International Radiation Safety Standards and Systems

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Why International System?

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Bad & Good example of international systems

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Despite Standards some may do things differently, but still Standards are necessary

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Why International system?

- You work in country A and dose limit is 20 mSv/yr, another country 50 mSv, yet another 100 mSv, and also 10 mSv.. Result- confusion.
- One month leave for all occupationally exposed
- Badge over lead apron or under lead apron
- Person sitting in the room next to X-ray room wants to be labelled as "occupationally exposed"
- Separate areas for attendants in NM dept

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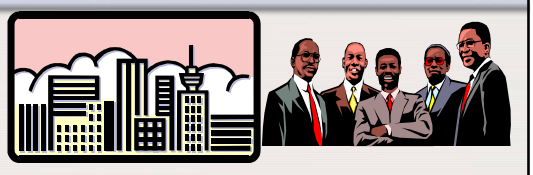
National Regulatory Authority



- How to frame regulations?….. Let these be consistent with UK…..No..No…with USA. … Oh no..it should be India, S. Africa…no Europe…
- Is there some Harmonised set of regulation?

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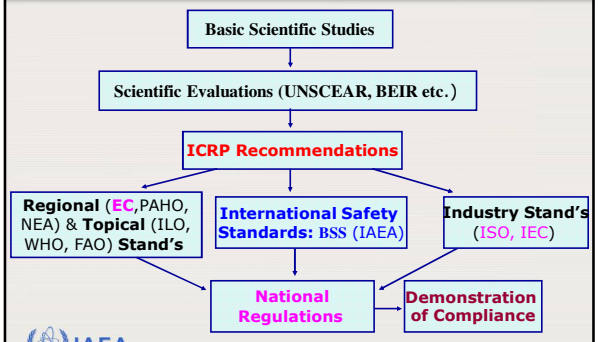
Organisations in the Cosmic Scheme



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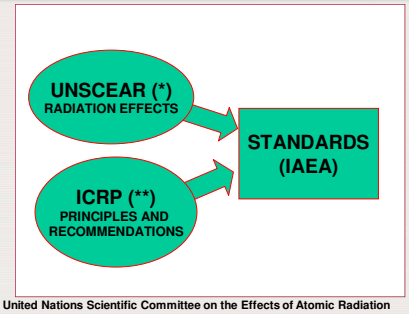
The Basis for the International Safety Standards



(*) United Nations Scientific Committee on the Effects of Atomic Radiation

(**) International Commission on Radiological Protection

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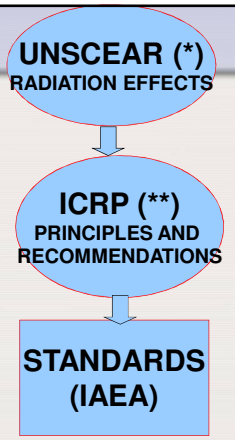

A matter of interpretation

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International Radiation Safety Standard

- Is it mandatory?
  - No
- Then what is legally applicable?
  - National. In Europe European Directive
- What is the role of International Standards?
  - Robust, sound standards that countries can adopt
  - Where national regulations are lacking, international standards provide acceptable system for legal authorities
  - Since it is based on WIDE consensus, most countries tend to adopt it. Essential for seeking IAEA assistance

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What people know MOST

ICRP--- Dose limits
IAEA--- Iran, Iraq actions
UNSCEAR---??

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What you think that they do?

ICRP
- Establishes principles of radiation protection
- Provides protection philosophy

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- Has programs for promoting
  - Nuclear medicine, radiotherapy and medical physics
  - Radiation protection of patients

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UNSCEAR

- UNSCEAR was established by the General Assembly of the United Nations in 1955.
- Its mandate in the United Nations system is to assess and report levels and effects of exposure to ionizing radiation.
- Governments and organizations throughout the world rely on the Committee's estimates as the scientific basis for evaluating radiation risk and for establishing protective measures.

