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

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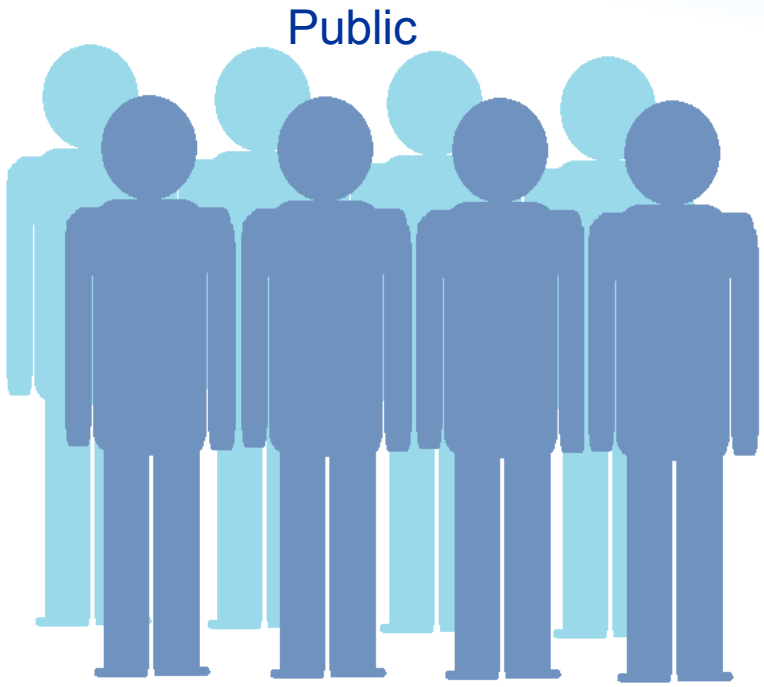
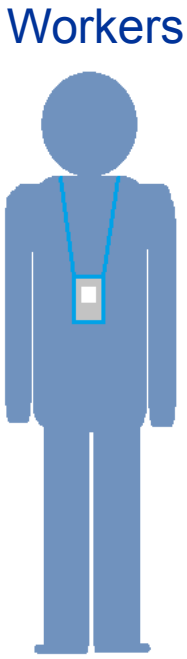
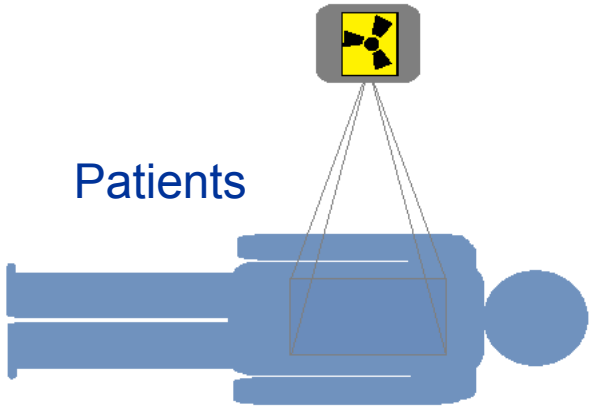
Radiation protection dosimetry







