AIR²
Access to INFRASTRUCTURES for Radiation protection Research

Issue 32
November 2018

Editorial

MELODI, the European Platform dedicated to low dose radiation risk research, was founded in 2010 with 15 Institutional Members. Eight years later, now with a membership of 47, an amendment of the statutes and internal rules was considered necessary. This amendment was adopted during the Rovinj meeting, and I am very pleased to announce that MELODI will now include a new membership category: Associated Members. These new members will be individuals working in or interested in the field of low dose research and the risks associated with exposure to ionising radiation, and who are not affiliated to an Institutional Member of MELODI. Associated Members (granted free membership for 3 years, renewable) will contribute to the scientific activities and objectives of the Association.
If you are interested in joining MELODI, please contact melodi.secretariat@sckcen.be.

Dr Laure Sabatier, CEA

The floor to...

The role of DRR/NPHC in Radiation Protection Research in Hungary

The Hungarian National Public Health Centre (NPHC) offers a wide range of national health services, particularly in public, occupational and environmental health, chemical safety, infectious disease control, and in radiobiology and radiohygiene. NPHC comprises several departments, including the Department of Radiobiology and Radiohygiene (DRR).

DRR is the Technical Safety Organisation (TSO) for the Hungarian Radiation Protection Authority. DRR staff prepare expert opinions for authority decisions and perform acceptance and performance tests on medical radiology equipment. They also participate in national radiological environmental surveillance programmes and play a central role in the National Radon Action Plan. In addition, DRR runs the National Personal Dosimetry Service for all radiation workers in Hungary. The Division of Radiation Medicine at DRR plays a key role in national preparedness for medical management of overexposed persons and runs a biodosimetry laboratory. They maintain laboratories in molecular biology, cell culture and immunology, and are responsible for the department's animal facility. The division has been actively involved in several EURATOM supported research programs such as NOTE, CEREBRAD, DoReMi, OPERRA and CONCERT.

Previous studies include individual radiosensitivity in cancer patients. DRR researchers were among the first to study radiation-induced transcriptional alterations in primary human fibroblast cells by whole genome microarrays. They investigated low dose induced, non-targeted effects and inflammatory reactions in experimental animal systems and detected that parts of the immune system bear different radiosensitivity. They also found that low dose irradiation induces long-lasting functional changes in brain mitochondria and that bone-marrow derived exosomes from irradiated mice can induce bystander effects in non-irradiated mice. Currently DRR is investigating the potential role of exosomes in the development of radiation-induced leukaemias.

In CONCERT, DRR/NPHC participates in WP2, WP3, WP7, and coordinates the 2nd CONCERT Call funded project, LEU-TRACK. In addition, it is a member of the MELODI and EURADOS platforms. Its broad research area and participation in various European platforms enables it to contribute effectively to the development of the SRA and to efforts to determine priority research and joint programme needs. NPHC can also contribute to establishing new E&T activities at European level and help with the integration of E&R programmes in universities.

Dr Géza Sáfrány
DRR/NPHC
CONCERT WP2, WP3, WP7, LEU-TRACK

Photo: DRR/NPHC

CONCERT CORNER

Future events:

Call for Travel Grants
Next deadline: 31st December 2018
Information

WP 6 News:

The first version of CONCERT's Web-handbook (D6.4) is now online!

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

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Contents:

Next issue

December 2018

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

The AGOR Facility at KVI-CART

Cell and Animal Irradiation

The AGOR cyclotron facility, located within the KVI-Centre for Advanced Radiation Technologies (KVI-CART), is part of the University of Groningen (the Netherlands). AGOR (Accélérateur Groningen-ORsay) is a superconducting K=600 MeV cyclotron used for the acceleration of both light and heavy ions, and is the result of a collaboration between KVI-CART and the IPN, Orsay, France.

