International Commission on Radiological Protection:

Present & Future

Presentation to the National Institute of Advanced Industrial Science and Technology (AIST)

13 November, 2023

No COI; many slides courtesy of ICRP office

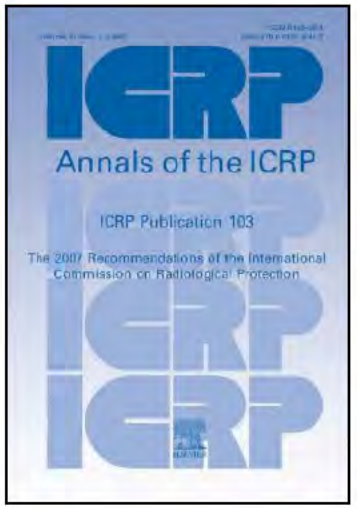
Kimberly Applegate, MD,MS
ICRP Main Commission
Chair Committee 3 on Medicine

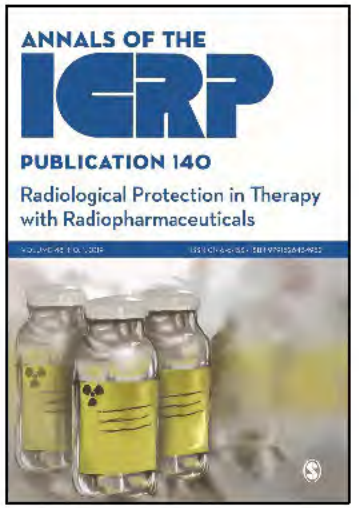
Outline

- Introduction to ICRP
- Current Activities
- The Future of Radiological Protection

ICRP Mission

*Advance for the **public benefit** the science of radiological protection, in particular by providing **recommendations and guidance** on all aspects of protection against **ionising radiation***





International Commission on Radiological Protection

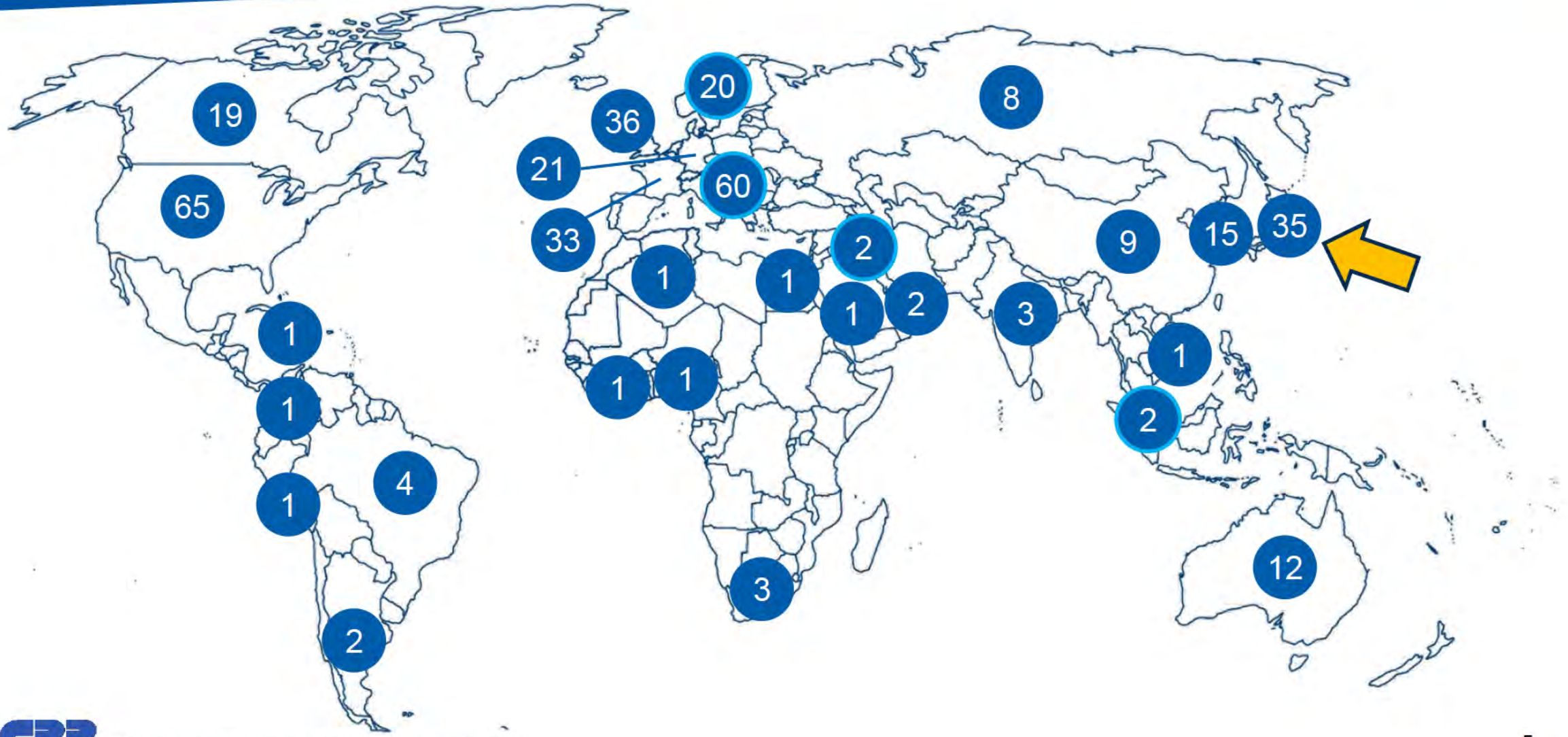
- **Underpins <u>all</u> ionising RP standards, legislation, and practice <u>world-wide</u>**
- Independent international organisation working for the public benefit
- Charity relying on voluntary contributions
- ~350 experts from ~50 countries volunteering their time
- Established in 1928 (Stockholm)

