EUROPEAN COMMISSION

Community research

STAR

(Contract Number: Fission-2010-3.5.1-269672)

DELIVERABLE (D-N°1.8)

Performance Report

Author(s): Thomas Hinton and Laureline Février

Reporting period: 01/08/12 – 31/01/14

Date of issue of this report: 31/03/2014

Start date of project: 01/02/2011 Duration: 54 Months

STAR

STRATEGY FOR ALLIED RADIOECOLOGY

EURATOM

DISTRIBUTION LIST

Name	Number of copies	Comments
André Jouve, STAR EC Project Officer	1	Electronically
Thomas Hinton, STAR Co-ordinator ;WP-1, IRSN	1	Electronically (pdf file)
Laureline Février, Assistant Co-ordinator. WP-1, IRSN.	1	Electronically (pdf file)
STAR Management Team members: WP-2; T. Ikaheimonen, STUK WP-3; A. Liland, NRPA WP-4; H. Vandenhove, SCK-CEN WP-5; F. Alonzo, IRSN WP-6; D. Oughton, NMBU WP-7; B. Howard, NERC	1 per member	Electronically (pdf file)
STAR Steering Committee M. Steiner, BfS A. Real, CIEMAT J-C. Gariel, IRSN T. Ikaheimonen, STUK H. Vandenhove, SCK-CEN C. Bradshaw, SU A. Liland, NRPA B. Howard, NERC B. Salbu, NMBU	1 per member	Electronically (pdf file)
STAR Wiki site		Electronically (pdf file)
STAR's External Advisory Board	1 per member	Electronically (pdf file)
ALLIANCE members	1 per member	Electronically (pdf file)

Project co-funded by the European Commission under the Seventh Euratom Framework Programme for Nuclear Research &Training Activities (2007-2011)		
Dissemination Level		
PU	Public	PU
RE	Restricted to a group specified by the partners of the [STAR]	
CO	Confidential, only for partners of the [STAR] project	

Table of Contents

1. Executive Summary: Five Key Value-Added Contributions

STAR (Strategy for Allied Radioecology) is a Network of Excellence (NoE) in Radioecology funded under the EC's 7th framework. STAR is a consortium of nine partners[1] from eight countries dedicated to strengthening the science of radioecology in Europe. This document is a Performance Report of STAR for its second 18 months of funding, from 1 August 2012 to 31 January 2014. STAR is funded for 54 months, beginning on 1 February 2011.

Radioecology is the science concerned with how radioactive substances released to or present in the environment are dispersed by various transfer processes and retained by different environmental components. The quantification of these processes allows determination of radiation exposures. From exposure, radioecologists estimate the absorbed dose, potential biological/ecological effects, and ultimately assess the risks to humans and the environment.

With the scientific challenges related to the nuclear fuel cycle the need for radioecological expertise is increasing world-wide. Concurrently, education related to radioecology has declined, leading experts are approaching retirement, and funding for radioecological research is at a minimum in many European countries.

STAR is dedicated to strengthening the science of radioecology in Europe by facing these challenges and reducing its further fragmentation. *The goal of STAR is to efficiently integrate important organisations, infrastructures, and research efforts into a sustainable network that contributes to a European Research Area in radioecology.*

STAR has made considerable progress in advancing the science of radioecology over the last 36-months, and in developing a sustainable network, as demonstrated by these five value-added contributions:

1) **STAR has made significant progress in developing the long-term integration of the radioecology community.** This is demonstrated by the following:
   - STAR is integrating two new partners into the STAR consortium, selected after an external call for proposals. The new partners (State University of New York and Tokai University in Japan) will conduct research on marine radioecology related to the 2011 accident at Fukushima.
   - STAR's parent platform, the Radioecology Alliance, has established a legal association, and has grown during STAR's tenure by adding six new members, bringing the current membership to 14. Expanding the Radioecology Alliance is important because it reduces the fragmentation of the radioecology community and integrates the critical mass of resources and expertise.

[1] Institut de Radioprotection et de Sûreté Nucléaire (IRSN, France); Radiation and Nuclear Safety Authority (STUK, Finland); Belgian Nuclear Research Centre (SCK-CEN, Belgium); Natural Environment Research Council - Centre for Ecology & Hydrology (NERC, United Kingdom); Research Centre in Energy, Environment and Technology (CIEMAT, Spain); Bundesamt für Strahlenschutz (BfS, Germany); Stockholm University (SU, Sweden); Norwegian Radiation Protection Authority (NRPA, Norway); and the University of Life Sciences (UMB, Norway).

- STAR partners were successful in obtaining funding for another consortium (COMET[2]) to advance the goals of STAR. All organisations within STAR are part of COMET, plus four new members from Ukraine, Poland and Japan
- STAR, and more prominently COMET, is developing radioecology as a key pillar under the OPERRA radiation protection scheme within the EC's Horizon2020 programme. This task is a key goal within the COMET consortium.
- STAR developed the concept of field Observatories for Radioecological Research, and has selected two sites, one in Poland and the other at Chernobyl. Focused research at common observatory sites will efficiently maximize improvements in methods and models, as well as encourage international collaboration. Data collected from these sites will be made accessible on the STAR Web portal resulting in a valuable European compilation. Such a pooled, consolidated effort will facilitate the sharing of data and resources, as well as provide excellent opportunities for training and education. STAR's efforts in this area are state-of-the-art, innovative and multidisciplinary.

2) STAR produced the first Strategic Research Agenda (SRA) in radioecology. The SRA is a powerful document that has the potential to influence the future direction of radioecology. A second version of the SRA recently produced by STAR integrates stakeholder input into the SRA and includes a strategy for radioecological education and training. The SRA is a key document that gives strategic direction for an entire discipline of science. As such, the SRA is important for the Radioecology Alliance, EC funding agencies and for the entire radiation protection field, including its numerous stakeholders. STAR's method of obtaining stakeholder input to the SRA has been examined and modelled by other research platforms under the OPERRA umbrella. Additionally, NCoRE, a radioecology network of excellence in the United States has developed its strategic agenda based on the one produced by STAR.

3) STAR has developed the first web portal that openly provides radioecological information (publications, data, EURATOM reports, training materials, 'news items', methods) to stakeholders. STAR's website, the *Radioecology Exchange* (www.star-radioecology.org), is now a common depository for developments, data, training material, and radioecological news that is routinely used by all consortium members, as well as outside stakeholders. The portal enhances communication among stakeholders, is a stimulus for collaboration and integration, serves as an archive for data in future meta-analyses, and maximizes the accessibility of data from EURATOM projects concerned with environmental radioactivity. Among other things, the *Radioecology Exchange* contains a:

- Virtual Laboratory, publically available, that provides radioecological information in four categories:
    - *Methodological*: descriptions of analytical methods (including problems likely to be encountered); video clips of methods; protocols and manuals;

[2] COMET (Coordination and iMplementation of a pan-European instrument for radioecology) is an EC-funded project designed to further the work of STAR and to bring radioecology within the OPERRA radiation protection programme established by the EC's next funding framework: Horizon2020

  - *Informative*: fact and datasheets, databases, sample archives and examples of sources of environmental dose
  - *Practical*: how to use models CROM and ERICA
  - *Educational*: lectures, videos and links to other websites related to training activities
- Infrastructure database**,** that provides insight into resources available among the STAR partners (facilities, equipment, analytical methods, sample archives, models, expertise). The database will help ensure effective collaboration and integration between the partners, with the possibility to enlarge to other radioecology institutes the world-over.

The *Radioecology Exchange* has attracted over 700 unique visitors between January 1st 2013 and November 1st 2013, many visiting on more than one occasion. Popular pages included those describing the consortium; the Strategic Research Agenda (SRA); and what jobs or training opportunities are available. Sixteen percent of the visitors came from Spain, 14% from the USA (mainly interested in the SRA), 8% France, 8% UK, 2% from Japan, with the remainder spread worldwide. The site was used for the open call for research associated with Fukushima marine research. We anticipate the numbers to increase in 2014 when the Virtual Laboratory information and Observatory data becomes available and STAR is well published at the international radioecology conference in Barcelona.

STAR, as well as COMET, and ultimately the Radioecology Alliance, promote the integration of radioecological expertise within the European community by networking outside the consortium and using the *Radioecology Exchange* to enhance communication among stakeholders. STAR's website maximizes the public accessibility of data concerned with environmental radioactivity and provides an archive for future meta-analyses. Recent agreements between STAR, COMET and the Radioecology Alliance will permit the information collated on the *Radioecology Exchange* to be held in a sustainable format, thus providing a valuable resource to stakeholders and supporting radioecology in the future.

4) **Through a series of stakeholder consultations, STAR has identified and responded to the demands for and supply of relevant radioecological training and educational needs within Europe.** The stakeholder information is being used by STAR to enhance radioecological training programmes and thus:
   - develop a sustainable integrated European training and education platform in radioecology that will attract top-level graduates,
   - maintain a relevant workforce that is in a position to meet future economic and societal needs within the nuclear sciences, and
   - fill the identified European postgraduate education gap in radiological sciences, as well as provide a modular structure that is easily accessed by stakeholders for professional development training..

STAR has developed the *Radioecology Education and Training Platform* (E&T platform). It is a website focal point for students and professionals interested in the educational aspects of radioecology. The platform presents an overview of education and training course modules within radioecology/environmental radioactivity presently offered by the STAR consortium. Information on course curriculums and learning outcomes are provided, with recommended pathways to obtained academic merited education (MSc, PhD). The Radioecology E&T platform also provides links to other

E&T platforms, such as those within Radiochemistry, Radiobiology and Radiation Protection. Additionally, STAR has:

- successfully held two E&T Courses: Environmental Radiobiology (PhD course, 5 ECTS) and Experimental Radioecology (MSc Course 5/10 ECTS). Participation was 28 and 16 students, respectively, which is more than a 100% increase on past attendance, and with good student feedback.
- attracted funding from the DoReMi Network of Excellence to sponsor participation of additional students and foster links with the radiobiology community.
- participated in MELODI/OPERRA E&T network meetings to initiate integration and to further develop STAR's E&T in OPERRA and Horizon 2020
- progressed on procedures for awarding joint degree between different universities

Overall STAR has made an important contribution to the education and recruitment of students to radioecology, as well as strengthened international recognition of the importance of radioecology as a relevant discipline for other areas of nuclear science. The significant increase in the number of students taking courses and registering for the Radioecology MSc was one of the main performance indicators set at the start of the project, and this has now been achieved.

