



5th EUROPEAN RADIATION PROTECTION WEEK

BILLROTHHAUS, VIENNA, AUSTRIA

22–24 NOVEMBER 2021

Book of Abstracts

**Organised by the European Alliance for Medical Radiation Protection Research
(EURAMED)**

Table of Contents

Invited Scientific Session I

The Importance of MEENAS in the European Radiation Protection Research and Innovation Scene.... 1

Abstract Session A: Radioecology and Emergency Preparedness

Modelling the Transfer of ¹³⁷Cs along a River–Sea Continuum and Application to Accidental Release Scenarios 3

Spatial Clustering of Contaminated Agricultural Parcels for Efficient Remediation in a Post-Accident Situation 4

The Ecotoxicology of Tritium: Effects on Fish Using Several Endpoints, from Molecule to Individual Responses 5

Ionizing Radiation, Genotoxic Stress, and Mitochondrial DNA Copy-Number Variation in *Caenorhabditis Elegans*: Droplet Digital PCR Analysis 6

Training Researchers in Operational Radiation Protection: An Opportunity for Dialogue and Optimization 7

Radiation Protection and Climate Change: How Do the Dose Response Models Influence the Choices of Solutions to Mitigate Climate Problems 8

Identification and Prioritisation of ALLIANCE SRA Topics Relevant to Medical Radiation Protection Research 9

Abstract Session B: Dosimetry in the Medical Context

MEDIRAD - Implications of Medical Low-Dose Exposure 10

ICRP Approach to Determining Reference Organ and Effective Dose Coefficients for Common X Ray Imaging Examinations 11

Effectiveness of Five Radioprotective Devices for Staff during Fluoroscopically Guided Procedures: Recommendations from the MEDIRAD Project 12

The Translational Challenge for Medical Radiation Applications and Protection Research: Methodological Approach and Preliminary Results 14

Inter- and Intra-Individual Variability of Gamma-H2AX in Healthy Volunteers and Clinical Radiotherapy Patients 16

Extremity and Whole-Body Dose Monitoring of Staff with Thermoluminescent and Real-Time Detectors during Treatments of Neuroendocrine Tumours with ¹⁷⁷Lu-Dotatate (Luthatera) 18

Assessment of Blind Scan in Chest CT Examinations 19

Invited Scientific Session II: Challenges in Research on Individual Radiosensitivity and Susceptibility

Radiation-Induced Nucleoshuttling of the ATM Protein and the Differences between Radiosensitivity and Radiosusceptibility 20

Abstract Session C: Low-Dose Research

Bone-Marrow-Derived Extracellular Vesicles Influence Radiation-Induced Leukemogenesis 21

Concurrent Live-Cell Imaging of DNA Double-Strand Break Repair and Its Cell-Cycle Status: From Cells to Animal Models 22

Dose Responses for Mortality from Cerebrovascular and Heart Diseases in Atomic Bomb Survivors: 1950–2003.....	23
A Mathematical Model for Analyzing the Effects of Protracted Irradiation on Cancer and Lifespan in Mice.....	24
Effect of Caesium-137 Chronic Low-Dose Exposure on Neovascularization Process	25
The HARMONIC Project: Epidemiological Study for the Assessment of Radiation Doses and Associated Cancer Risks Following Cardiac Fluoroscopy in Childhood	26
The Effect of Low- and High-Dose Rate Brachytherapy on the Immune Phenotype of Prostate Cancer Patients.....	28

Abstract Session D: General Dosimetry and Various Topics

Fragmentation Cross-Sections Study of High-Energy ^{20}Ne Ion for Radiation Shielding and Radiotherapy Purposes	29
Childhood CT Scans and Cancer Risks Estimates: An Update of the French CT Cohort Study	30
Determination of Diagnostic Reference Levels and Achievable Doses for Pediatric CT Examinations in the United States and Comparison with International Benchmarks	31
Assessment of Uncertainties Affecting Dosimetric Calculations for the Intake of Radon and NORM .	32
Novel Detector for Monitoring Airborne Radioactivity and Fallout during a Nuclear Emergency	33
Radio-Biologically Motivated Modelling of Radiation Risks of Mortality from Ischemic Heart Diseases in the Canadian Fluoroscopy Cohort Study.....	34
Radiation Protection of Volunteers in Medical Research – A Multifaceted Challenge.....	35

Invited Scientific Session III: Envisioning the Future of Radiation Protection Research: Big Data, AI and Beyond

Ethics in Radiological Protection for Medical Diagnosis and Treatment, ICRP TG109.....	36
--	----

