AIR²
Access to INFRASTRUCTURES for Radiation protection Research

Issue 6
April 2016

Editorial

The European Strategy Forum on Research Infrastructures (ESFRI) identifies Research Infrastructures (RIs) of pan-European interest. Furthermore, it is considered that "Enhancing and optimising RIs and their access by scientists and innovation developers is a key ingredient of competitiveness as well as a necessary basis for tackling the grand societal challenges". The ESFRI Roadmap 2016 has just been published: http://ec.europa.eu/research/infrastructures.

Many ESFRI RIs are of great importance for Radiation Protection, and a crucial challenge which began in DoReMi, was amplified in OPERRA and continues in CONCERT (WP6) is to increase our knowledge of each of the relevant RIs and to facilitate access to these high quality facilities. The ESFRI RIs and their national nodes will be presented in future issues of AIR². - **Dr Laure Sabatier**

The floor to...

It is a pleasure to make a contribution to the CONCERT project's bulletin on infrastructures, AIR². As always with such invitations to contribute, the next question is ….what am I going to write? This led to a search for definitions and something of the etymology of the word 'infrastructure'. Perhaps appropriately, given the leadership of work package 6, 'infrastructure' has its origins in French, being adopted into English in the early 20th Century, probably around 1920-1930, although some sources identify an 1875 origin in French and 1887 in English. While the word originated in military circles it is more commonly used now to define 'the basic physical and organisational structures and facilities (eg buildings, roads, power stations) needed for the operation of a society or enterprise' (http://www.oxforddictionaries.com/definition/english/infrastructure). Furthermore, in its relatively brief existence, usage of the word has changed and developed as it has been adopted in different sectors (see https://hakpaksak.wordpress.com/2008/09/22/the-etymology-of-infrastructure-and-the-infrastructure-of-the-internet/). Despite the flexible usage, the word is remarkably similar in most European languages.

So, what infrastructures are required to further research in radiation protection? Many are well defined and categorised into the three groupings – exposure platforms; databases, sample banks & cohorts and analytical platforms. As is becoming clear and will continue to clarify with future AIR² issues, Europe has many high quality infrastructures to support radiation protection research. It will nevertheless be important to identify gaps and remain responsive to new requirements that may emerge with technological and other developments. The availability of a comprehensive catalogue of infrastructures in itself will likely be one of the catalysts that help further the ambitions of the CONCERT project and inspire new experiments and analyses. While the infrastructures themselves are important, it will be the careful thought into their application and development that will bring the real benefits in terms of improved evidence on which to base radiation protection standards.

> **"Europe has many high quality infrastructures to support radiation protection research"**

Dr Simon Bouffler—PHE
CONCERT WP5 Leader
«Stakeholder involvement and communication in radiation preotection research»

Photo: L. Gibbens/PHE

CONCERT CORNER

Future events:

12 July 2016: ExB meeting, Brussels, Belgium

13 July 2016: MB meeting, Brussels, Belgium

20 Sept 2016: ExB meeting, Oxford, UK

23 Sept 2016: MB meeting, Oxford, UK

WP 6 News:

Update of AIR²D²: Please complete the online form(s) to register your infrastructure(s) in the database

11 July 2016: "Harmonization and Exercise" Pesentation Day, Brussels, Belgium

12 July 2016: WP6 meeting, Brussels, Belgium

Sept 2016: Task 6.2 presentation day, Oxford, UK

Contents:

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May 2016

EUROPEAN JOINT PROGRAMME FOR THE INTEGRATION OF RADIATION PROTECTION RESEARCH CONCERT
HORIZON 2020

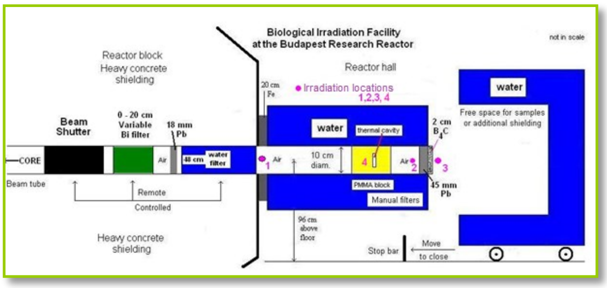
This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

BIOLOGICAL IRRADIATION FACILITY (BIO)

Providing a reliable platform for biological irradiation studies

The Biological Irradiation Facility operates within the Budapest Neutron Centre (BNC) to provide a reliable platform for biological irradiation studies. The physical properties of the facility are described below.