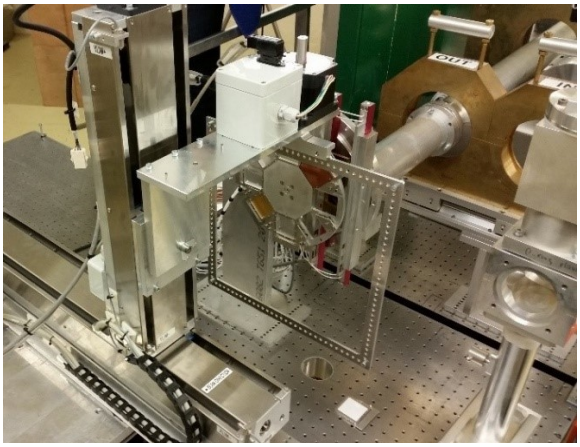

Photo: H. Kiewiet/KVI-CART

AGOR's in-air irradiation beamline

The cyclotron has just celebrated 20 years of successful operations, including the performance of numerous animal irradiations with proton beams and of cell cultures with proton, helium, carbon and oxygen beams at various energies. A high-precision and efficient ion irradiation facility for radiobiology has been developed to study DNA damage and gene expression after ion irradiation.

This system uses a double scatter foil to generate a 70 mm field size for ≤190 MeV protons (uniformity of ±1.5%) and a dose rate of up to 50 Gy/min. Carbon ions are also provided, using a single scatter foil at ≤90 MeV/u (uniformity of ±1.5%) and dose rates of 2-5 Gy/min for cell cultures, and up to 50 Gy/min for DNA damage studies. In all cases, a spread-out Bragg peak (SOBP) is formed with a modulator wheel (SOBPs of 1.3 mm and 3 mm have been provided for carbon ions). Neutron irradiations at dose rates of up to 100 mGy/min can be performed under near clinical conditions by stopping a proton of the required energy in water.

Since April 2018, a scanned pencil beam is available. Depending on the ion and energy chosen, and the required uniformity, the field size can be up to 10 x 10 cm^2 (protons). Uniform scanning with a frequency up to 200 Hz has already been implemented, and spot scanning is under development. Future development plans include image-guided animal irradiations (for which a large funding request is under evaluation) and flash (ultra-high dose rate) and mini-beam irradiations. The feasibility of higher dose rate neutron irradiations is currently under study.

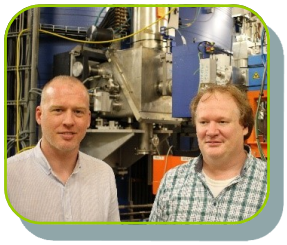

Photo: H. Kiewiet/KVI-CART

Dr B. N. Jones
&
Dr M. J. van Goethem

The AGOR facility is a user facility for the international scientific community. Beamtime can be obtained by submitting a proposal for evaluation by the AGOR Programme Advisory Committee (PAC). Proposal submission deadlines are 1 March and 1 October. In the context of Transnational Access within the EU/Horizon2020 Integrating Activities action, KVI-CART provides access support (travel and subsistence) under the Integrating Activities ENSAR2 and INSPIRE (see: https://www.rug.nl/kvi-cart/research/facilities/agor/).

AGOR has also been recognised by the ESA (European Space Agency) as a ground based facility for its research programme on the biological effects of space radiation (https://www.esa.int/Our_Activities/Human_Spaceflight/Research/Research_Announcements).

Access for commercial use is available to users from industry, businesses and the public sector with no need to submit a scientific proposal.

