EURADOS Strategic Research Agenda – Visions for Dosimetry of Ionizing Radiation

Fachverband für Strahlenschutz
Jahrestagung 2016
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Heringsdorf, Usedom

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EURADOS

The Role of Dosimetry in European Projects

OPEN PROJECT FOR EUROPEAN RADIATION RESEARCH AREA

WP 2, Task 2.2: Determining joint funding mechanisms for national & EU Fission R&D programmes

Report on: Radiation Protection related EU funded projects, FP 4 – FP 7

Version 3, as of 20 August 2014

Assembled by B. Grosche based on information collected and provided by (in alphabetical order) M. Birschwilks, F. Gerich, N. Impens, J.-R. Jourdain, A. Jouve

Table 2: Percentage of overall EC funding per target platform, broken down by FPs (based on CORDIS); for FP 4 as far as information could be retrieved (modified)

Target Platform	FP 4	FP 5	FP 6	FP 7
Radioecology	27.1%	12.5%	16.3%	8.4%
E&T	0.1%	0.9%	5.0%	2.0%
Dosimetry	16.3%	14.7%	1.6%	3.3%
Low-dose	36.1%	44.3%	48.4%	63.2%
Emergency	8.3%	15.9%	21.7%	6.6%
Medical Applications	10.2%	7.6%	6.9%	16.5%
OTHER	1.9%	4.2%	0.0%	0.0%
EC contribution	56,887,708 €	49,536,777 €	61,206,333 €	88,214,693 €

FP4: 1994-1998
FP5: 1998-2002
FP6: 2002-2006
FP7: 2007-2013

Funding of dosimetry projects decreased dramatically

- Increase visibilty of Eurados!
- Eurados should play an active role!
- Various Council actions (meetings, tele-, webconf's, …)

EURADOS (as of June 2016)

- **Mission**: Independent platform promoting R&D in the field of the dosimetry of ionizing radiation

- **Voting Member Status (June 2016)**

  67 Voting Members from 31 countries

- **EURADOS Board of Officers**

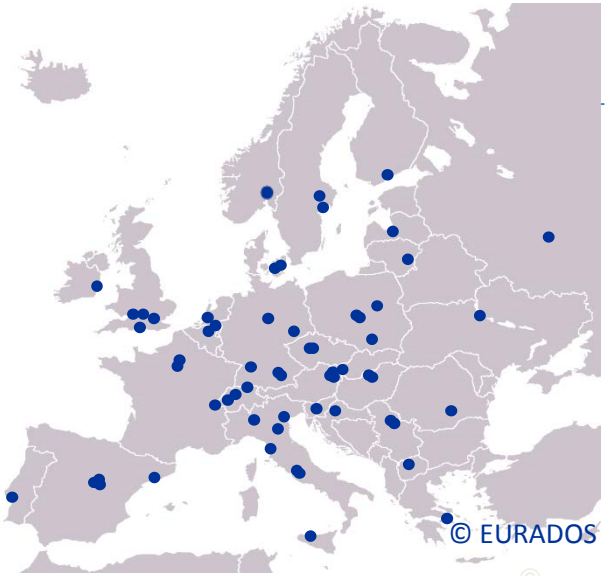
  Chair: W. Rühm (Helmholtz Munich, Germany)
  Vice-Chair: F. Vanhavere (SCK-CEN, Belgium)
  Secretary: JF. Bottollier (IRSN, France)
  Treasurer: H. Schumacher (PTB, Germany)

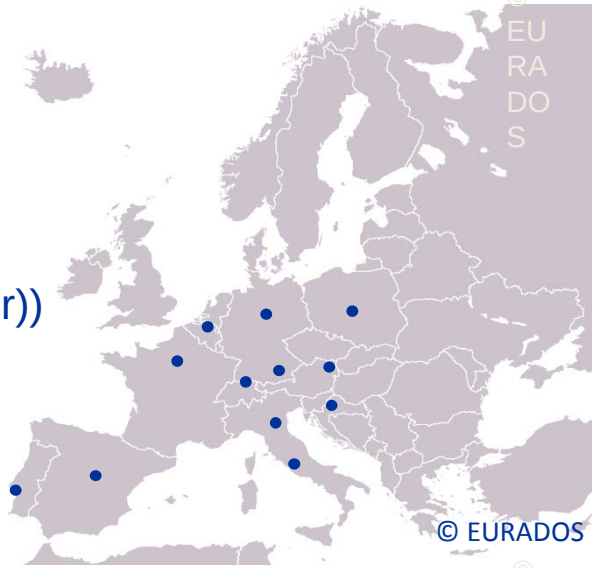
- **EURADOS Office**

  operated by HMGU (W. Rühm, J. Brehme, (H. Schuhmacher))

