

Next Steps in Advancing the System of Radiological Protection



Congrès National de Radioprotection – SFRP 2023

June 13- 15, 2023
Dijon, France

ICRP: UK Registered Charity 1166304



Werner Rühm
ICRP Chair

The International Commission on Radiological Protection (ICRP)



- Founded in **1928**

- **Provides independent recommendations and guidance** on radiological protection for the public benefit

- **Does not formulate standards**, regulations, and codes of practice (this is the responsibility of other national and international organisations)

- Considers **scientific knowledge**, evolving **social values**, and **practical experience**

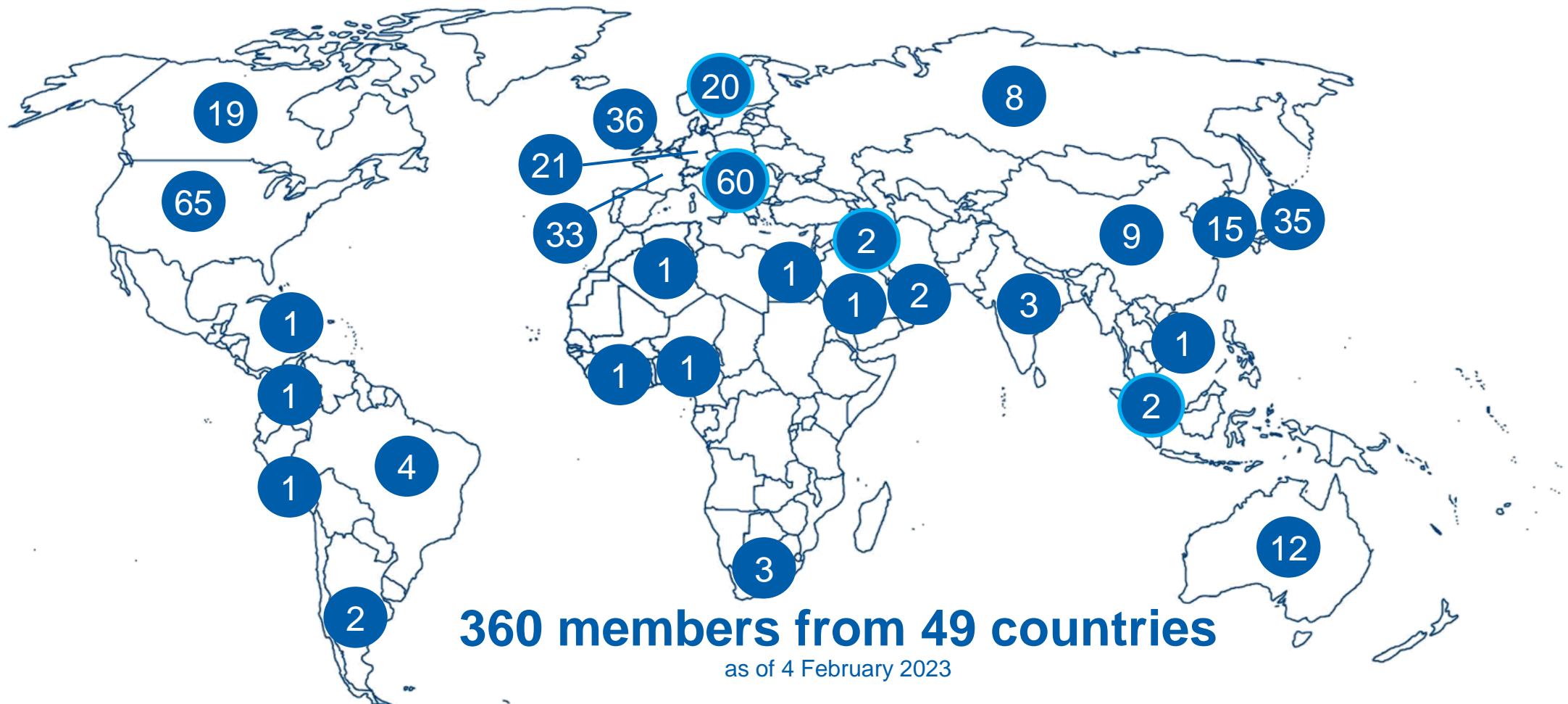
- **To contribute to an appropriate level of protection against the detrimental effects of ionising radiation exposure without unduly limiting the benefits associated with the use of radiation.**

