AIR² Access to INFRASTRUCTURES for Radiation protection Research

Issue September 2016 10

Editorial

From the first MELODI workshop in Stuttgart (2009) to the Radiation Protection Week in Oxford (2016), the Infrastructure session has always been present and constantly renewed. The next session is on **20 September (4-6 pm)**, co-chaired by Laure Sabatier and Nick Beresford (MELODI-ALLIANCE). The emphasis will be on databases with an invited lecture on STORE (Bernd Grosche, Paul Schofield) and talks by David Copplestone on FREDERICA and Miquel Vidal on Kd datasets. You will also hear about exposure platforms: External, with Giovanni Cenci presenting an underground facility, and Internal, with Isabelle Dublineau describing PARISII. Eugenia Ostroumova will present cohorts from Kazatskan and Juan Carlos Mora will explain models for dose assessment.

We hope that you and your colleagues will join us for this interesting session. **Dr Laure Sabatier, CEA**

The floor to...

Adequate infrastructure is a necessary resource for state-of-the-art radioecological research, impact assessments and education and training activities. Infrastructure encompasses facilities, equipment, methods, parameter databases and models. Different scientific methods and equipment are needed to support our Strategic Research Agenda (SRA)* and topical roadmaps, for example, to acquire the data necessary to parameterise key processes controlling the transfer of radionuclides (see SRA Challenge 1), to develop biomarkers of effect and exposure (Chal-2), to develop models integrating human and environmental risk assessment (Chal-3).

The ALLIANCE wants to further develop a sustainable, integrated infrastructure network to best meet the needs of the radioecology community

ALLIANCE partners have an impressive array of highly specialised laboratory equipment, databases and models which have been collated into a virtual laboratory (www.radioecology-exchange.org)

The ALLIANCE wants to further develop a sustainable, integrated infrastructure network to best meet the needs of the radioecology community. Therefore, the following actions are being addressed (in collaboration with CONCERT):

1. Identify requirements for infrastructure to deliver our SRA and create partnerships of excellence that bring together this required infrastructure and tools.
2. Promote the visibility and joint use of existing infrastructures. Sustainability of scarce highly-specialised, but necessary, facilities will be given priority (for example chronic irradiation facilities).
3. Further develop and sustain Observatory Sites (OS) for radioecology. OS are radioactively (and sometimes chemically) contaminated field sites that provide a focus for joint, long-term radioecological research. Over the years, joint efforts will result in a comprehensive data set specific to the OS and will allow validation and efficient improvement of the predictive capacity of radioecological models through testing hypotheses under realistic conditions. The ALLIANCE with EC-COMET (COordination and iMplementation of a pan-European instrumenT for Radioecology) is developing these long-term observatory sites in the Chernobyl and Fukushima exclusion zones, and NORM OS are envisaged.
4. Ensure and promote efficient use of infrastructure for students and scientists.

Dr Hildegarde Vandenhove—SCK-CEN
ALLIANCE President

PHOTO: SCK-CEN

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:

31 Oct 2016: D6.3
Recommendations for infrastructure related topics for the 2nd CONCERT call and Recommendations for funding schemes to support infrastructure use for the 2nd CONCERT call input to WP3 (M17)

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.

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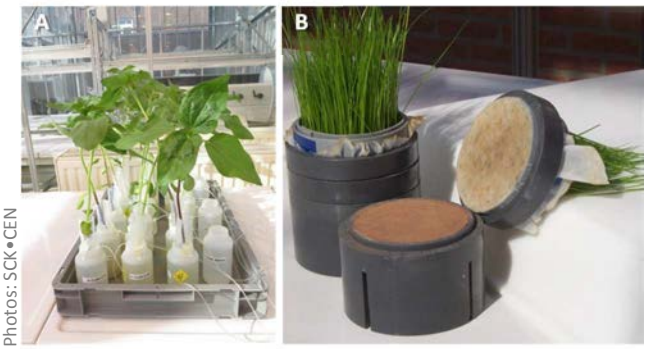
This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287

Facility radionuclides availability, transfer and migration

Understanding the behaviour of radionuclides in the biosphere

At the Biosphere Impact Studies group (BIS) of the Belgian Nuclear Research Centre (SCK•CEN), mechanisms and processes are studied to better understand and predict radionuclide behaviour in the terrestrial, freshwater and marine environment by using dedicated laboratory set-ups, greenhouse experiments and field studies, as well as developing modelling tools calibrated and validated with the data sets thus developed. To perform this research, an infrastructure is available for conducting lab experiments to study radionuclide availability, transfer and migration in the environment.