- **EURADOS Council**

  J. Alves, J.F. Bottollier, M. Caresana, E. Fantuzzi, P. Fattibene, M.A. Lopez, S. Miljanic, P. Olko, W. Rühm, H. Schuhmacher, H. Stadtmann, F. Vanhavere





EURADOS (as of June 2016)

Associate Members

- Almost 500 active scientists contributing to the overall EURADOS objectives

Eight EURADOS Working Groups

- Harmonization of Individual Monitoring (P. Gilvin, UK)
- Environmental Dosimetry (A. Vargas, Spain)
- Computational Dosimetry (R. Tanner, UK)
- Internal Dosimetry (M. A. Lopez, Spain)
- Radiation Dosimetry in Radiotherapy (R. Harrison, UK)
- Retrospective Dosimetry (C. Woda, Germany)
- High-Energy Radiation Fields (JF Bottollier, France)
- Dosimetry in Medical Imaging (Z. Knezevic, Croatia)

www.eurados.org

Organisation of

- Annual Meetings
- Winterschool
- Intercomparisons
- Training actions

EURADOS Visibility – Website, Newsletter, Reports

Website and newsletter (S Miljanic, P Fattibene): > 900 subscribers

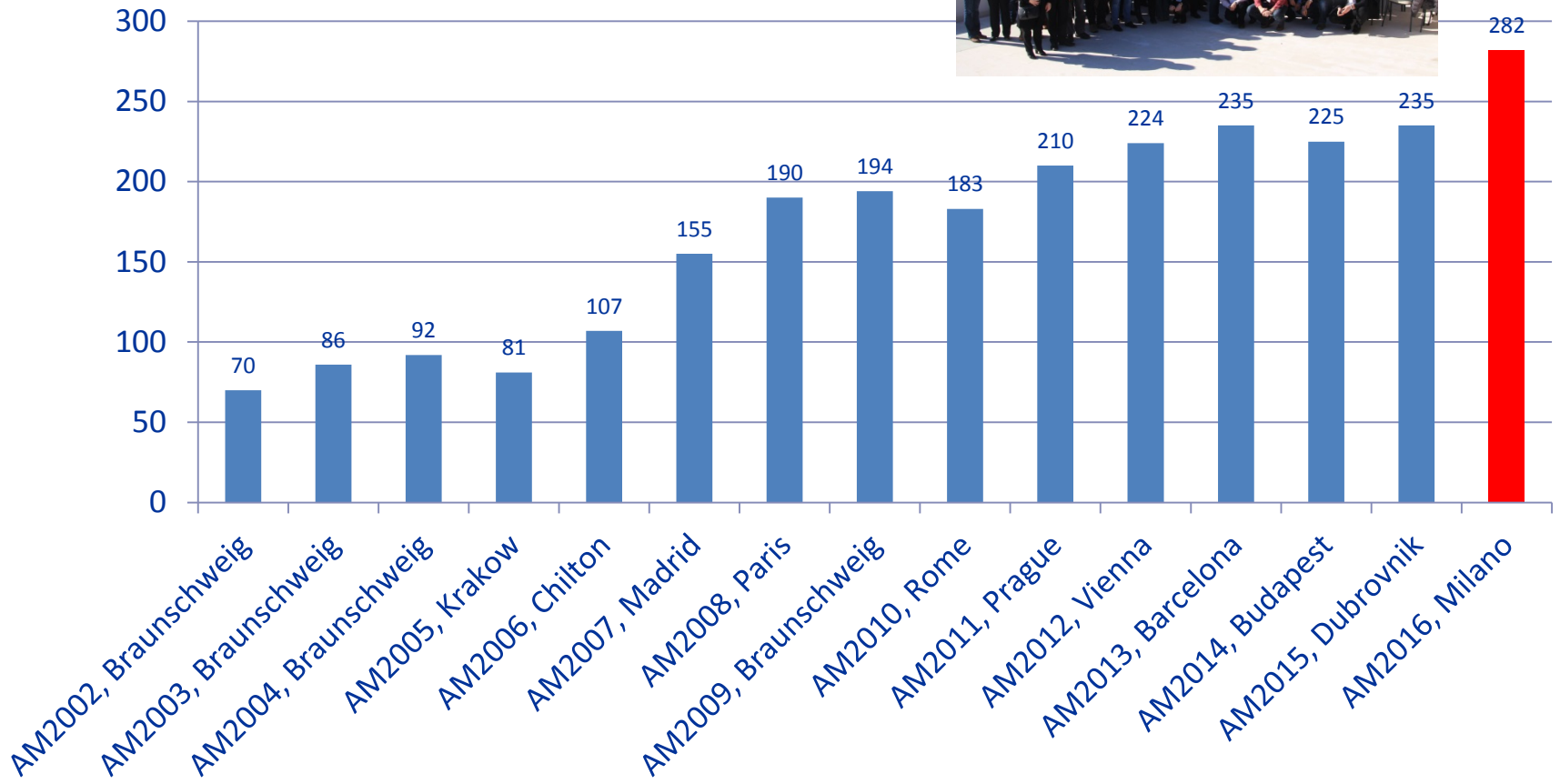
Feel free to subscribe if not yet done!

