the Chernobyl accident: what do we know about the effects of radiation on the environment?** Chernihiv, Ukraine, 30<sup>th</sup> August – 1<sup>st</sup> September 2016.

COMET organising committee: CEH, IRSN, Chornobyl Center, University of Stirling (COMET advisory group member)

The aim of the workshop was to discuss what we have learnt from studies of the effects of radiation on the environment (i.e. wildlife) in the Chernobyl Exclusion Zone (CEZ), and what questions still remain, given that there is a lack of consensus in the scientific community on the extent of these effects. This leads in turn to conflicting information being published in the media and difficulties in communication between scientists and the general public and policy makers. Thirty-nine participants from 11 countries (France, Sweden, UK, Ukraine, USA, Belgium, Finland, Japan, Spain, Canada and Belarus) attended the workshop, not only from the fields of radioecology/radiation protection but also from regulatory organisations, nuclear related industries, an NGO, the media, a chemical ecotoxicologist and representation from the social sciences and humanities fields. An attempt was made to address how we can resolve the anomalies between field and laboratory studies and what the implications of Chernobyl (and Fukushima) studies are for current benchmark dose rates. Recommendations were made by the workshop which can be found in the [workshop report](#). A series of papers resulting from the workshop will be published in a special issue of the Journal of Environmental Radioactivity in 2017.

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## 4. Vocational Education and Training (VET)

During the time of COMET, the need for future VET within radioecology has been explored, and the conclusion is that there are some current and future demand for VET. The information shows that the need for VET is stronger towards Nuclear Chemistry and Radiation Safety than when it comes to Radioecology. There was, however, clear consensus on the need of clear learning outcomes from courses given within all radiological disciplines. The Comet courses have, therefore, been quite specific into defining the expected learning outcome to meet the stakeholder needs. For the future, exploration on how to convert learning outcome to VET is needed.

## 5. What is the added value of the COMET contribution?

Organizing such E&T activities through the COMET consortium has had many benefits. It has been possible to draw on the partner organisations to assemble relevant experts to teach courses, to reach out to a large international recruitment base for students and to utilize relevant infrastructure (e.g. laboratories, field site access) that has significantly contributed to the content and attractiveness of the courses. The wide range of expertise in the COMET consortium has also enabled the provision of courses at different levels for different target groups (e.g. students, researchers and stakeholders).

To secure future research and education cooperation after COMET, Memorandum of Understanding (MoU) agreements between COMET institutions on both research and education could make specific commitment between partners to continue the work started by COMET. Such MoU agreement have been signed between NMBU and several universities and research institutes in COMET, to promote mobility of both students and professionals and cooperation on MSc-, PhD- and research projects. The following institutes have signed an MoU:

- National University of Life and Environmental Sciences of Ukraine, Ukraine.
- University of Fukushima, Japan.
- University of Seville, Spain.
- CIEMAT, Spain.

A cotutelle (joint supervision) agreement has been signed between NMBU and the University of Seville (UoS), Spain, giving credits to both universities (NMBU and UoS) for taking on common PhD students, meaning financial support to both institution for PhD student. The PhD students are connected to the COMET project RATE. Such cotutelle agreements could be utilized further between universities to share PhD students within the same scientific field.

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**Table 1. Illustrating the multi-partner, diverse and international nature of the courses and workshops held in COMET**

Activity	COMET participants involved in organizing / teaching	Course attendees
Chernobyl course, Sept 2016	UIAR, NuBIP, NMBU, SU	28 participants (PhD and Masters students) from 10 countries (Japan, Ukraine, UK, Spain, China, Norway, France, Czech Republic, Sweden, Finland and Austria).
Chernobyl workshop, Aug/Sept 2016	CEH, IRSN, Chornobyl Center, University of Stirling (COMET advisory group member)	39 participants from 11 countries (France, Sweden, UK, Ukraine, USA, Belgium, Finland, Japan, Spain, Canada, Belarus). Participants were from radioecology/radiation protection, regulatory organisations, nuclear related industries, an NGO, the media, ecotoxicology, social sciences and humanities
Seville workshop, June 2016	NMBU, UoS, CIEMAT, SCK, BfS	55 participants from 17 countries: Norway, UK, Belgium, Russia, Ukraine, France, Spain, Sweden, Austria, Czech Republic, USA, Romania, Portugal, Japan, Finland, Germany and Estonia. Participants were scientists, both experimentalists and modellers, and stakeholders.
NORM field course, Sept 2015	GIG, NMBU, SU, NRPA	16 participants from 11 countries: Sweden, Belgium, UK, Angola, Estonia, Finland, Germany, Greece, Norway, Poland, and Spain. Participants from universities, authorities, companies involved in radiation protection, research institutes and national waste repository authorities.
MSc course: Radioecology and Environmental Radioactivity Oct 2015	NMBU, SCK•CEN, CIEMAT, NRPA	15 participants (PhD and MSc students) from 6 countries different countries.
ICOBTE/Fukushima workshop, July 2015	NERC, Fukushima Univ., IRSN, NRPA, SCK•CEN	Series of events: 73 presentations, including 25 posters, from 9 countries. 42 participants from 6 countries.
Environmental Radiobiology PhD course, June 2015	NMBU, SU, McMaster	28 students; 12 PhD and 8 MSc, 8 Postdoc/professionals, (Norway 8, EU 15, non-EU 5 (USA, Russia, Argentina))

