EURADOS activities in RN emergency and NERIS and EURADOS synergies

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NERIS

EURADOS

European ionizing radiation dosimetry group

An Association

A no-profit body

An EU platform

Voting Member Status

61 Voting Members from 29 countries and almost 500 scientists

Eight EURADOS Working Groups

- Harmonization of Individual Monitoring (J. Alves)
- **Environmental Dosimetry** (A. Vargas)
- **Computational Dosimetry** (R. Tanner)
- **Internal Dosimetry** (M.A. Lopez)
- Radiation Protection Dosimetry in Medicine (R.Harrison)
- **Retrospective Dosimetry** (C. Woda)
- High-Energy Radiation Fields (J.F.Bottolier)
- Dosimetry in Medical Imaging (Z. Knezevic)

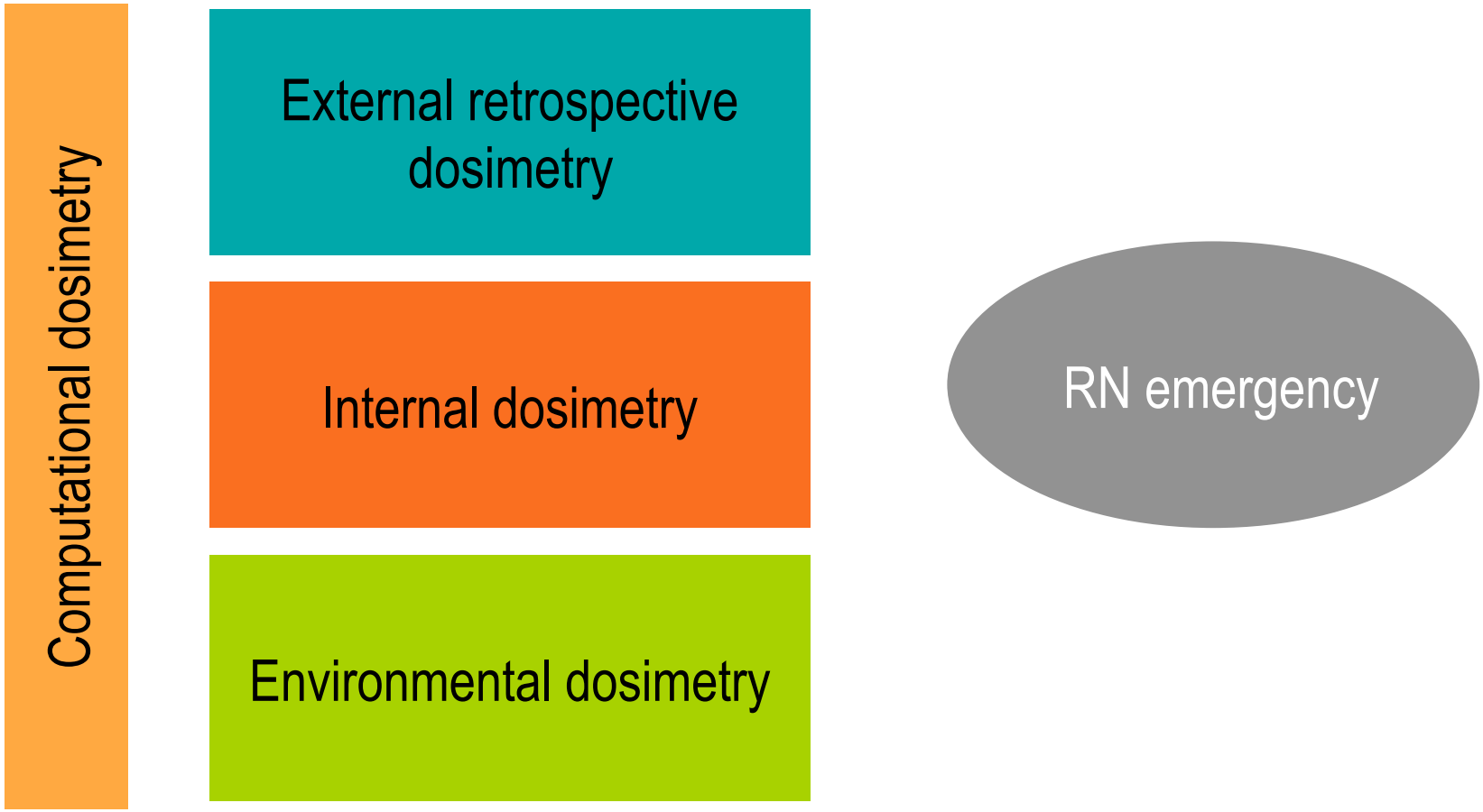
Scope

- To promote technical development of dosimetry and its implementation in routine work
- To contribute to compatibility within Europe and conformance with international practices
- To organie scientific meetings and training activities
- To organize intercomparisons and benchmark studies

SRA – 5 Visions

3. Towards an efficient dose assessment in case of RN emergencies

EURADOS and RN emergencies



Priorities from EURADOS SRA
as voted by Voting Members and Council Members

rank	
1	**To quantify correlations between track structure and radiation damage**
2	To improve neutron dosimetry techniques
3	**To quantify doses after accidental internal contamination**
4	To develop accurate and on-line personal dosimetry for workers
5	To improve out-of-field dosimetry for photon and particle therapy
