Review and Revision of the System of Radiological Protection

NASEM Nuclear and Radiation Studies Board (digital)

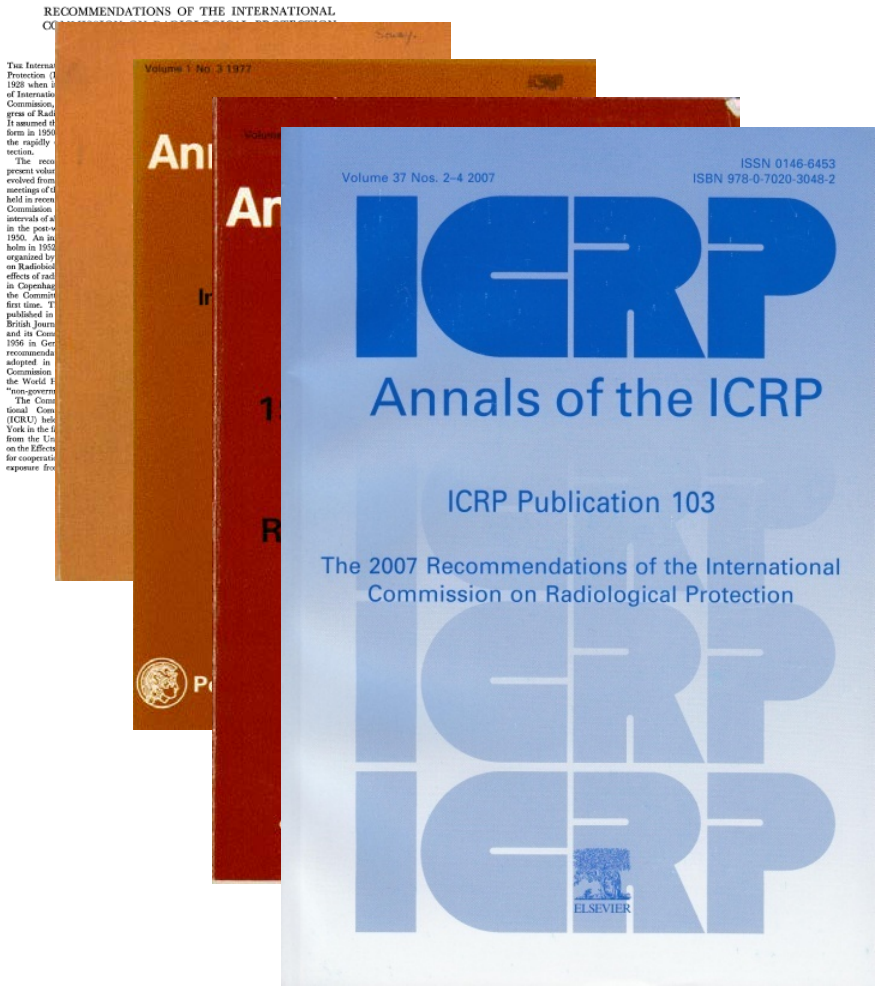
14 December, 2021

UK Registered Charity 1166304

Werner Rühm
ICRP Chair

Publication of General Recommendations

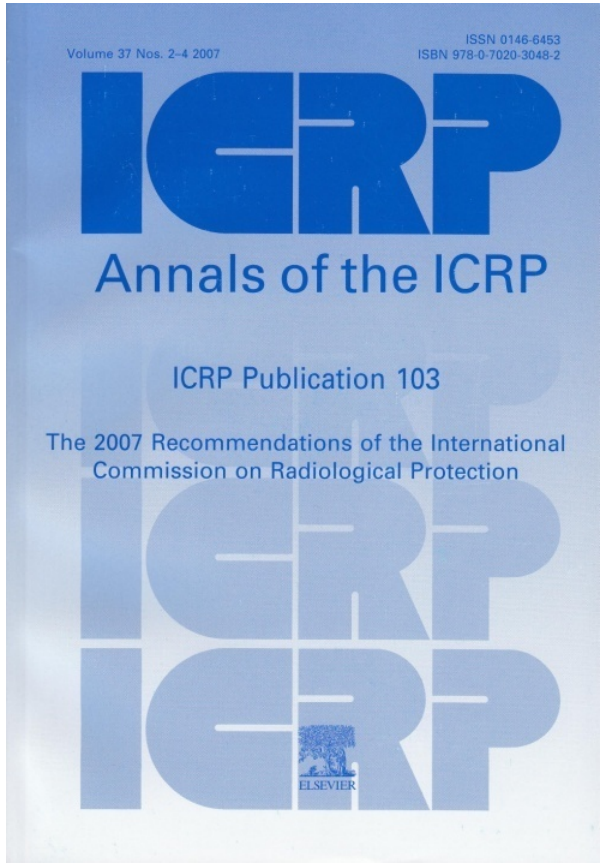
- 1928 (ICR, 1929)
- 1931 (ICR, 1931)
- 1934 (IXRPC, 1934)
- 1937 (IXRPC, 1938)
- 1950 (ICRP 1951)
- 1954 (ICRP, 1955)
- 1956 (ICRP, 1958)
- 1959 (ICRP *Publication 1*)
- 1964 (ICRP *Publication 6*)
- 1966 (ICRP *Publication 9*)
- 1977 (ICRP *Publication 26)*
- 1991 (ICRP *Publication 60*)
- 2007 (ICRP *Publication 103)*