5) STAR's three research programmes are making significant progress in key areas identified within the Strategic Research Agenda:

- As part of the goal to determine if radiation protection criteria for humans and wildlife need to be considered within a mixed contaminant context, STAR has produced the first critical evaluation of the applicability of ecotoxicological methods for radioecological research and assessments. The report is available on the STAR website and is a valuable reference for scientists conducting mixed contaminant research.
    - Research within this Work Package suggests that co-contaminants do not have a significant effect on the speciation of radionuclides, and hence unlikely to impact radionuclide mobility in the environment. This is an important finding, relevant to the scientific community.
    - Ongoing research with this Work Package is assessing the impact of mixed contaminants on radiation induced effects to several wildlife species. Binary mixtures of contaminants that include ionizing radiation are being evaluated using classical ecotoxicological methods that are atypical for radioecology. These results will be a focus of STAR's final report (July 2015).

- STAR is addressing the need for integrating human and non-human radiation protection, and to approach the problem on levels ranging from conceptual to practical. All the actions in this Work Package are leading to tools that can be used by regulators, operators, risk assessors and stakeholders:
    - A comparison of the risk assessment frameworks for humans and non-human biota has been performed and possibilities and obstacles of creating a holistic framework are currently being discussed.
    - Literature reviews and theoretical considerations of various extrapolation techniques have been performed.
    - A model screening tool combining human and non-human biota risk assessment is being developed. STAR is integrating the human model CROM with the biota model

ERICA-Tool into a new Tier-1 model named CROMERICA. A combined screening tool for both human and non-human biota will be very useful for regulators and operators.

- STAR is developing a method that will reduce the current uncertainties in predicting effects to populations of wildlife exposed to radiation, and thus potentially reduce the costs associated with implementation of environmental protection programs. This will be accomplished with the establishment of a method for effectively extrapolating from measurable effects on individuals to broader impacts that can be used as protection criteria and applied as protection benchmarks at the screening-tier of ecological risk assessments.
    - The method developed by STAR for effectively extrapolating from measurable endpoints on individuals to ecologically relevant impacts will soon be published. The method is being promoted within the IAEA program MODARIA and ICRP's Committee 5.
    - The work package is researching early warning biomarkers of contaminant exposure that will establish fingerprints for different types of exposure based on specific response mechanisms.
    - The work package is using coupled a Biokinetics/Dynamic Energy Budget approach to understand the metabolic mode of actions of radiological exposures at the individual level. This is a novel approach in radioecology

The five contributions highlighted above, along with the numerous contributions detailed in the rest of this report, indicate that over the last 36 months STAR has established itself as the primary source in Europe for value added expertise in environmental radioactivity. The STAR partners have more than 170 experts covering a wide range of knowledge in terrestrial, freshwater and marine radioecology; atmospheric dispersion; dosimetry; ecology; ecotoxicology; environmental radiation protection; environmental surveillance; modelling; radiobiology and radionuclide analytics; emergency preparedness; education and training.

The experience gained by STAR will help the Radioecology Alliance achieve integration among its partners and develop long term sustainability of the science. Based on the vanguard work of STAR, members of the Radioecology Alliance will bring together parts of their respective research and development programmes into an integrated platform that enhances radioecological competences; maintains experimental infrastructures; and addresses the scientific and educational challenges of assessing the impacts of radioactive substances on humans and the environment. In doing so, the Radioecology Alliance will help support the radiation protection needs of national authorities, non-governmental organisations, industry, scientists and stakholders.

2. Introduction

This document is a Performance Report of the STAR project for the second 18-month period of work, from 1 August 2012 to 31 January 2014. STAR (Strategy for Allied Radioecology) is a Network of Excellence (NoE) in Radioecology funded under the EC's 7th framework. STAR is a consortium of nine partners from eight countries (**Table 1**) dedicated to strengthening the science of radioecology in Europe.

Table 1. Partners within the STAR Network of Excellence

Partner name	Abbreviation	Country code
Institute of Radioprotection and Nuclear Safety	IRSN	FR
Radiation and Nuclear Safety Authority	STUK	FI
Belgian Nuclear Research Centre	SCK-CEN	BE
Natural Environmental Research Council	NERC	UK
Research Centre in Energy, Environment and Technology	CIEMAT	ES
Stockholm University	SU	SE
Federal Office of Radiation Protection	BfS	DE
Norwegian Radiation Protection Authority	NRPA	NO
*University of Life Sciences	*NMBU	NO

* formerly UMB

STAR is composed of seven work packages (WPs) that focus on coordination of the NoE (WP-1); integration among the partners and developing a strategy for long-term sustainability of radioecology (WP-2); research (WPs -3, -4 and -5); education (WP-6); and knowledge dissemination (WP-7). Details about the NoE and individual WPs can be found on STAR's website (www.star-radioecology.org).

This particular report:

- highlights five key value-added contributions that STAR has made over the last 36 months (see Executive Summary)
- evaluates STAR's progress based on Performance Indicators established within the Grant Agreement with the EC
- includes the most recent report from STAR's External Advisory Board.

3. Performance Indicators

Performance indicators (PIs) were established within STAR's Grant Agreement with the EC to help evaluate STAR's progress and success. The PIs are divided into five categories within the following tables (1- Research; 2- Dissemination; 3- Education; 4- Integration; and 5- Management). Success factors are listed in the first column of the table. The second column provides the performance indicators, as listed in STAR's Grant Agreement, that are to be used to evaluate success. The third column provides a status report for each respective performance indicator as achieved during the first 18-month reporting period. The fourth column provides an update by presenting the progressive advancement that STAR has made during the second 18-month reporting period.

3.1 Research

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Relevance of research	Research is focused on key issues identified by the ALLIANCE Strategic Research Agenda (SRA) Research results are published in well-respected, peer-reviewed journals	• STAR's three research lines are: (1) to integrate human and non-human radiation protection approaches; (2) to determine if radiation protection criteria for humans and wildlife need to be considered within a mixed contaminant context; and (3) to enhance the scientific robustness of ecological protection criteria and their applicability as protection benchmarks. • The research lines are relevant from the perspective that each was identified as an important topic within a draft Strategic Research Agenda (SRA) of the ALLIANCE. • Improvements to the draft SRA were made and the first SRA for radioecology was published during this 18-month period. The relevance and applicability of the SRA itself is now being critiqued via invited stakeholder review. Initial indications suggest that the SRA is being well received by the international radioecology community. An analysis of the reviews, with an associated workshop, is planned for	• STAR continues to make progress on key issues that are important to numerous stakeholders of radiation protection. The research topics are particularly pertinent to the current IAEA MODARIA programme and ICRP's work within Committee 5 (non-human biota). Several STAR members are actively involved in both. • During this 18-month period STAR sought stakeholder input on the Strategic Research Agenda via a questionnaire sent out to 4000 email addresses and a workshop in Paris designed specially to obtain stakeholder input. • The relevance of the SRA was evident in that all 15 research lines within the SRA had support among the stakeholders as being important. • The relevance of STAR's work was also indicated by the topic of STAR's call for new members. The call for research proposals was for human or environmental aspect of marine radioecology associated with the 2011 Great Earth Quake and Tsunami in Japan. • Work within the STAR consortium has resulted in 10

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		November 2012. • The research lines were chosen in part because of the difficulty for a single laboratory to accomplish such complex work. Thus the research requires multi-disciplinary collaboration. Collaboration will help STAR achieve its larger goal of integration among the consortium partners. • Work within the STAR consortium has resulted in 5 publications to date: Brown J.E., Hosseini A., Seymour C. 2011. Modelling transfer to animals accounting for trans-generational factors. *Radioprotection* 46(6):S509–S514 Brown J.E., Beresford N.A., Hosseini A. 2012. Approaches to providing missing transfer parameter values in the ERICA Tool - How well do they work? *Journal of Environmental Radioactivity* 126:399-411. Hinton T.G., Garnier-Laplace J., Vandenhove H., Dowdall M., Adam-Guillermin C., Alonzo F., Barnett C., Beaugelin-Seiller K., Beresford N.A., Bradshaw C., Brown J., Eyrolle F., Février L., Gariel J.-C., Gilbin R., Hertel-Aas T., Horemans	additional publications during this reporting period, including a manuscript related to the accident in Japan that was published in the *Proceedings of the National Academy of Sciences*, one of the world's most-cited multidisciplinary scientific journals: Beresford N.A., Vives i Batlle J. 2013. Estimating the biological half-life for radionuclides in homoeothermic vertebrates: a simplified allometric approach. *Radiation and Environmental Biophysics* 52: 505-511. Beresford N.A., Yankovich T.L., Wood M.D., Fesenko S,. Andersson P., Muikku M., Willey N.J. 2013. A new approach to predicting environmental transfer of radionuclides to wildlife: A demonstration for freshwater fish and caesium. *Science of the Total Environment*. 463-464: 284-292. Fisher N.S., Beaugelin-Seiller K., Hinton T.G., Baumann Z., Madigan D.G., Garnier-Laplace J. 2013. Evaluation of radiation doses and associated risk from the Fukushima nuclear accident to marine biota and human consumers of seafood. *Proceedings of the National Academy of Sciences*. 110: 10670-10675. Hinton et al. 2013 An invitation to contribute to a strategic research agenda in radioecology. Translated into Spanish and published in *Radioproteccion* 74:48-61, 2013.