The channel lock consists of 3 segments made of steel and heavy concrete and turnable around an eccentric axis to open and close the channel. There is a remotely controlled internal filter holder, at a distance of 262 cm from the core, which has six windows with the following characteristics: four Bi disks of 5, 10, 15 and 20 cm, one Pb disk of 20 cm thickness, and the 6th window is an open hole. At the orifice of the beam tube, two cylindrical tanks constructed



Source: www.bnc.hu

Figure 1: Schematic view of the Biological Irradiation Facility

from alumina serve respectively as a water shutter and as its emergency water storage. The water can be pumped up from and released into a larger buffer tank located outside the reactor shielding block using pressurised air. The construction materials inside the beam tube work as internal, non-removable filters with total thickness of 18 mm Pb and 15 mm Al.

The irradiation cavity is situated outside the shielding block of the reactor at a distance of 1400 mm, thus its surface-to-reactor core distance is 3100 mm including the exchangeable core window (65 mm), made either of beryllium (serving as the fast neutron reflector also) or aluminium. The use of the aluminium window results in a hard neutron spectrum. Between the shielding surface of the reactor and the cavity, there is a borated water shielded collimator with a useful diameter of 10 cm. It is possible to use this collimator as a holder for external filters of about 800 mm length. At present, filters made of plexiglass, polyethylene, iron, aluminium and lead are available to decrease the gamma and neutron intensity or to modify the neutron spectrum and the neutron-to-gamma ratio. There are two changeable filter disks of boron-carbide which work as thermal and epithermal absorbers. The collimator is movable on a rail. The samples to be irradiated can be rotated to achieve a uniform, homogeneous irradiation. Cadmium or boron-carbide filters are used, if required, for decreasing the thermal neutron contribution.

Balázs Zábori

Three levels of the dosimetry system were developed: real time, active beam monitors; passive activation, track-etched and TL detectors, and computer codes for spectrum and dose calculations. Each exposure is individually planned and continuously monitored during the procedure. Some typical dose and flux values are presented in Table 1 and a schematic view of the system is presented in Figure 1.

The irradiation facility is suitable for studying the effects of the neutron and gamma radiation and high dose rate on seeds, cells, electronic devices, etc.

Quantity	Energy range	Min	Max
Neutron dose rate (mGy/s)	E > 0.5 eV	0.023	14
Gamma dose rate (µGy/s)	-	1.5	2570
Fast neutron flux ($cm^{-2}s^{-1}$)	E > 100 keV	2×10E+6	2×10E+9
Intermediate neutron flux ($cm^{-2}s^{-1}$)	100 keV > E > 0.5 eV	8×10E+3	2×10E+6
Thermal neutron flux ($cm^{-2}s^{-1}$)	E < 0.5 eV	5×10E+4	3×10E+8

Table 1:Presently existing minimum and maximum dose and flux values.

The hall of the research reactor

Source: www.bnc.hu

BNC Budapest Neutron Centre

ID Card:

Exposure type:
External

Source:
Research reactor

Neutron dose rate:
0.023 – 14 mGy/s

Gamma dose rate:
1.5 – 2570 µGy/s

Irradiation type:
Neutron, gamma

Possible targets:
Seeds, cells, small animals, electronic devices etc.

Address:
H-1121, Budapest, Konkoly-Thege M. út 29-33.
Hungary

Access:
Joint ongoing research collaboration or made available with charge for access costs

Supporting lab:
Radiation protection laboratories, cell culture lab in the near future

Internet link:
http://www.bnc.hu/?q=node/8

Contact:
Balázs Zábori,
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Related to:
ALLIANCE, EURADOS, MELODI

REALISTIC NEUTRON SPECTRA FOR RADIATION PROTECTION AND OTHER APPLICATIONS AT AERI, BUDAPEST. Pálfalvi J.K., et al. 2002. Nucl. Instrum. Methods A 476, 452-456.
RADIATION DAMAGE IN VIDEO DIAGNOSTIC DEVICES FOR WENDELSTEIN 7-X. Náfrádi, et al. 2008. 4 p. (Europhysics conference abstracts; Vol 32D P 5.079.)

