AIR² Access to INFRASTRUCTURES for Radiation protection Research

Issue 8
June 2016

Editorial

Time is flying and we're already entering our second year of CONCERT.

In year 1, we implemented two major dissemination tools: the AIR2 Bulletin and the AIR2D2 database, both of which will reach cruising speed during AWP2.

Our focus will now shift to Quality Management. Two brainstorming days for WP6 "Access to Infrastructures" will be organised in Brussels on 11-12 July. Starting with a Workshop on subtask WP6.2.2, our aim will be to define suitable harmonisation exercises and protocols that can be developed for CONCERT infrastructures. Day 2 will be dedicated to in-depth discussion of each WP6 task and subtask. The programme is available here.

To contribute to any point, please contact us with your suggestions, feedback or questions. **- Dr Laure Sabatier**

The floor to...

The application of ionising radiation should do more good than harm. All those who work in radiation protection research have an obligation to fulfil this public expectation. This is challenging, however, because the health hazards from ionising radiation depend on the dose, and because there exist various natural and artificial sources of ionising radiation.

For a quantitative risk-benefit analysis, radiation doses must be determined as reliably as possible. One of the missions of EURADOS is to harmonise dosimetric practices in Europe to ensure that doses are determined with similar and acceptable accuracy for a wide range of applications, radiation qualities, energies and conditions. Infrastructures such as irradiation facilities are indispensable to this process.

"Doses must be accurately determined, and infrastructure plays a central role in this effort"

EURADOS organises intercomparisons where instruments are irradiated under the same conditions at different reference facilities. Instruments include those used for occupational, medical or environmental dosimetry, or for retrospective dosimetry relevant to emergency dosimetry networks such as RENEB. The participants are asked to report the doses obtained with their instruments. Statistical analysis demonstrates the consistency of the measured doses and identifies any outliers. Overall results are discussed and recommendations to improve dosimetric practices are provided. This procedure, also used for the harmonisation of computational dosimetry techniques using computing facilities, has led to significant improvements in the consistency of dose quantification in Europe.

Furthermore, instrumentation for the detection of ionising radiation must be continuously developed as technology advances and new applications of ionising radiation evolve. For example, there is an increasing need to develop methods for high-energy secondary neutron detection in particle cancer therapy. Quantification of doses in pulsed radiation fields also poses major problems when electronic dosimeters are used. These and other technical developments can only be pursued if proper irradiation facilities are available.

The application of ionising radiation should do more good than harm. To guarantee this, doses must be accurately determined, and infrastructure plays a central role in this effort.

Prof. Dr. Werner Rühm –
Helmholtz Zentrum München
EURADOS Chairperson

Source: private

CONCERT CORNER

Future events:

19 Sept 2016: ExB meeting, 1:00-3:00pm, Oxford, UK

23 Sept 2016: MB meeting, 9:00am-3:00pm, Oxford, UK

WP 6 News:

Update of AIR²D²:

- Please complete the online form(s) to register your infrastructure(s) in the database.

- A new option to feature your infrastructure is now available: add document.

11 July 2016: "Harmonization Exercise" Presentation Day, Brussels, Belgium

12 July 2016: Task 6.2 presentation day, Brussels, Belgium

Contents:

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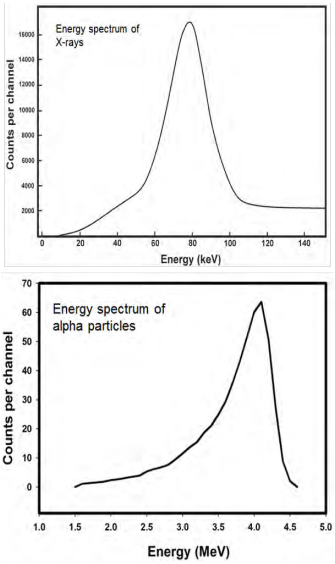
July 2016

This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

Mixed alpha and X-ray exposure facility

Simultaneous exposure of cells to high and low LET radiation

People are often simultaneously exposed to a mixed field of low and high linear energy transfer (LET) radiation. The most common scenario occurs in areas with high natural background radiation, where both the levels of gamma radiation and indoor radon are elevated. Another situation occurs during aeroplane and space flights where cosmic high LET radiation interacts with shielding material to produce gamma radiation. Finally, radiotherapy patients treated with intensity-modulated radiation therapy, fast neutron therapy and boron neutron capture therapy are exposed to mixed beams of neutrons and photons.