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		N., Howard B.J., Ikäheimonen T., Mora J.C., Oughton D., Real A., Salbu B., Simon-Cornu M., Steiner M., Sweeck L., Vives i Batlle J. 2013. An invitation to contribute to a strategic research agenda in radioecology. *Journal of Environmental Radioactivity* 115: 73-82. Lance E., Alonzo F., Garcia-Sanchez L., Beaugelin-Seiller K., Garnier-Laplace J. 2012. Modelling population-level consequences of chronic external gamma irradiation in aquatic invertebrates under laboratory conditions. *Science of the Total Environment* 429: 206-214. Oughton D.H., Howard B.J. 2012. The social and ethical challenges of radiation risk management. *Ethics, Policy and Environment* 15:71-76	Hosseini A., Stenberg K., Avila R., Beresford N.A., and Brown J.E. 2013. Application of the Bayesian approach for derivation of PDFs for concentration ratio values. *Journal of Environmental Radioactivity* 126:376-387. Howard, B.J. 2013. A new IAEA handbook quantifying the transfer of radionuclides to wildlife for assessment tools. *Journal of Environmental Radioactivity* 126:284-287. Howard B.J., Wells C., Beresford N.A., Copplestone D. 2013. Exploring methods to prioritise concentration ratios when estimating weighted absorbed dose rates to terrestrial Reference Animals and Plants. *Journal of Environmental Radioactivity* 126:326-337. Psaltaki M., Brown, J.E., Howard, B.J. 2013. TRS Cs CRwo-water values for the marine environment: analysis, applications and comparisons. *Journal of Environmental Radioactivity* 126:367-375. Vanhoudt N., Vandenhove H., Real A., Bradshaw C., Stark K. 2012. A review of multiple stressor studies that include ionising radiation. *Environmental Pollution*. 168:177-192. Wood M.D., Beresford N.A., Howard B.J., Copplestone D. 2013. Evaluating summarised radionuclide concentration ratio datasets for wildlife. *Journal of Environmental*

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
			Radioactivity 126:314-325 • STAR will have a major presence at the upcoming International Conference on Radioecology and Environmental Radioactivity, scheduled for September 2014. ICRER is held once every three years and is the major radioecology meeting in Europe. 15 abstracts of STAR's work were submitted to ICRER. 1. **A mechanistic approach to link biological effects of radionuclides from molecules to populations in wildlife species.** F. Alonzo, F. Parisot, D. Plaire, C. Adam-Guillermin, J. Garnier-Laplace. 2. **Mechanistic study of the toxicity of ionizing radiation in *Daphnia Magna.*** F. Parisot, F. Alonzo, J. Bourdineaud, J. Poggiale. 3. **Radiological Observatories—Breeding grounds for innovative research**. M. Steiner, N. A. Beresford, B. Howard, C. Bradshaw, K. Stark, M. Dowdall, A. Liland, F. Eyrolle-Boyer, J. Guillevic, T. Hinton, S. Gashchak, K-L Hutri, T. Ikäheimonen, M. Muikku, B. Michalik, J-C. Mora, A. Real, B.Robles, D. Oughton, B. Salbu, L. Sweeck, L. Urso, K. Wichterey, C. Willrodt, V. Yoschenko. 4. **Recent development of wildlife transfer databases.** N. Beresford, D. Copplestone; A. Hosseini, J.E. Brown, M.

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
			Johansen, G. Hirth, S. Sheppard, E. Dagher, T. Yankovich, S. Uchida, J. Napier, I. Outola, C. Wells, B.J. Howard, C.L. Barnett, M.D. Wood. 5. **Making the most of what we have: Application of extrapolation approaches in wildlife transfer models.** N. Beresford, M.D. Wood, J. Vives i Batlle, J.E. Brown, A. Hosseini, C. Barnet,. T. Yankovich, N. Willey. 6. **To what extent can human and non-human radiation protection frameworks be integrated?** C. Bradshaw, K. Beaugelin, N. Beresford, J. Brown, J. C. Mora, M. Dowdall, T. Hinton, A. Hosseini, A. Liland, D. Oughton, A. Real, B. Robles, K. Stark, M. Steiner, L. Sweeck, J. Vives I Batlle. 7. **Combined effects of gamma irradiation and cadmium on celluar and population-level endpoints of the microalga *Pseudokirchneriella subcapitata*.** C. Bradshaw, D. Abdul Meseh, H. Alasawi, M. Qiang, F. Nascimento 8. **Interactive effects of gamma irradiation and the PAH fluoranthene on the transfer of carbon between phytoplankton and zooplankton**. F. Nascimento, C. Bradshaw, C. Svendsen. 9. **Is the use of wildlife group-specific concentration**

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
			ratios justified? M. Wood, N. Beresford, D. Copplestone, B. Howard, T. Yankovich 10. **The Radioecology Exchange.** C. Barnett, N. A. Beresford, S. Patel, C. Wells, B. J. Howard, J- C. Mora, A. Real, B. Robles, K. Beaugelin-Seiller, R. Gilbin, T. Hinton, P. Vesterbacka, M. Muikku, I. Outola, L. Skuterud, M. Album, Ytre-Eide; C. Bradshaw, B. Jaeschke, D. Oughton, L. Skipperud, H. Vandenhove, M.Steiner. 11. **STAR Infrastructure Database: An effort to know each other**. J.C. Mora P. Vesterbacka, I. Outola, C. Barnett, N. Beresford; A. Real, C. Bradshaw; L. Skipperud; C. Wilrodt, M. Steiner; N. Vanhoudt; M. Komperød, R. Gurriaran, R. Gilbin, T. Hinton. 12. **Interaction matrices as a tool for prioritizing radioecology research**. J.C. Mora, C. Bradshaw, K. Stark, B. Robles, L. Sweeck, J. Vives i Batlle, N. Beresford, H. Thørring, M. Dowdal, I. Outola, T. Turtiainen, V. Vetikko, M. Steiner, K. Beaugelin-Seiller, L. Février, P. Hurtevent, P. Boyer. 13. **Radioecology: Challenges and opportunities in common with low dose radiation biology.** T. Hinton, A. Real, D. Oughton, W. Morgan. 14. **Advances in environmental radiation protection: Re-**

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
			thinking animal-environment interaction modelling for wildlife dose assessment. M. Wood, N. Beresford , C. Bradshaw, S. Gashchak, T. Hinton. 15. **The European Radioecology ALLIANCE: Encouraging the coordination and integration of research activities in radioecology.** Real, A., L. Currivan, J-C Gariel, F. Hardeman, B. Howard, S. Lukashenko, I. Lund, L. Sabatier, S. Sachs, S. Salomaa, J. Smith, M. Steiner, P. Strand, J. Tschiersch, T. Hinton, H. Vandenhove.
Exploitation of results by end-users	Open inter-disciplinary workshops International collaboration Number of attendees to workshops Collaboration with EU- and international projects	•WP-4 and WP-5 held a combined workshop (24-27 May 2011) on multi-stressors, DEBtox-theory, and "-omics" in which 31 participants attended. Six experts from disciplines outside of radioecology shared with us their expertise on exposure, effects and risk assessment under multiple stressor exposure conditions. •WP-4 held an additional workshop on multi-stressors in which experts from ecotoxicology were invited participants (7-9 November 2011) •The workshops resulted in EC deliverable D4.1., *Critical review of existing approaches, methods and tools for mixed contaminant exposure, effect and risk*	• STAR has produced several EC-Deliverables that are publically available on the STAR website and provide useful guidance to students, scientists, professionals, and various stakeholders: 1. STAR Work Package 5 produced a manual that describes the basic concepts, needs, data generation and mathematical treatments for laboratory radiation effect studies. 2. STAR Work Package 5 produced a report that describes life history traits, radiosensitivity and population modelling methods to extrapolate from individual endpoints to population dynamics in exposed non-human biota. 3. STAR Work Package 6 produced a summary document of

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		assessment in ecotoxicology and evaluation of their usefulness for radioecology. The workshops were also key in developing STAR's experimental plan for hypothesis-driven, multi-stresor research (published as milestone MS43; *Integrated Research and Experimental Plan under STAR-WP4 in March 2012).* Both documents are freely accessible on STAR's public web-site, and thus constitute valuable resources for other scientists interested in conducting mixed contaminant research. • STAR's WP-5 produced a deliverable report on methods for effects research in radioecology. The report (*Experimental Plan for hypothesis-driven laboratory work: Selection of radionuclides, biological models, endpoints, experimental design and models, tools and statistics for data interpretation*) is freely accessible on STAR's public web-site, and thus constitutes a valuable resource for other scientists interested in conducting effects-type research. • WP-2 is seeking international input on the Strategic Research Agenda developed by STAR. The SRA has been published in the open literature and posted on the STAR website. An invitation to comment on the SRA	two stakeholder workshops on education and training in radioecology. A total of 47 stakeholders from outside the STAR network participated, providing valuable input and advice on the education and training work planned in STAR. 4. STAR Work Package 4 produced a document that provides an overview of existing approaches, methods and tools developed in ecotoxicology for assessing exposures, effects and risks in a mixed contaminant context. The document evaluates their applicability for radioecological research and radioecological risk assessments. • STAR has produced several documents associated with Milestones that will be available to the public once the data are published. ○ Work Package 3 has produced several reports on the topic of integrating human and wildlife risk assessments: Milestone MS 3.2 "*Complete interaction matrices for humans and wildlife for hypothetical site/scenarios*" was completed in May 2013; Milestone MS3.3 *"Description of coupled combined model for humans and wildlife"* was completed in March 2013, as a report called *"Integrated Screening Model for Humans and*

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		and to participation in developing the next version was sent via email to some 3000 individuals worldwide (from ~85 countries). Comments are obtained via a questionnaire available on the STAR website. •Through a series of stakeholder consultations in May and November 2011, STAR's WP-6 identified the demands for and supply of relevant radioecological training and educational needs within Europe. A total of 47 stakeholders from outside the STAR consortium contributed to the workshops. The information will be used to enhance existing educational structures; to secure a sustainable integrated European training and education platform in radioecology; to attract top-level graduates; and to maintain a relevant workforce that is in a position to meet future economic and societal needs within the nuclear sciences. •The STAR partners have established themselves as the primary source in Europe for value added expertise in environmental radioactivity. This has been accomplished, in part, by the strength of the STAR-produced web-based inventory of infrastructure, models, expertise and archived samples held by the STAR member organizations. The inventory reveals	*Wildlife"* ; MS3.4 *"Internal report on comparative analysis of human and non-human frameworks"* in July 2013. ○ Work Package 4 has completed research that examined the influence of co-contaminants on the speciation and availability of radionuclides. The results suggest that co-contaminants do not have a significant effect on the speciation of natural radionuclides, and that co-contaminants will unlikely alter the mobility of radionuclides. This is interesting and relevant to the scientific community. • STAR is developing a *Virtual Laboratory* on its website that is publically accessible. It provides information related to four categories: • *Methodological*: descriptions of analytical methods (including problems likely to be encountered); video clips of methods; protocols and manuals; • *Informative*: fact and datasheets, databases, sample archives and examples of sources of environmental dose • *Practical*: how to use models CROM and ERICA • *Educational*: lectures,videos and links to other websites