Membership

- More than 350 volunteer members from almost 50 countries selected on the basis of recognized competence and experience, for four year terms.

ICRP is a Charity registered with the Charity Commission of England and Wales
ICRP is an independent Non-Governmental Organisation (NGO)

The International Commission on Radiological Protection (ICRP)



Structure



ICRP Main Commission



Werner Rühm

Chair



Simon Bouffler

Vice-Chair



Christopher Clement

Scientific Secretary



Dominique Laurier

C1 Chair



François Bochud

C2 Chair



Kimberly Applegate

C3 Chair



Thierry Schneider

C4 Chair



Kun-Woo Cho

Member



Gillian Hirth

Member



Michiaki Kai

Member



Senlin Liu

Member



Sergey Romanov

Member



Andrzej Wojcik

Member

ICRP Scientific Secretariat



Christopher Clement

Scientific Secretary & CEO,
Editor-in-Chief of Annals of the ICRP



Takashi Yasumune

Assistant Scientific Secretary,
Assistant Editor of Annual of the ICRP



Hyungjoon Yu

Assistant Scientific Secretary,
Assistant Editor of Annual of the ICRP



Lynn Lemaire

Executive
Administrator



Kelsey Cloutier

Head of Stakeholder
Engagement and Communications



Charlotte White

Brand and Digital
Media Specialist

Abdulkadir Alaydarous (Technical Secretary), USA

Adrienne Ethier (Technical Secretary), Canada

Franklin Eze (Technical Secretary), Cyclomedical International, Nigeria

Camille Pacher (Technical Secretary), Canada

Boniface Kouamé Yao (Technical Secretary), Cote D'ivoire

Constantinos Zervides (Technical Secretary), Mediterranean Hospital of Cyprus / University of Nicosia Medical School, Cyprus

Suryakanta Acharya (Technical Writer), PAY-W Clinic, Assam Cancer Care Foundation, India

Barrington Brevitt (Technical Writer), Kingston Public Hospital South East Regional Health Authority , Jamaica

ICRP Committees



Committee 1 Effects

considers the effects of radiation action from the subcellular to population and ecosystem levels, including the induction of cancer, hereditary, and other diseases, impairment of tissue/organ function and developmental defects, and assesses implications for protection of people and the environment

Chair: Dominique Laurier, France



Committee 3 RP in Medicine

addresses protection of persons and unborn children when ionising radiation is used in medical diagnosis, therapy, and biomedical research, as well as protection in veterinary medicine

Chair: Kimberly Applegate, USA



Committee 2 Doses

develops dosimetric methodology for the assessment of internal and external radiation exposures, including reference biokinetic and dosimetric models and reference data and dose coefficients, for use in the protection of people and the environment

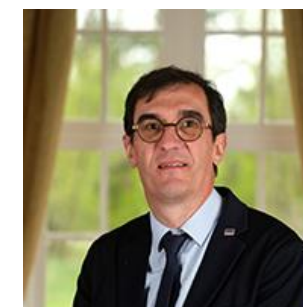
Chair: François Bochud, Switzerland



Committee 4 Application

provides advice on the application of the Commission's recommendations for the protection of people and the environment in an integrated manner for all exposure situations

