Current international activities in the field of radiation protection dosimetry and calibrations

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Radiation protection dosimetry

Aim is to

• estimate radiation exposure (and potential induced risk)
• assure compliance with the dose limits (ICRP 103:2007).

Internal dosimetry excluded from this presentation.
How to do accurate dosimetry

• We need appropriate
  – quantities
  – equipment
  – calibrations
  – measurements.

ICRU: International Commission on Radiation Units and Measurements
ICRP: International Commission on Radiological Protection
ISO: International Organization for Standardization
IAEA: International Atomic Energy Agency
Physical quantities

• Measurable
• Point quantity
• Traceable to primary standards
• Air kerma $K_a$ ...(ICRU 85a:2011)

Absorbed doses in the body depend
• Radiation quality (source, spectra)
• Irradiation geometry
• Individual characteristics
Protection quantities

Physical quantities

Protection quantities

ICRP/ICRU adult reference phantoms in ICRP 110:2009

• Used for dose limits (ICRP 103:2007)
• Current protection quantities – based on ICRP 103:2007 and ICRP 116:2010
  – use adult reference phantoms defined in ICRP 110:2009
• Averaged “risk related” quantities
• Cannot be measured

Effective dose $E$...
Protection quantities

- How to move from Physical quantities to Protection quantities?
  - Possible if exposure parameters (spectra, geometry) are known.
  - Not practical
A step toward protection quantities

- Defined in ICRU soft tissue
- Defined in a hypothetical field (expanded/aligned)

"Measurable"

Personal dose equivalent $Hp(d)$…

Rationale for update of operational quantities

• Current definitions are 30 years old.
• Protection quantities have changed.
• Application of the quantities has changed
  – New quantity for lens of the eye.
  – Range of particles and energies has extended.

Future activity: Potential change of the operational quantities. ICRU/ICRP draft report was proposed but not yet published.
Equipment

Area monitoring

Survey meters

Individual monitoring

Personal dosimeters
Need for calibration

Country 1, Institute 1

Country 1, Institute 2

Country 2, Institute 1

Country 2, Institute 2

- Measurements should be comparable.
- Equipment needs a traceable calibration
Current activity: Primary standards updated according to ICRU 90:2016 recommendations.

- Conversion coefficients defined only for reference radiation fields.

Current activity: Comparison programme also available for radiation protection level.

Current activity: DOLNET: https://ssdl.iaea.org/

IAEA acts as central laboratory

86 SSDLS

5 International organizations

16 PSDLS

73 countries

IAEA/WHO SSDL network
Measurements: area monitoring

- Worst case scenario (spectra, geometry, individual)
Measurements: Individual monitoring

- “Real” geometry + uncertainties.
- Real-time reading
- Spectral information?
Individual characteristics
Future

• Quantities:
  – update of operational quantities.

• Equipment:
  – real-time reading, locating
  – simulations and mapping
  – spectral measurements, “black boxes”.

• Calibrations:
  – cooperation.

• Measurements
  – improved technology (accuracy ↑), increased awareness.
IAEA activities...

• Dosimetry Laboratory services
  – SSDL Network https://ssdl.iaea.org

• Websites:
  – Human Health Campus: www.humanhealth.iaea.org
  – RPOP: www.iaea.org/resources/rpop


• Technical cooperation

• Training, conferences
  – Next week IDOS2019!
References

International Commission on Radiation Units and Measurements, ICRU

International Commission on Radiological Protection, ICRP

International Organization for Standardization, ISO

International Atomic Energy Agency, IAEA:
Thank you!