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		that STAR partners have more than 170 experts covering a wide range of areas in terrestrial, freshwater and marine radioecology; atmospheric dispersion; dosimetry; ecology; ecotoxicology; environmental radiation protection; environmental surveillance; modelling; radiobiology and radionuclide analytics; emergency preparedness; education and training. The STAR partners' expertise covers at least 40 different models that calculate activity concentrations, dose rates, and risks of radiation to humans and the environment. This information could be used for coordination and integration in response to emergencies; for training; and for collaboration between STAR/ALLIANCE and other research organisations, international organizations (e.g. IAEA) and other platforms (NERIS, HERCA, MELODI). • Following the Fukushima accident of March 11, 2011, the EC suggested that STAR consider a Japanese partner. This was viewed favourably by the existing STAR partners. STAR partners then offered suggestions as to likely candidate laboratories and debates of the pros and cons followed. STAR partners agreed upon a path forward, and the procedure of inviting a specific laboratory (rather than through an open call procedure)	related to training activities

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		was discussed with our EC project officer. The STAR members voted to invite a specific Japanese laboratory of radioecology into the STAR consortium. A letter of invitation was sent to the Japanese laboratory on 9 May 2011. Their response was favourable; however, the laboratory requested additional time to fully consider STAR's offer. Considering the complexity of the accident situation and the huge demands currently placed on the Japanese people and on Japanese radiological laboratories, STAR did not press the Japanese laboratory for a final decision. However, one year later the conditions in Japan remained such that the Japanese laboratory initially contacted by STAR was still unable to commit to a full membership within the Network of Excellence. STAR received notification from the Japanese laboratory that they would prefer to participate in another manner. STAR then conducted in-house discussions and decided on a second Japanese laboratory to invite within the NoE. That Japanese laboratory was contacted in May 2012 and The Director General expressed interest. In June, representatives of STAR met with the Director General in Japan and further advanced the negotiations. STAR's goal is to finalize negotiations and have the laboratory a full	

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		partner before the end of 2012. •Several STAR partners were actively involved in the IAEA EMRAS-ii project, with STAR partners leading 4 out of the 9 working groups. Several STAR partners will also be involved in the IAEA follow-up program, MODARIA.	
Observatory for Radioeco-logical Research	Establishment of sites Communication of their potential to the wider scientific audience Number of participants outside of STAR	• STAR developed a list of selection criteria for the evaluation of potential Observatories for Radioecological Research. The Observatories are contaminated field sites chosen, and thereafter prioritized, for common field research. The sharing of resources and data from an Observatory Site is a strong integrating component to STAR, the ALLIANCE and the scientific community at large. The Observatories will foster innovative co-operation amongst the partners. Over time, they will involve the wider radioecological and stakeholder community in the development of a sustainable European Research Area in radioecology. •STAR held a workshop on Observatories in mid-May. The workshop goals were to complete a preliminary list of criteria for selecting sites and to address the	• Based on the list of selection criteria for the choice of the European observatories sites created during the first 18-month period and the Observatory workshop held in Berlin, 13-14 June 2012, two sites were selected as Observatories for Radioecoogical Research: a coal mining site in Poland that contains radium contaminated settling ponds, and the Chernobyl exclusion zone. Milestone 2.6 *"Selection of the European Observatory site(s)"* was completed in November 2012 and D2.3 *"Observatory for radiological research – description"* was completed in March 2013.

RESEARCH ORIENTED			
SUCCESS FACTOR Research Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		problem of weighting criteria. • The Observatory concept was presented to the wider radioecology community at the ICRER meeting in Hamilton, Canada; June 19-24, 2011. • A list of candidate Observatory sites was compiled, including a coal mining site in Poland, Chernobyl, a French uranium mining site near Clermont-Ferrand, a German site in a former uranium mining area and Fukushima. The sites were discussed with input from invited experts outside of the STAR consortium at a workshop held in Berlin, 13-14 June 2012.	

3.2 *Knowledge Dissemination*

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Wide dissemination of high-quality results	# of original publications; # of visits to public web site; # of press releases;	• STAR developed a Communication Plan (CP) that identifies STAR's various stakeholders with a matrix of their communication needs and delivery schedules. • STAR's website, the *Radioecology Exchange*, was established early in the project (April 2011) and is regularly updated with (e.g.) deliverables and news items. Interesting topics are selected to become 'Starlights'. Twitter (see @STARadioecology) and Facebook accounts have been created, and hyperlinks have been made to the accounts from the *Radioecology Exchange*. STAR deliverables and news items are 'Tweeted' as they become available; some STAR partner institutes are following the STAR Twitter feed and 'Retweet' as appropriate. • Communication about the STAR project was made in the EC parliament magazine (issue 332; 18 July 2011). • STAR manages a Group Page on Linked-In, the website for networking among professionals	• An updated Communication Plan (CP) was produced during this period as Deliverable 1.5. The CP is a guide to improve the efficiency and effectiveness of communicating information to stakeholders of STAR and the Radioecology Alliance. The CP defines what is a stakeholder, categorizes types of information that various stakeholders might want from STAR, identifies STAR's key stakeholders, discusses the changes in setting communication priorities with stakeholders, particularly with the upcoming Horizon 2020 funding framework of the EC, describes some media options for communicating with stakeholders, gives guidance on how best to communicate with stakeholders and lists several communication events planned within STAR's funding period. • STAR co-organised a special session, *Environmental Radioactivity: Legacy Sites, Chernobyl and Fukushima*, at the 12th International Congress on Biogeochemistry of Trace Elements. The session occupied two full days and consisted of 30 oral presentations, seven posters and an invited plenary speaker (i.e. STAR's Coordinator). STAR members then co-edited the manuscripts for a special issue of the *Journal of Environmental Radioactivity* (2014; 131). The STAR,

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		• Posters and flyers promoting STAR have been made and are available to be used at conferences and other appropriate events. • A special session (seven presentations) promoting STAR was held at the International Conference on Radioecology and Environmental Radioactivity (ICRER) in Hamilton, Canada; June 2011. The session was entitled '*An invitation to participate in the integration of international radioecological efforts*'. • Work within the STAR consortium has resulted in five publications to date (listed above under the Research Section) • Several STAR personnel have published manuscripts, independent of STAR, that concern the Fukushima accident. The manuscripts are listed below to demonstrate the knowledge contained within the STAR consortium and the value that the consortium offers to diverse stakeholders: Oughton, D.H. and B. J. Howard. 2012. The social and Ethical Challenges of Radiation Risk Management. *Ethics, Policy and Environment.*	ALLIANCE, and International Union of Radioecology logos are displayed on the front page of the preface to the special issue. The preface is attached in **ANNEX 1.** • STAR was represented at the '*Environmental Radioactivity: Implications for Environmental and Human Health*' conference hold in Plymouth, UK on 4-5th September 2012 where a special session was held for PhD students (introducing the STAR PhD Research School to a wider audience) • STAR's web site, the Radioecology Exchange, attracted over 900 unique visitors between August 1st 2012 and January 31st 2014, many visiting on more than one occasion. Popular pages included those describing the STAR professional development courses, the consortium, and those describing jobs or training opportunities. Thirty three percent of visitors came from the UK, 12% from the USA (SRA), 11% from India (jobs) 4%, from France, 3% from Germany with the remainder spread worldwide. The site was used to obtain stakeholder input on STAR Strategic Research Agenda and to publicise the open call for new STAR members. • The Website provides a regularly updated news blog for information related to environmental radioactivity e.g. upcoming conferences, jobs, publications etc.

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		http://dx.doi.org/10.1080/21550085.2012.672690 Garnier-Laplace, J., K, Beaugelin-Seiller and T. G. Hinton. 2011. Fukushima wildlife dose reconstruction signals ecological consequences. *Environmental Science & Technology*. doi.org/10.1021/es201637c Beresford, N. A. and D. Copplestone. 2011. Effects of ionizing radiation on wildlife - what knowledge have we gained between the Chernobyl and Fukushima accidents? *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.238 Beresford, N. A. and B. J. Howard (2011) An overview of the transfer of radionuclides to farm animals and potential countermeasures of relevance to Fukushima releases. *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.235 Vandenhove, H. and C. Turcanu. 2011. Agricultural land management options following large-scale environmental contamination. *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.234	

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		Salbu, B. 2011. Radionuclides released to the environment following nuclear events. *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.232 Vives i Batlle, J. 2011. Impact of nuclear accidents on marine biota. *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.231 Oughton, D. H. 2011. Social and ethical issues in environmental risk management. *Integrated Environmental Assessment and Management*. DOI:10.1002/ieam.226 Vandenhove, H. and L. Sweeck (2011). Soil vulnerability for cesium transfer. *Integrated Environmental assessment and Management*. DOI:10.1002/ieam.237.	
Data management	Effective use of internet in establishing public accessible data bases	• STAR established a web-based database listing all the methods, models, laboratory facilities, equipment and general protocols used by the STAR partners, together with datasets that they are willing to make openly available. The strength and size of the STAR-produced web-based inventory establishes STAR as the primary source in Europe for value added	• Publications produced by STAR are available on the website at: https://wiki.ceh.ac.uk/x/a4FiC. • STAR has produced radionuclide-specific 'factsheets' that focus on basic radioecology related to some important elements. These one- and two-page sheets are publically available on the website.