Chair: Thierry Schneider, France



31 Active ICRP Task Groups



- | | |
|---|---|
| TG36 Radiopharmaceutical Doses | TG113 Dose Coefficients for X-ray Imaging |
| TG91 Low-dose and Low-dose Rate Exposure | TG114 Reasonableness and Tolerability |
| TG95 Internal Dose Coefficients | TG115 Risk and Dose for Astronauts |
| TG96 Computational Phantoms and Radiation Therapy | TG116 Risk and Dose for Radiotherapy |
| TG97 Surface and Near Surface Dose | TG117 Risk and Dose for T |
| TG98 Contaminated Sites | TG118 Risk and Dose for the Circulatory System |
| TG99 Reference Animals and Plants Monitoring | TG120 Radiation Emergencies and Malicious Events |
| TG103 Mesh-type Computational Phantoms | TG121 Offspring and Next Generations |
| TG105 The Environment in the System of RP | TG122 Risk and Dose for Cancer |
| TG106 Mobile High Activity Sources | TG123 Radiation-induced Effects |
| TG108 Optimisation in Medical Imaging | TG124 Risk and Dose for Justification |
| TG109 Ethics in RP in Medicine | TG125 Risk and Dose for Services |
| TG110 Veterinary Practice | TG126 Human Biomedical Research |
| TG111 Individual Response to Radiation | TG127 Exposure Situations and Categories of Exposure |
| TG112 Emergency Dosimetry | TG128 Individualisation and Stratification in Rad. Protection |

**New Task Groups
announced on the
ICRP website**

**Membership
identified through
Open Calls**

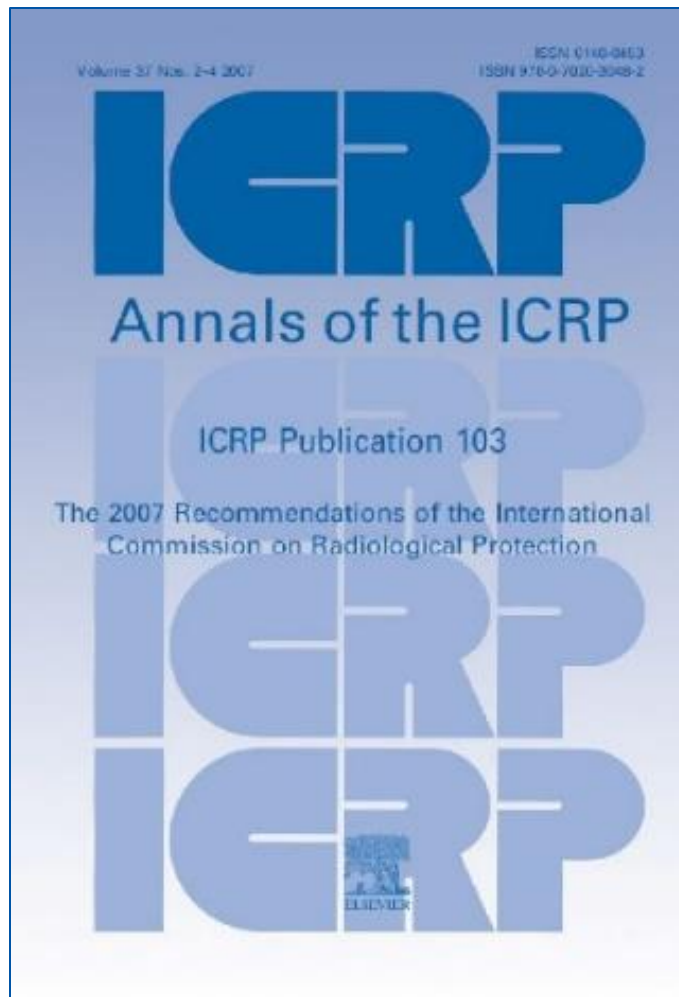
For ICRP, International Collaboration is Important