Photos: SCK•CEN

Fytoremediation experiment with sunflower (A) - Rhizoplan system (B)

The facility is located in a controlled area, making it possible to work with open radioactive sources. A large range of radionuclides can be used, e.g. ^{134}Cs, ^{137}Cs, ^{60}Co, ^{90}Sr, ^{238}U, ^{232}Th, ^{241}Am. The permitted activities are dependent on the dose rate, shielding possibilities, radioactive waste limits, etc., and need to be discussed and approved by the physical control unit of SCK•CEN before starting the experiments.

The facility offers the possibility to contaminate soil, sediment and water and simulate atmospheric deposition. Plants (and other organisms) can be grown on/in these contaminated substrates to study their uptake of radionuclides (figure A). Many plant species have already been used in the labs, e.g. ryegrass, sunflower, clover, maize, pine trees and rice, plus other organisms such as mycorrhizas.

Specific experimental set-ups have been developed at BIS, for example:

- In order to screen the radionuclide uptake potential of plants for a large array of soils, a rhizoplan system was developed in which only a small amount of soil is used, and the roots, shoots and soil can be harvested separately (figure B).
- To be able to differentiate between root uptake and stem uptake of radiocaesium by rice, a hydroponic system was developed in which rice stems are in contact with ^{134}Cs while rice roots are in contact with ^{137}Cs (figure C).

Photo: Patrick Liebens

Nathalie Vanhoudt

The facility is equipped with a greenhouse consisting of four compartments (each 20 m²) in which the environmental conditions can be separately regulated with heaters, screens, natural ventilation and lights (figure D). To ensure more controlled environmental conditions, two large climate chambers (8 m² and 3 m²) are available in which the temperature and light conditions can be programmed and controlled. Also, one fully controlled climate chamber of 1 m² is available if, in addition to light and temperature, humidity also needs to be regulated.

In addition to the indoor lab experiments, lysimeters are available with different soil types to perform outdoor experiments.

The facility is supported by fully equipped labs for soil sampling and characterisation, element analyses (ICP-MS, IC, etc.) and radioactivity measurements (low level alpha, beta, gamma). In addition, a collection of Belgian, Japanese and European soils is available.

The facility is open for collaboration, and proposals for projects with CONCERT partners are welcome.

Rice experiment to differentiate between roots and stem uptake of radiocaesium (C) - Greenhouse (D)

Photo: SCK•CEN

SCK•CEN
STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

ID Card:

Exposure type:
Internal exposure (through uptake of radionuclides from contaminated soil/sediment/water)

Source:
Large range of radionuclides (^{134}Cs, ^{137}Cs, ^{238}U, ^{232}Th, ^{90}Sr, etc.)

Dose rate:
Radionuclide-dependent (according to radiation type, shielding possibilities, radioactive waste limits, etc.)

Irradiation type:
Alpha, beta, gamma

Irradiated organism type:
Exposure of plants and mycorrhiza via contaminated soil, sediment or water

Address:
Belgian Nuclear Research Centre (SCK•CEN), Boeretang 200, 2400 Mol, Belgium

Access:
Joint research collaboration and subject to internal approval

Supporting lab:
Labs for soil characterisation and (radio) analytical chemistry

Contact:
Nathalie Vanhoudt, nathalie.vanhoudt@sckcen.be, +32 14 33 21 12

Related to:
ALLIANCE

CAN WE PREDICT URANIUM BIOAVAILABILITY BASED ON SOIL PARAMETERS? PART 1: EFFECT OF SOIL PARAMETERS ON SOIL SOLUTION URANIUM CONCENTRATION. H. Vandenhove et al., Environ. Pollut. 2007; 145(2):587-95.

PREDICTING RADIOCAESIUM SORPTION CHARACTERISTICS WITH SOIL CHEMICAL PROPERTIES FOR JAPANESE SOILS. S. Uematsu et al., Sci.Total Environ. 2015; 524-525:148-56.

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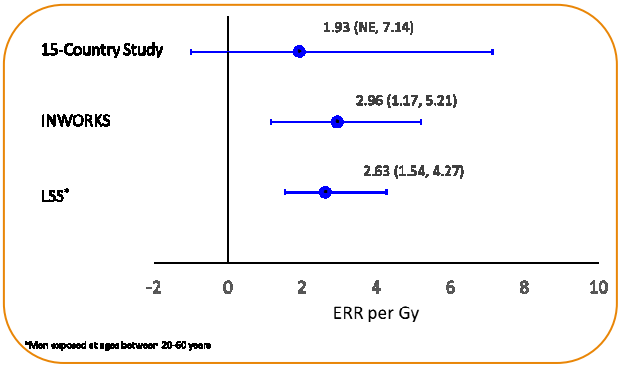
INWORKS Cohort

Multinational cohort study of nuclear workers

The International Nuclear Workers Study (INWORKS) is a collaborative study of cancer risk among radiation workers in the nuclear industry. It is built upon the previous '15-Country Study' using the same core protocol and takes advantage of updated follow-up and exposure data from the three most informative cohorts involved in that study. The INWORKS study comprises 308,297 workers employed by the Atomic Energy Commission (CEA), AREVA Nuclear Cycle and the National Electricity Company (EDF) in France; the Departments of Energy and Defense in the USA; and, in the UK, by nuclear industry employers included in the National Registry for Radiation Workers (NRRW).