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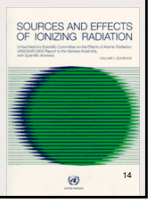
UNSCEAR

- The original committee was composed of senior scientists from 15 designated UN Member States, namely Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, Egypt, France, India, Japan, Mexico, Sweden, the UK, the USA and the USSR.
- Currently 21 countries
- Last report 2010
- HQ in Vienna
- Meeting once every year



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ICRP	IAEA
Independent Charity	Independent international organisation under UN family
Established to 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	Pillars: Safety and Security; Science and Technology; and Safeguards and Verification.

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INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Main Commission

C1 | **C 2** | **C 3** | **C 4** | **C 5**

Task Groups (TG)
Working Parties (WP)

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INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Chairperson
Dr. Claire Cousins, UK

Chris Clement
Sc Secretary

Main Commission *Chair + 12 members*

C1- Radiation Effects *Dr William F Morgan, US*

C2- Doses from Radiation Exposure *Dr H Menzel, CH*

C3- Protection in Medicine *Dr Eliseo Vano, Spain*

C4- Application of ICRP Recommend. *Dr Jacques Lochard, FR*

C5-Prot. of the Environment *Prof J Pentreath, UK*

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Membership of the International Commission on Radiological Protection

as of 2010 February 02

Main Commission

Claire Cousins (Chair)
Abel Julio González (Vice-Chair)
R. Julian Preston (C1 Chair)
Hans-Georg Menzel (C2 Chair)
Eliseo Vaño (C3 Chair)
Jacques Lochard (C4 Chair)
Jan Pentreath (C5 Chair)
John Boice
John Cooper
Jai-Ki Lee
Ohtsura Niwa
Zi Qiuang Pan
Natallya Shandala

Secretariat

Christopher Clement (Scientific Secretary)
Lynn Lemaire (Executive Assistant)

Committee 1 Effects

R. Julian Preston (Chair)
Jolyon Hendry (Secretary)
Tamara Azizova
Ranajit Chakraborty
Sarah Darby
William Morgan
Colin Muirhead
Nori Nakamura
Werner Rühm
Sisko Salomaa
Alice Sigurdson
Fiona Stewart
Dan Stram
Margot Tirmarche
Richard Wakeford
Ping-Kun Zhou

Committee 2 Doses

Hans-Georg Menzel (Chair)
John Harrison (Secretary)
Mikhail Balonov
David Bartlett
Vladimir Berkovski
Wesley Bolch
Roger Cox
Günther Dietze
Keith Eckerman
Akira Endo
Nobuhito Ishigure
Richard Leggett
Joyce Lipsztein
Jizeng Ma
Francois Paquet
Nina Petoussi-Henß
Ambika Sahai Pradhan

Committee 3 Medicine

Eliseo Vañó (Chair)
Madan Rehani (Secretary)
Katrine Åhlström Riklund
Mario Baeza
Jean-Marc Cosset
Lawrence Dauer
Igor Gusev
John Hopewell
Pek-Lan Khong
Pedro Ortiz Lopez
Sören Mattsson
Donald Miller
Hans Ringertz
Marvin Rosenstein
Yoshiharu Yonekura
Baorong Yue

Committee 4 Implementation

Jacques Lochard (Chair)
Jean-François Lecomte (Sec)
Peter Burns
Donald Cool
Michiaki Kai
Hua Liu
Senlin Liu
Sigurður Magnússon
Pedro Carboneras Martinez
Gustavo Massera
Ann McGarry
Khammar Mrabit
Serguy Shinkarev
Jane Simmonds
Alex Simanga Tsela
Wolfgang Weiss
Werner Zeller

Committee 5 Environment

Jan Pentreath (Chair)
Kathryn Higley (Secretary)
Francois Bréchignac
David Copplestone
Almudena Real Gallego
Carl-Magnus Larsson
Gerhard Pröhl
Kazuo Sakai
Per Strand

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ICRP Committee 3
Protection in medicine

VANO Eliseo (Spain) Chairman
COSSET Jean Marc (France) Vice-Chairman
REHANI Madan (IAEA) Secretary

ÅHLSTRÖM RIKLUND Katrine (Sweden)
BAEZA Mario (Chile)
DAUER Lawrence (USA)
GUSEV Igor (Austria)
HOPEWELL John W (UK)
KHONG Pek Lan (Hong Kong, China)
MATTSSON Sören (Sweden)
MILLER Donald (USA)
ORTIZ LOPEZ Pedro (Spain)
RINGERTZ Hans (Sweden)
ROSENTEIN Marvin (USA)
YONEKURA Yoshiharu (Japan)
YUE Baorong (China)