Organisations in Formal Relations with ICRP

- Conference of Radiation Control Program Directors (CRCPD)
- European ALARA Network (EAN)
- European Alliance for Medical RP Research (EURAMED)
- European Association of Nuclear Medicine (EANM)
- European Commission (EC)
- European Nuclear Installations Safety Standards Initiative (ENISS)
- Europ. Platform on Preparedness for Nucl. & Radiol. Emergency Response & Recovery (NERIS)
- European Radiation Dosimetry Group (EURADOS)
- European Radioecology Alliance (ALLIANCE)
- European Society of Radiology (ESR)
- European Training and Education in RP Foundation (EUTERP)
- Heads of the European RP Competent Authorities (HERCA)
- Ibero American Forum of Radiological and Nuclear Regulatory Organisations (FORO)
- IEC Electrical Equipment in Medical Practice (IEC/TC62)
- IEC Nuclear Instrumentation (IEC/TC45)
- IndustriAll Global Union's International Network (INWUN)
- Information System on Occupational Exposure (ISOE)
- International Atomic Energy Agency (IAEA)
- International Commission on Radiation Units and Measurements (ICRU)
- International Labour Organisation (ILO)
- International Organization for Medical Physics (IOMP)
- International Radiation Protection Association (IRPA)
- International Society of Radiographers and Radiological Technologists (ISRRT)
- International Society of Radiology (ISR)
- Multidisciplinary European Low Dose Initiative (MELODI)
- National Council on Radiation Protection and Measurements (NCRP)
- OECD Nuclear Energy Agency (NEA)
- United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)
- World Health Organisation (WHO)
- World Nuclear Association (WNA)





- **General Recommendations** (most recent 2007)
- **Publications on specific aspects of radiological protection**, e.g., deep geological disposal
- **Publications providing tools needed to implement radiological protection**, e.g., dose coefficients
- **Publications that assess impacts of new scientific findings**, e.g., cancer risks from uranium



ICRP Mentorship Programme

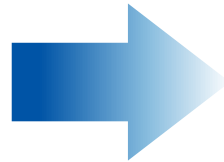
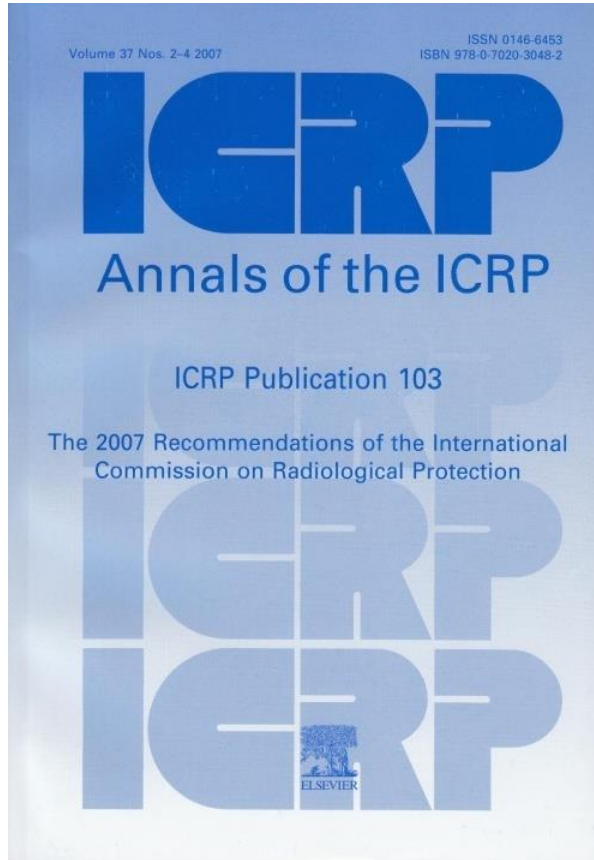


- Engagement of university students, early-career professionals, scientists in ICRP Task Groups
 - Mentees may come from educational, governmental, private, other organisations
 - Assignment of specific roles or tasks
 - Mentor is responsible for providing guidance and support to the mentee
- > **Aidana Amrenova** (TG121), IRSN, France