Photo: P. Tahl/KVI-CART

AGOR Cyclotron

university of groningen

ID Card:

Exposure type:
Scanned pencil and scattered beam

Source:
Cyclotron

Dose rate:
Adjustable, protons with typical dose rates of up to 50 Gy/min

Carbon ions at ≤90 MeV/u with typical dose rates of up to 50 Gy/min

Flux: max 10^9 protons per cm^2 per second, 10^6 heavy ions per cm^2 per second

Irradiation type:
Proton beam of up to 190 MeV, He to O up to 90 MeV/amu

Irradiated organism type:
Cells, animals (rats using protons, 10 x 10 cm^2 field and max range 15 cm water equivalent)

Address:
AGOR irradiation liaison KVI-CART,
Zernikelaan 25
9747 AA GRONINGEN
The Netherlands

Access:
EU support available for travel and subsistence costs (PAC approved)

Technical support available

Supporting lab:
Limited microbiology facilities on site, support from UMCG radiobiology group can be arranged.

Internet link:
https://www.rug.nl/kvi-cart/

Contact:
AGOR irradiation liaison (KVI-CART)

Dr M. J. van Goethem
irradiations@kvi.nl

Involved in:
ESA-CORA-GBF
ENSAR2
INSPIRE, both within the EU H2020 programme

Related to:
EURADOS

Development of a facility for high-precision irradiation of cells with carbon ions, van Goethem M. J., Niemantsverdriet M., Brandenburg S., Langendijk J. A., Coppes R. P., van Luijk P. (2011), Med Phys, 38 (1), 256-263
Sparing the region of the salivary gland containing stem cells preserves saliva production after radiotherapy for head and neck cancer, van Luijk P., Pringle S., Deasy J. O., Moiseenko V. V., Faber H., Hovan A., Baanstra M., van der Laan H. P., Kierkels R. G. et al. (2015), Sci Transl Med, 305 (7), 305ra147

Laboratory for Nuclear Calibrations at SCK•CEN

Irradiations of a wide range of samples in ISO standard beams

The Laboratory for Nuclear Calibrations (LNK) at SCK•CEN performs calibrations of dosemeters from research centres, nuclear power plants, industry and hospital radiotherapy departments. The irradiations of different sample types represent a significant part of the activity. Samples used for research in radiobiology, radioecology or dosimetry are irradiated following the recommendations of specific ISO standards.

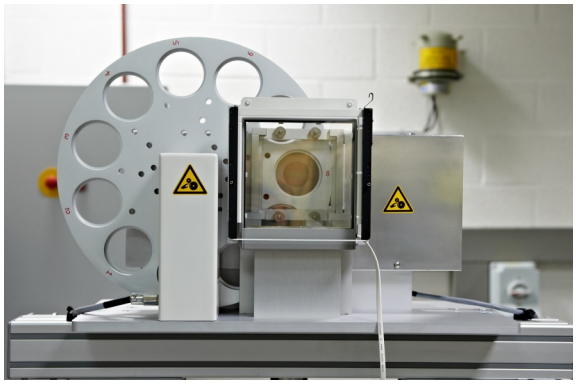

Photo: SCK•CEN

The 100 kV tube of the X-ray generator. A filter wheel with holes for 11 filters and a DAP ionisation chamber are visible downstream the focal point.

LNK was set up more than 30 years ago. It has been a member of the EURAMET network and a Designated metrology Institute (DI) since 2012, and is also a member of the Secondary Standard Dosimetry Laboratories (SSDL) network of the IAEA (International Atomic Energy Agency). In 2016, its first primary standard (for air kerma in Co -60 beam) was characterised and officially compared with the standard of the International Bureau of Weights and Measures (BIPM, Sevres, France). Most of the Calibrations and Measurement Capabilities (CMC) of LNK are covered by the scope of ISO 17025 accreditation.

LNK performs irradiations for a wide range of samples and dosimetry equipment with dose rates of up to a few Sv/h for photons and a few mSv/h for neutrons. The laboratory is specially designed for dosimetry irradiations and calibrations and follows the ISO 4037 (photons) and ISO 8529 (neutrons) recommendations. Encapsulated and small-size radioactive sources are used for the irradiations. Sample sizes of up to tens of cm can be fitted inside the beam while holders and electronic equipment can be kept outside the beam. A lot of space is available around the sources; the irradiation rooms are several metres wide. Irradiation times can vary from a few seconds to several days, or even weeks, depending on the availability of the irradiators and the needs of the customer.