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		expertise in environmental radioactivity. • STAR is producing web-accessible 'factsheets' on the basic characteristics of some radioecologically important elements. Two video meetings between STAR partners NERC, CIEMAT, IRSN and NRPA have been held to develop and discuss their design and content. NERC has now finalised the design and has recently circulated a template for use by other partners. Initially five 'factsheets' and associated 'data tables' were created, with each participating partner taking responsibility for one (or two) elements. The elements selected were: Cs and I (NERC), H (IRSN), Po (CIEMAT) and U (UMB). Supporting documentation (which will be accessed via hyperlinks) is being produced. Drafts of the Cs factsheet and data table are in **APPENDIX-1.** Once the initial five factsheets and associated data tables are finalised (due end September 2012), they will be accessed via a dedicated page on the *Radioecology Exchange*. Supporting documents will be produced which will contain explanatory text and a glossary. Throughout the project further factsheets and data tables will be created for other radiologically important elements as time allows.	• The milestone MS7.5 *"Uploaded previous Euratom outputs"* was delivered in October 2012. The outputs are available on the *Radioecology Exchange* at: https://wiki.ceh.ac.uk/x/bYFiC. • EURATOM publications collated by STAR have also been made available for IAEAs International Nuclear Information System (INIS) (see http://www.iaea.org/inis/). • Data that were generated prior to STAR by several STAR partners have now been put on the website. The data have been collected from marine, freshwater and terrestrial ecosystems for a variety of sample types (e.g. foodstuffs and crops, milk, fungi and wildlife. All the data were indexed to aid 'searchability' and were made publically available via the Radioecology Exchange: https://wiki.ceh.ac.uk/x/7AXNCw in late December 2013.

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		• STAR is placing documents from prior EURATOM-funded research on the public- assessable *Radioecology Exchange.* An interim web page on the *Radioecology Exchange* was created by NERC (see: https://wiki.ceh.ac.uk/x/bYFiC) to host some information that was readily accessible. NRPA have arranged that all EURATOM publications collated by STAR will also be made available on the IAEAs International Nuclear Information System (INIS) (see http://www.iaea.org/inis/) which currently does not contain EURATOM reports amongst the many grey literature publications it holds. • A dedicated wiki site (access restricted to STAR partners) has been designed by NERC and is currently hosting an ongoing collation of data holdings which all STAR partners wish to make publicly available on the *Radioecology Exchange*. Metadata entries have been made for all entries for which the supplying partner has requested this; some partners have requested not to have metadata entries. Further decisions on presenting the data on the *Radioecology Exchange* will be taken Month 20 (September 2012) as all partners have been requested to make data record entries by the end of	

DISSEMINATION ORIENTED			
SUCCESS FACTOR Dissemination Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		Month 21. • Some data from STAR partners have already been made available via an Information Gateway which is compliant with the European INSPIRE Directive. To view STAR entries, access the Information Gateway (https://gateway.ceh.ac.uk/home) and enter STAR_NOE as the search term (n=24 datasets).	

3.3 *Education*

EDUCATION ORIENTED			
SUCCESS FACTOR Education Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Educating young scientists	# of education and training courses; # of MSc and PhD theses; # of students entering and passing; feedback from students	• The *PhD research school* has been launched through a website (https://wiki.ceh.ac.uk/display/star/STAR+PhD+Research+School) and 18 PhD students from STAR have joined. The school was opened to the wider research community after the STAR Berlin meeting in July 2012, and will be promoted at a number of upcoming conferences. The school is intended to promote networking between students and between students and potential employees, thorough arrangement of joint PhD courses, interactions with other training initiatives and promotion of internships with stakeholders. • The *EU MSc in Radioecology* will, under the signed Memorandum of Understanding, work towards a full joint degree between UMB and the University of Aix-Marseille. Although this is an activity outside the STAR project, the quality control of the whole syllabus and inclusion of STAR partners in teaching is expected to make a significant contribution to the ongoing and future EU MSc.	• STAR has produced an Education and Training Platform as Milestone 6.5 in June 2013, and then further developed into Deliverable 6.2. *"Training and education platform structure"* delivered to EC at the end of September 2013. ○ The E&T platform consists of a two-year MSc programme in Radioecology that is Bologna accredited. ○ MSc Radioecology course modules open to MSc students from other programmes, including the STAR flagship course: *Experimental Radioecology*. ○ PhD courses ○ Training courses aimed primarily at professionals, included a web-based course on BLM and mixture toxicity. ○ On the STAR website there are links to e-learning tools and STAR's Virtual Laboratory.

EDUCATION ORIENTED			
SUCCESS FACTOR Education Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		• Scientist and student mobility has been supported by student exchange between SU and UMB (participation of two PhD students in experiments, 3 weeks); joint experiments on *C. elegans* between IRSN and UMB (two UMB scientists visiting IRSN for 1 week) and IRSN, UMB and NERC (scientists from UMB and IRSN visiting NERC for 1 week).	
Improving the competence of NoE partners	Arranging specialist workshops; # of attendees; feedback from attendees	• Two stakeholder workshops were arranged in Helsinki and Oslo, with the participation of 47 stakeholders from outside the STAR network. The first workshop, on education and training demand, was aimed primarily at potential employers, but with additional participation from experts who could provide insights into the overarching drivers for radioecology in society. The second workshop, on education and training supply, was aimed primarily at those who are engaged in education and training in the nuclear sciences. • A workshop was held in May 2011, where experts outside the field of radioecology shared their expertise on exposure, effects and risk assessment for multiple stressor exposure conditions. An experimental plan was developed and presented to	• STAR has produced three Training Courses during the last 18-month period: ○ *Environmental Radiobiology*; 24-18 June 2013; PhD Course, Norwegian University of Life Sciences; in collaboration with STAR and DoReMi. (28 participants) ○ *Radioecology and Environmental Radioactivity*; 7-18 October 2013; MSc Course, Norwegian University of Life Sciences; in collaboration with STAR (16 participants) ○ *Mixture Toxicity Workshop*; 27-30 January 2014; for Ph.D. students and scientific teachers. at SCK-CEN in Mol, Belgium; in collaboration with STAR. (12 participants)

EDUCATION ORIENTED			
SUCCESS FACTOR Education Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		experts external to STAR (EAB and several other experts). Comments were received from Nina Cedergreen (EAB) and Leo Posthuma (external expert) and these comments were discussed at a meeting held in January 2012. The work resulted in an EC-deliverable (D4.1) and important milestone (MS43). • Other important activities include fostering links with the education and training activities in other areas including promoting radioecology through lectures on other Environmental Science Courses. • Brit Salbu and Deborah Oughton gave lectures at the DoReMi MSc course on Epidemiology and Radioecology (part of the EU MSc in Radiobiology) • Hildegarde Vandenhove gave a lecture at the DoReMi MSc course in Radiobiology on Radioecology and possible applications to Fukushima. • Tom Hinton gave a lecture at a DoReMi workshop on strengthening collaborations among radiation biologists and radiation	•

EDUCATION ORIENTED			
SUCCESS FACTOR Education Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		ecologists. • Clare Bradshaw gave a number of lectures at radiobiology and ecology courses at Stockholm University • Deborah Oughton gave a lecture at the EU Erasmus MSc course Environmental Pollution in Estonia, 43 students from 8 counties (www.eu-eip.eu)	
Contribution of STAR to science policy	Incorporation of STAR generated results into National and International forums	• . STAR's development of the first version of the Strategic Research Agenda (SRA) in radioecology and the launching of the public consultation of this document has the potential to impact the international radioecology community. The SRA focuses and prioritises collective efforts, resulting in increased value to the EC and other stakeholders. It provides a long term vision of radioecological research needed within the European Community, and will ensure the maintenance and enhancement of competence required to assess the impact of radioactivity on man and the environment.	• Several STAR participants are now on committees of the ICRP. STAR participants are also working on several IAEA programmes (EMRAS-ii and MODARIA).

3.4 Management

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Efficient and transparent decision making	Regular Steering Committee meetings and continuous interaction with partners; Evaluation by External Advisory Board; Timely publication of agendas and minutes on website	• STAR produced a Quality Assurance (QA) manual (Deliverable 1.2) that provides guidance for dealing with contingency issues, delays in deliverables, funding arrangements, or access to infrastructures. It also provides guidance on research and technology development protocols within STAR relative to good scientific and laboratory practices. • Meetings organised by the Coordinator during this first period include the kick-off, the management team, the steering committee and the external advisory board meetings. • The first Management Team (MT; comprise of Work Package Leaders and the STAR Coordinator) meeting was held during the kick-off meeting (March 2011). The second MT meeting took place in January 2012, in Brussels. During this meeting, it was decided to organise more frequent MT meeting, in order to improve the communication. • For that purpose, IRSN bought a web video-conferencing system (Adobe Connect) and used it to organise short management team meetings (about 1h). Three were held since March 2012 (1 March 2012, 4	• An updated Quality Assurance (QA) manual was developed during this 18-month period (Deliverable 1.5). The QA is a synopsis of STAR's network structure, management organisation and administrative protocols. • A key addition to the QA document was a *policy for authorship on scientific publications.* STAR members bring many different native languages, customs, and internal organizational approaches to their collaborative scientific publications. As a consequence there are possibilities for misunderstandings about authorship procedures. Because an overarching goal of STAR is to integrate research among its members, it is logical to have an agreed-upon authorship policy to help avoid potential problems. The publication policy is intended to help scientists within STAR avoid authorship problems. • The Coordinator now holds monthly Management Team meetings via Video Conferencing. This has greatly enhanced communication and helped with decision making. • STAR's Steering Committee met during this 18-month funding period (in January 2014). Their primary task was a review of the proposals for new STAR members and to obtain

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		May 2012 and 3 July 2012), leading to a greater number of MT meetings than initially scheduled in the Grant Agreement. Now the MT routinely conducts a 1-hour video conference call the first Friday of each month. All STAR's MT meetings have been opened to representatives of each STAR institute, even those that are not in charge of a WP. This way of conducting management decisions favours integration and transparency among the STARs partners, as well as enhances the flow of communication. • The second administrative body of STAR is the Steering Committee (SC). It is composed of one representative from each of STAR's partners, plus the Coordinator. It is the ultimate decision-making body of the NoE. Only one SC meeting was initially scheduled for this reporting period (on month 18). It was held in Berlin on June 2012, hosted by BfS. An additional SC meeting was organised on October 2011 by video-conferencing to approve the pre-financing allocations among partners. • The External Advisory Board (EAB) of STAR was initiated within the first month of the project. The EAB is composed of seven experts, chosen for their	feedback from STAR's External Advisory Board.