6	To improve dosimetry in modern external beam radiotherapy
7	To optimize dose estimations in interventional radiology
8	**To rapidly identify individuals with highest doses**
9	To establish reliable patient dosimetry in CT examinations
10	To Update Operational Quantities for External Exposure
11	**To improve understanding of dosimetry and biokinetics of internal emitters**
12	**To improve understanding of spatial correlations of radiation interaction events**
13	**To explore exposure pathways not yet considered or validated**
14	To improve retrospective dosimetry for exposure pathways already considered
15	**To improve internal microdosimetry in radiotherapy and medical imaging**
16	**To handle a large number of dosimetric samples in a short time**
17	To include nuclide-specific information in environmental monitoring
18	**To improve, validate and implement new biokinetic models**

NERIS SRA and dose assessment

Main challenges from NERIS SRA where Retrospective dosimetry could contribute:

Use of **Retrospective dosimetry** techniques to improve inverse estimation of unknown source term in urban areas and open spaces („New challenges in atmospheric and aquatic modelling“)

Use of Retrospective dosimetry techniques for improvement of existing Decision Support Systems in „difficult environments“ such as explosions in buildings, subways, hidden sources („New challenges for better **dose assessments** and decision support…“)

WG3: Environmental dosimetry (Arturo Vargas (UPC, Barcelona)