Task Group	Opportunity	Mentor	Task(s), Role	Application Deadline
Task Group 103	Mesh-type Reference Computational Phantoms	Chan Hyeong Kim Choonsik Lee	Task Group 103 is seeking mentees to assist in the development of mesh-type reference computational phantoms. The developed phantoms will be used to produce specific absorbed fractions for organs as sources and the entire foetus or foetal organs as targets. The mentees will contribute to the development of Monte Carlo dose calculations, ensure quality assurance of specific absorbed fractions produced, and manage and analyse the data (including plotting graphs for record and analysis purposes).	16 June 2023
Task Group 126	Radiological Protection in Human Biomedical Research	TBD	Task Group 126 is seeking mentees for the organization of an international survey on national/regional practices of Radiation Protection in Research involving Human Biomedical Research. The survey is intended to investigate the principles and implementation of human biomedical research involving ionising radiation and to consider the protection aspects together with design, assessment (justification), evaluation and oversight of human biomedical research. Mentees will contribute to update literature, develop questionnaires, establish contact with relevant authorities, distribute questionnaires and analyze the survey to be used by the wider Radiation Protection Community.	9 June 2023

Currently 43 ICRP mentees!

System Review: The Next Decade



- Identify **basic open questions (“building blocks”)**: essential work required for the next general recommendations

Keeping the ICRP Recommendations Fit for Purpose

🔒 iopscience.iop.org/article/10.1088/1361-6498/ac1611

IOPscience



Journals ▾

Books

Publishing Support







Login ▾

Journal of Radiological Protection

ACCEPTED MANUSCRIPT • OPEN ACCESS

Keeping the ICRP recommendations fit for purpose

Christopher Clement¹ , Werner Ruehm², John D Harrison³ , Kimberly E Applegate⁴, Donald Cool⁵ , Carl-Magnus Larsson⁶, Claire Cousins⁷, Jacques Lochard⁸, Simon D Bouffler⁹ , Kunwoo Cho¹⁰, M Kai¹¹, Dominique Laurier¹², Senlin Liu¹³ and Sergey Anatolyevich Romanov¹⁴

– Hide full author list

Accepted Manuscript online 20 July 2021 • © 2021 Society for Radiological Protection. Published on behalf of SRP by IOP Publishing Limited. All rights reserved.

[What is an Accepted Manuscript?](#)



Accepted Manuscript PDF

Paper 1:
OPEN ACCESS



INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Are there any areas that would require review (views of the previous Main Commission)?

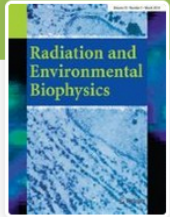
- Background and Purpose
- Objectives and Principles of the System
- Overarching Considerations
- Dose
- Effects and Risk
- Conclusions

Highlights Identified for Potential Review



- Classification of effects, with focus on tissue reactions
- Reformulation of detriment, potentially including non-cancer diseases
- Relationship between detriment and effective dose
- Individual variation in response to exposure
- Hereditary effects
- Effects and risks in non-human biota and ecosystems
- Integrating protection of people and the environment
- Fundamental principles of justification and optimization
- New approach to protection of vulnerable groups
- Clarification of exposure situations
- Explicit incorporation of the ethical basis of the System
- Communication and stakeholder involvement
- Education and training

To stimulate discussion



Radiation and Environmental Biophysics

Review Paper

Areas of Research to Support the System of Radiological Protection

D. Laurier, W. Rühm, F. Paquet, K. Applegate, D. Cool, C. Clement, on behalf of the International Commission on Radiological Protection (ICRP)

- Introduction
- Research to support radiation risk assessment
- Research to support dosimetry
- Research to support the application/implementation of the System of Radiological Protection
- Conclusions