<table>
<tr><th colspan="4">MANAGEMENT ORIENTED</th></tr>
<tr><th>SUCCESS FACTOR
Management Oriented</th><th>PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT</th><th>18 MONTH PROGRESS
01 FEB 2011 – 31 JULY 2012</th><th>36 MONTH PROGRESS
01 AUG 2012 – 31 JAN 2014</th></tr>
<tr><td></td><td></td><td>expertise relative to the different themes covered by the STAR project. During the reporting period, the EAB met twice (May 2011 and June 2012).
•, Table showing dates of Management (MT), External Advisory Board (EAB) and Steering Committee (SC) meetings.
<table>
<tr><th colspan="2">Management and Coordination meetings</th></tr>
<tr><th>date</th><th>venue</th></tr>
<tr><td>7-8 March 2011</td><td>St Maximin, France</td></tr>
<tr><td>7-8 June 2011</td><td>Paris, France</td></tr>
<tr><td>10 October 2011</td><td>Web meeting</td></tr>
<tr><td>19 January 2012</td><td>Brussels, Belgium</td></tr>
<tr><td>1 March 2012</td><td>Web meeting</td></tr>
<tr><td>4 May 2012</td><td>Web meeting</td></tr>
<tr><td>11-12 June 2012</td><td>Berlin, Germany</td></tr>
<tr><td>12 June 2012</td><td>Berlin, Germany</td></tr>
<tr><td>3 July 2012</td><td>Web meeting</td></tr>
</table>
•Minutes to all meetings, including the web-based ones, are posted on the STAR website</td><td></td></tr>
<tr><td>Efficient and transparent operation</td><td>Feedback from management team and steering</td><td>•The Consortium Agreement among STAR partners was established within the first 6 months of the project. It created the legal framework that regulates</td><td>• STAR's External Advisory Board reviewed progress for this 18-month period. No major problems were noted. Their report is in Section 4 of this document.</td></tr>
</table>

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
	committee meetings; Feedback from External Advisory Board; Accessibility of coordinator; Effectiveness of coordinator; Timely publication of agendas, minutes	the relationship among the partners, in particular the organization of the work between the partners, the management of the project and the rights and obligations of the partners concerning amongst other things liability, access rights and dispute resolution between partners for the work to be done together. • The External Advisory Board produced reports following their two meetings. The first report was part of Deliverable 1.1 and the EAB's second report follows within the current document. • The coordinator is readily accessible. All Deliverables to the EC have been produced on-time. • Minutes of Coordinator responsible meetings, including web-based ones, are posted on the STAR website in a timely manner (within 10 days).	• The agenda and minutes of all meeting organized within WP-1 have been dealt with in a timely fashion. • WP-1 meeting types (MT= management team; EAB = External Advisory Board; SC = Steering Committee) and dates are shown below for this 18-month period.

Meeting Type	Date
MT	3 July 2012
MT	5 October 2012
MT	7 December 2012
MT	11 January 2013
MT	8 February 2013
MT	1 March 2013
MT	5 April 2013
MT	3 May 2013
MT	7 June 2013
MT	5 July 2013
MT	6 September 2013
MT	18 October 2013
MT	8 November 2013
EAB	12-16 January 2014
SC	12-16 January 2014
MT	12-16 January 2014

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Coordination with EC	Effective communication with EC; Obligations delivered according to the Grant Agreement	• STAR's commitments, according to the Grant Agreement with the European Commission, have been met on-time and as promised. • Communication with the EC's representative is fluid and without problems	• STAR's commitments, according to the Grant Agreement with the European Commission, have been met as promised. • Communication with the EC's representative is fluid and without problems. Our EC project coordinator has been very helpful and responsive.
Financial Aspects	Prompt allocation of funds to partners; Transparent record keeping; Effective use of flexibility budget	• The pre-financing allocated by the EC for STAR was received by IRSN on the 22th of December 2010, prior to the official start date of STAR (1 February 2011). It corresponded to an amount of 1 933 215.20 €. A first allocation of the pre-financing was delivered to each partner on the 4th of February 2011, at the beginning of the project. The second part of the pre-financing was allocated to each partner on the 9th of December 2011, with the amounts allocated based on a Steering Committee decision. • Flexible funds of 100 k€ were earmarked for an open competitive call for new partners to the NoE or for subcontracts to third countries, and 59.5 k€ for unforeseen allocations. No flex funds have been used to date. For the time being, flex funds are in the	• Financial details for this 18-month period are provided in STAR's Deliverable D1.9; Project Report. All allocations of funds, audits and financial liabilities were handled on schedule and according to EC guidance. • Details of STAR's use of Flex Funds are provided in STAR's Deliverable D1.7; Flex Funds Report. No flex funds were used during this 18-month funding period. However, STAR will soon spend most of its Flex Funds on two new members to the consortium. Their entry is anticipated in May 2014. • WP-1 is now in the process of bringing two new members into the consortium (State University of New York and Tokai University in Japan) via a Grant Amendment request to the EC. Their addition to the consortium was based on a call for research proposals, evaluation by STAR's External Advisory Board, and approval by STAR's Steering Committee. The

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		STAR bank account, rather than IRSN's, allowing a greater access.	process is described in Deliverable 1.7. Their addition to the consortium is particularly exciting because both are outside of the European Union, and thus will bring new perspectives and ideas to STAR. Additionally, the new members will be researching marine radioecology related to the accident at Fukushima, Japan in 2011. STAR anticipates submitting the Grant Amendment request to the EC during April 2014.
Develop a culture of team spirit with high ethical standards	A survey will be designed to query STAR participants on an annual basis. The survey will target questions that pertain to team spirit and ethics. An on-line short course will be developed to teach ethics in science to students and young professionals	• In order to promote a culture of scientific excellence, innovation, team spirit, and high ethical standards, as well as the success and long term sustainability of this Network of Excellence in Radioecology, the Coordinator produced a newsletter to inform STAR partners about the latest news and achievements. Two letters were produced in 2011 (in July and December) and one is planned for 2012. These newsletters are sent to all STAR partners and are posted on STAR's public website. • The Coordinator recognised the similarity of attempting to integrate portions of each STAR partner's organisation to that of a corporate merger in the business sector. Lacking such experience, the	• An important change in attitude among individual STAR members is apparent. Their shared experiences over the last 36-months have resulted in the participants merging into a team and forming an identity associated with the Network of Excellence. There is now a sense of camaraderie among many STAR members that was not present in the beginning. This evolving solidarity among individuals is essential to the ultimate goal of integrating the member organisations.

MANAGEMENT ORIENTED			
SUCCESS FACTOR Management Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		Coordinator obtained the assistance of the Aix-Marseille Business School. Five Master of Business Administration (MBA) students developed a "change management" strategy for STAR and instructed the STAR coordinator in some appropriate business principals dealing with corporate mergers. The MBA students developed a questionnaire and queried the STAR participants on aspects of change management and the developing Network of Excellence. STAR's External Advisory Board considered the assistance of the business school a positive task of WP-1	

3.5 Integration

INTEGRATION ORIENTED			
SUCCESS FACTOR Integration Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Researcher mobility	# of visits to other partners/labs; ease of access to shared infrastructures	• As part of the work on stimulating researcher mobility, a set of criteria have been drafted for partner use of the mobility stimulus budget. To be viable the activity should facilitate active collaboration and integration between STAR partners, by supporting exchange of scientists and students between partner institutions. It should entail a visit of at least 3 days, preferably longer. The budget does not cover attendance of STAR meetings and short workshops. A more detailed description is available on the STAR members' pages. These were discussed and ratified at the EAB/WP6 meeting in Berlin (June 2012). • Scientist and student mobility has been supported by student exchange between SU and UMB (participation of two PhD students in experiments, 3 weeks); joint experiments on *C. elegans* between IRSN and UMB (two UMB scientists visiting IRSN for 1 week) and IRSN, UMB and NERC (scientists from UMB and IRSN visiting NERC for 1 week).	• For this second 18-month period, researcher mobility was accomplished through short-term exchanges of students working on joint STAR experiments. • Mobility was also obtained by senior researchers traveling to other STAR partner facilities to teach courses.

INTEGRATION ORIENTED			
SUCCESS FACTOR Integration Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
Integration of RTD activities	# of new members to the ALLIANCE; # of joint publications; # of joint research projects	• One of the most prominent tasks concerning efficient integration of the STAR partners, as well as the larger radioecology community, is the creation Observatories for Radioecological Research. The concept is that contaminated field sites will be identified and managed to provide a forum for international collaboration and shared field work. The Observatory sites will enable STAR to test hypotheses and approaches developed by the various work packages. All data collected will be archived on the web portal. • Work within the STAR consortium has resulted in six joint publications to date (listed above under the Research Section). The degree of collaboration is exemplified in the Strategic Research Agenda publication by Hinton, et al. (2013), where all nine STAR Partners are represented and a total of 27 co-authors contributed to the documented. • STAR made progress in developing a virtual laboratory as a new way to promote integration. The virtual laboratory will be on the *Radioecology Exchange* and will contain information about STAR partners, their infrastructure, facilities, analytical	• STAR developed common experimental approaches and protocols; approaches for setting up BLM, CA/IA experiments; and methods for selecting common biomarkers to use across the numerous experiments • STAR increased integration by conducting shared experiments on *C. elegans* at the radiation facility of SCK. The research work was conducted by IRSN and NMBU. • STAR's website *Virtual Laboratory* will also encourage integration through joint research and joint use of infrastructures. It will be used to share data and sample materials within the network, and also by the wider community. At the end of the STAR project it will form the basis for an expanded virtual laboratory for the ALLIANCE.