Registered with the Charity Commission for England and Wales, #1166304



360 Members from 49 Countries

as of 04 February 2023



ICRP Structure

Main Commission

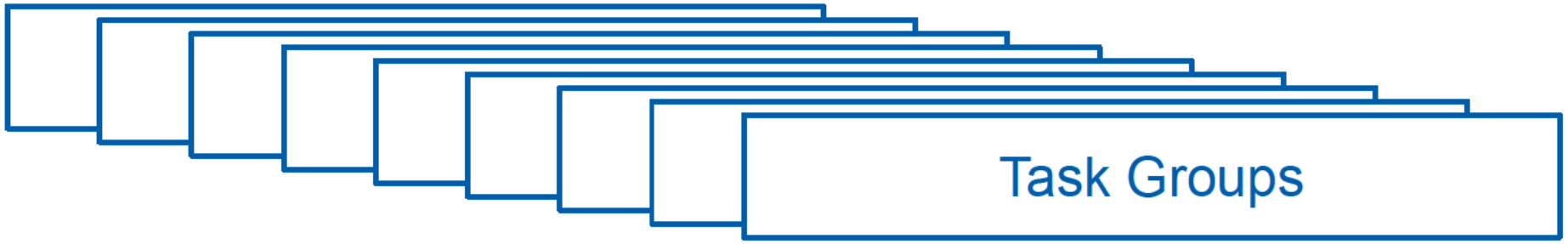
Scientific Secretariat

Committee 1
Effects

Committee 2
Doses

Committee 3
Medicine

Committee 4
Application



ICRP Members from China, Japan & Korea

11 members including: Main Commission (Senlin Liu), Committees 1, 2, 3, and 4, and 3 mentees

34 members including: Main Commission (Michiaki Kai), Scientific Secretariat (Takashi Yasumune), Committees 1, 2, 3, and 4, and 2 mentees

16 members including: Main Commission (Kunwoo Cho), Scientific Secretariat (Hyungjoon Yu), Committees 2, 3, and 4, and 1 mentee

ICRP Main Commission (11 countries)

The Main Commission

is ICRP's governing body, providing oversight, setting policy, and giving general direction

Werner Rühm (Chair), Germany
Simon Bouffler (Vice-Chair), UK
Christopher H. Clement (Scientific Secretary), ICRP, Canada *

Kimberly Applegate, University of Kentucky COM (retired), USA
François Bochud, IRA CHUV, Switzerland
Kun-Woo Cho, Korea Institute of Nuclear Safety, Korea
Gillian Hirth, ARPANSA, Australia
Michiaki Kai, Nippon Bunri University (NBU), Japan
Dominique Laurier, French Institute for Radiological Protection and Nuclear Safety (IRSN), France
Senlin Liu, China Institute of Atomic Energy, China
Sergey Romanov, Southern Ural Biophisics Institute, Russian Federation
Thierry Schneider, CEPN, France
Andrzej Wojcik, Centre for Radiation Protection Research, Stockholm University, Sweden

Roger H. Clarke (Member emeritus), United Kingdom
Fred A. Mettler (Member emeritus), University of New Mexico, USA
R. Jan Pentreath (Member emeritus), United Kingdom
R. Julian Preston (Member emeritus), Environmental Protection Agency (EPA), USA
Christian Streffer (Member emeritus), University-Clinics Essen, Germany
Eliseo Vañó (Member emeritus), Complutense University, Spain

* Formally not a MC member but integral to the work of the MC and part of the ICRP executive consisting of the Chair, Vice-Chair, and Scientific Secretary

ICRP Scientific Secretariat

The Scientific Secretariat

located in Ottawa, Canada, manages the daily business of ICRP

Christopher Clement (Scientific Secretary & CEO), Canada
Lynn Lemaire (Executive Administrator), Canada
Kelsey Cloutier (Head of Stakeholder Engagement and Communications), Canada
Charlotte White (Brand and Digital Media Specialist), Canada
Takashi Yasumune (Assistant Scientific Secretary), Japan
Hyungjoon Yu (Assistant Scientific Secretary), Korea

Suryakanta Acharya (Technical Writer), India
Abdulkadir Alaydarous (Technical Secretary), USA
Barrington Brevitt (Technical Writer), Jamaica
Anna Denisnova (Technical Secretary), Russian Federation
Adrienne Ethier (Technical Secretary), Canada
Franklin Eze (Technical Secretary), Nigeria
Luana Hafner (Intern), Switzerland
Toshihiro Higuchi (Historian), USA
Boniface Kouamé Yao (Technical Secretary), Cote d'Ivoire
Camille Pacher (Technical Secretary), Canada
Constantinos Zervides (Technical Secretary), Cyprus