Comparison of INWORKS leukaemia findings with other studies

Workers from the nuclear industry represent a unique population in which to study the health effects of ionising radiation; they are mostly exposed to radiation at low levels over the course of their working life. Moreover, all workers included in INWORKS have records that provide individual quantitative radiation dose estimates. Workers in INWORKS were mainly exposed to external radiation, usually gamma-rays, and doses were measured regularly with personal dosimeters. For all participating cohorts, records of individual recorded doses have been kept since the very beginning of the industry in the 1940's. Recorded external penetrating radiation dose estimates are converted to absorbed organ doses expressed in gray (Gy) using the appropriate conversion factor. The mean individual cumulative colon and red bone marrow dose estimates over the period from 1945 to 2005 were 21mGy and 16mGy, respectively.

Over a mean follow-up duration of 27 years, the total number of observed deaths was 66,632, including 17,957 deaths due to solid cancers, 1,791 deaths due to haematological cancers and 27,848 deaths due to cardiovascular diseases.

Photo: R. Dray/IARC

Ausrele Kesminiene

INWORKS demonstrated a significant association between cumulative red bone marrow dose and the risk of all leukaemias, excluding chronic lymphocytic leukaemia (CLL) (n=531 deaths), with an Excess Relative Risk (ERR) of 2.96 per Gy, 90% Confidence Interval (CI)= [1.17 ; 5.21], and between cumulative colon dose and the risk of solid cancers, with an ERR of 0.47 per Gy, 90% CI = [0.18 ; 0.79]. Estimated dose-risk relationships are very close to those derived from the cohort of Japanese A-bomb survivors. Sensitivity analyses demonstrated the stability of the observed relationships. When restricting to low doses (below 100 mGy for solid cancer and below 300 mGy for non-CLL leukaemia), the dose-risk relationships demonstrated reduced precision; the estimated ERR per Gy were not significantly different from zero, but remained consistent with those obtained over the whole dose range.

INWORKS has assembled some of the strongest evidence to strengthen the scientific basis for the protection of adults from low dose, low dose rate exposures to ionising radiation.

INWORKS study group meeting

Photo: R. Dray/IARC

International Agency for Research on Cancer
World Health Organization

ID Card:

Database type:
Individual data on humans exposed to protracted low-doses of ionising radiation

Cohort type:
International cohort comprising 308,297 workers from the nuclear industry in France, the UK and USA

Age/follow-up:
- age at exposure: from 20 to 60 years
- mean age at end of current follow-up: 58 years
- mean duration of follow-up: 27 years, total of 8.2 million person-years

Data available:
Vital status, causes of death for cancer and non- cancer diseases, individual organ doses due to external radiation, socio-economic status

Biobank available:
No

Access:
The data are maintained at IARC for an agreed period of time; for ethical reasons and due to agreements with data contributors, it is not possible to send the data outside of IARC.

Internet link:
http://www.iarc.fr/

Contact:
Ausrele Kesminiene, International Agency for Research on Cancer (IARC), Lyon, France
kesminienea@iarc.fr

Related to:
MELODI, CARPEM

IONISING RADIATION AND RISK OF DEATH FROM LEUKAEMIA AND LYMPHOMA IN RADIATION-MONITORED WORKERS (INWORKS): AN INTERNATIONAL COHORT STUDY. Leuraud K et al. Lancet Haematol 2015;2:e276-81
RISK OF CANCER FROM OCCUPATIONAL EXPOSURE TO IONISING RADIATION: RETROSPECTIVE COHORT STUDY OF WORKERS IN FRANCE, THE UNITED KINGDOM, AND THE UNITED STATES (INWORKS). Richardson DB et al. BMJ 2015;351:h5359

France Génomique

French National Infrastructure for Genomics

Over the last 20 years, Life Sciences has hugely benefited from the spectacular developments in genome sequencing technologies which have rendered data acquisition faster, easier and cheaper. This has resulted in research discoveries and progress in all fields (biology, medicine, agronomy, biodiversity, etc.) that were beyond reach only a few years ago.

The sequencing of the human genome (3 billion bases) was officially completed in 2003 after more than 10 years of work. Today, the complete resequencing of an individual can be done within days, at a cost of only a few hundred euros. Given these developments, which are radically transforming our approach to the life sciences, it was deemed essential for French research to remain independent and competitive in the genomics field in order to retain ownership of its results. This led to the creation of France Génomique.