An important question related to the health effects of exposure to mixed beams is whether the risk can be calculated by simply adding the effects of the low and high LET dose components or whether the different radiations act in a synergistic manner. The available experimental data do not allow a definite conclusion to be drawn. Indeed, both additivity and synergism have been reported. The reason for this discrepancy is not understood but one factor could be that cells are exposed sequentially, rather than simultaneously, to the two types of radiation. Simultaneous irradiation is the desirable scenario but requires a dedicated irradiation facility. At Stockholm University, a facility has been constructed where cells can be simultaneously exposed to 241Am alpha particles and X-rays at 37 °C.

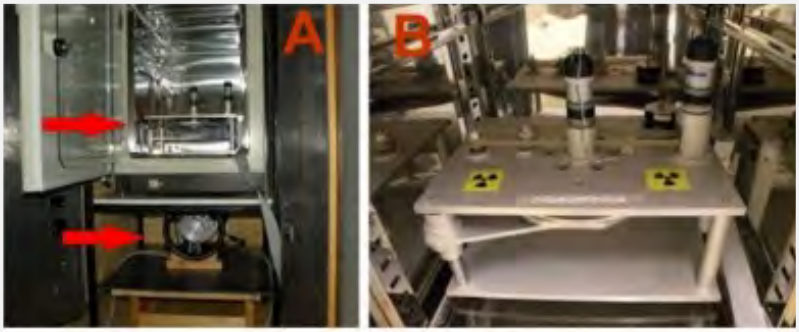
Photo: A. Wojcik/SU

Andrzej Wojcik

The facility consists of an alpha irradiator, custom-constructed in the Institute of Nuclear Chemistry and Technology, Warsaw, Poland, an X-ray tube (YXLON SMART 200, Yxlon International, Hamburg, Germany) and a 164 l cell incubator. The alpha irradiator is positioned inside and the X-ray tube under the incubator. The whole setup is placed in a lead container so that it can be safely operated in a laboratory room.

The source of alpha radiation is 241Am (Eckert and Ziegler, Berlin, Germany) with a total activity of 50 MBq. The source is attached to a steel disc that in turn is glued to a circular turn-table, with the active side (ca 15 cm in diameter) facing downwards. Below the source is an aluminium shelf on which cells on polyamide discs can be positioned for exposure and covered by a Mylar foil. The shelf can be moved vertically by a remote-controlled step-engine. The X-ray tube is operated at 190 kV, 4.0 mA without any additional filtering.

The facility works as intended, allowing exposure of cells to alpha particles, X-rays and a combination of both in a temperature-controlled environment. It allows to further characterise the response of cells, both adherent and in suspension, to mixed beams of high and low LET, thus providing the opportunity to generate much needed data on the effect of mixed beams of ionizing radiation.



A: Incubator with the alpha irradiator (top arrow) and the X-ray tube underneath (bottom arrow). B: Close-up picture of the alpha irradiator

Photo: A. Wojcik/SU

ID Card:

Exposure type:
External

Source:
Am-241, X-ray machine

Dose rate:
Alpha: 0.26 Gy per minute
X-rays: 0.06 Gy per minute

Irradiation type:
Alphas and photons, vertical beams

Irradiated organism type:
Adherent cells

Address:
Stockholm university

Access:
Free, decision by source owner

Supporting lab:
Biomolecular and cell culture lab

Contact:
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tel: 0046762122744

Related to:
MELODI, EURADOS

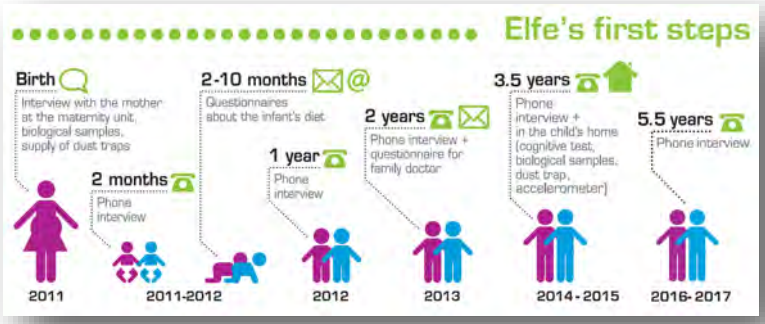
CHARACTERISATION OF A SETUP FOR MIXED BEAM EXPOSURES OF CELLS TO 241AM ALPHA PARTICLES AND X-RAYS. Staaf E, et al. Radiat Prot Dosimetry. 2012 Sep;151(3):570-9.
COMPLEX ABERRATIONS IN LYMPHOCYTES EXPOSED TO MIXED BEAMS OF 241AM ALPHA PARTICLES AND X-RAYS. Staaf E, et al. Mutation Research 756: 95-100, 2013.