ICRP Committees

Committee 1 Effects

considers the effects of radiation action from the subcellular to population and ecosystem levels, including the induction of cancer, heritable, 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 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 3 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

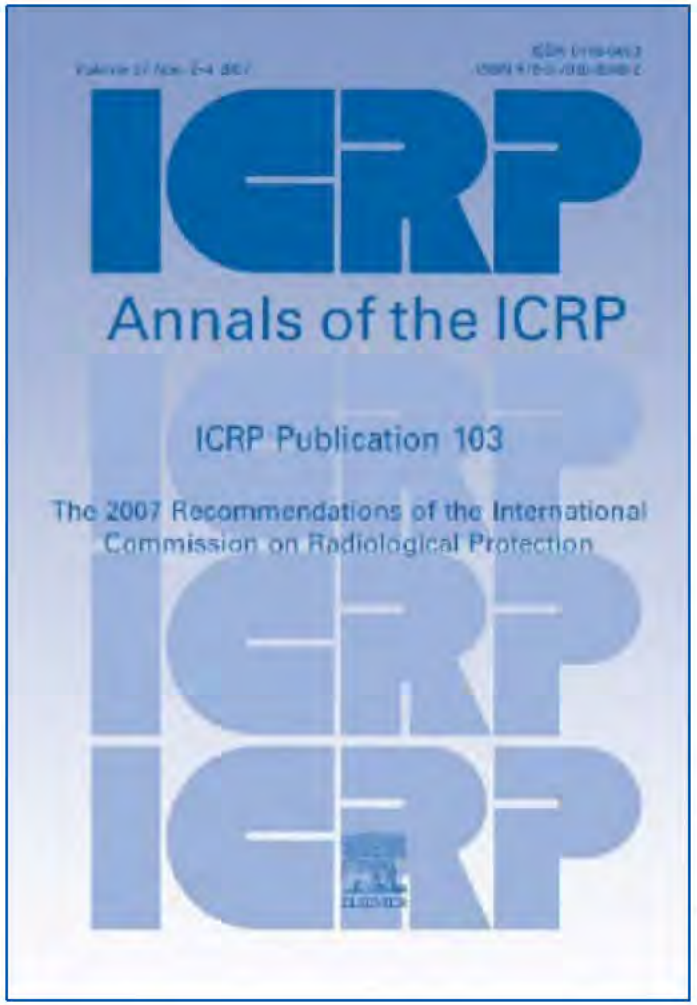
Chair: Kimberly Applegate, USA

Committee 4 Application

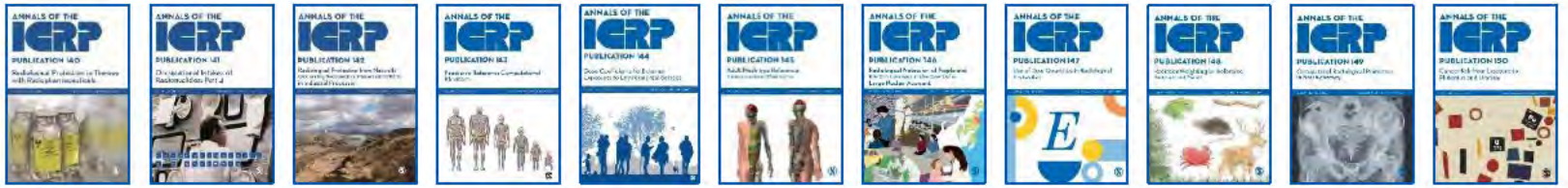
provides advice on the application of the Commission's recommendations for the protection of people and the environment in an integrated manner for all exposure situations

Chair: Thierry Schneider, France

ICRP Publications



- **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 Publications

Annals of the ICRP is the authoritative source of recommendations and guidance of the International Commission on Radiological Protection (ICRP). It is published by SAGE UK on behalf of ICRP.

邦訳版ICRP刊行物
Japanese Translations

한국어 번역본
Korean Translations

中文翻译
Chinese Translations

Latest Publications

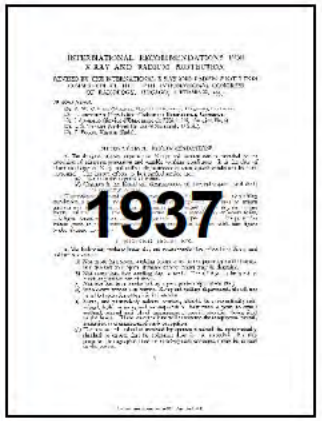
Publication	Title
ICRP Publication 153	Radiological Protection in Veterinary Practice
ICRP Publication 152	Radiation Detriment Calculation Methodology
ICRP Publication 151	Occupational Intakes of Radionuclides: Part 5
ICRP Recovery Conference Proceedings	**FREE!** Proceedings of the International Conference on Recovery after Nuclear Accidents: Radiological Protection Lessons from Fukushima and Beyond
ICRP Publication 150	Cancer Risk from Exposure to Plutonium and Uranium