Dr L. C. Mihailescu

Photo: SCK•CEN

Several irradiators are available with different types of collimation systems and beam directions:

- Cs-137 and Co-60 irradiators with horizontal and vertical beam and 20 degree angle collimators,
- Cs-137 and Co-60 irradiator in a panoramic 2π beam, very useful for simultaneous irradiation of many dosemeters or samples,
- Dual tube X-ray generator that covers the energy range from 10 keV up to 300 keV,
- Panoramic 2π neutron beam from Cf-252 and Am-Be sources,
- Co-60 irradiator with horizontal beam for radiotherapy dosimetry calibrations (IAEA TRS-398 protocol).

The X-ray system is intensively applied for irradiation of radiobiological samples using standard H-250 (high air kerma rate series) beam quality (ISO 4037). Photon spectroscopy is used to verify the energy spectra of the beam qualities used at LNK.

Access to the facility is possible with proper planning. Approximately 500 irradiation certificates and 200 calibration certificates are issued every year at LNK.

An ISO 17025 accredited irradiation facility is available at SCK•CEN for dosimetry, radiobiology or radioecology experiments. Additional support can be obtained through collaboration with other research groups at SCK•CEN.

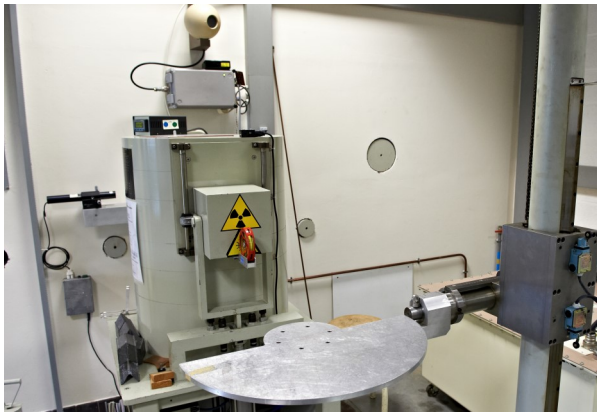

Photo: SCK•CEN

Horizontal Cs-60 and Co-60 irradiator

ID Card:

Exposure type:
External

Source:
γ-rays: Cs-137, Co-60
X-rays: 10-300 kVp (ISO 4037 N-series, H-250 and IEC RQR-series)
β particles: Sr-90/Y-90,
neutrons: Cf-252, Am-Be

Dose rate:
Up to a few Sv/h for photons and a few mSv/h for neutrons

Irradiation type:
γ-rays, X-ray, β particles and neutrons

Irradiated organism type:
Any sample, flexibility for size

Address:
Laboratory for Nuclear Calibrations (LNK)
SCK•CEN
Boeretang 200
B-2400 Mol
Belgium

Access:
Free (no Scientific Committee)

Supporting lab:
Radiobiology and Radioecology research groups at SCK•CEN

Internet link:
www.sckcen.be

http://science.sckcen.be/en/Services/RDC/Dosimetry_calibrations

Contact:
Dr Liviu-Cristian Mihailescu

nuclearcalibrations@sckcen.be
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Involved in:
Secondary Standard Dosimetry Laboratories (SSDL) of IAEA

Related to:
EURAMET

Key comparison BIPM.RI(I)-K1 of the air-kerma standards of the SCK•CEN, Belgium and the BIPM in ^{60}Co gamma radiation, Kessler C., Burns D., Mihailescu L. C., Chiriotti S. (2017), Metrologia, 54, Tech Supl 06004
Photon energy (8–250 keV) response of optically stimulated luminescence: Implications for luminescence geochronology, Guérin G., Mihailescu L. C., Jain M. (2018), J Lumin, 204, 135-144

MARS beamline at Synchrotron SOLEIL

X-ray analyses of radioactive samples

Radioactive samples for environmental and nuclear energy research require to be characterised at the atomic or molecular level. This can be done using X-ray synchrotron techniques such as those of the MARS beamline at the French national synchrotron SOLEIL facility.