French longitudinal study of children (Elfe)

18,000 children followed from birth to adulthood

The conditions in which children live and grow are changing fast. Research is therefore needed to find out more about how children's environment in their early years affects their development, their health and even their socialisation. A cohort follow-up study is the best means of closely monitoring children's trajectories. This involves recruiting a large sample of children and tracking them throughout their development.

It was for precisely this reason that Elfe was set up, taking into account questions submitted by 15 themed groups representing more than 150 researchers, as well as concerns expressed by various public bodies. Launched in metropolitan France in April 2011, this resolutely multidisciplinary study recruited more than 18,000 children born that year.



The bulk of the data has so far been collected via surveys of the children's parents (telephone interviews at the 2-month, 1-year, 2-year and 3.5-year milestones or postal/Internet questionnaires). The children were directly studied for the first time when they reached the age of 3.5 years, on the occasion of a home visit during the 2014-2015 wave.

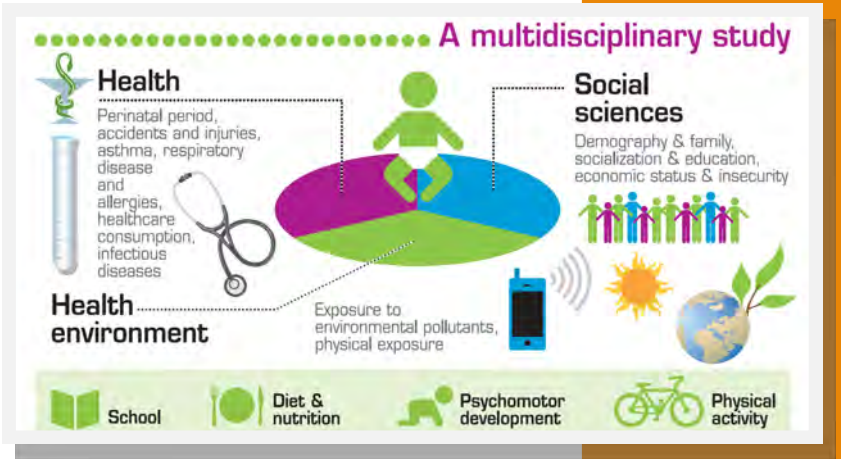
Alongside the cohort, we have set up a biobank containing samples from a subgroup of Elfe families. These were collected in the maternity units where the children were born (mother's urine, venous blood, hair and breast milk, cord blood, newborn's meconium/stool), and again during the survey at 3.5 years (child's hair, urine and stool).

The research carried out by the Elfe teams can be placed under three main headings: health, social sciences and the environment. In the latter, the emphasis is on measuring exposure to various chemical substances or physical agents and studying their impact on children's health and development. Regarding physical agents, for example, the radon study undertaken by a team from the French Institute for Public Health Surveillance (InVS) seeks to identify variations in childhood exposure to radon in the home. A further aim is to assess the public health risks for the dose levels that are observed, and revisit current hypotheses on the dose-response relationship. The medical radiation study, meanwhile, led by researchers from the French Institute for Radiological Protection and Nuclear Safety (IRSN), is intended to provide a detailed and exhaustive picture of children's exposure to diagnostic medical imaging with or without ionizing radiation (IR). It will then be possible to establish dosimetric estimates of IR exposure, based on standardised measurements or literature findings. A second objective will be to join international consortiums collecting the same sort of data, in order to assess the risk of cancer and other pathologies potentially associated with this exposure.

Source: Guenet/Inserm

Marie-Aline Charles

Since 2013, Elfe data have been available to researchers actively involved in the study - mainly in the design of its questionnaires, and a year ago, access was extended to the whole of the scientific community, under certain conditions.