General Recommendations

3y

3y

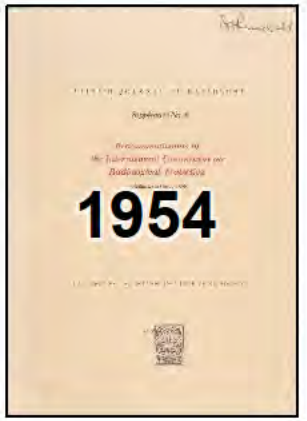
3y



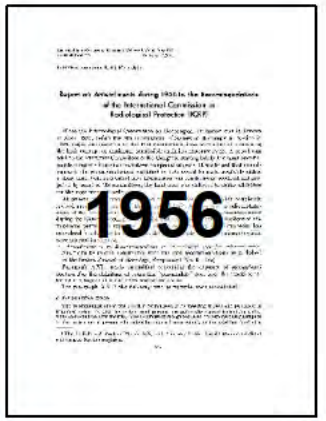
World War II

13y

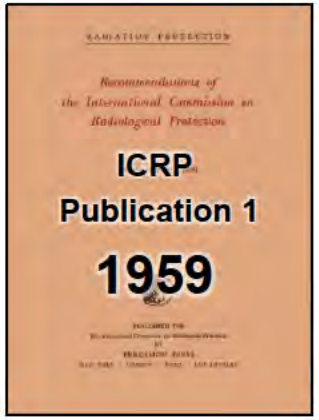
4y



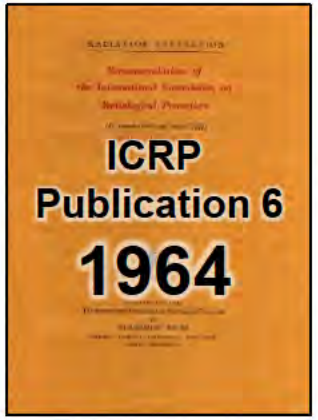
2y



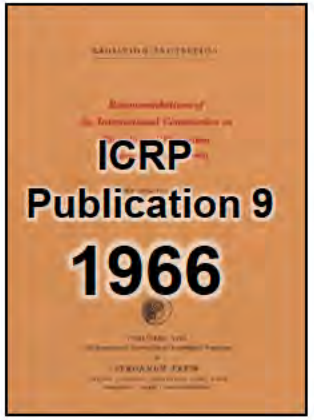
3y



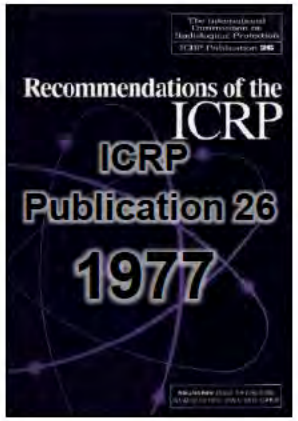
5y



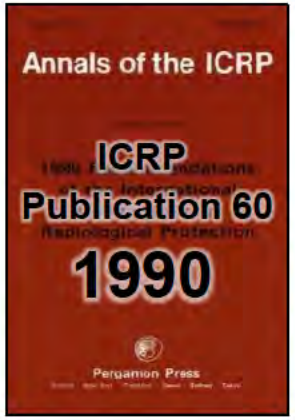
2y



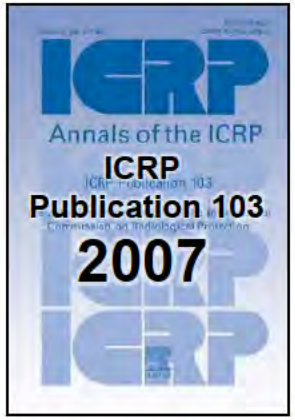
11y



13y



17y



>20y

30 Active ICRP Task Groups

TG36 Radiopharmaceutical Doses
TG91 Low-dose and Low-dose Rate Exposure
TG95 Internal Dose Coefficients
TG96 Computational Phantoms and Radiation Transport
TG97 Surface and Near Surface Disposal
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 Sources
TG108 Optimisation in Medical Imaging
TG109 Ethics in RP in Medicine
TG111 Individual Response to Radiation
TG112 Emergency Dosimetry
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
TG128 Individualisation & Stratification

Public Consultations/MC Vote in Tokyo

TG109 Ethics in RP for Medical Diagnosis and Treatment (MC vote Tokyo)

TG117 Radiological Protection in PET and PET/CT (public comments until Dec 29)

Possibly late 2023 / early 2024:

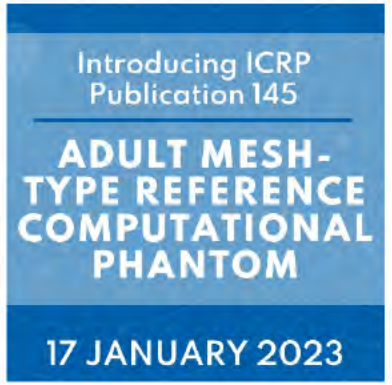
TG36 Radiation Dose to Patients in Diagnostic Nuclear Medicine (revision of P128, March 2024 MC vote for public consultation)

TG91 Radiation Risk Inference at Low-dose and Low-dose Rate Exposure for RP Purposes

TG96 Paediatric Specific Absorbed Fractions

TG113 Reference Organ and Effective Dose Coefficients for Common Diagnostic X-ray Imaging Examinations – Radiography (March 2024, MC vote for public consultation)

ICRP Online Events: Workshops, Webinars, etc. Includes all C3 task group reports during open consultation



Many more to come…

www.icrp.org/events

The Future of Radiological Protection:

What's Next?