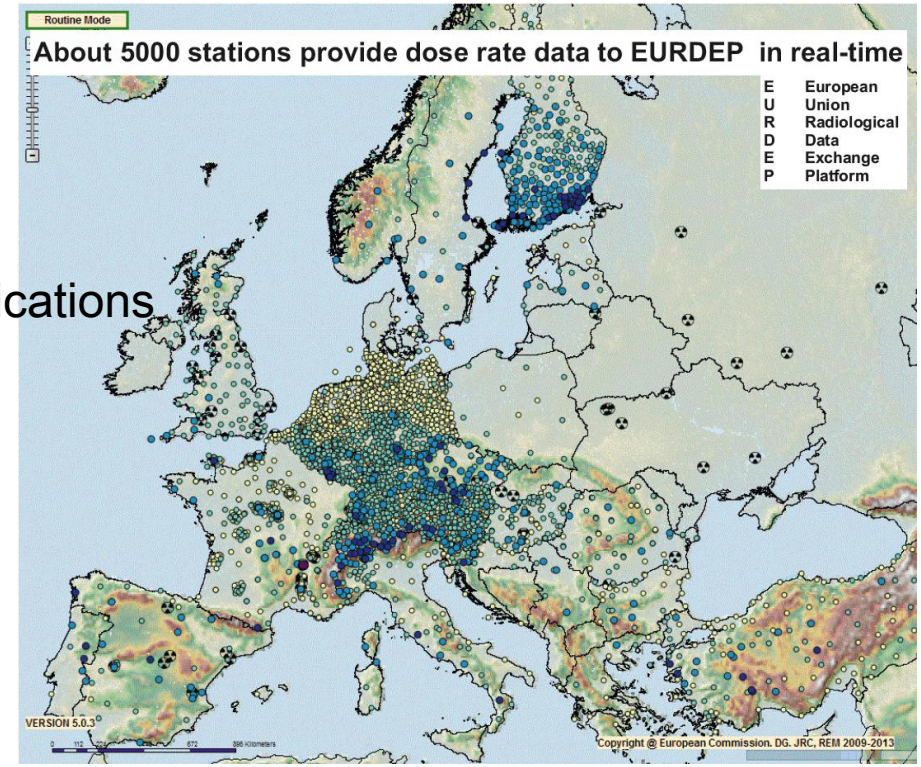
Environmental Radiation Monitoring

for different scenarios

- Monitoring of nuclear installations
- Nuclear emergencies with local impact
- Nuclear desasters with transboundary implications

aim: correct measurement of

- dose and dose rate values
- radioactivity concentrations



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WG3: Environmental dosimetry (Arturo Vargas (UPC, Barcelona)

Support of dosimetry services ...

- organisation of intercomparison exercises ...
- development of new measurement methods ...
- investigation of spectrometry systems for the use ...
- definition of standards and recommendations ...
- stimulation of cooperation ...

…in the field of Environmental Radiation Monitoring (“ERM”)

1st international EURADOS intercomparison of passive *H**(10) photon area dosemeters

JRP-v15: Metrology for radiological early warning networks in Europe

EURAMET
European Association of National Metrology Institutes

Participation of 15 (50%) WG3-members:

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WG 10 – Retrospective dosimetry (C. Woda) (46 institutions)

Motivation

To establish a network of contacts and collaborations throughout European laboratories with expertise in the area of physical and biological retrospective dosimetry

development

uncertainty estimate approach

multi-disciplinary
(biologists and physicists)

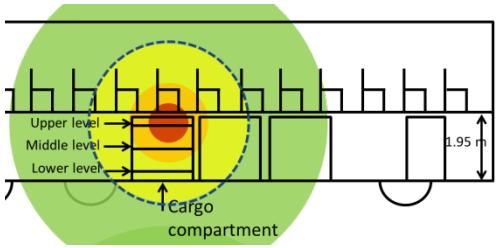
links to internal and computational dosimetry WGs

training

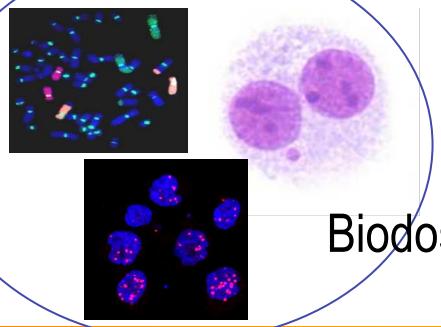
intercomparisons (Multibiodose, RENEB and CATO projects)

WG 10 – Retrospective dosimetry (C. Woda) (46 institutions)

Intercomparison exercises of biological and physical dosimetry for triage and dose assessment in radiological emergency scenarios
(EU projects: MULTIBIODOSE, RENEB, CATO)



CATO field test with a RED source in a bus



Biodosimetry

Dosimetry with personal items

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WG 10 – Retrospective dosimetry (C. Woda) (46 institutions)

Biodosimetry in case of internal exposure (with Internal dosimetry WG)

Objective:	Review on the use of biodosimetry methods in scenarios involving internal exposures
Case scenario:	Comparison of biodosimetry evaluations vs. internal dose estimation.