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Ethical Basis for the ICRP System

Utilitarian ethics *Judge actions by the consequences*	Deontological* ethics *Some duties are imperative*
Justification *Do more good than harm*	
Optimisation *Maximise good > harm*	
	Limitation *No individual unduly harmed*

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**how* people accomplish their goals(e.g. by duty, obligation)

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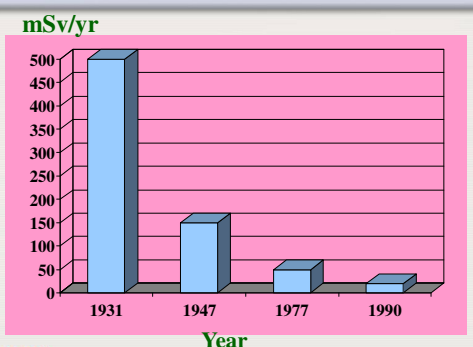
Changes in occupational Dose Limit (ICRP)



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Past ICRP Recommendations

- **At first**: Occupational exposures in medicine
  - **Avoid deterministic harm**
  - 1928: Working hours limited (~1000 mSv)
  - 1934: ~500 mSv
- Then: Occupational exposures
  - 1950: ~150 mSv
- Now: Exposures
  - ...**and minimise stochastic harm**
  - 1956: 50 mSv; 5 mSv
  - 1959: Publ. 1; 1964: Publ. 6
  - 1966: Publ. 9, reduce doses if readily achievable
  - 1977: Publ. 26, ...if reasonably achievable
  - 1990: Publ. 60: 20 mSv, 1 mSv

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ICRP INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

ICRP ref 4825-3093-1464

Statement on Tissue Reactions

Approved by the Commission on April 21, 2011

- Lens of the eye, threshold in absorbed dose is now considered to be 0.5 Gy (against 0.5 to 2 for detectable opacities and 5 for visual impairment) .
- Occupational Exposure Lens of Eye Limit
  - **20 mSv in a y** (against 150), averaged over defined periods of 5 y, with no single y exceeding 50 mSv

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ICRP INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

(4) Although uncertainty remains, medical practitioners should be made aware that the absorbed dose threshold for circulatory disease may be as low as 0.5 Gy to the heart or brain. Doses to patients of this magnitude could be reached during some complex interventional procedures, and therefore particular emphasis should be placed on optimisation in these circumstances.

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Tissue Weighting factor W_T (ICRP 103 vs 60)

- Breast, gonads, and the treatment of remainder tissues.
- The W_T changes in question are:
  - Breast (new 0.12, old 0.05); Increase by factor 2.4
  - gonads (new 0.08, old 0.20); Decrease by factor 2.5
  - remainder tissues (new 0.12, old 0.05 using a new additive system)

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2007 recommendations

Tissue weighting factor for breast increased from 0.05 to 0.12 (2.4 times, ⇧ by 140%) and for gonads decreased from 0.2 to 0.08, by ≈ ⇩ 60%

Remainder tissues (new 0.12, old 0.05 using a new additive system)

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The Genetic Risk Estimate Is Smaller, But…

Gonad shielding is still imperative in order to keep doses ALARA !

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Implementation Takes Time

- ICRP 1977 Recommendations
  - International standards 1984
    - National standards ~1989
- ICRP 1990 Recommendations
  - International standards 1996
    - National standards ~2000
- ICRP 2007 Recommendations
  - International standards 2012
    - …national standards after 2014?