- Consider evolution in ethics, experience, and science
- Societal expectations in shared decision-making, especially in medicine

Set systems for bidirectional feedback, learning. QA

ICRP INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Fit for Purpose

The System of Radiological Protection is robust and has performed well

however

it must adapt to address changes in science and society to remain fit for purpose

A Key Consideration: ‘Simplification’ And ‘Clarification’

The System of Radiological Protection must be:

- **Easier to understand**
- **Easier to communicate**
- **Easier to use**

Nonetheless, the underlying basis of the system must be **robust**, to handle **complex problems** and consider **complex scientific, ethical, and practical issues**

The Next Generation

ICRP has initiated a review and revision of the System of Radiological Protection, laying the groundwork for new General Recommendations to supersede the 2007 Recommendations

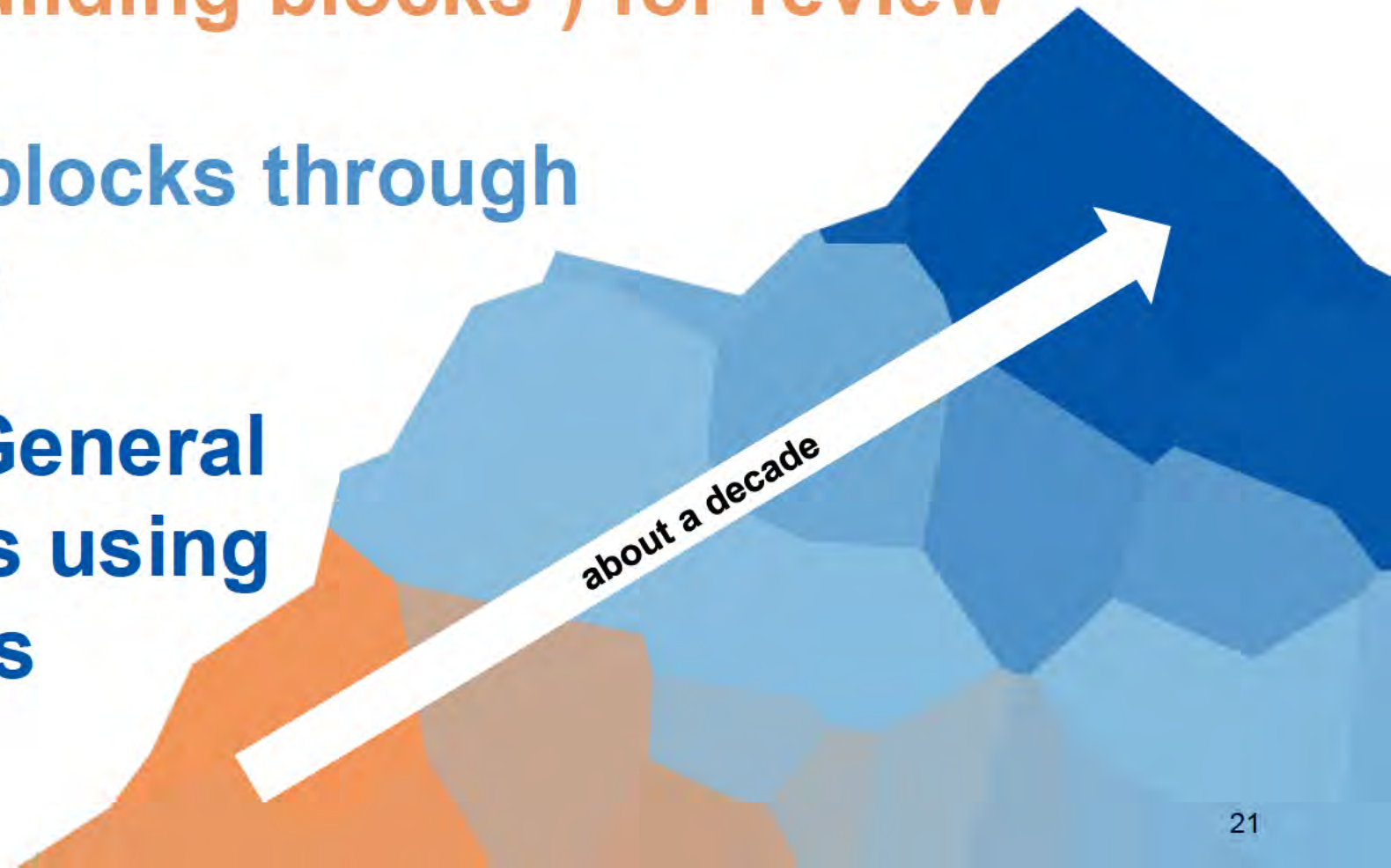
- This will be the foundation of RP standards, regulations, guidance, and practice world-wide for **the next generation**
- Cooperation and collaboration is essential, across borders and generations; involvement of **the next generation** of RP professionals is crucial

Review & Revision of the System of RP

Identify topics ('building blocks') for review

Develop building blocks through ICRP Task Groups

Prepare the next General Recommendations using the building blocks



Guiding Principles

In the review and revision of the System, ICRP is guided by a code of ethics, and further emphasises:

Solid **science & ethical values**

Inclusiveness & accessibility so everyone who wants to contribute can, and to benefit from a wide variety of perspectives

Transparency in the process

ICRP Code of Ethics

Commitment to public benefit – Act to protect humans and the environment from the harmful effects of Radiation