Abstract Session E: Medical Radiation Protection

Cell-Type Specific Differences in the Competitive Relationship between Cell Killing and Accumulation of Carcinogenic DNA Lesions Following Fractionated Radiation Exposure.....	38
Differences of Ex Vivo and In Vivo DSB Repair Capacity in Pbmcs of Patients before and during Radioiodine Therapy	39
Structural Differences in Tumor and Ablated Tumor Tissue by Measuring Noise Performance Using Artificial Intelligence Method.....	40
Accurate Estimation of Organ Doses from Chest CT Using Patient-Specific Dosimetry	41
Interpretation of Radiation-Induced Aging Based on a Mathematical Model.....	42
Status of the Implementation of the Requirements of the Basic Safety Standards Directive at National Level Regarding Education & Training in Radiation Protection: Results from EURAMED Rocc-n-Roll Project	43
Early Subclinical Cardiovascular Changes after Radiotherapy for Breast Cancer Detected by Echocardiography: Contribution of the MEDIRAD EARLY-HEART Cohort.....	45

Digital Poster Session

Salivary Dysfunctions after Radioiodine Treatment (START): Results of a Self-Controlled Study in France	47
---	----

RadoNorm: Towards Effective Radiation Protection Based on Improved Scientific Evidence and Social Considerations – Focus on Radon and NORM.....	49
Continuous Education and Training through a Dose-Management Platform.....	50
Cancer-Related Changes in Cells Exposed to Alpha Radiation in Combination with Nicotine.....	51
Physiologically Based Pharmacokinetic Modelling for Novel Radiopharmaceuticals Using a Multilevel Object-Oriented Modelling Methodology.....	52
Dose Variations Using an X Ray Cabinet to Establish Calibration Curves for Biological Dosimetry Techniques	53
An Innovative Curriculum Model to Boost the Number of Medical Physicists and Radiation Protection Experts in Medical Radiation.....	54
Response of Current Environmental Dosimeters to New Operational Quantities	55
Neutrophil Infiltration in Radiation-Induced Cardiovascular Inflammation	56
Optimization Process in Radiotherapy (OPRORA) Project: Dosimetry Audit on VMAT and IMRT for Prostate and Head and Neck Treatment.....	57
Effect of Antioxidant rA1M on Expression of Apoptosis and Oxidative-Stress-Related Genes during ¹⁷⁷ Lu-Octreotate Treatment of GOT1 Neuroendocrine Tumours	58
The Questionnaire on GDPR Compliance Developed in the Framework of MEDIRAD Project: Results	59
Typical Effective Dose Values in Nuclear Medicine Single Photon Emission Imaging in Croatia	60
Inter-Laboratory Comparison (2021) on the Dicentric Chromosome Assay in the Frame of the European Network of Biological and Physical Retrospective Dosimetry (RENEB).....	62
Effects of Low-Dose γ Radiation on Atherosclerosis in Apoe(-/-) Mice: Study of Short-Term Effects on Macrophage Polarization and Evaluation of Long-Term Phenotypical and Immunological Effects in the Atherosclerotic Plaque	63
European Federation of Organisation for Medical Physics (EFOMP) Perspective on the Current Role and Future Direction of the Physical Scientist as a Medical Physics and Radiation Protection Expert	64
Optimisation Process in Radiotherapy Project: Clinical Audit on VMAT and IMRT for Prostate and Head & Neck Treatment.....	65
The European Metrology Network for Radiation Protection: Benefits and Challenges	66
Methodologies Used for the Optimisation of Radiation Doses Applied in Stereotactic Radiosurgery of a Brain Tumour.....	68
Radiological Component of the Exposome, Multiple Exposures, Risks of Cancer and Other Chronic Diseases in the Constances Cohort (CORALE)	69
Cytogenetic Biodosimetry Intercomparison Exercises among Laboratories in South Korea.....	70
Cytogenetic Aberrations after Partial-Body Irradiation during Fractionated Radiotherapy.....	71
Cellular and Gene Expression Changes in VH10 and AHH-1 Cells after Chronic and Acute Exposure to Low Doses of Low, High and Mixed LET Ionising Radiation	72
Managing Patients in High-Dose Procedures at Centro Hospitalar Universitário do Porto.....	73
Occupational Radiation Exposure in Chemoembolizations: Evaluation of Doses in Different Body Regions of Professionals.....	74