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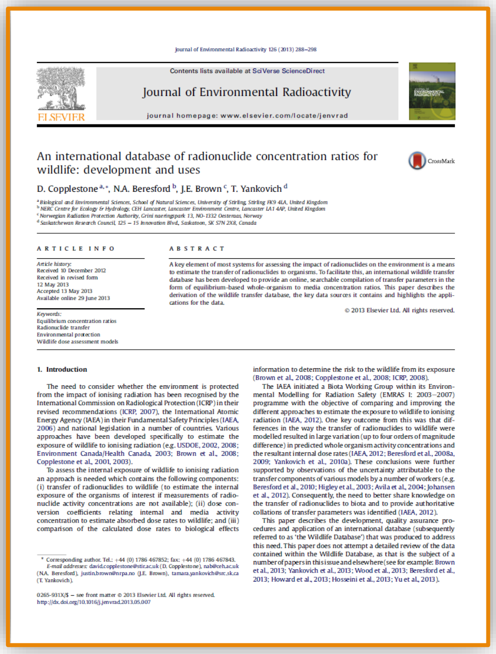
Wildlife Transfer Database

Database collating concentration ratios for wildlife

A key element of most systems for assessing the impact of radionuclides on the environment is a means to estimate the transfer of radionuclides to organisms. To facilitate this, an international wildlife transfer database (WTD) was developed


Journal of Environmental Radioactivity 126 (2013) 288–298
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Journal of Environmental Radioactivity
journal homepage: www.elsevier.com/locate/jenvrad

An international database of radionuclide concentration ratios for wildlife: development and uses

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ABSTRACT
A key element of most systems for assessing the impact of radionuclides on the environment is a means to estimate the transfer of radionuclides to organisms. To facilitate this, an international wildlife transfer database has been developed to provide an online, searchable compilation of transfer parameters in the form of equilibrium-based whole-organism to media concentration ratios. This paper describes the derivation of the wildlife transfer database, the key data sources it contains and highlights the applications for the data.

1. Introduction

The need to consider whether the environment is protected from the impact of ionising radiation has been recognised by the International Commission on Radiological Protection (ICRP) in their revised recommendations (ICRP, 2007), the International Atomic Energy Agency (IAEA) in their Fundamental Safety Principles (IAEA, 2006) and national legislation in a number of countries. Various approaches have been developed specifically to estimate the exposure of wildlife to ionising radiation (e.g. USDOE, 2002, 2008; Environment Canada/Health Canada, 2003; Brown et al., 2008; Copplestone et al., 2001, 2003).

To assess the internal exposure of wildlife to ionising radiation an approach is needed which contains the following components: (i) transfer of radionuclides to wildlife (to estimate the internal exposure of the organisms of interest if measurements of radionuclide activity concentrations are not available); (ii) dose conversion coefficients relating internal and media activity concentration to estimate absorbed dose rates to wildlife; and (iii) comparison of the calculated dose rates to biological effects information to determine the risk to the wildlife from its exposure (Brown et al., 2008; Copplestone et al., 2008; ICRP, 2008).

The IAEA initiated a Biota Working Group within its Environmental Modelling for Radiation Safety (EMRAS I: 2003–2007) programme with the objective of comparing and improving the different approaches to estimate the exposure to wildlife to ionising radiation (IAEA, 2012). One key outcome from this was that differences in the way the transfer of radionuclides to wildlife were modelled resulted in large variation (up to four orders of magnitude difference) in predicted whole organism activity concentrations and the resultant internal dose rates (IAEA, 2012; Beresford et al., 2008a, 2009; Yankovich et al., 2010a). These conclusions were further supported by observations of the uncertainty attributable to the transfer components of various models by a number of workers (e.g. Beresford et al., 2010; Higley et al., 2003; Avila et al., 2004; Johansen et al., 2012). Consequently, the need to better share knowledge on the transfer of radionuclides to biota and to provide authoritative collations of transfer parameters was identified (IAEA, 2012).