Independence – Act independently of governments and organisations, including industry and other users of radiation

Impartiality – Act impartially in its development of recommendations and guidance

Transparency – Engage stakeholders and strive to be transparent in actions and judgements

Accountability – Be accountable to the framework that governs the activities of a charity

Guiding Principles → Open Process

Inclusiveness • Accessibility • Transparency

- Ensure everyone who wants to contribute can do so
- Benefit from a wide variety of perspectives

Topic	Task Group	Workshop	Consult	Publish	Webinar
• Initiate Task Groups on specific topics based on feedback	• Select TG members based on open call for experts • Mentee(s)	• Present and get input on work in progress	• Open public consultation (might include workshop)	• Resolution of comments explained • Open access after 2 years	• Presentation of the published work

The Future of ICRP

14 OCT - 3 NOV 2021

On-Demand Presentations

19 - 20 OCT 2021

Live Presentations

ICRP Digital Workshop

UK Registered Charity 1166304

Purpose

Feedback & discussion on the review and revision of the System of Radiological Protection

Programme

63 presentations, live & on-demand, covering the full spectrum of topics on the System of Radiological Protection

Participation

~1500 registered from ~100 countries

~10,000 live & on-demand views

Opportunities for Q&A and chat

Results

All materials available on ICRP.org

- Summary paper (www.doi.org/10.1088/1361-6498/ac670e)

Direct impact on priorities for review & revision

Key Milestones (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

Thoughts from ICRP & invitation to contribute

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

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

Key Milestones

ICRP Workshop on the Future of Radiological Protection (Estoril, Portugal, October 2022)

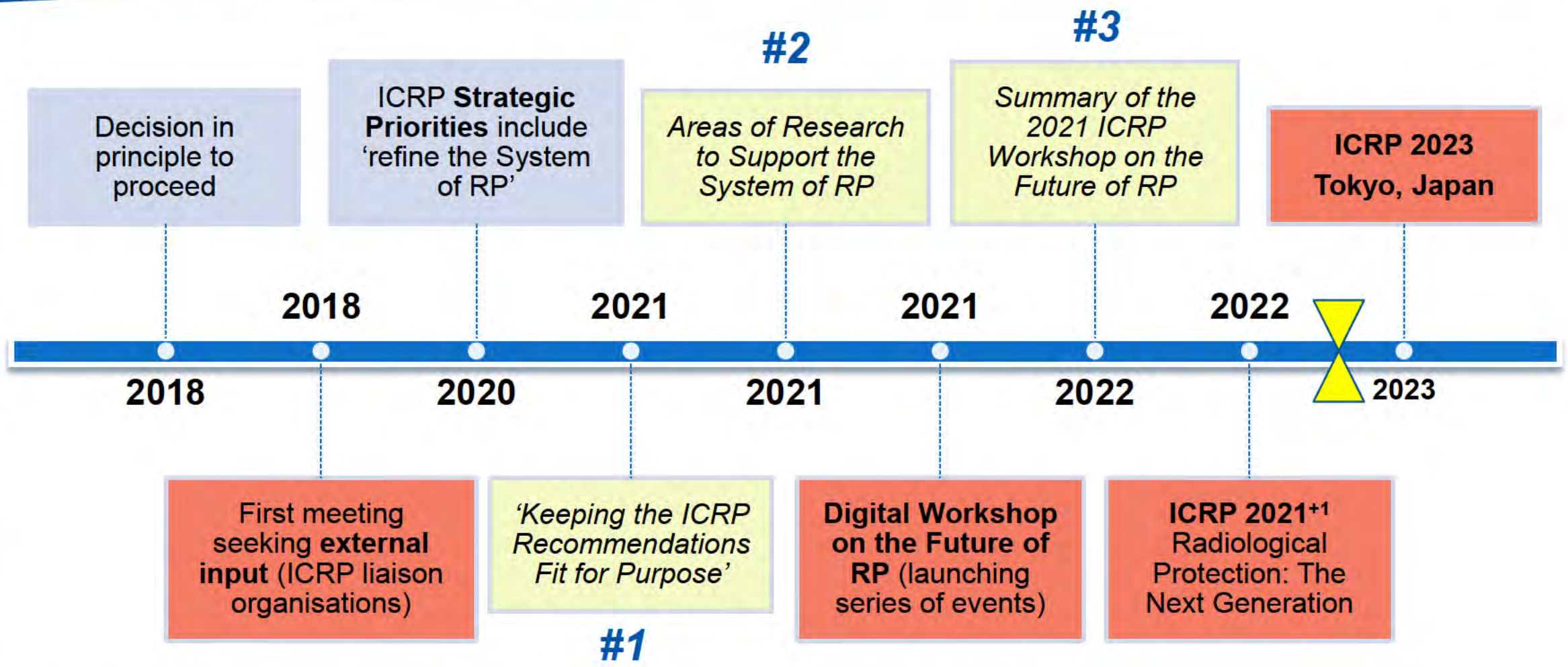
- Focus on research priorities

ICRP 2021^{+1}: ICRP Symposium on the System of Radiological Protection (Vancouver, November 2022)

- Broad review of work in progress and work to be completed in the review & revision of the System

NEXT: ICRP 2023 (Tokyo, November 2023)