QuADRANT: Constant Improvement through Clinical Audit in Radiology, Radiotherapy and Nuclear Medicine — An ESR-Led Project on Behalf of the European Commission.....	75
The Current Status of Uptake of European Basic Safety Standard (2013/59/Euratom) Requirements: Results of a Follow-Up Survey in European Radiology Departments.....	77
Deposition of Ionising Energy Leads to Population Decline via Impaired Meiosis in <i>Caenorhabditis Elegans</i>	78
Comprehensive Reporting Solution with Integrated Radiation Dose and Quality Analysis.....	79
Your Occupational Dose in Your Pocket: Helping to Know Personal Occupational Doses to Improve the Interventional Practices	80
Investigation of Monolithic and Pixelated Detectors and Two-Layer Geometry for Hemispheric PET Systems: A Simulation Study	81
Effects of rA1M on the Regulation of Apoptotic Related Genes in Kidney Medulla after ¹⁷⁷ Lu-Octreotate Injection in Mice	82
The Cytokinesis-Block Micronucleus Assay on Human Cryopreserved Whole Blood and Isolated Peripheral Blood Mononuclear Cells.....	83
Characteristics of Complete Blood Cell Count among Radiation Workers in South Korea (2014–2019)	84
Prediction of Changes in the Frequency of Chromosome Aberrations in Peripheral Blood Lymphocytes after Radiotherapy	85
Proposal of New Model Including Proliferation and Irradiation for Cancer Therapy	86
A Study Using a Mathematical Model on the Radiation Damage Suppression Effect by Stem Cell Competition.....	87
Investigation on Coastal Sand as a Fortuitous Dosimeter by Optically Stimulated Luminescence	88

The European Metrology Network for Radiation Protection: Benefits and Challenges

B. Khanbabaee¹, A. Röttger¹, H. Zutz¹, O. Hupe¹, A. Veres², V. Sochor³, M. Pinto⁴, M. Derlacinski⁵, M.R. Ioan⁶, A. Sabeta⁷, R. Bernat⁸, C. Adam-Guillermin⁹, J. Alves¹⁰, M. Caldeira¹⁰, D. Glavič-Cindro¹¹, S. Bell¹², B. Wens¹³, L. Persson¹⁴, M. Živanović¹⁵, R. Nylund¹⁶

¹ National Metrology Institute (PTB), Braunschweig, Germany

² Saclay Nuclear Research Centre, French Alternative Energies and Atomic Energy Commission (CEA), Saclay, France

³ Czech Metrology Institute (PTK), Jihlava, Czechia

⁴ National Institute of Ionising Radiation Metrology; National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA-INMRI); Rome; Italy

⁵ Central Office of Measures (GUM), Warsaw, Poland

⁶ Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH), Măgurele, Romania

⁷ Institute of Metrology of Bosnia and Herzegovina (IMBiH), Sarajevo, Bosnia and Herzegovina

⁸ Ruđer Bošković Institute (IRB), Zagreb, Croatia

⁹ Institute of Radiation Protection and Nuclear Safety (IRSN), Fontenay-aux-Roses, France

¹⁰ Metrology Laboratory of Ionising Radiation, Laboratory of Radiological Protection and Safety (LPSR-LMRI), Bobadela, Portugal

¹¹ Jožef Stefan Institute (IJS), Ljubljana, Slovenia

¹² National Physical Laboratory, Teddington, United Kingdom

¹³ Belgian Nuclear Research Centre (SCK CEN), Mol, Belgium

¹⁴ Swedish Radiation Safety Authority (SSM), Stockholm, Sweden

¹⁵ Vinča Institute of Nuclear Sciences, Belgrade, Serbia

¹⁶ Radiation and Nuclear Safety Authority of Finland (STUK), Helsinki, Finland

Abstract

The European regulation on ionizing radiation is essentially laid down in the Council DIRECTIVE 2013/59/EURATOM. This Directive implements the basic safety standards for the protection of humans and the environment against the dangers arising from exposure to ionizing radiation.

However, the practical implementation of the European basic safety standards has become more complex due to the lack of consideration of the metrological implications and the adaptation to new technological developments, which lead to new standards, technological innovations, and improved capabilities.

It is therefore of vital importance to create a network that acts as a focal point between the metrology communities and the relevant radiation protection stakeholders, including regulators, standardization bodies, manufacturers, users of radiation sources and international organizations and platforms dealing with radiation protection such as HERCA, IAEA and EURADOS.

The development of such a metrology network under the umbrella of EURAMET was planned by the consortium of the JNP EMPIR project 19NET03 supportBSS. The plan was successfully evaluated by EURAMET and the European Metrology Network (EMN) for Radiation Protection was approved by the EURAMET General Assembly in June 2021.

The EMN for radiation protection will interact with innovative technological developments and has set itself the goal of being the central point of contact in order to cover the metrological needs in radiation protection and to find metrological solutions on a European level.

The main challenges for this goal are in the first step the implementation of a long-term ongoing dialogue between the metrology communities and relevant stakeholder groups and, on the other hand, the development of a joint and sustainable European metrology infrastructure that underpins radiation protection regulation. The first step is visualized in this work.

Acknowledgement

This project 19NET03 supportBSS has received funding from the EMPIR programme co-financed by the participating states and from the European Union's Horizon 2020 research and innovation programme. 19NET03 supportBSS denotes the EMPIR project reference.