Uncertainty estimate approaches of retrospective dose assessment for emergency and epidemology

Organ dose estimate (with Computational dosimetry WG)

Relating dose in material of personal items to organ doses/whole body dose for radiological emergency exposure scenarios

WG7: Internal dosimetry (M.A. Lopez) (38 Institutes, 23 countries)

Intercomparison on Emergency Bioassay

Objective: To test bioassay methods developed for emergency response (in-vitro monitoring of urine samples)

Samples: (1) human urine (2) rat urine with metabolized isotopes

Radionuclides: Am-241, Pu-239, Ra-226, Sr-90

Development of monitoring strategies

In-vivo monitoring, dose assessments and MC simulations of ^{131}I in thyroid in children and adults in case of RN emergency:

- Intercomparison of systems for in-vivo monitoring (thyroid counting)
- Screening methods
- Dose calculations
- Monte Carlo simulations and Voxel phantoms

Training

TECHREC Project: “Establishment of technical recommendations for monitoring individuals for occupational intakes of radionuclides”– EURADOS-EC contract (2014-)

WG7: Internal dosimetry (M.A. Lopez, CIEMAT, Spain)

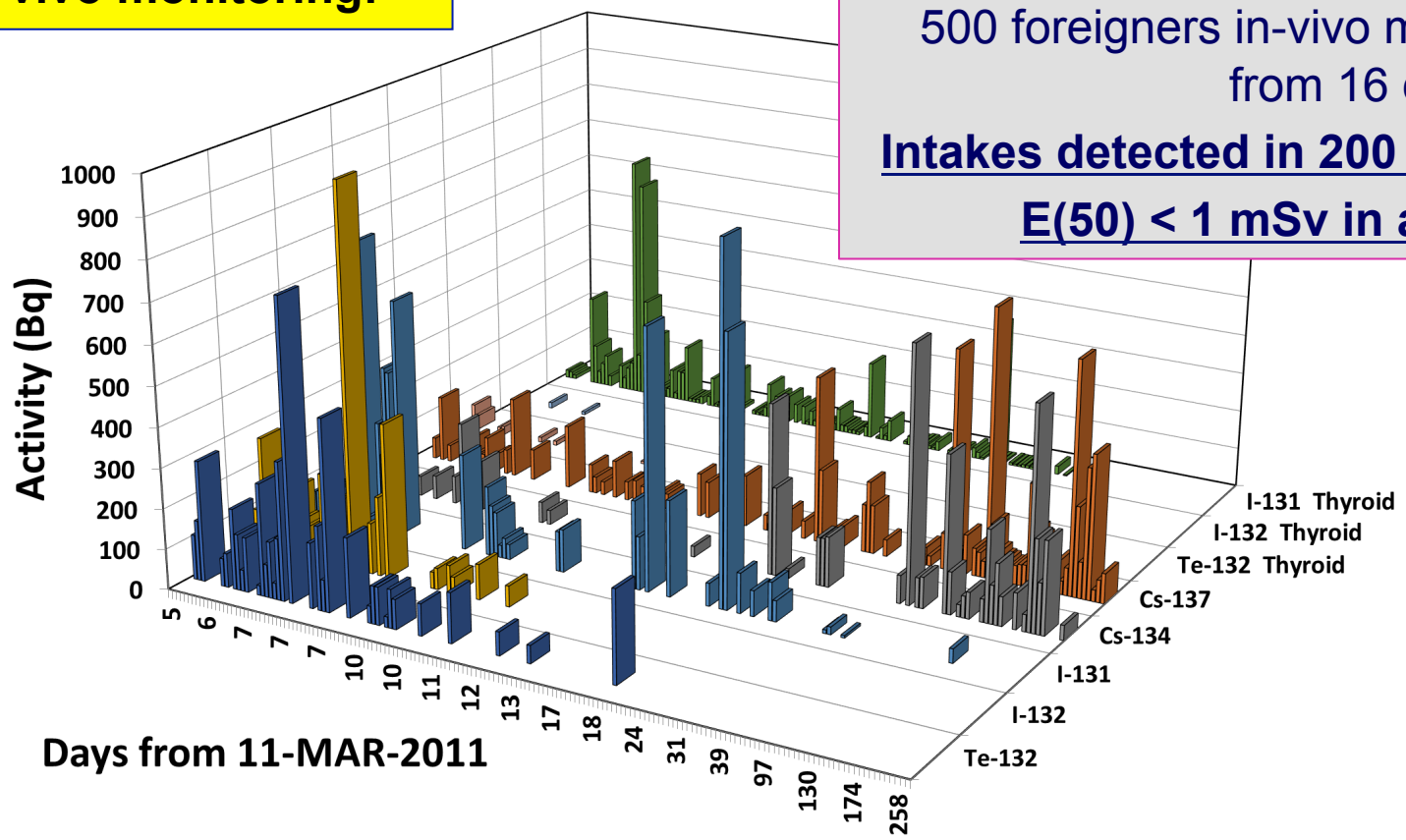
EURADOS Survey on in-vivo and in-vitro monitoring data of **exposed foreigners in Japan**, obtained in their respective countries at early stage after the nuclear accident of Fukushima Daaichi NPP.