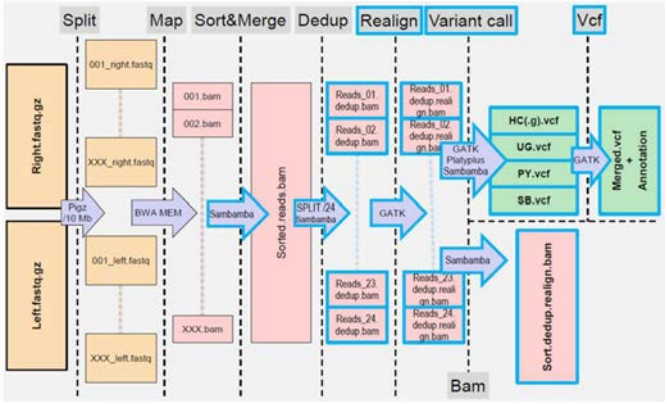


Photo: V. Meyer / IG

The VarScope 2.0 pipeline for whole-genome analysis

Created in 2011 through grant support from the French government programme "Investments for the Future", France Génomique (FG) is a national genomics infrastructure born out of the desire to maintain France at the highest level of competitiveness and performance, at the cutting edge of the field of genomics production and data analysis, thus reinforcing France's visibility in the international genomics landscape. The FG infrastructure brings together the majority of the French sequencing and bioinformatics platforms: CEA (coordinator), INRA, CNRS, Inserm, INRIA, Pasteur Institute, Curie Institute, ENS Paris and IGBMC Strasbourg.

The FG infrastructure offers: (1) an integrated structure and governance, providing greater visibility and higher functionality to the network in general and to each of its platforms, (2) access to a network facility of sequencing and/or bioinformatics platforms that have been operational for many years and have each developed complementary expertise, (3) the opportunity to undertake ambitious projects with strong visibility, through submission to the FG "large projects" call for proposals and selection on the basis of scientific excellence by external scientific review committees, (4) a critical mass to generate innovation collectively through continual survey, evaluation and development of new sequencing and bioinformatics methodologies and technologies, (5) access to competitively priced genomics services and associated bioinformatics with state-of-the-art, permanently upgraded data production, storage and processing systems and (6) access to a high performance computing centre and to data storage systems at the CEA/TGCC, equipped with large scalable capacity that is adapted to the exponential growth of the data being generated.

Photo: P Le Ber / CEA

Pierre Le Ber

An essential mission of FG is to disseminate its expertise, knowledge and know-how within the FG community but also more importantly to the wider French life sciences community: regular training sessions and workshops are organised by the FG platforms to allow students and researchers to improve their skills in this highly strategic field.

Genomics platform in Evry

Photo: F. Rhodes

ID Card:

Analytical platform type:
- Genomics
- Bioinformatics

Main techniques proposed:
- Next-Generation Sequencing (NGS): genome (de novo / resequencing), transcriptome, epigenome …
- 3rd generation sequencing (long reads, single molecule)
- Genotyping
- High-throughput data processing

Capacity:
100+ Terabases/month

Waiting time:
Depends on the project (sample availability)

Duration of experiment:
Depends on project size and complexity

Training proposed:
Various general or specific training courses (wet lab techniques and/or data processing and analysis)

Address:
CEA/Institut de Génomique, 2 rue Gaston Crémieux, 91057 Evry Cedex, France

Access:
Although international projects are accepted, the project PI has to be from a French laboratory. Projects can be submitted continuously via the Web portal or directly to the platforms. Very large projects can be submitted via the "large scale projects" call for proposals (every 18 months).

Internet link:
www.france-genomique.org

Contact:
Pierre Le Ber
contact@france-genomique.org

Related to:
MELODI, ALLIANCE, CARPEM

EUKARYOTIC PLANKTON DIVERSITY IN THE SUNLIT OCEAN. De Vargas C, et al., Science (2015) 348 (6237): 1261605.
CHARACTERISATION OF MUTATIONS OF THE PHOSPHOINOSITIDE-3-KINASE REGULATORY SUBUNIT, PIK3R2, IN PERISYLVIAN POLYMICROGYRIA: A NEXT-GENERATION SEQUENCING STUDY. Mirzaa GM et al., Lancet Neurol (2015) 14 (12): 1182-1195.

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
Jul 2016, #9	SCRS-GIG	RES3T	CROM-8
Sept2016,#10	Facility radionuclides availability, transfer and migration	INWORKS cohort	France Génomique
Coming soon:			
Oct 2016 #11	LIBIS gamma low dose rate facility ISS	JANUS	Transcriptomics platform SCK CEN

Future events:

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

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

5-7 Dec 2016: 8th EAN_{NORM}, Stockholm, Sweden.

14-19 May 2017: Neutron and Ion Dosimetry Symposium, NEUDOS13, Krakow, Poland

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

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