<http://link.springer.com/article/10.1007/s00411-021-00947-1>

Paper 2:
OPEN
ACCESS

Radiation Risk Assessment

a) Short/Mid-term

- Better characterization of tissue reactions
- Stochastic effects and radiation detriment
- Individual response of humans to radiation
- Radiation effects on non-human biota

b) Long-term

- Basic research
- Effects of combined exposures

- Cancer risk models and tissue weighting factors
- Dose rate effects of cancer
- Impact of non-radiation factors in detriment calculations
- Potential impact of diseases of the circulatory system on radiation detriment
- Effects of radiation from in utero exposure
- Hereditary effects
- Uncertainty analysis

Dosimetry – Short/Mid-term

- Relative biological effectiveness, quality factor and radiation weighting
- Appropriate dosimetric quantities for medicine and other applications
- Dosimetry in emergency situations

Dosimetry – Long-term

- Dosimetric targets in \dots
- Dosimetric targets \dots technology for the protection of \dots environment
- Biokinetic models in human tissues

Research to support the application and implementation of the System

- Development \dots use of radiation technology \dots legal use implications, \dots social implications, NORM, \dots (sources)
- \dots system protection
- Research needs for the application of the system of radiological protection (AI, social science, stakeholder involvement, communication)
- Ethics
- Behavioural science

TO stimulate discussion

The Future of



14 OCT - 3 NOV 2021

On-Demand Presentations

19 - 20 OCT 2021

Live Presentations

ICRP
Digital
Workshop

UK Registered Charity 1166304

Attractive programme

- 20 Live-Presentations in 4 sessions
 - Session 1: The Big Picture
 - Session 2: Risks and Effects
 - Session 3: RP Concepts
 - Session 4: Applications and Practice
- 50 On-Demand Presentations

International audience from all over the world

- Almost 1,500 registrations from 97 countries
 - Session 1: 826 total viewers
 - Session 2: 643 total viewers
 - Session 3: 608 total viewers
 - Session 4: 521 total viewers
 - On-demand presentations: 7,294 visits

Much opportunity for interaction

- Chat function, possibility for video calls

The 2021 ICRP Digital Workshop



Journal of
Radiological
Protection



Official journal of
the Society for
Radiological Protection

Summary of the 2021 ICRP Workshop on the Future of Radiological Protection

W. Rühm, C. Clemens, M. Laurier, F.
Bochud, K. Anderson, S. Bouffler, K.
Cho, G. F. ... S. Romanov, A.
Wojcik

- Introduction and participation
- Scientific basis of the System
 - Concepts of the System
 - Application of the System
 - Role of ICRP
- Live-streamed presentations
- Conclusions

[https://iopscience.iop.org/
journal/0952-4746](https://iopscience.iop.org/journal/0952-4746)

Paper 3:
OPEN ACCESS
(support BMUV)

Basically, feedback on Paper 1

Topics highlighted at the Workshop - Examples



- Scientific basis of the System (including both radiation-related effects and dosimetry)
- Application of radiation technologies
- Communication of the benefits/risks of these technologies
- Role of ethics in decision-making
- Role of uncertainties in effects, dosimetry, and the benefits/risks of technological uses.
- Need for the System to be practical and understandable
- Communication, education, and training are tied directly to this
- Interaction of ICRP with other international organisations (scientific institutions, regulators, practitioners, etc.)
- Engagement of ICRP with stakeholders including workers, members of the public, and patients

Key Milestones so far (open access papers)



Keeping the ICRP recommendations fit for purpose

Clement et al 2021 J. Radiol. Prot. 41 1390
www.doi.org/10.1088/1361-6498/ac1611

Paper 1: Thoughts from ICRP & invitation to contribute



Summary of the 2021 ICRP workshop on the future of radiological protection

Rühm et al 2022 J. Radiol. Prot. 42 023002
www.doi.org/10.1088/1361-6498/ac670e

Paper 3: Feedback on Paper 1



Areas of research to support the system of radiological protection

Laurier et al 2021 Radiat Environ Biophys 60, 519–530
www.doi.org/10.1007/s00411-021-00947-1

Paper 2: Thoughts from ICRP & invitation to contribute



Discussions at the European Radiation Protection Week, 9 – 14 October 2022



ICRP Workshop on the Review and Revision of the System of Radiological Protection - Focus on Research Priorities

Views of **Paper 4: Feedback on Paper 2** discussed in formal relations with ICRP on “Areas of Research” paper (Laurier et al.).