Aim is to

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

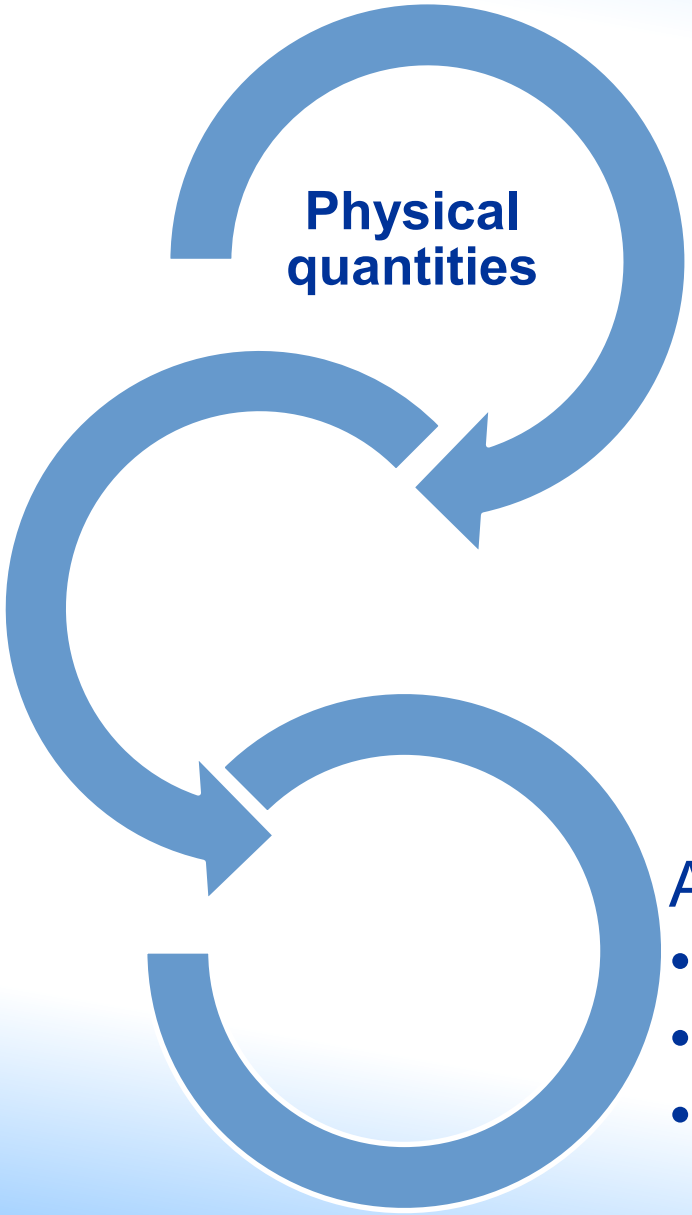
Internal dosimetry excluded from this presentation.

How to do accurate dosimetry

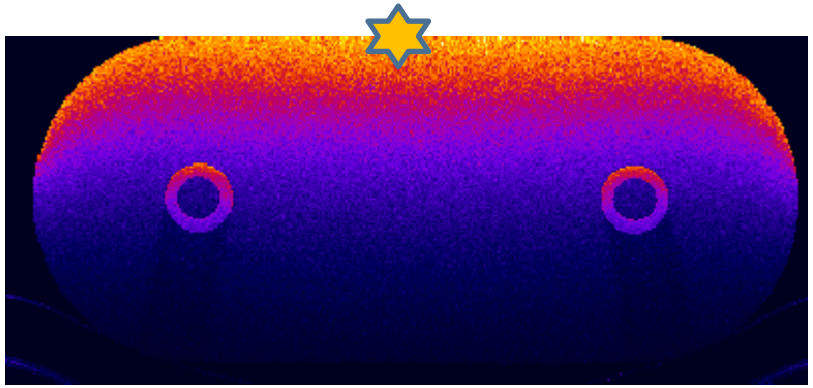
- We need appropriate
  - quantities
  - equipment
  - calibrations
  - measurements.

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



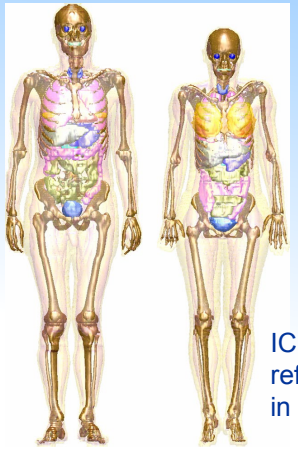
- Measurable
- Point quantity
- Traceable to primary standards
- *Air kerma K_a…(ICRU 85a:2011)*