Outline: So Far…

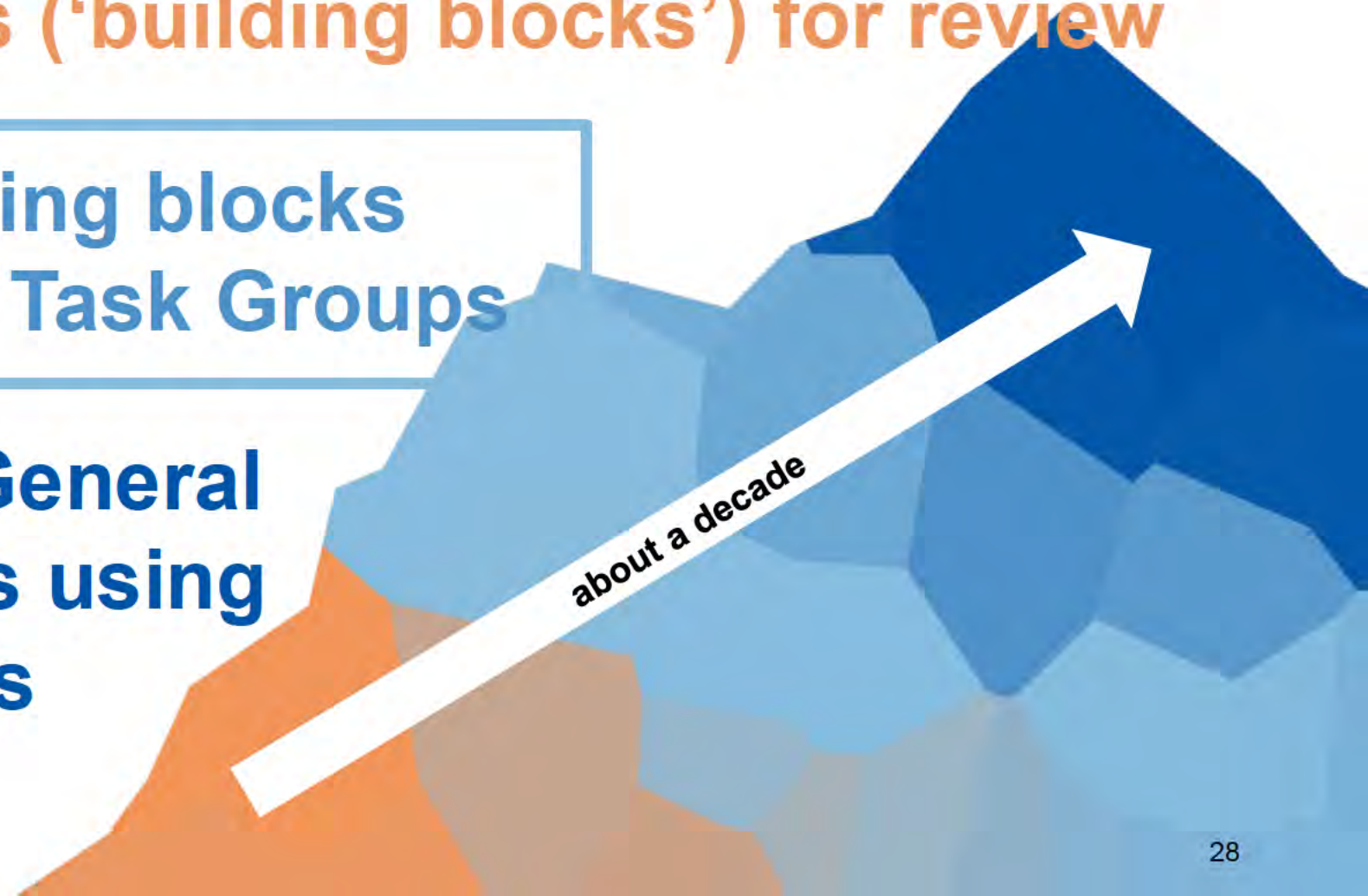


Review & Revision of the System of RP

✓ Identify topics ('building blocks') for review

→ Develop building blocks through ICRP Task Groups

Prepare the next General Recommendations using the building blocks



30 Active ICRP Task Groups

TG36 Radiopharmaceutical Doses
TG91 Low-dose and Low-dose Rate Exposure
TG95 Internal Dose Coefficients
TG96 Computational Phantoms and Radiation Transport
TG97 Surface and Near Surface Disposal
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 Sources
TG108 Optimisation in Medical Imaging
TG109 Ethics in RP in Medicine
TG111 Individual Response to Radiation
TG112 Emergency Dosimetry
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
TG128 Individualisation & Stratification