Open Access paper is **currently being prepared**

European Radiation Protection Week 2022

ERPW 2022

9 - 14 October
Estoril, Portugal



List of topics ICRP has identified as a priority to review to prepare the next General Recommendations

Discussed with organisations in formal relations with ICRP



It seemed that most of the topics have **already been included**

The first phase of the journey towards the review and revision of the RP System has come to an end (i.e., to publish ideas of the ICRP, stimulate discussion, and collect the feedback from the international RP community on the topics to be reviewed)

Of course we continue to listen and are open for any additional/new ideas!!



~20 Building Blocks now being addressed

Thierry Schneider (Co-Chair)

- TG36 Radiopharmaceutical Doses
- TG91 Low-dose and Low-dose Rate Exp**
- TG95 Internal Dose Coefficients**
- TG96 Computational Phantoms and Radiation Transport**
- TG97 Surface and Near S
- TG98 Contaminated Sites
- TG99 Reference Animals and Plants Monographs**
- TG103 Mesh-type Computational Phantoms**
- TG105 The Environment in the System of RP**
- TG106 Mobile High Activity
- TG108 Optimisation in Med
- TG109 Ethics in RP in Medicine**
- TG110 Veterinary Practice**
- TG111 Individual Response to Radiation**
- TG112 Emergency Dosimetry

Dominique Laurier (Co-Chair)

Francois Paquet (Chair)

Christelle Adam-Guillermin (Co-Chair)

- TG113 Dose Coefficients for X-ray Imaging
- TG114 Reasonableness and Tolerability**
- TG115 Risk and Dose for Astronauts**
- TG116 Imaging for Radiotherapy
- TG117 PET and PET/CT
- TG118 RBE, Q, and w_R**
- TG119 Diseases of the Circulatory System**
- TG120 Radiation Emergencies and Malicious Events
- TG121 Offspring and Next Generations**
- TG122 Detriment Calculation for Cancer**
- TG123 Classification Radiation-induced Effects**
- TG124 The Principle of Justification**
- TG125 Ecosystem Services**
- TG126 Human Biomedical Research**
- TG127 Exposure Situations and Categories of Exposure**
- TG128 Individualisation and Stratification in Rad. Prot.**

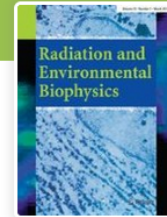
Ludovic Vaillant (Co-Chair)

Ludovic Vaillant (Chair)

Yann Billarand (Chair)

Lack of Support for Research, Education and Training in Radiological Protection

- IAEA-WHO: 2012 Bonn Call for Action
- NCRP 2015, US
- Salomaa et al. 2017, Europe
- Cho et al. 2019, International
- Ottolenghi et al. 2019, Europe
- SSK 2021, Germany
- Vasileva et al. 2021, International
- Linet et al. 2022, US
- NAS 2022, US



Radiation and Environmental Biophysics

Vancouver Call for Action to Strengthen Expertise in Radiological Protection Worldwide

W. Rühm, K. Cho, C.-M. Larsson, A. Wojcik, C. Clement, K. Applegate, F. Bochud, S. Bouffler, D. Cool, G. Hirth, M. Kai, D. Laurier, S. Liu, S. Romanov, T. Schneider

<https://link.springer.com/article/10.1007/s00411-023-01024-5>

**OPEN
ACCESS**

What's Next?



Next opportunity to provide feedback



...

... and - see you in Tokyo for ICRP 2023!



ICRP

THANK YOU!

www.icrp.org