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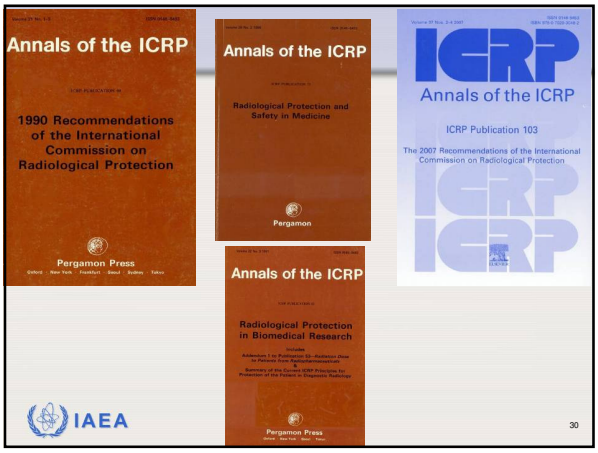

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European Commission Projects

MEDRAPET

Medical Radiation Protection EDUCATION AND TRAINING

April 21-23, 2012
European Workshop on education and training in medical radiation protection
in Athens/Greece

Workshop Presentations

CONTACT

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Guidelines on Medical Physics Expert Project
TREN/09/NUCL/SI2.549828

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Phone: +34 913941551, Fax: +34 913941675, email: eec@med.ucm.es
http://portal.ucm.es/web/medical-physics-expert-project

IPEM

Welcome. Objectives and structure of the EC Guidelines on Medical Physics Expert project

Eduardo Guibelalde

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Qualification Framework for the Medical Physics Expert (MPE) in Europe

MPE: "An individual having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure, whose competence to act is recognized by the Competent Authorities" (Revised BSS)

The Qualifications Framework is based on the European Qualifications Framework (EQF). In the EQF learning outcomes are defined in terms of Knowledge, Skills, Competences (KSC) (European Parliament and Council 2008/C 111/01)

EDUCATION

EQF Level 6 (e.g., Bachelor with 180 - 240 ECTS) (i)

Physics or equivalent (ii)

EQF Level 7 (e.g., Master with 90 - 120 ECTS) (iii)

Medical Physics or equivalent. (iv)

CLINICAL TRAINING

To **Medical Physicist** (v)

Accredited residency based training in the specific area/s of Medical Physics* for which the candidate seeks recognition as Medical Physicist. The duration of this training is *two* full-time year equivalents for the *first* area of Medical Physics, plus *one* further full-time year equivalent for *each* additional area. (vi)

EXPERIENCE and CPD

To EQF Level 8 (vii)

Advanced experience and CPD in the specific area/s of Medical Physics for which the candidate seeks recognition as MPE. The duration would be a further *two additional full-time year equivalents beyond* the level of Medical Physicist for the *first* area of Medical Physics, plus *one* further full-time year equivalent for *each* additional area. (viii)

RECOGNITION

By Competent Authorities as MPE in specific area/s of Medical Physics (ix)

RE-CERTIFICATION

5 year CPD cycle (x)

* Diagnostic and Interventional Radiology, Nuclear Medicine, Radiation Oncology

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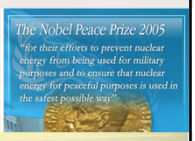
- Headquarter in Vienna
- 2400 staff from> 90 countries
- Director General, 6 Deputy DG, Directors, SH, UH



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IAEA- Development of Standards

- The IAEA is the world´s center of cooperation in the nuclear field.
- It was set up as the world´s "Atoms for Peace" organization in 1957 within the United Nations family.

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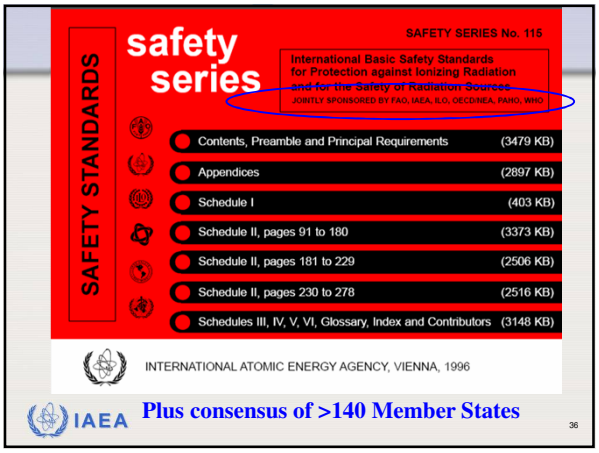