Some Developments since *Publication 103*

- 45 new ICRP publications since *Publication 103*
  - Integration of protection of the **environment**
  - New clarity on the **ethical** foundation
  - Improved understanding of radiation **effects** (e.g., lens of eye, radon)
  - More focus on protection against **tissue reactions**
  - Experience with **exposure situations**
- Increasing **engagement** with stakeholders
- New **domains** of RP (e.g., human spaceflight, veterinary patients)

System Review: The Next Decade



- Recognise gaps
- Consider needed updates
- Identify **building blocks**: essential work required for the next general recommendations

Some Complete & Underway Building Blocks

- **Effect & Risk**

  Publication 148 w_R for Ref Animals & Plants

  Publication 118 Tissue Reactions

  TG 64 Cancer Risk from Alpha Emitters

  TG 91 Low-dose and Low-dose Rate Risk

  TG 102 Detriment Calculation Methodology

  TG 111 Individual Response to Radiation

  TG 119 Diseases of the Circulatory System

- **Ethics**

  Publication 138 Ethics in RP

  TG 109 Ethics in RP for Medicine

  TG 114 Reasonableness and Tolerability

- **Dose**

  Publication 147 Dose Quantities in RP

  Dose Coefficients Publications

  TG 99 Reference Animals and Plants Monographs

  TG 103 Mesh-type Reference Phantoms

  TG 118 RBE, Q, and w_R

- **Concepts / Scope / Structure / Application**

  Publication 126 Radon

  Publication 124 Environment

  TG 105 Environment

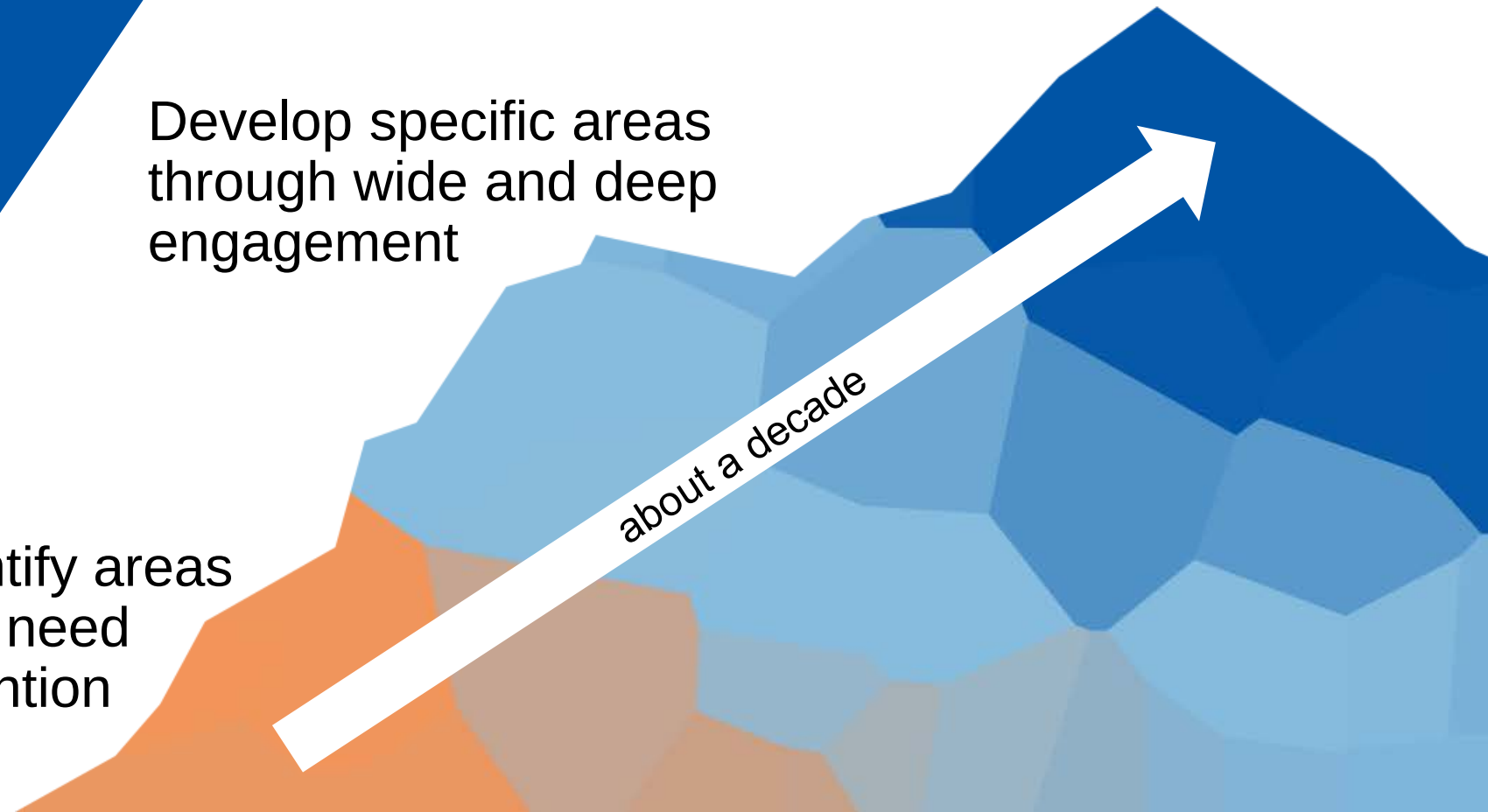
  TG 110 Veterinary Practice

  TG 115 Astronauts

Review & Refinement of the System of Radiological Protection

Draft and consult on new general recommendations

Develop specific areas through wide and deep engagement



Identify areas that need attention

International Collaboration Important for the Process

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)

Initiating the process …

ICRP invites responses relating to the review of the System of Radiological Protection

How to initiate the process?

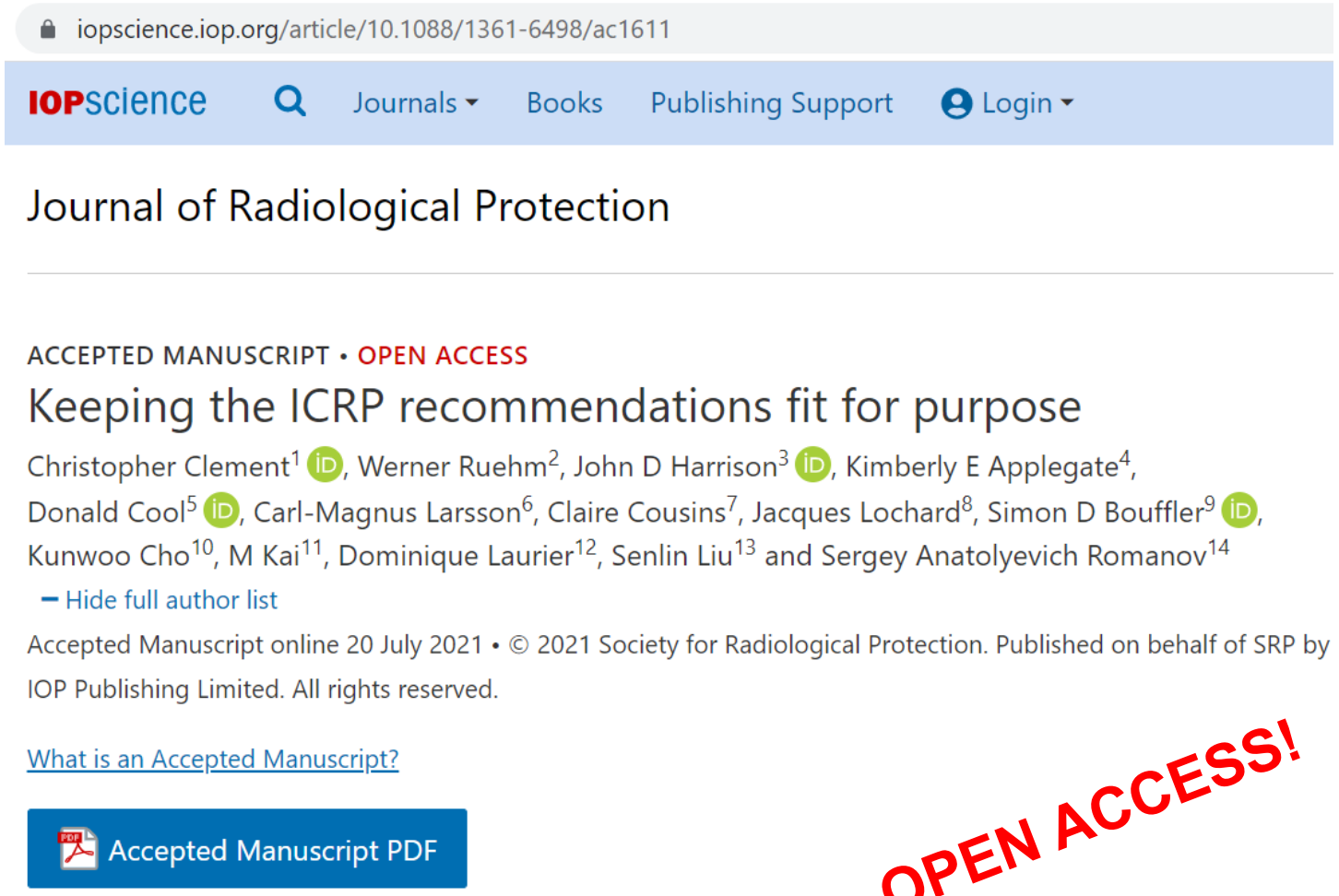
How to structure the process?