This paper describes the development, quality assurance procedures and application of an international database (subsequently referred to as 'the Wildlife Database') that was produced to address this need. This paper does not attempt a detailed review of the data contained within the Wildlife Database, as that is the subject of a number of papers in this issue and elsewhere (see for example: Brown et al., 2013; Yankovich et al., 2013; Wood et al., 2013; Beresford et al., 2013; Howard et al., 2013; Hosseini et al., 2013; Yu et al., 2013).

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to provide an online (http://www.wildlifetransferdatabase.org/), searchable compilation of transfer parameters in the form of equilibrium-based whole-organism to media concentration ratios (CRwo-media). The database was subsequently used to produce IAEA (TRS-479) and ICRP (ICRP-114) publications and also to populate version 1.2 of the ERICA Tool (http://www.erica-tool.com/).

The original version of the WTD, as described by Copplestone et al. (2013) contained information from 523 references. There were more than 50,000 lines of data representing 86,979 CRwo-media values for 1438 species and 71 elements. Subsequently, about 17,000 additional CRwo-media values have been added to December 2013 (Brown et al., 2016). These new inputs include: data for representative species of the ICRPs Reference Animals and Plants from a UK forest; monitoring data from Finland and Japanese estuaries; Canadian wildlife data; Pu data from US weapons testing programme sites; data for wild plants and invertebrates from north western USA. The number of elements included, as of December 2013, had increased to 80.

Photo: R. Fawkes(University of Salford

Nick Beresford

Currently the database is being used to: develop the update of IAEA SRS-19; by the ICRP in the development of its environmental protection framework; and to develop novel transfer models by the TREE project (http://www.ceh.ac.uk/tree).

The wildlife transfer database is being maintained and is open for all interested parties to add appropriate data. Periodically updated summary tables are provided on the database website. A help file for completing the database is available from: https://wiki.ceh.ac.uk/x/-QHbBg. Anybody wanting to add large amounts of data should contact Nick Beresford or David Copplestone to discuss how this can be most efficiently done.

Sampling earthworms (http://www.ceh.ac.uk/tree)

Photo: C. Barnett/NERC-CEH

ID Card:

Database topic:
Radioecology

Information available type:
Wholebody radionuclide concentration ratios

Data type:
Database

Link with a biobank:
no

Exportable:
Summary tables only

Species:
All wildlife (plants and animals)

Internet link:
http://www.wildlifetransferdatabase.org/

Access:
Free – to add data and view/export summaries

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Related to:
ALLIANCE

AN INTERNATIONAL DATABASE OF RADIONUCLIDE CONCENTRATION RATIOS FOR WILDLIFE: DEVELOPMENT AND USES. Copplestone, D. et al. 2013. J. Environ. Radioact. 126, 288-298.
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, 141-148.

Radiobiology and immunology platform (CTU-FBME)

Analytical platform for immunology and radiobiology

The immunological laboratory of CTU FBME, located in Prague, disposes of SPF animal facility for small rodents breeding and in vivo experiments, and of the tissue culture laboratory. Experimental animals are housed in different levels of barrier protection including GMO Class I and Class II (Optimice racks with IVC cages).

We can analyze radiation induced changes, i.e. the health condition of animals, the phenotype

Photo: CTU FBME

SPF animal facility

and functional analyses of immune cells; proliferation or cytotoxicity evaluated on established cell lines, biological samples and primary cultures employing Core facility for cytometry FACS (LSRII), confocal microscopy (Olympus FV-1000), ELISA reader (Tecan Infinite), and evaluation of gut microflora (MALDI, Bruker). We can offer various experimental mouse models for cancer, inflammation or autoimmunity as well as newly generated mouse strains with different sensitivity to radiation. We can also provide frozen sections of biological material for further analyses.

In cooperation with small enterprise (APIGENEX Ltd.) we are developing safe radioprotectants (nor-muramyl lipoglycopeptides derived from bacterial cell wall peptidoglycans) for restoration of hematopoiesis, and thus prevention of leukopenia evoked by radiotherapy. APIGENEX Ltd. company is focused to research and development for foreign companies (e.g. Novo Nordisk, Pfizer, GSK, Schering Plough) in the development of innovative pharmaceuticals.