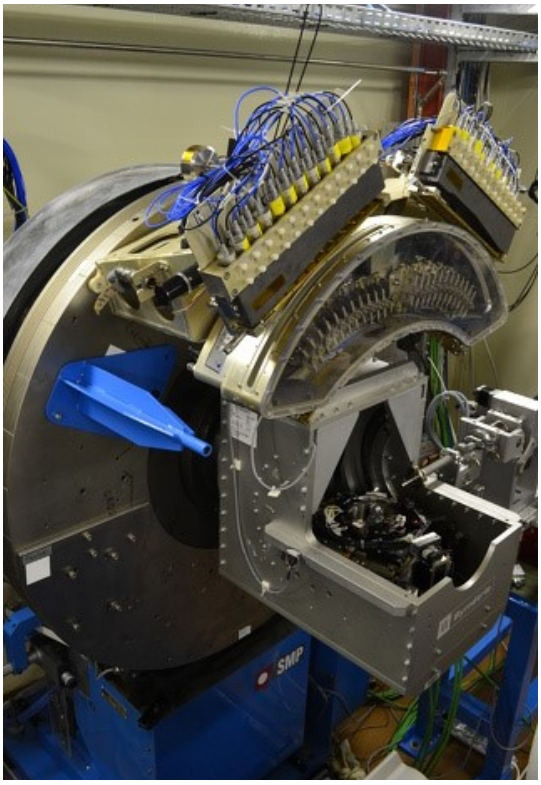

Photo: SOLEIL

Figure 1: High resolution diffractometer.

MARS is a hard X-ray beamline, dedicated exclusively to the study of radioactive samples. Since September 2013, analyses can now be performed on radioactive samples at ambient temperature and pressure, with activities up to 20,000 times the French exemption limit (thus for actinides, activities of up to 200 MBq). Yet, the ultimate aim is to extend this exemption limit to a wider range of experiments, and to activities of up to 18.5 GBq, in order to perform experiments on highly radioactive samples such as spent nuclear fuel. It is also possible to conduct analyses at high and low temperature, at high pressure, and on chemical reactions, but only for activities currently below the exemption limit.

The beamline, which was built through a partnership with the CEA, is located on a bending magnet source of SOLEIL's storage ring, and operates in the energy range of 3.5 keV to 35 keV. Currently, six different types of experiments are available on two different experimental end-stations. The first end-station is a special diffractometer dedicated to High-Resolution X-Ray Diffraction (HRXRD) analyses (Figure 1). It was specially designed in collaboration with CEA, to analyse irradiated nuclear fuel with specific shielding.

Photo: SOLEIL

D. Menut P.L. Solari M. Hunault

The second end-station is more versatile (Figure 2), and is mainly dedicated to X-ray Absorption Spectroscopy (XAS) both in standard mode and in High-Resolution mode (HRXAS) using a crystal analyser spectrometer. X-ray absorption spectroscopy technique allows determining the electronic state and local structure of specific elements in samples to be studied irrespective of their physical form. It can thus be used, for example, to study actinide or radionuclide elements in solutions down to sub-millimolar concentrations. The same end-station can also be used to perform Transmission X-Ray Diffraction (TXRD). Small and Wide Angle X-ray Scattering (S/WAXS) analyses have also been recently developped.

Finally, the use of a specific refocusing setup allows performing X-ray microbeam analyses, e.g. X-ray fluorescence imaging (XFR), microXAS and microXRD, with a beamsize of 15 by 15 micrometers.

The main research studies conducted at SOLEIL are in the areas of structural materials of interest for nuclear power plants, actinide oxides in relation to nuclear fuels, actinide and other radionuclide solutions of interest in nuclear fuel reprocessing, different types of glass of interest for nuclear waste storage, and radionuclide-containing samples of biological or environmental interest.