Four EURADOS Reports in 2015 (free for download)

- 2015-01: A. F. McWhan et al. EURADOS Intercomparison 2010 for Whole Body Dosemeters in Photon Fields
- 2015-02: A. F. McWhan et al. "EURADOS Intercomparison 2012 for Whole Body Dosemeters in Photon Fields"
- 2015-03: H. Järvinen et al. „Technical Aspects on DAP Calibration and CT calibration“
- 2015-04: P. J. Gilvin et al. „Quality Assurance in Individual Monitoring for External Radiation – Results of EURADOS Survey 2012“

EURADOS Annual Meetings

Number of participants - History



EURADOS Workshops and Winterschools

Winter Schools :

"Refreshment courses"

- Dosimetry for Epidemiology (AM2016)
- Fukushima (AM2015)
- RBE, radiation weighting factor and quality factor (AM2014)
- Status and Future Perspectives of Computational Micro- and Nanodosimetry (AM2013)
- Radiation Protection for Medical Staff (AM2011)
- Radiological Emergencies – Internal exposures (AM2010)
- Low-Dose Radiation Effects (AM2009)
- Retrospective Dosimetry (AM2008)

Workshops with Proceedings [1)]

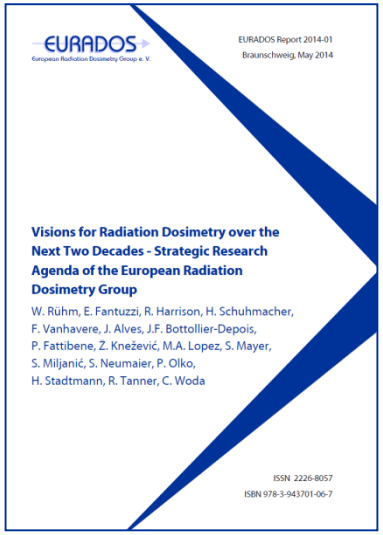
Related to research topics where EURADOS Working Groups are involved

- Dosimetry for second cancer risk estimation in radiotherapy (AM2012)
- Accelerator radiation protection and shielding (AM2010)
- Cosmic Radiation and Aircrew Exposure (AM2009)
- Dosimetric Issues in the Medical Use of Ionizing Radiation (AM2008)
- Characterization of Workplaces for the Assessment of the Doses to Individuals (AM2007)

[1)] 2004-2010: in RPD; 2012: in Rad Meas

EURADOS SRA Working Group

- SRA Task Group established in 2013
  (W Rühm, E Fantuzzi, R Harrison, H Schuhmacher, F Vanhavere)
- SRA prepared with input from all EURADOS WGs
- **EURADOS Report 2014/01 finished** and published
- SRA presented at various occuasions including IRPA2014 in Geneva, and AKD 2014 in Neuherberg
- **Publication for RPD published in 2016**
  - Ref. 1: "… could serve as a reference for possible research topics … which could potentially bear academic and practical significance."
  - Ref. 2: "… the paper identifies all relevant research needs in radiation dosimetry …good reference to justify future research projects. "


EURADOS
European Radiation Dosimetry Group e. V.