INTEGRATION ORIENTED			
SUCCESS FACTOR Integration Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		methods, expertise, sample banks etc. A "brainstorming" workshop for the virtual laboratory was held in Madrid in April 2012. During the workshop fourteen feasible ideas were identified for the virtual laboratory.	
Sustainability after EC funding	Effective merger of STAR into the ALLIANCE; Effective response to other calls for proposals; Expansion of ALLIANCE with new members	• The legal status for the ALLIANCE was finalized as an association governed by French law. The ALLIANCE is seeking new members and stronger ties with other research platforms: NERIS (post-accidental management, IGDTP (Waste management) and MELODI (low dose effects). • Following the Fukushima accident, the STAR partners voted to invite a specific Japanese laboratory of radioecology into the STAR consortium. A letter of invitation was sent to the Japanese laboratory on 9 May 2011. Their response was favourable; however, the laboratory requested additional time to fully consider STAR's offer. Considering the complexity of the accident situation and the huge demands currently placed on the Japanese people and on Japanese radiological laboratories, STAR did not press the Japanese laboratory for a final decision. However, one year	• During this 18-month period, STAR has made considerable progress in enhancing the long term stability and sustainability of radioecology in Europe. ○ Integration of the European radioecology community is well underway because of STAR's efforts. This is demonstrated by the success of the STAR partners in obtaining funding for another consortium (COMET) to advance the goals of STAR and to help position radioecology within the wider radiation protection community supported under OPERRA within the EC's Horizon2020 programmes; ○ Six new members joined the Radioecology Alliance. Integration is the primary goal of the STAR project, and it is vital to the long-term success of the entire radioecology field. Expanding the Radioecology Alliance reduces the fragmentation of the radioecology community by integrating a critical mass of resources

INTEGRATION ORIENTED			
SUCCESS FACTOR Integration Oriented	**PERFORMANCE INDICATOR LISTED IN GRANT AGREEMENT**	**18 MONTH PROGRESS 01 FEB 2011 – 31 JULY 2012**	**36 MONTH PROGRESS 01 AUG 2012 – 31 JAN 2014**
		later the conditions in Japan remained such that the Japanese laboratory initially contacted by STAR was still unable to commit to a full membership within the Network of Excellence. STAR received notification from the Japanese laboratory that they would prefer to participate in another manner. STAR then conducted in-house discussions and decided on a second Japanese laboratory to invite within the NoE. That Japanese laboratory was contacted in May 2012 and the Director General expressed interest. In June, representatives of STAR met with the Director General in Japan and further advanced the negotiations. STAR's goal is to finalize negotiations and have the laboratory a full partner before the end of 2012.	and expertise.; ○ The development of radioecology as a key pillar under the OPERRA radiation protection scheme started with STAR and COMET efforts during this 18-month period. Closer ties are being forged between radioecology, via the ALLLIANCE, the radiation biology platform (MELODI), and the Emergency Response platform (NERIS). Several presentations have been made by STAR personnel to highlight the value and importance of radioecology to the other aspects of radiation protection.

4. Report from STAR's External Advisory Board

The External Advisory Board of STAR, as approved by the EC, is composed of seven experts (**Table 2**). Three members were chosen specifically outside the discipline of radioecology so that they could provide guidance on STAR activities that are beyond traditional radioecology.

TABLE 2*:* STAR's External Advisory Board members

EAB Member	Position / Institute	Expertise
Mikhail BALONOV	Head of Protection Lab, Institute of Radiation Hygiene, Petersburg, Russia	Radiation biology; Chernobyl Forum; ICRP member, formerly with IAEA
Maria BETTI* (left EAB in 2013 after taking a new position in the EC)	Director, IAEA Environmental Laboratories, Monaco	Radiation chemistry; radioecology; science management
Nina CEDERGREEN	Department of Basic Sciences and Environment Faculty of Life Sciences, University of Copenhagen, Denmark	Ecotoxicology; chemical mixtures; dose-response modelling; science education
Valery FORBES	Director, School of Biological Sciences, University of Nebraska, Lincoln, USA	Ecotoxicology; science education; science management; statistics
Rick JONES	Former Chairman of the OECD/NEA Committee on Radiation Protection and Public Health (CRPPH) and former head of the Radiation Control Department at the US-DOE.	Radiation protection; public health; science management
Dick ROELOFS	Department of Animal Ecology, Vrije Universiteit, Amsterdam	Gene expression profiling and ecotoxicogenomics
Satoshi YOSHIDA	Research Center for Radiation Protection, National Institute of Radiological Sciences (NIRS), Chiba, Japan	Radioecology; science management; Asian Network of Excellence in Radioecology; IUR.

The External Advisory Board Report had their third meeting during this 18-month funding period. The following is their report, as compiled by Rick Jones, EAB member.

The third meeting of the STAR External Advisory Board (EAB) met in Rovaniemi, Finland on 15 January 2014.

Progress and specific issues identified by the STAR Team concerning each STAR Work Package were discussed. Results of discussions between STAR members and the EAB on the below discussion topics and EAB Recommendations are provided:

Work Package 1: Communication Challenges with Stakeholders

A broad ranging discussion was conducted between the EAB and STAR members on how best to research and communicate with a spectrum of stakeholders on the contributions of STAR to advance radioecology. The discussion included the possibility of having STAR establish itself as the organization to respond to statements in the press and Internet that were incorrect to taking no further actions.

The EAB recommended that STAR should focus its activities and resources promoting STAR contributions and accomplishments to advancing radio ecology, using Fukushima as an example. STAR should identify trusted sites where STAR can publish its accomplishments and activities to promote radio ecology. This would be a timely demonstration of the value added of the STAR project. The STAR Project should also promote more proactive communications in the conduct of future activities.

Work Package 2: Challenges of Integrating Consortium Partners

The STAR has been unable to establish legally binding agreements with property owners for the establishment of the Observatory site in Poland due to the unwillingness of the Alliance organization to enter into such agreements. The STAR should continue its initiatives with COMET in order to have access to Observatory sites like those in Poland. The 5 December 2013, signing of an MOU to establish the Open Project for European Radiation Research Area (OPERA) is an opportunity the STAR project should pursue to formalize the establishment of MOU's between researchers and Virtual Site owners for the conduct of critically important on-site research. It is important that these signed MOUs will be effective for periods of time longer than specific projects. This can be achieved by the actual Institutes signing these MOUs.

The EAB further requested that STAR recommend OPERA conduct proactive outreach to international organizations (e.g., IEAE, NEA/CRPPH, ICRP) on OPERA ongoing activities to eliminate duplication of activities and prepare members, the professional community and international organizations to anticipate and use OPERA products and deliverables.

To determine the effectiveness of web based communications value added and usefulness of STAR and OPERA products and deliverables the websites and data bases should be made available to the public. The project should also keep track of site and data base use and include a survey by visitors and users to indicate if they found the site and data bases useful or not (e.g., the "Did you find this site useful?" Yes or No, as the user departs the site).

Work Package 3: Integration of Human and Non-human Assessments

At the request of the STAR Work Package leader the EAB provided comments on their latest paper concerning the integration of human and non-human radiation protection assessments. The paper needs to clarify: 1) If the biological processes are the same or different; 2) What are the end points to protect against (e.g., reproductive health, protection of the most sensitive individual, biodiversity); and 3) Identify the intended use and target audience of the final product. The STAR should

demonstrate that combining human and non-human assessments will provide value added and be transparent about the associated uncertainties.

The EAB felt that the paper should be limited to a unified model for dose assessment. The paper should also list the "actions" and questions needing to be answered to reduce uncertainties, eliminate the use of jargon if the target audience is to be other than radiation protection professionals, and add examples and case studies to demonstrate the use of the model for integrating human and non-human assessments. Perhaps characterizing radiation as a general environmental stressor would be an effective way to broaden the context and understand on this issue.

The EAB also provided detail comments on the text of the paper.

Work Package 4: How should we best plan the remaining time allocated to WP4: What with the bottleneck fluoranthene and is there still room for mixtox risk assessment?

After much discussion the EAB recommends that the fluoranthene experiments be abandoned, but the possibility of developing a protocol for fluoranthene mixtox experiments for future use should be evaluated. The usefulness of conducting temperature flucutation experiments should be evaluated. The project should focus on the completion of the U-Cd and gamma-Cd experiments and explain the antagonism phenomenon and its mechanisms of interaction. The project should also show the impact, or lack of impact, of mixtox risk assessments on radiation protection criteria. The EAB recommends the project focus on establishing threshold effects (e.g., EC-50, mortality curve) then add contaminates to identify any changes to the dose response curve. The remaining time and effort should be devoted to the development of dose response curves for identified mixtox situations and not pursue risk assessment activities.

Work Package 5: Definition of a Robust Protection Criterion for Populations

The Work Package 5 team requested comment on establishing a protection criteria of 10% reduction in the lambda value for species extinction with an end point being the protection of the most sensitive individual. The EAB identified that based upon the radiation exposure scenario there may very well be the need to identify and use different end points. For example, in the case of "recovery" activities an end point of species growth rate is most appropriate.

The EAB proposed the use of focal species in parallel with the usual ecotox models so that extrapolation to field situations can be better addressed or quantified. Case specific focal species should be identified based upon the stressors present and exposure conditions. The results of these activities should be integrated with Work Package 3 for the protection of non-human biota.

The products of the work package should clearly identify and communicate their assumptions so readers can evaluate their usefulness to given situations. The EAB also identified that the use of laboratory lambda values by the work package team will over-estimate the lambda in the field and that this point should be clearly stated in their Work Package products.

Work Package 6: The Education and Training Strategic Agenda: Ensuring Funding and Sustainability

The STAR team is to be congratulated on its advances to expand education and training in radioecology and the success and increased interest in their MSc courses.

The EAB fully supports the inclusion of Education and Training into the Strategic Research Agenda (SRA) in order to have scientists available to conduct the research needs of the future. The STAR is encouraged to continue their initiatives to gain acceptance for joint degrees. The education and training initiatives by STAR and follow on organizations should reach out to primary school students to create a population of students interested in pursuing careers in science. Future education and training activities should also focus on the expanded use of "distance learning" tools to reach a broader base of students and minimize the cost and time of having mobility of students and professors.