Photo: Photo: V. Moncorgé

Figure 2: Dr M. Hunault and Dr P.L. Solari positioning a sample-holder on the XAS experimental end-station.

ID Card:

Analytical platform type:
Synchrotron beamline dedicated to the analysis of radioactive samples with X-rays.

Main techniques proposed:
X-ray Absorption Spectroscopy, X-ray Diffraction, X-ray Fluorescence.

Capacity:
Total activity of the samples should be lower than 20,000 times the exemption limit.

Delay to start:
Experiments are usually scheduled in advance for the semester that follows the selection process (see Access).

Duration of experiment:
Usually experiments last one week (5 working days).

Address:
Synchrotron Soleil
L'Orme des Merisiers
Saint Aubin - BP 48
F-91192 Gif-sur-Yvette Cedex
France

Access:
Call for proposal opens twice a year.

Internet link:
https://www.synchrotron-soleil.fr/en/beamlines/mars

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Myrtille Hunault
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Related to:
ALLIANCE
MELODI

Characterization of radioactive materials using the MARS beamline at the synchrotron SOLEIL, Sitaud B., Solari P. L., Schlutig S., Llorens I., Hermange H. (2012), J Nucl Mater, 425 (1-3), 238-243
X-ray absorption spectroscopy investigations on radioactive matter using MARS beamline at SOLEIL synchrotron, Llorens I., Solari P.L., Sitaud B., Bes R., Cammelli S., Hermange H., Othmane G., Safi S., Moisy P., Wahu S., Bresson C., Schlegel M. L. et al. (2014), Radiochim Acta, 102 (11), 957-972

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	Pulex 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 TransferDatabase	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	RES^{3}T	CROM-8
Sep 2016, #10	Facility radionuclides availability, transfer and migration	INWORKS cohort	France Génomique
Oct 2016 #11	LIBIS gamma low dose rate facility ISS	JANUS	Transcriptomics platform SCKCEN
Nov 2016, #12	Microtron laboratory	EPI-CT Scan cohort	CATI
Dec 2016, #13	Nanoparticle Inhalation Facility	UEF Biobanking	The Analytical Platform of the PREPARE project
Feb 2017, #14	Infrastructure for retrospective radon & thoron dosimetry	Chernobyl Tissue Bank	HZDR Radioanalytical Laboratories
Special Issue 1	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES	1st CONCERT Call: CONFIDENCE, LDLensRad, TERRITORIES
Mar 2017, #15	Alpha Particles Irradiator Calibration Laboratory at KIT		SYMBIOSE
Apr 2017, #16	Changing Dose rate (SU) Low dose rate (SU)		Advanced Technologies Network Center
May 2017, #17	Chernobyl Exclusion Zone	Chernobyl clean-up workers from Latvia	BfS whole and partial body Counting
Jun 2017, #18	MELAF	Belgian Soil Collection	INFRAFONTIER
Jul 2017, #19	MICADO'LAB	Estchern Cohort	ECORITME
Sep 2017, #20	DOS NDS		CERES

Future events:

CONCERT Short Courses

21 January-1 February 2019

Radiation epidemiology, dosimetry and radiation protection concepts of ICRP, Helmholtz Center, Munich Institute for Radiation Protection, Germany

Contact:
Werner Rühm
werner.ruehm@Helmholtz-muenchen.de

Registration deadline:
10 December 2018

11-22 February 2019

Two-week training course on radiation-induced effects with particular emphasis on genetics, development, teratology, cognition, cancer as well as space-related health issues, SCK•CEN, Belgium

Contact:
Sarah Baatout
sbaatout@sckcen.be

Registration deadline:
18 January 2019

18-22 February 2019

Emergency and recovery preparedness and response. National Center of Radiobiology and Radiation Protection, Bulgaria