EURADOS Report 2014-01
Braunschweig, May 2014

Visions for Radiation Dosimetry over the Next Two Decades - Strategic Research Agenda of the European Radiation Dosimetry Group

W. Rühm, E. Fantuzzi, R. Harrison, H. Schuhmacher, F. Vanhavere, J. Alves, J.F. Bottollier-Depois, P. Fattibene, Z. Knežević, M.A. Lopez, S. Mayer, S. Miljanić, S. Neumaier, P. Olko, H. Stadtmann, R. Tanner, C. Woda

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EURADOS STRATEGIC RESEARCH AGENDA: VISION FOR DOSIMETRY OF IONISING RADIATION

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[12]Instytut Fizyki Jądrowej (IFJ), Krakow, Poland
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Since autumn 2012, the European Radiation Dosimetry Group (EURADOS) has been developing its Strategic Research Agenda (SRA), which is intended to contribute to the identification of future research needs in radiation dosimetry in Europe. The present article summarises—based on input from EURADOS Working Groups (WGs) and Voting Members—five visions in dosimetry and defines key issues in dosimetry research that are considered important for the next decades. The five visions include scientific developments required towards (a) updated fundamental dose concepts and quantities, (b) improved radiation risk estimates deduced from epidemiological cohorts, (c) efficient dose assessment for radiological emergencies, (d) integrated personalised dosimetry in medical applications and (e) improved radiation protection of workers and the public. The SRA of EURADOS will be used as a guideline for future activities of the EURADOS WGs. A detailed version of the SRA can be downloaded as a EURADOS report from the EURADOS website (www.eurados.org).

Vision 1 – Towards Updated Fundamental Dose Concepts and Quantities

Absorbed dose does not always provide an adequately detailed description of an irradiation, to allow predicting biological consequences, in particular when the dose to a tissue is inhomogenous

Therefore, the present system of limiting and operational quantities in radiation protection dosimetry needs improvement

This **Vision** includes **4 Challenges**

- Better understand of space/time correlations of radiation interaction events
- Establish correlations between track structure and radiation damage
- Update operational quantities for external exposure
- Better understand radiation-induced effects of internal emitters

Vision 2 - Towards Improved Radiation Risk Estimates Deduced from Epidemiological Cohorts

The purpose of radio-epidemiological studies is primarily the deduction of risk coefficients

> Effect (y-axis) per dose (x-axis) (slope)

> Dosimetry essential

This **Vision** includes **2 Challenges**

- Explore exposure pathways not yet considered or validated in epidemiologicals studies

  e.g., residual radioactivity for LSS, SPEs for air crew, out-of-field doses in radiotherapy, …

- Improve retrospective dosimetry for historical cohorts

  e.g., confouding by other stressors, assessment of internal dose uncertainties, improvement of organ dosimetry e.g. for eye lens, brain, heart arteries and walls, α emitters in lung

Vision 3 - Towards an Efficient Dose Assessment in Case of Radiological Emergencies

Radiological emergencies are considered a major challenge of modern societies (e.g. nuclear accidents, terroristic attacks, lost radiation sources)

This **Vision** includes **3 Challenges**

- Identify and characterize new markers of exposure
  (e.g., use of daily life materials as dosemeters, protein biomarkers, …)

- Develop strategies and methods to increase measurement capacity
  (e.g., automatisation of CA scoring, web-based scoring of captured images, networking of laboratories)

- Quantify doses after accidental internal contamination

Vision 4 - Towards an Integrated Personalized Dosimetry in Medical Applications

Modern medical therapy includes a number of diagnostic procedures involving ionizing radiation (X-Ray, CTs, PET, etc.).

Additionally radio-therapy is a major treatment modality in cancer therapy

This **Vision** includes **5 Challenges**

- Establish out-of-field dosimetry for photon and particle therapy (focus on pediatrics) (scattered primary beam, secondary photons and neutrons, imaging procedures; development of suitable detectors and phantoms)
- Optimize dose estimations in interventional radiology (determination of skin doses)
- Establish reliable patient dosimetry in CT examinations (automatic dose mapping and collection of patient doses)
- Improve dosimetry in modern external beam radiotherapy
- Include internal microdosimetry in radiotherapy and medical imaging procedures

Vision 5 - Towards an Improved Radiation Protection of Workers and the Public

This **Vision** includes **5 Challenges**

- Refine, validate and implement new ICRP biokinetic models (including how to use ICRP models, differences healthy persons and patients, validation of these models)
- Develop calibration procedures for partial body counters
- Develop accurate and on-line personal dosimetry for workers (including real-time monitoring of wholebody dose, eye lens, extremities, development of suitable active dosemeters)
- Improve neutron dosimetry techniques (e.g., for high-energy and pulsed neutron fields, including the photon component that is always present; note: a high-energy quasi-monoenergetic neutron reference field will soon be missing in Europe!)
- Include nuclide-specific information in doserate measurements in the environment (e.g., environmental monitoring with suitable spectrometric instrumentation)

Additionally, the SRA includes …

Separate Chapter on Training and Education

- Implementation of EC directives and technical recommendations into practice
- Training courses on novel or improved dosimetric methods
- Winter schools, workshops and scientific symposia