Work Package 7: Suitable topics for a data workshop

It was noted that some members of STAR are experiencing difficulties in the release of their historical data and input of this historical data (i.e., data generated prior to STAR work) into the STAR data bases, but work continues to overcome this issue. The STAR members also identified some issues associated with the planning and conduct of field activities in the area of sample collection and the timing for bringing statisticians into the conduct of field research.

The EAB recommended that STAR use well established protocols for the conduct of field activities and bring statisticians in at the planning stage of field activities to make sure sufficient data is collected to establish statistical strength of results.

Update the EAB on STAR transition to COMET

The EAB was provided with a briefing on the sustainability of the STAR program initiatives by transition to the COMET and OPERA programs. The EAB recommended that STAR partner with COMET to take proactive and aggressive actions to reach out to and demonstrate to OPERA the value added of including STAR ongoing activities into their programs.

Open issues from 12 June 2012 EAB Meeting

As stated at the 2012 meeting, the EAB would once again request the opportunity to attend meetings, symposia or conferences where STAR PhD students or post-Docs present the results of their research.

The EAB recommendations relative to Work Package 3 have not been effectively addressed. The STAR project is requested to take action to further develop the system of environmental protection.

The STAR program should clearly identify to the EAB if they are going to pursue the development of molecular mechanistic research as discussed in Work Package 4.

Concluding Remark

The STAR project has achieved some significant progress in advancing radio ecology and the EAB looks forward to it's continued involvement to assure future success of the STAR Program.

5. Annex 1: Preface to a special issue of the *Journal of Environmental Radioactivity*.

Journal of Environmental Radioactivity 131 (2014) 1–3

Contents lists available at ScienceDirect

Journal of Environmental Radioactivity

journal homepage: www.elsevier.com/locate/jenvrad

PREFACE to a Special Issue
Environmental radioactivity: legacy sites, Chernobyl and Fukushima

This issue of the *Journal of Environmental Radioactivity* is a compilation of twelve manuscripts from a special session, *Environmental Radioactivity: Legacy Sites, Chernobyl and Fukushima*, held during the 12th ICOBTE Congress in Athens, Georgia, USA (16–20 June 2013). The special session on environmental radioactivity occupied two full days and consisted of 30 oral presentations, seven posters and an invited plenary speaker.

1. Symposium justification

The biogeochemistry of radioactive elements is of interest because of the "good" and "bad" of nuclear energy. On the good side is its potential to provide energy without carbon emissions. On the downside is nuclear energy's potential to contaminate the environment (if something goes wrong). A world-wide resurgence of nuclear energy production was stalled because of safety concerns following the reactor accidents from the 2011 Great East-Japan Earthquake and Tsunami. The difficult task of weighing the good and bad has resulted in opposing views, with some countries closing their nuclear facilities (e.g. Japan and Germany), while others are building new facilities with enhanced safety features (e.g. China, India, Southeast Asia, and parts of Europe).

The biogeochemistry of radionuclides is also needed because of changes in the management of radioactively contaminated environments. Historically, effects of radiation on the environment were approached anthropocentrically; inferring that if humans are protected then all other components of the environment are automatically protected as well. Now a more eco-centric approach is recognized with incentives to develop specific environmental protection criteria. The relevance of these developments to biogeochemistry is that precise knowledge of the fluxes, transfers, speciation and dynamics of radionuclides in the environment is a prerequisite for accurately assessing risks to all components of the environment.

Part of the motivation for a special session on environmental radioactivity was to give scientists the opportunity to present improvements in modelling radionuclide contaminated environments. Historically, most radiological assessment models relied on simplistic, empirical ratios (ERs) to simulate contaminant transfers between environmental compartments. ERs are favoured because of the pragmatic ease with which they facilitate modelling. Their use, however, increases the uncertainty of model predictions because they do not account for the underlying processes that govern natural spatial and temporal variation. Major improvements are needed to make models more accurate, that is more process-based and capable of simulating the kinetics of contaminant transfers. However, major challenges are to: (1) identify where the

http://dx.doi.org/10.1016/j.jenvrad.2013.12.002

greatest advantages can be gained in reducing model uncertainty and understanding variability; (2) develop criteria to identify when the additional research required to parameterise dynamic-mechanistic models is warranted; and (3) identify the level of model complexity needed for specific exposure scenarios.

We think you will find these 12 papers on environmental radioactivity interesting. They address a wide spectrum of topics related to contamination at Chernobyl, legacy sites and Fukushima. They are state-of-the-art explorations on the speciation of plutonium, uranium and iodine; computer modelling of contaminants (e.g. releases of Cs-137 into Japan's marine environment; Sr-90 in Chernobyl watersheds; assessments of radionuclides at the geosphere-biosphere interface); transfers of Cs, Pu and I to wildlife; characterization of legacy sites in Russia; and methods to treat low-level waste at a U.S. Department of Energy facility. The research presented at the ICOBTE conference, and partially presented in this special issue, expands our knowledge of environmental radioactivity such that the good and the bad of nuclear energy can be managed to the maximum benefit of society. We hope you enjoy!

2. A special tribute to Rudie Heling

The lead paper in this issue is a special tribute to one of its co-authors, **Rudie Heling**, who passed away in February 2013. The paper is titled, *Regional long-term model of radioactivity dispersion and fate in the Northwestern Pacific and adjacent seas: application to the Fukushima Dai-ichi accident*. Our respect for Rudie and the loss we feel prompted us to dedicate this issue of the *Journal of Environmental Radioactivity* to him. We knew Rudie as a highly motivated, enthusiastic colleague whose scientific contributions and friendships are deeply missed. Rudie's colleague and friend, Govert de With, offered the following:

I had the pleasure of working with Rudie over a period of nearly 5 years, and during this period I worked with him on a variety of radiation related issues. Since his unexpected death now nearly a year ago I have increasingly realized the vast amount of work he was involved with, his influence in the field of radiation protection and in particular his contributions to the various software tools used in the radiological impact assessment.

During his nearly 25 year period with KEMA and later NRG he submitted many academic papers on the subject of marine modelling, hydrological dispersion modelling, and biological uptake, but as well on issues like radon and tritium. Most tangible are his contributions to the emergency decision support system RODOS, which include various aquatic models to predict the radionuclide levels in water, sediment and fishery in different types of ecosystems. In addition he was one of the main developers of LAKECO, the POSEIDON software and its further extension BURN. Those tools still provide a modelling standard for radionuclide exposure to biota and marine life. His latest work on the radiological consequences in the North-Western pacific following the Fukushima Dai-ichi accident gives an outstanding summary of his contribution to the field. Furthermore, he was a main factor in the use of 3-dimensional hydrological modelling to assess the environmental impact of cooling water release from power plants in the Netherlands.

However, this impressive list of scientific contributions fails to address his unique personality, his unrestrained enthusiasm and his passion for the field of radiation protection. Rudie developed an impressive international network and worked closely with his peers from all around the globe. In the technical discussions he always provided a solid source of enthusiasm, drive and persistency, and he remained in close contact with those who needed further persuasion for his views and ideas. I have seen his passion from nearby and we had numerous discussions on a range of topics; particularly his views on the use of more advanced calculation methods were a regular topic for discussion.

His drive and persistency to make these advances happening were outstanding and maybe his holidays to the far northern part of Scandinavia reflected his drive to continue where others would stop. We will remember Rudie as a unique person with a great passion for the field of radiation protection, and it goes without saying that he will be greatly missed.

We encourage you to read Rudie's modelling paper. You will find it to be an interesting, thought-provoking manuscript that does an excellent job of demonstrating the difference in predictions when empirical ratios are used (as discussed above) versus predictions made when processes are modelled dynamically.

Acknowledgements

The Environmental Radioactivity session held at ICOBTE was sponsored by the University of Georgia's Savannah River Ecology Laboratory (SREL). Our thanks go to SREL's Director, Dr. Gene Rhodes, and to Dr. John Seaman. John co-chaired the ICOBTE conference and continually promoted the session on environmental radioactivity. We thank Dr. Steve Sheppard, Chief Editor of *JENR*, for encouraging us to develop this special issue and for his guidance throughout. We also thank the many authors and co-authors, as well as those that attended the sessions and participated in group discussions: R. Aladova; H. Bashu; J. Brown; S. Buettner; M. Dortch; A. Filonova; D. Gudkov; A. Hatfield; B. Howard; T. Jannik; M. Johansen; B. Johnson; D. Kaplan; P. Koster-van Groos; P. Krisanangkura; W. Kuhne; M. Leonard; D. Li; V. Maderich; N. Martinez; K. Maslova; M. Monter-Cabrera; J. Neeway; D. Neville; D. Perez-Sanchez; E. Peters; B. Powell; N. Quafoku; N. Rashydov; M. Renteria-Villalobos; E. Ruedig; N. Shandala; C. Simonucci; R. Singhal; G. Smith; M. Sneve; A. Sowder; S. Walker; M. Wood; C. Yu. Partial funding came from the European Community and its support of the STAR Network of Excellence in radioecology (www.star-radioecology.org; contract number: Fission-2010-3.5.1-269672).

December 2013

Guest Editors

- Thomas HINTON; Coordinator, STAR Network of Excellence in Radioecology; French Institute of Radiation Protection and Nuclear Safety (IRSN)
- Francois BRECHIGNAC; President, International Union of Radioecologists; IRSN, France
- Brenda HOWARD; Centre for Ecology and Hydrology, Lancaster, UK
- Astrid LILAND, Norwegian Radiological Protection Authority, Norway
- Stuart WALKER, Environmental Protection Agency, USA
- Tamara YANKOVICH; Department of Nuclear Safety and Security, International Atomic Energy Agency, Vienna, Austria

Thomas Hinton*
Institute of Radioprotection and Nuclear Safety Cadarache, France

G. de With
Nuclear Research and Consultancy Group (NRG) Department of Radiation and Environment Arnhem, The Netherlands
E-mail address: g.dewith@nrg.eu.

*Corresponding author.
E-mail address: thomas.hinton@irsn.fr (T. Hinton).

Available online 17 January 2014