In-vivo monitoring:

EURADOS Survey 2013-2015:
500 foreigners in-vivo monitored from 16 countries

Intakes detected in 200 persons

E(50) < 1 mSv in all cases



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WG6: Computational dosimetry (R. Tunner, PHE, UK)

Scope of work within the Working Group:

All numerical methods applied to radiation protection and medicine

- Monte Carlo methods
- Unfolding techniques
- Deterministic methods

Synergies of NERIS/EURADOS with other platforms

	identified by NERIS, ALLIANCE and EURADOS	
V6-2	Spatial and temporal environmental **modelling** and **human dose assessment after a nuclear accident**.	1. To develop time and space dependent models to assess the evolution of radioactivity and related dose to man dynamically from regional scale to local scale, the latter being relevant for farmers and farmer communities. 2. To develop countermeasure strategies at local level 3. To develop dose reconstruction techniques to infer doses and contamination for past days of a long lasting release and in this way improve the DSS.
V6-3	Priorities for **pre-accident recovery preparedness**.	Develop better tools and guidance for pre-accident recovery planning to facilitate and improve accident specific remediation by defining vulnerable areas and areas of high risk around the NPP in Europe and improved radioecological models for these areas. Remediation strategy handbooks should be further developed.
V6-4	Decision support based on **multi-criteria decision aiding tool**s in the various phases of an emergency (including the post-emergency remediation phase).	Defining a framework for the application of formal decision aiding tools such as Multi-Criteria Decision Analysis (MCDA), based on economic, infrastructural, social services and dosimetric data, in the various phases of an emergency (including the post-emergency remediation phase), in order to structure the decision process and to optimise management approaches for radioactive contamination at national, regional and local levels.

	identified by NERIS, MELODI and EURADOS	
V6-5	Development of **health surveillance** procedures.	To draw lessons from Chernobyl and Fukushima situations; to develop procedures for health surveillance in a broader perspective of improving living conditions of affected populations, including sampling of population and dose reconstruction, and involvement of stakeholders; and to ensure the maximum information is obtained to refine current health risk estimates and clinical decision making.
V6-6	**Biological indicators** of radiation exposure, effects, health risk and disease susceptibility to inform emergency management and epidemiological studies.	Biological indicators of radiation exposure and effects, particularly in relation to health play an important role in emergency management and can be integrated into epidemiological studies of risk and susceptibility. Identification of new and further validation of existing biomarkers in relation to dose and relationship to health is required. For emergency use simple and rapid methods will be of greatest benefit.
	identified by NERIS and EURADOS	
V6-7	Development of **monitoring** strategies, processes and tools.	To improve methods and tools to enhance the efficiency of the monitoring strategy with the aim to produce a complete and consistent picture of the radiological situation during a nuclear emergency response and recovery. This includes among others the development of new and the optimization of existing resources such as mobile units, trans-border information exchange, laboratory networking, dose assessment techniques. Furthermore, the development of sound methods for extracting dose parameters for decision making from all available measurement data, i.e. environmental radiological data and exposure/ contamination measurements of the affected population; and measurements by expert teams and performed by the public. Improved guidelines on monitoring strategies will be derived.