Contact:
Nina Chobanova
n.chobanova@ncrrp.org

Registration deadline:
20 January 2019

11-15 March 2019

Radiation Protection: Basics and Applications. Forschungszentrum Jülich, Germany

Contact:
Ralf Kriehuber
r.kriehuber@fz-juelich.de

Registration deadline:
11 December 2018

15-19 April 2019

EURADOS-CONCERT School on uncertainty in biological, physical, and internal dosimetry following a single exposure. Institut de radioprotection et de sûreté nucléaire (IRSN), France

Contact:
Sophie Ancelet
sophie.ancelet@irsn.fr

Registration deadline:
15 February 2019

Editorial Committee: Maria Panagiotopoulou, Jean-Michel Dolo, Elisabeth May, Laure Sabatier

Issue 32
November 2018

AIR²

Access to INFRASTRUCTURES for Radiation protection Research

Issue	Exposure platforms	Databases, Sample banks, Cohorts	Analytical platforms, Models & Tools
Published to date:			
Oct 2017, #21	CALLAB Radon Calibration Laboratory		CORIF
Nov 2017, #22	Calibration and Dosimetry Laboratory (INTE-UPC)	German airline crew cohort	Centre for Omic Sciences (COS)
Dec 2017, #23	NMG	Techa River Cohort (TRC)	iGE3
Special Issue 2	MEDIRAD	MEDIRAD	MEDIRAD
Feb 2018, #24	UNIPI-AmBe	Greek interventional cardiologists cohort	SNAP
Special Issue 3	2nd CONCERT Call: LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS	2nd CONCERT Call: L EU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS	2nd CONCERT Call: LEU-TRACK, PODIUM, SEPARATE, VERIDIC, ENGAGE, SHAMISEN-SINGS
Mar 2018, #25	IRRAD	MARiS	BIANCA
Apr 2018, #26	Forest observatory site in Yamakiya	BBM	OEDIPE
May 2018, #27	Belgian NORM Observatory Site	The German Thorotrast Cohort Study	VIB Proteomics Core
Jun 2018, #28	CERF	Mayak PA worker cohort	Geant4-DNA
Jul 2018, #29	TIFPA	RHRTR	D-DAT
Sep 2018, #30	HIT	The TRACY cohort	COOLER
Oct 2018, #31	PTB Microbeam	The BRIDE platform	BRENDA
Nov 2018, #32	AGOR Facility at KVI-CART LNK		MARS beamline at SOLEIL
Coming soon:			
Dec 2018, #33	To Be Announced	To Be Announced	To Be Announced

Future events:

Other Events

6-9 November 2018
15th SPERA Conference: South Pacific Environmental Radioactivity Association, Perth, Western Australia

9-25 January 2019
Radioecology Courses 2019 - NMBU, Aas, Norway
Contact:
Ole Christian Lind
olelin@nmbu.no

25-28 March 2019
TRANSAT:
First Tritium School, Ljubljana, Slovenia

3-5 April 2019
5th NERIS Workshop & 10th General Assembly, Roskilde, Denmark

10-12 April 2019
8th EUTERP Workshop 2019 : Optimizing radiation protection training, Qawra, St. Paul's Bay, Malta

13-16 May 2019
Confidence training course
Use of uncertain information by decision makers at the various levels within the decision making process and its Communication, VUJE, Trnava, Slovak Republic

10-14 June 2019
Seventh International Conference on Radiation in Various Fields of Research (RAD 2019), Herceg Novi, Montenegro

27-31 May 2019
ICDA-3:
3rd International Conference on Dosimetry, Lisbon, Portugal

25-29 August 2019
ICRR 2019: 16th International Congress of Radiation Research, Manchester, UK

See also on CONCERT website

Editorial Committee: Maria Panagiotopoulou, Jean-Michel Dolo, Elisabeth May, Laure Sabatier

Issue 32
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