ID Card:

Cohort type:
18,000 French children born in 2011

Age:
Birth to adulthood

Biobank available:
Yes

Sample type:
Maternal urine, blood, milk and hair at birth
Cord blood and meconium/ stools of newborns + hair, urine and stools of children aged 3,5 years

Sample storage conditions:
Hairs : room temperature
Urine, milk, stools : - 80°C
Products derived from blood (total blood, serum, plasma) : liquid nitrogen

Conditions of use:
External use possible subject to conditions

Access:
Access to data and/or biological samples subject to conditions

Internet link:
http://www.elfe-france.fr/
https://pandora.vjf.inserm.fr/public/

Contact:
marie-aline.charles@inserm.fr

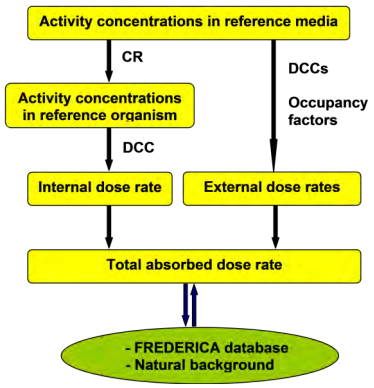
Related to:
MELODI

CONSTRUCTING A COHORT: EXPERIENCE WITH THE FRENCH ELFE PROJECT. Pirus C. et al. Population 2010, 65(4), 637-670.
QPCR STANDARD OPERATING PROCEDURE FOR MEASURING MICROORGANISMS IN DWELLINGS IN THE ELFE STUDY. Scherer E, et al. Sc Tot Environ 2014; 466-467:716-24.

ERICA Tool

The ERICA Tool supports adept environmental risk assessment

A key component of the ERICA Integrated Approach was the quantification of environmental risk involving, as an initial step, the combination of data on environmental transfer and dosimetry to provide a measure of wildlife exposure. These values, in the form of dose rates or corresponding activity concentrations for screening purposes, could then be compared with benchmarks, derived from exposure levels at which detrimental effects are known to occur, for the estimation of risk. In view of the large data sets underpinning the assessment approach and the potential to introduce errors when performing numerous calculations by hand, a supporting computer-based tool, the ERICA Tool, was developed as described in Brown et al. (2008). The Tool gives the option to cover a comprehensive list of radioisotopes and organism types, and has particular emphasis on the assessment of planned routine discharges of radionuclides and existing exposure situations.



Source: NRPA

Components within the assessment part of the ERICA Tool

The ERICA Tool adopts a tiered structure. There are two generic screening tiers and a third site-specific tier. The first Tier is very simple, based around Environmental Media Concentration Limits, EMCLs, defined as the activity concentration of a given radionuclide in media (soil, sediment water) that will result in a dose-rate to the most exposed reference organism equal to the screening dose-rate. This Tier requires minimal input from the assessor. The second Tier, although still a screening tier, is used to calculate dose rates explicitly and requires more detailed input from the assessor allowing for scrutiny and editing of default parameters in the process. A key procedural element of Tier 2 involves the application of Uncertainty Factors, UFs. Such factors reflect knowledge concerning probability distribution functions and provide a way of incorporating conservatism into the assessment by allowing the consideration of high percentile values in underlying parameters. Tier 3 allows a fully probabilistic analysis to be undertaken.

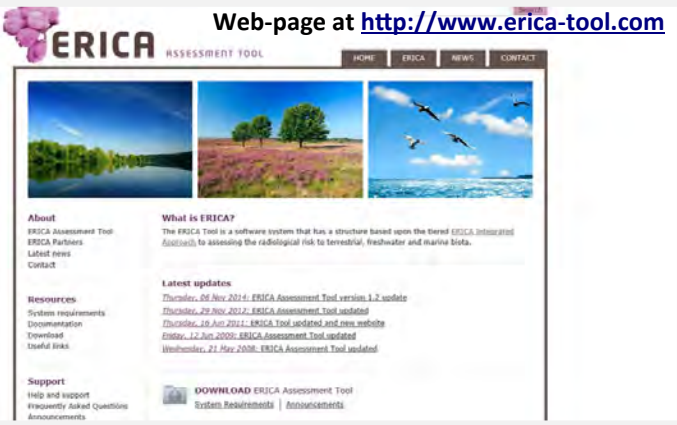
Photo: Justin Brown/NRPA

Justin Brown

The ERICA Tool has been further evaluated in numerous studies and has been widely applied by the scientific community. Examples include: consideration of potential environmental impacts from deep geological disposal facilities in various European countries; scoping analyses in line with newly introduced environmental regulations; in quantifying environmental impacts from operating and planned nuclear power stations and assessments of the impact of near-surface radioactive waste repositories in Europe and Australia.