IAEA **Plus consensus of >140 Member States**

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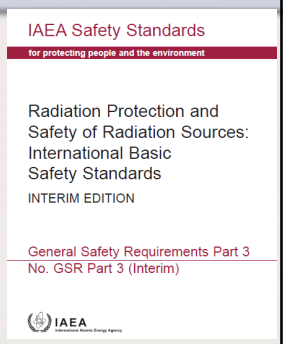
International BSS

- **Most important document for Member States of the IAEA pertaining to radiation safety regulatory requirements**



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Requirements

- Governments- what they are supposed to do
- Regulatory bodies
- Licensees
- Professional bodies, e.g. medical physics
- Safety Guides and Safety reports- to help in implementation of requirements

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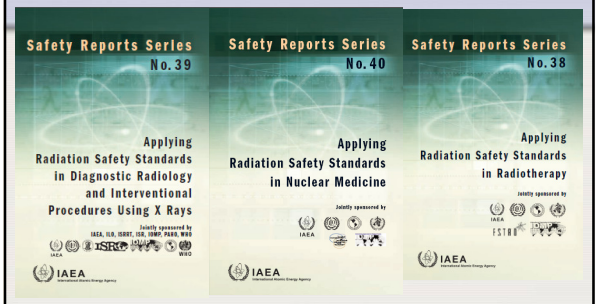

http://rpop.iaea.org

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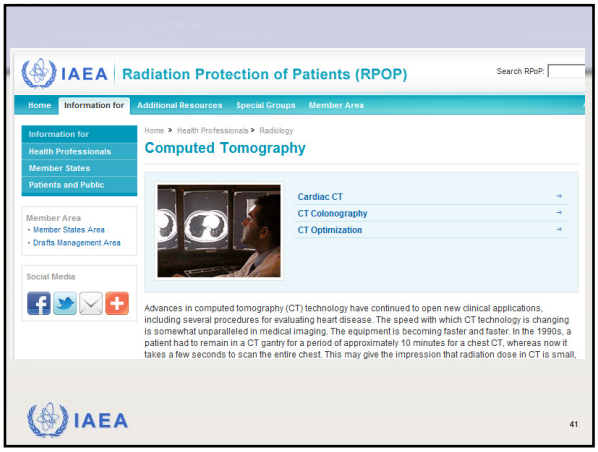
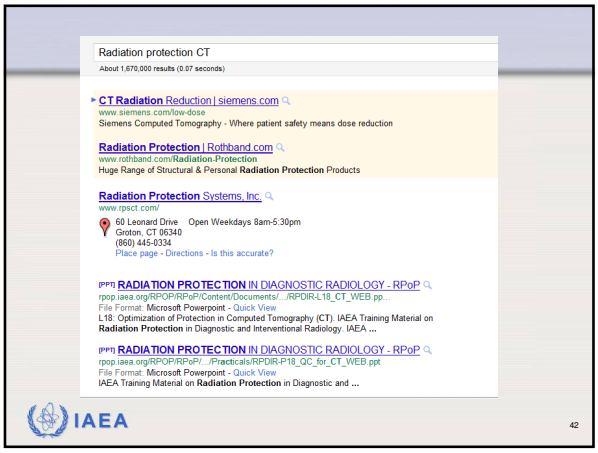
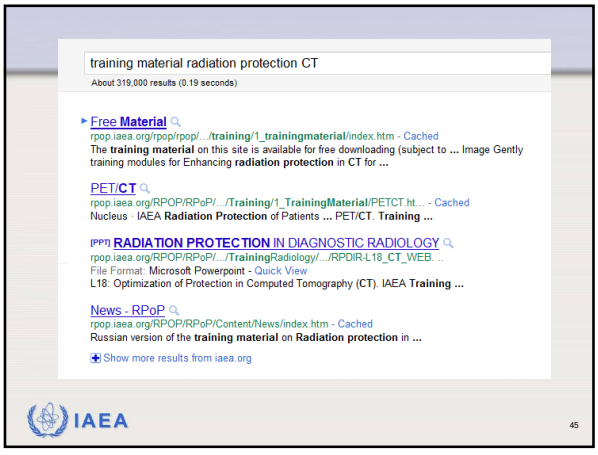
10 million hits/y
≈ 200,000 visits/y, 190 countries





Is there information from the IAEA for PATIENTS?