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Oxford workshop, Dec 2014	CEH, IRSN, SCK•CEN	48 participants from 12 countries (Belgium, Canada, USA, Spain, France, Germany, Japan, Norway, Portugal, United Kingdom, Russia and Sweden).
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COMET partners have also been part of other European projects and platforms (e.g. STAR, OPERRA, ALLIANCE, MELODI, NERIS, CINCH-II), promoting COMET E&T or collaborating on E&T. This has secured more funding for COMET workshops and courses through co-funding with other E&T platforms (DoReMi) and institutions (CERAD), more expert teachers funded by COMET etc., but most importantly it has enabled outreach to students in other nuclear disciplines in need of courses within radioecology. Links to other platforms are given at the Radioecology Exchange E&T webpage.

## 6. Future ideas and challenges

In the future, Education and Training in radioecology will be led and promoted by the Radioecology ALLIANCE who will take charge of Radioecology Exchange website, which hosts the E&T platform. An ALLIANCE E&T working group (WG) is already in place and currently comprises nine organisations (UB, NMBU, CEA, IST, IRSN, UP, HZDR, SCK•CEN and CIEMAT). This working group also connects to E&T CONCERT WP and to other platforms, consortiums and projects (e.g., DoReMi; MELODI, OPERRA, TREE; PETRUS III).

The aims of the ALLIANCE E&T WG are similar to those of COMET:

- To strengthen and secure a sustainable integrated European training and education platform in radioecology that will attract graduates.
- To ensure and maintain sustainable workforce in radioecology, by interacting with radioecology stakeholders (e.g., students; teachers; employers), to meet future needs within nuclear sciences.
- To put students in contact with research projects.
- To put students in contact with potential employers, as well as to ensure that training and education in radioecology meets the needs of those employers.
- To enhance the mobility of teachers and scientists as a means of securing competence building as well as dissemination of radioecology knowledge.

The aim is that this will be done through continuation of and building on existing activities (PhD and MSc courses, workshops, training courses, student networking etc.) started in STAR and continued in COMET, as well as the introduction of new initiatives. Future activities should include:

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- 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:
  - Link with TERRITORIES, CONFIDENCE – how the ALLIANCE E&T WG can interact with the E&T WG of both projects will be developed in the near future.
  - European Training and Education in Radiation Protection (EUTERP)
  - European Network on Education and Training in Radiation Protection (ENETRAP)
  - European Nuclear Education Network (ENEN)
  - Advanced Networking for Nuclear Education and Training and Transfer of Expertise (ANNETTE)
  - Competence Maintenance, Education and Training (CMET) within IGD-TP
  - Nuclear and Radiochemical Education Network (NRC, coming from CINCH-II)
  - Nuclear and Radiochemistry Division of the European Association for Chemical and Molecular Sciences (EuChemS).
- Further exploring the possibility to send in an application through the Erasmus Mundus Joint Master Degree mechanism for a common European MSc in Radioecology. 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

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funding mechanisms. Future plans within the ALLIANCE must address this lack of sustainability if radioecological competence is to be maintained in Europe.

### 6.1 Relevant STAR and COMET reports and deliverables

D 5.3: Oxford workshop: <http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/Deliverable%205-3.pdf>

D 5.4 ICOBTE and Fukushima workshop. <http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/files/COMET%20Deliverable%205%204%20ICOBTE%202015%20and%20Fukushima%20COMET%20Workshop%20in%20Japan.pdf>

D 5.6 (Chernobyl workshop) [http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/Deliverable\\_56\\_COMET\\_workshop\\_4\\_final.pdf](http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/Deliverable_56_COMET_workshop_4_final.pdf)

MS 53 (Chernobyl course) <http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/COMET%20Milestone%20Report%2053%20final.pdf>

MS 54 (NORM course) [http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/COMET%20Milestone%20Report%2054\\_final.pdf](http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/COMET%20Milestone%20Report%2054_final.pdf)

<http://www.radioecology-exchange.org/content/workshops>

<http://www.radioecology-exchange.org/content/training-courses>

STAR Deliverable 6.1 [http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/D6.1%20Stakeholder%20workshops\\_1.pdf](http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/D6.1%20Stakeholder%20workshops_1.pdf)

STAR D2.5 SRA <http://www.radioecology-exchange.org/sites/www.radioecology-exchange.org/files/D2.5%20Strategic%20research%20agenda-updated%20version.pdf>

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