Biodosimetry in case of internal exposures

Scenario	Radionuclides	WG 7	WG 10
Goiania Accident	Cs-137	G. Etherington, M. Youngman	C. Lindholm
Techa River (Mayak)	Sr-90	A. Giussani	J.F. Barquinero, A. Testa, J Moquet
Plutonium Workers	Pu-239, Am-241	McComish	H. Romm, K Rothkamm
Tritium intakes	HTO	M.A. Lopez	E. Gregoire, J Moquet, K Rothkamm
Radioiodine, Medical	I-131, I-125	A.Rojo, A. Giussani	O. Gil, H. Romm, J Moquet, K Rothkamm, A. Wocjik, A. Testa, N. Maznyk
Thorotrast patients	Th-232	I. Malatova	J. Moquet, K. Rothkamm
Thorium workers	Ra-224, Bi-212:	M.A. Lopez	I. Güclu
Chernobyl area	Cs-137:	J. Marsh, D. Gregoratto	A. Jaworska, N. Maznyk
Semipalatinsk	Pu, Cs, Sr:	S. Tolmachev	A. Testa, C. Lindholm, A. Jaworska
Others: medical…	Ra-224	Kuba Osko	J.F. Barquinero, E. Gregoire

- Task 7.4.- Individual Monitoring and Application of Monte Carlo methods to in-vivo monitoring - D. Franck (IRSN) / A.L. Lebacq (SCK-CEN)
  - ✓ In-Vivo + MC Intercomparisons on monitoring of 241Am in 3 skull phantoms. P. Nogueira (HMGU) / T. Vrba (TU-Prague)
  - ✓ Emergency: (1) Intercomparison on Emergency Bioassay (C. Li) (2) In-vivo monitoring of foreigners in Japan after Fukushima

- Task 7.5.- Uncertainty on Dose Assessments - E. Blanchardon (IRSN, Fr)
- Task 7.6.- Training on Internal Dosimetry
  - ✓ TECHREC Project, May 2014-2016. G. Etherington (PHE, UK)

- Task 7.8.- Biodosimetry in case of internal exposures. (WG10+WG7) M.A. Lopez (CIEMAT, Spain) / A. Giussani (BfS, Germany)

Uncertainties on dose assessments

Link with “CURE Project” group (DoReMi Call)
Joint work of biologists, epidemiologists and internal dosimetrists for uranium exposures.

To learn more…

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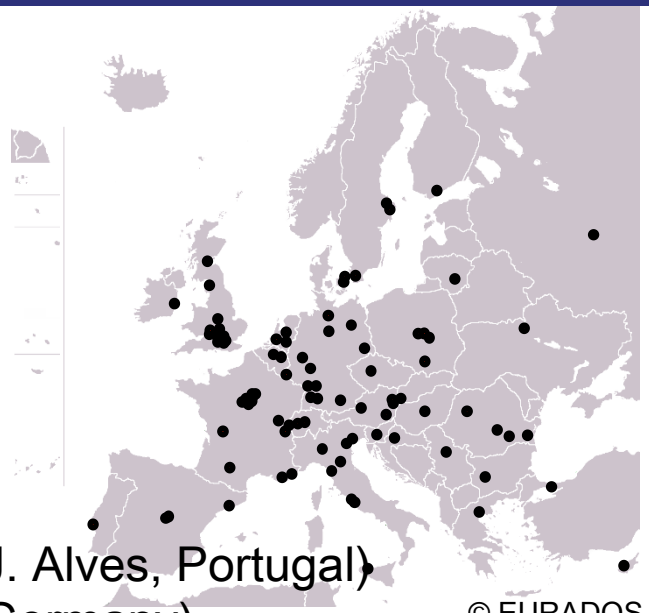
EURADOS: European Radiation Dosimetry Group e.V.

- **Associate Members**

  61 Voting memebrs and almost **500 active scientists** contributing to the overall EURADOS objectives



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- EURADOS Working Groups

  - ✓ WG2: Harmonization of Individual Monitoring (J. Alves, Portugal)
  - ✓ WG3: Environmental Dosimetry (S. Neumaier, Germany)
  - ✓ WG6: Computational Dosimetry (R. Tanner, UK)
  - ✓ WG7: Internal Dosimetry (M.A. Lopez, Spain)
  - ✓ WG9: Medical Dosimetry (R. Harrison, UK)
  - ✓ WG10: Retrospective Dosimetry (C. Woda, Germany)
  - ✓ WG11: High-Energy Dosimetry (W. Rühm, Germany)
  - ✓ WG12: Dosimetry in Medical Imaging (Z. Knezevic, Croatia)