New terms

- Distinguishing the roles of the “referrer” and the “doer”, namely:
  - *Referring medical practitioner*
  - *Radiological medical practitioner*

    (Note: these can be the same person, e.g. a dentist, a radiation oncologist)
- Medical physicist (based on IOMP definition)
- Medical radiation technologist
  - Radiographer,…

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Key players

- Crucial to radiation protection in medical exposure
  - Radiological medical practitioner
  - Medical physicist
  - Medical radiation technologist
  - Radiopharmacist
- But who is such an expert?
  - Education, training & competence
  - Specialization
  - Formal recognition

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Key players, continued

- All definitions have a similar format:
  - A health professional, with education and specialist training in ……., competent to …… .
- Explanatory note to each definition:
  - Competence of persons is normally assessed by the Member State by having a formal mechanism for registration, accreditation or certification of ….
  - Member States that have yet to develop such a mechanism need to assess …. based either on international accreditation standards or standards from another country ….

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Revised BSS & the medical physicist

- The MP has a mandated role in:
  - Therapeutic uses of radiation:
    - The requirements for calibration, dosimetry and QA, including the acceptance and commissioning of medical radiological equipment
      - Are fulfilled by or under the supervision of a medical physicist
  - Diagnostic uses & image-guided interventional procedures
    - The requirements for imaging, calibration, dosimetry and QA, including the acceptance and commissioning of medical radiological equipment
      - Are fulfilled by or under the oversight of or with the documented advice of a medical physicist
      - Whose degree of involvement is determined by the complexity of the radiological procedures and the associated radiation risks

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Principles of radiation protection for medical exposure

- Justification
  - Expanded in line with ICRP 73, 103
  - Responsibilities assigned
- Optimization
  - Much technical detail removed (to go into SG)
  - Medical physicist has a major role

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Optimization of protection

- Calibration
  - Medical physicist assigned responsibility
- Dosimetry of patients
  - Medical physicist assigned responsibility
- Diagnostic reference levels (DRLs)
  - Strengthened through link made to dosimetry of patients requirements

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Level 3 justification

- The justification of medical exposure for an individual patient shall be carried out through consultation between the radiological medical practitioner and the referring medical practitioner, as appropriate,….

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Does BSS recognize Medical Physicist?

YES

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Medical Physicist

A health professional,

- with specialist education and training in the concepts and techniques of applying physics in medicine, and
- competent to practise independently in one or more of the subfields (specialties) of medical physics.

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Education and Training Requirements

What is responsibility of the Government?

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Governments Responsibilities

The government shall ensure that requirements are established for:

- (a) education, training, qualification and competence in protection and safety of all persons engaged in activities relevant to protection and safety;
- (b) the formal recognition of qualified experts;
- (c) the competence of organizations that have responsibilities relating to protection and safety.

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Responsibilities of Regulatory bodies

- **Shall ensure the application of the requirements for education, training,**
- **Qualification and competence in protection and safety of all persons engaged in activities relevant to protection and safety**.

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Responsibilities of principal parties

- The relevant principal parties and other parties having specified responsibilities in relation to protection and safety shall ensure that all **personnel engaged in activities relevant to protection and safety have appropriate education, training and qualification** so that they understand their responsibilities and can perform their duties competently, with appropriate judgement and in accordance with procedures.

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Is there a requirements for specialization?

Yes, this is "New" in revised BSS

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- **The regulatory body shall require that health professionals with responsibilities for medical exposure are specialized in the appropriate area and that they meet the requirements for education, training and competence in the relevant specialty.**

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Who should assess competence?

- Competence of persons is normally assessed by the State by having a formal mechanism for registration, accreditation or certification of medical physicists in the various specialties (e.g. diagnostic radiology, radiation therapy, nuclear medicine).

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- States that have yet to develop such a mechanism would need to assess the education, training and competence of any individual proposed by the licensee to act as a medical physicist and to decide, on the basis either of international accreditation standards or standards of a State where such an accreditation system exists, whether such an individual could undertake the functions of a medical physicist, within the required specialty.

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Recap

- Why international system?
- Which parties are involved?
- Consensus of >140 members states, besides co-sponsors
- ICRP, UNSCEAR, IAEA
- Main points in international BSS for medical physicists

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Thank You
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