Separate Chapter on Harmonisation and Practice

- Intercomparison for dosemeters used in individual monitoring
- Intercomparison for early-warning systems used in environmental monitoring
- Intercomparison for codes and simulations
- Surveys on practical dosimetry (to document quality of dosimetric practices)

Separate Chapter on Importance of Computational Dosimetry

- Monte Carlo method dominant in many fields of radiation protection and dosimetry
- Include representations of human body at macroscopic, microscopic, nanometric level

EURADOS – SRA is a Moving Target …

EURADOS Stakeholder Workshop – June 2016, Neuherberg, Germany

Meeting of 24 international organisations

- Commenting on EURADOS SRA
- Identifying missing topics
- Expressing interest (or not) in future cooperations

Participating organisations

ALLIANCE, EANM, EFOMP,
ENISS, ESR, ESTRO,
EURAMET, HERCA, IAEA, IARC,
ICRP, ICRU, ILO, IRPA, ISO,
ISSDO, MELODI, NEA, NERIS,
NUGENIA, PTCOG, RENEB,
SSH.

Major Achievements – Visibility/Role of EURADOS

EUROPEAN JOINT PROGRAMME FOR THE INTEGRATION OF RADIATION PROTECTION RESEARCH

CONCERT

European Joint Programme for the Integration of Radiation Protection Research

The 'European Joint Programme for the Integration of Radiation Protection Research-CONCERT ' under Horizon 2020 is operating as an umbrella structure for the research initiatives of the platforms MELODI, ALLIANCE, NERIS and EURADOS. It is a co-fund action that aims at attracting and pooling national research efforts with European ones in order to make better use of public R&D resources and to tackle common European challenges more effectively in key areas of radiation protection research.

http://www.concert-h2020.eu/~/media/Files/Concert/About_CONCERT_project_poster.pdf?la=en

Participation in CONCERT

- Defines research priorities for Europe (SRA!)
- Issues research calls
- Organises evaluation of incoming proposals
- Supervises successful proposals
- Kick-of: June 2015

Major Achievements – Visibility/Role of EURADOS

Invited talk at HPS-Meeting, USA 2015

Health Physics Society
60th Annual Meeting
Indianapolis, Indiana

2:30-5:15 PM **Room 108**

THPM-D: Special Session: Next Generation Challenges

Co-Chairs: Werner Ruhm, Shaheen Dewji

2:30 PM **THPM-D.1**

EURADOS Strategic Research Agenda - Vision for Dosimetry of Ionizing Radiation

Rühm, W., Fantuzzi, E., Harrison, R., Schuhmacher, H., Vanhavere, F., Alves, J., Bottolier Depois, J.F., Fattibene, P., Knežević, Ž., Lopez, M.A., Mayer, S., Miljanić, S., Neumaier, S., Olko, P., Stadtmann, H., Tanner, R., Woda, C.

Invited talk at HPS-Meeting, USA July 2016, Spokane, US

M. Lopez (EURADOS WG7)
On “Internal Dosimetry”

Establishment of formal relationships with ICRP

Major Achievements – Visibility/Role of EURADOS

Radiation Protection Week 2016

ICRP Symposium + Radiation Protection Week 2017

Cooperation ICRU – EURADOS

Report Committee 29 — **Goal: Joint ICRP-EURADOS Report**

Report Committee 29 on Retrospective Assessment of Individual Doses for Acute Exposures to Ionizing Radiation

Commission sponsors: S Bentzen, **E Fantuzzi**
Members: S McKeever, **C Woda**, S Amundson, **P Fattibene**, A Romanyukha, **H Romm**, S Simon, **F Trompier**, R Wilkins

Conclusions

- **EURADOS – Dosimetry Network in Europe**
- **Self-sustainable**
- **First Version of SRA developed and finalized**
- **Represents view of EURADOS community**

  (but note: many EURADOS members also serve for other institutions/networks)
- **Future: Priority list together with the other research platforms to be developed**
- **Future: View of stakeholders to be included**
- **Future: Regular SRA update needed**
- **Major input for future European radiation protection research**

EURADOS (European Radiation Dosimetry Group)

The five visions

- Towards Updated Fundamental Dose Concepts and Quantities
- Towards Improved Radiation Risk Estimates Deduced from Epidemiological Cohorts
- Towards an Efficient Dose Assessment in Case of Radiological Emergencies
- Towards an Integrated Personalized Dosimetry in Medical Applications
- Towards an Improved Radiation Protection of Workers and the Public

For details see www.eurados.org!

THANK YOU!