Fundamental: Effects & Risk

Selected examples only

Many cover multiple areas, but are not repeated on each page

TG91 Low-dose and Low-dose Rate Exposure

TG99 Reference Animals and Plants Monographs

TG111 Individual Response to Radiation

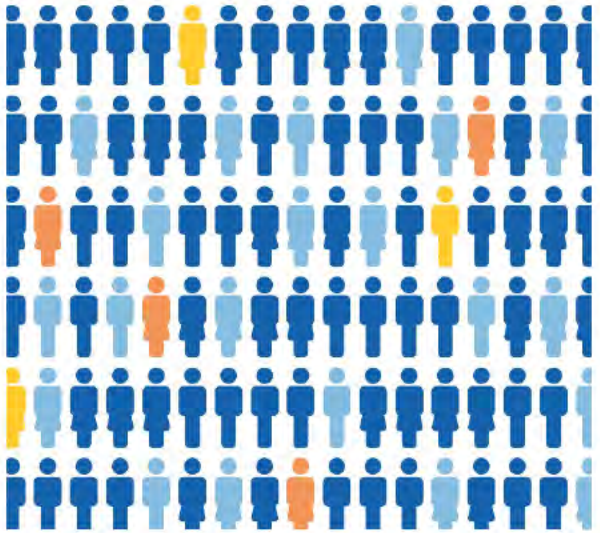
TG115 Risk and Dose for Astronauts

TG119 Diseases of the Circulatory System

TG121 Offspring and Next Generations

TG122 Detriment Calculation for Cancer

TG123 Classification Radiation-induced Effects



Fundamental: Dosimetry

Selected examples only

Many cover multiple areas, but are not repeated on each page

TG36 Radiopharmaceutical Doses

TG95 Internal Dose Coefficients

TG96 Computational Phantoms and Radiation Transport

TG99 Reference Animals and Plants Monographs

TG103 Mesh-type Computational Phantoms

TG113 Dose Coefficients for X-ray Imaging

TG115 Risk and Dose for Astronauts

TG118 RBE, Q, and w_R

Fundamental: Ethics & Concepts/Application

TG105 The Environment in the System of RP

TG108 Optimisation in Medical Imaging

TG109 Ethics in RP in Medicine

TG110 Veterinary Practice

TG114 Reasonableness and Tolerability

TG124 The Principle of Justification

TG125 Ecosystem Services

TG127 Exposure Situations and Categories

TG128 Individualisation & Stratification

Selected examples only

Many cover multiple areas, but are not repeated on each page

~18 Additional topics identified

May initiate this term (ca 2024)

- Dose limits / protection of the individual (TG128)
- Non-cancer effects beyond cardiovascular
- Sources and impacts of uncertainties (paper png)
- RP in space

May initiate early next term (ca 2025/26)

- Primary aim, human & environment objectives
- The principle of optimisation of protection
- Protection of other non-human biota
- Integration of RP of the environment
- Practical implications of ethics in RP
- Revised detriment & its application
- Dosimetry system consolidation
- Justification in medicine
- Justification and optimisation for the fetus, premature infant & neonate

May initiate late next term (ca 2027/28)

- RP in medicine (new P105)
- Education and training
- Communication
- Compendium of dose coefficients
- **Dose/risk coefficients for molecular radiotherapy**
- **Current working party on newer radiotherapies to include heavy ions, FLASH, and TAT: C3 with C1 and C2**

Approximate & subject to change

Revised General Recommendations

Role of ICRP Symposia (recordings available)

2021^{+1} First ICRP symposium after launch of review & revision

2023 **Specifically designed to directly address key fundamental topics**

2025 Structure likely similar to ICRP 2023

2027 Possible very early consideration of General Recommendations ?

2029 Possibly link to consultation on draft General Recommendations ?

VERY PRELIMINARY!

www.icrp.org

ICRP2023

TOKYO, JAPAN

6-9 NOVEMBER 2023

Venue: Grand Nikko Tokyo Daiba

3 days of live presentations

On-demand video presentations

Hybrid poster sessions

Hosted by QST ● In cooperation with JHPS & JRRS ● supported by NRA & many others

Registration and abstract submission now open

www.ICRP2023.jp

ICRP 2023

Preliminary Programme

Tuesday 7 Nov	Wednesday 8 Nov			Thursday 9 Nov
Welcome & Lindell Lecture	Atomic bombing, Suffering and Science			Clinical Potential and Prospects for Carbon Ion Radiotherapy from Physical and Biological Properties
Going Beyond Dose: Wellbeing in RP	The Next Generation of Scientists & Professionals			RP in Ion Beam and Targeted Alpha Therapy
Dosimetry for the Next General Recommendations	Stratification & Individualisation	Sustainable Development & Protection of the Environment	Classification of Effects	Radiation Detriment, Other Risk Metrics, and their Application
Communication	Exposure Categories & Situations	Tolerability & Reasonableness	Offspring & Next Generations	Effects & Dose Response: Cancer, Circulatory Disease, & Beyond
JRRS Poster Viewing	ICRP 2023 Poster Viewing			JHPS Poster Viewing
How Experience of the Fukushima Daiichi Accident is Improving RP	Radiation Emergencies	Imaging in Radiotherapy	Justification	Strengthening Expertise & Raising Public Awareness

The FUTURE of Radiological Protection

early 2030's
Next General Recommendations published

mid/late 2030's
Reflected in international standards, etc.

late 2030's and later
Reflected in national regulations, etc.

2060's ++ ???
Next-next General Recommendations ???

40 YEARS AGO

- Early personal computers
- No internet
- No smartphones
- CT scans were new technology (2% of per capita use today)
- First space shuttle
- No space tourists!

Collaboration: An Invitation to Contribute

IOPscience Journals Books Publishing Support Login

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]

– Hide full author list

Accepted Manuscript online 20 July 2021 •

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

OPEN ACCESS!

Radiation and Environmental Biophysics

Areas of Research to Support the System of Radiological Protection

https://link.springer.com/article/10.1007/s00411-021-00947-1