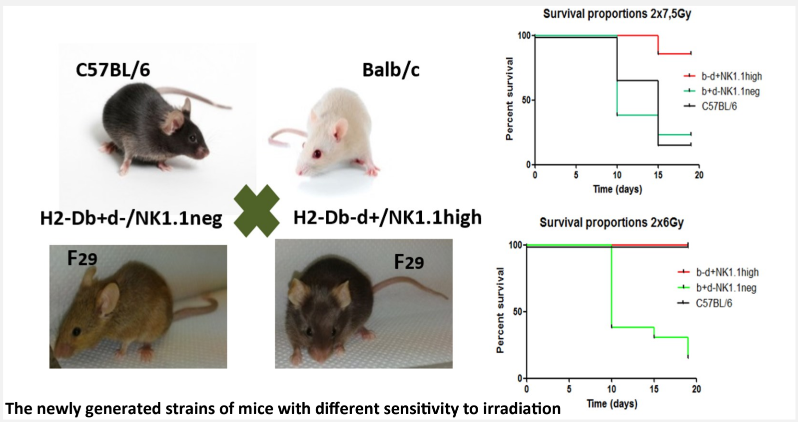
Photo: Fiser/CTU FBME

Anna Fiserova

The irradiation of mice will be performed using Microtron MT-25 (NPI ASCR v.v.i.) that will serve as a source of relativistic electrons (primary electron beam), secondary photon beams (bremsstrahlung), and neutrons from nuclear reactions. The accelerator applications involve radiation resistance testing studies in well controlled and monitored conditions, whole body or local irradiation of animals using collimator. Advanced neutron and photon activation analysis (PAA) will be applicable for determination of large number of elements in biological samples. Further we have access to ^{60}Co-irradiator for low doses irradiation.

Moreover, we have close collaboration with clinical departments employing radiodiagnostics or radiotherapy of patients (CT, X rays, ^{60}Co, ^{137}Cs, and proton therapy). Taken together, we can perform clinical, immulogical, and immunopharmacological examination of small rodents and humans. For obtained data processing we have specialist for bioinformatics.

We are open for collaboration with other infrastructures, preferentially focused to genomics, and CONCERT partners for common research.



The newly generated strains of mice with different sensitivity to irradiation

Picture: CTU FBME

ID Card:

Analytical platform type:
Imunology and radiobiology

Main techniques proposed:
Flow cytometry, confocal microscopy, immunological assays (ELISA, proliferation, cytokine synthesis), functional tests of cytotoxicity, antibody formation, microbiom

Delay to start:
None

Duration of experiment:
Design of experiment and assay-dependent

Training proposed:
Work with small rodents, isolation of biological material (organs, cells), cell culture, FACS analysis, ELISA

Address:
Immunological Laboratory of FBME CTU is located at National Institute of Public Health, Šrobárova 48, 10042 Prague 10, Czech Republic

Access:
National Institute of Public Health, Centre of Toxicology and Health Safety, NRL for Welfare of Laboratory Animals, Building 31

Internet link:
Under construction

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Related to:
MELODI, DoReMi, CONCERT

THE EVOLUTION OF RECTAL AND URINARY TOXICITY AND IMMUNE RESPONSE IN PROSTATE CANCER PATIENTS TREATED WITH TWO 3DCRT TECHNIQUES. Vránová J, et al. 2011. *Radiat Oncol*; 6:87.
COLLAGEN-INDUCED ARTHRITIS: SEVERITY AND IMMUNE RESPONSE ATTENUATION USING MULTIVALENT N-ACETYL GLUCOSAMINE. Richter J, et al. 2014. Clin. Exp. Immunol ;177:121-33.

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)
Coming soon:			
May2016, #7	LARIA	Tinea capitis Portuguese cohort	LDRstatsNet

Future events:

10-15 April 2016: 1^{st} International Conference on Radioanalytical and Nuclear Chemistry, RANC-2016, Budapest, Hungary
Registration: open

9-13 May 2016: 14^{th} Congress of the International Radiation Protection Association, IRPA14, Cape Town, South Africa
Registration open until 1^{st} May 2016

17-18 May 2016 : Health Effects of Chernobyl: Prediction and Actual Data 30 Years after the Accident, Obninsk, Russia

31 May 2016: Registration deadline for Msc Radiation Biology Programme. See website

1-3 June 2016: 2^{nd} 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 Sept 2016: 42^{nd} 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

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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