How to motivate potential contributors?

How to encourage discussions?

How to initiate collaborative efforts?

Keeping the ICRP Recommendations Fit for Purpose



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

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Journal of Radiological Protection

ACCEPTED MANUSCRIPT • OPEN ACCESS

Keeping the ICRP recommendations fit for purpose

Christopher Clement[1], Werner Ruehm[2], John D Harrison[3], Kimberly E Applegate[4], Donald Cool[5], Carl-Magnus Larsson[6], Claire Cousins[7], Jacques Lochard[8], Simon D Bouffler[9], Kunwoo Cho[10], M Kai[11], Dominique Laurier[12], Senlin Liu[13] and Sergey Anatolyevich Romanov[14]

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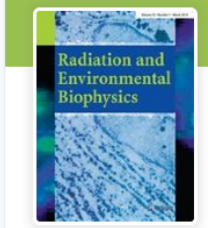
Are there any areas that would require review?

- 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 radiation exposure
- Heritable effects
- Effects and risks in non-human biota and ecosystems
- Integrating protection of people and the environment
- Fundamental principles of justification and optimisation
- Broader approach to protection of individuals
- Clarification of exposure situations
- Explicit incorporation of the ethical basis of the System
- Communications and stakeholder involvement
- Education and training

Areas of Research to Support the System of RP



Radiation and Environmental Biophysics

Review Paper

Area 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

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Areas of Research to Support the System of RP

Radiation Risk Assessment

a) Short/Mid-term

- Better characterization of tissue reactions
- Stochastic effects and radiation detriment
  - o Cancer risk models and tissue weighting factors
  - o Dose rate effects of cancer
  - o Impact of non-radiation factors in detriment calculations
  - o Potential impact of diseases of the circulatory system on radiation detriment
  - o Effects of radiation from in utero exposure
  - o Heritable effects
  - o Uncertainty analysis
- Individual response of humans to radiation
- Radiation effects on non-human biota

b) Long-term

- Basic research
- Effects of combined exposures

Areas of Research to Support the System of RP

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 organs and tissues
- Dosimetric targets and methodology for the protection of the environment
- Biokinetic models in human tissues

Research to support the application and implementation of the System

- Development and use of radiation technologies (medical use implications, veterinary practice implications, NORM, natural sources
- Ecosystem protection
- Research needs for the application of the system of radiological protection (AI, social science, stakeholder involvement, communication)
- Ethics
- Behavioural science

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

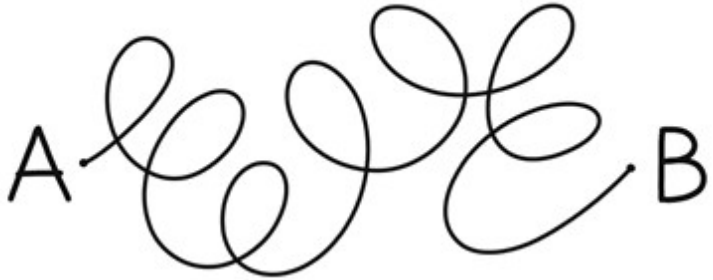
Much opportunity for interaction

- Chat function, possibility for video calls

Workshop summary in progress!

General Strategy

- Check for most recent scientific evidence
- Improve **clarity** and consistency
- **Simplify** where possible, recognising that the System of Radiological Protection needs to handle complex situation



ICRP 2021+1
Radiological Protection: The Next Generation

THANK YOU!

www.icrp.org