Training in the use of the Tool has been relatively comprehensive (see: https://wiki.ceh.ac.uk/x/dIPJBg) with a bespoke 'Questions & Answers' webpage having been developed (see: https://wiki.ceh.ac.uk/x/r48ZBw). The software is freely available for download (http://www.erica-tool.com and http://www.erica-tool.eu/) with the newest version of the software described in Brown et al. (2016).

Web-page at http://www.erica-tool.com



Source: NRPA

ID Card:

Purpose:
Environmental risk assessment

Information available type:
Radionuclide transfer, eco-dosimetry and biological effects for wildlife (summarised from published literature)

Use:
Individuals can download and use the software themselves for screening assessments, but may need a specialist for site specific analyses

Training proposed on the software:
Training in the use of the Tool has been relatively comprehensive (see: https://wiki.ceh.ac.uk/x/dIPJBg) and is ongoing – see website for details

Access:
Free

Internet link:
http://www.erica-tool.com and http://www.erica-tool.eu/

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Related to:
Alliance

The ERICA Tool. Brown, J.E., et al. (2008). J. Environ Radioact, 99, pp.1371-1383.

A new version of the ERICA Tool to facilitate impact assessments of radioactivity on wild plants and animals. Brown J.E., et al. (2016). J. Environ Radioact, 153, pp. 141-148.

AIR²

Access to INFRASTRUCTURES for Radiation protection Research

Issue	Exposure platforms	Databases, Sample banks, Cohorts	Analytical platforms, Models & Tools
Published to date:			
Oct 2015, #1	FIGARO	FREDERICA	RENEB
Nov 2015, #2	B3, Animal Contamination Facility	The Wismut Cohort and Biobank	The Hungarian Genomics Research Network
Dec 2015, #3	Cosmic Silence	STORE	Metabohub
Feb 2016, #4	SNAKE	French Haemangioma Cohort and Biobank	Dose Estimate, CABAS, NETA
Mar 2016, #5	Radon exposure chamber	3-Generations exposure study	ProFI
Apr 2016, #6	Biological Irradiation Facility	Wildlife Transfer Database	Radiobiology and immunology platform (CTU-FBME)
May2016, #7	CIRIL	Portuguese Tinea Capitis Cohort	LDRadStatsNet
Jun 2016, #8	Mixed alpha and X-ray exposure facility	Elfe Cohort	ERICA Tool
Coming soon:			
Jul 2016, #9	SCRS-GIG	RES3T	CROM-8

Future events:

1-3 June 2016: 2nd International Conference on Risk Perception, Communication and Ethics of Exposures to Ionising Radiation, RICOMET 2016, Bucharest, Romania

13-17 June 2016: OPERRA training course: PCR-based Techniques in Radiobiology and Low-Dose Risk Research,Budapest, Hungary

15-17 June 2016: COMET Workshop "Models fit for purpose", focussed on modelling in radioecology. Seville, Spain

4-8 July 2016: CONCERT Course on Uncertainty Analysis for Low Dose Research, Barcelona, Spain.
Registration until 3 June 2016

4-8 Sept 2016: 42nd Annual Meeting of the European Radiation Research Society, ERR2016, Amsterdam, Netherlands
Registration open

19-23 Sept 2016: Radiation Protection Week, RPW2016, Oxford, UK.
Registration open
Call for abstract until 16 June (at RPW2016@phe.gov.uk)

3-5 Oct 2016: International Conference on Research Infrastructures, ICRI2016, Cape Town, South Africa

5-7 Dec 2016: 8th EAN$_{NORM}$, Stockholm, Sweden.

Editorial Committee: Jean-Michel Dolo, Elisabeth May, Laure Piqueret-Stephan, Laure Sabatier

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