Absorbed doses in the body depend

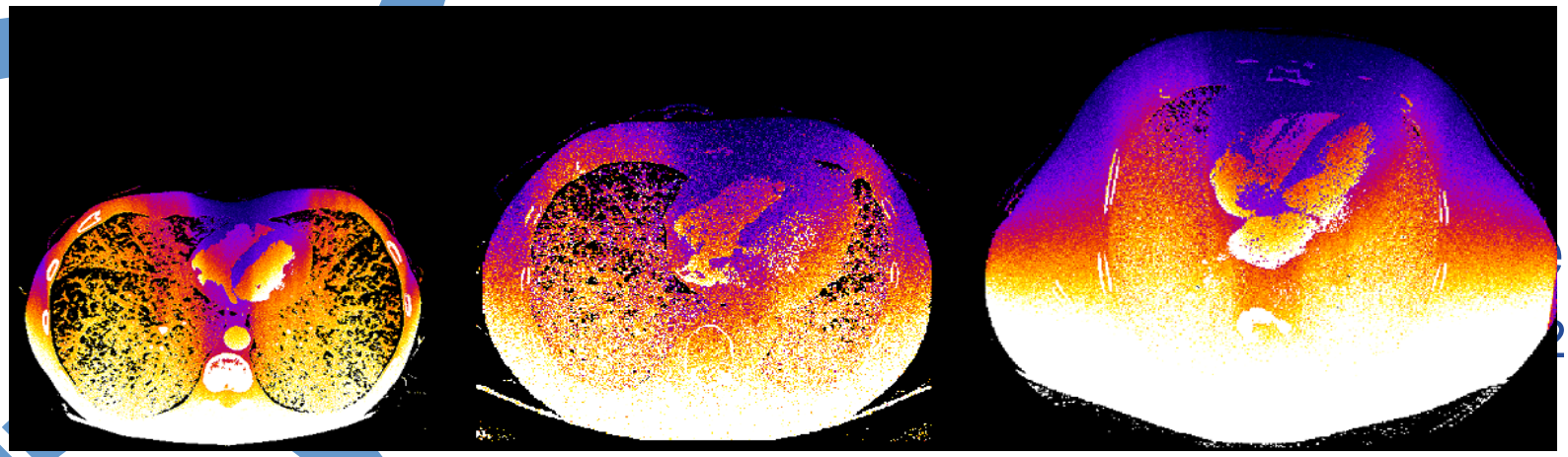
- Radiation quality (source, **spectra**)
- Irradiation **geometry**
- **Individual** characteristics

Protection quantities



ICRP/ICRU adult reference phantoms in ICRP 110:2009

Physical quantities



2010

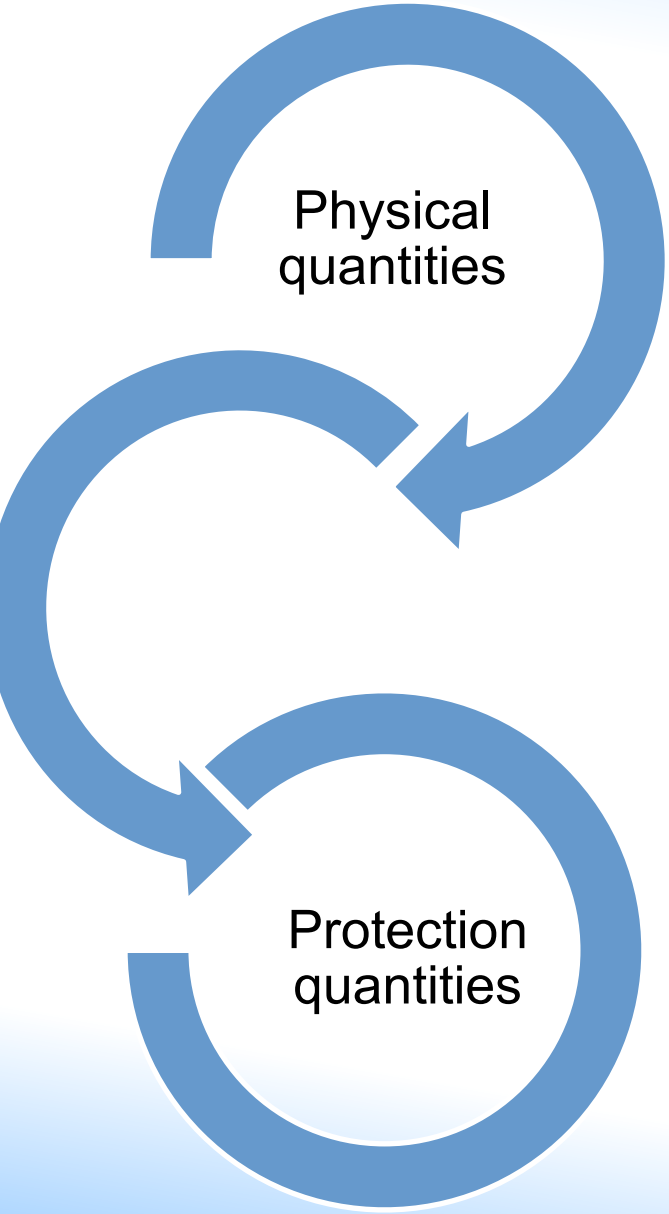
ICRP 110:2009

Protection quantities

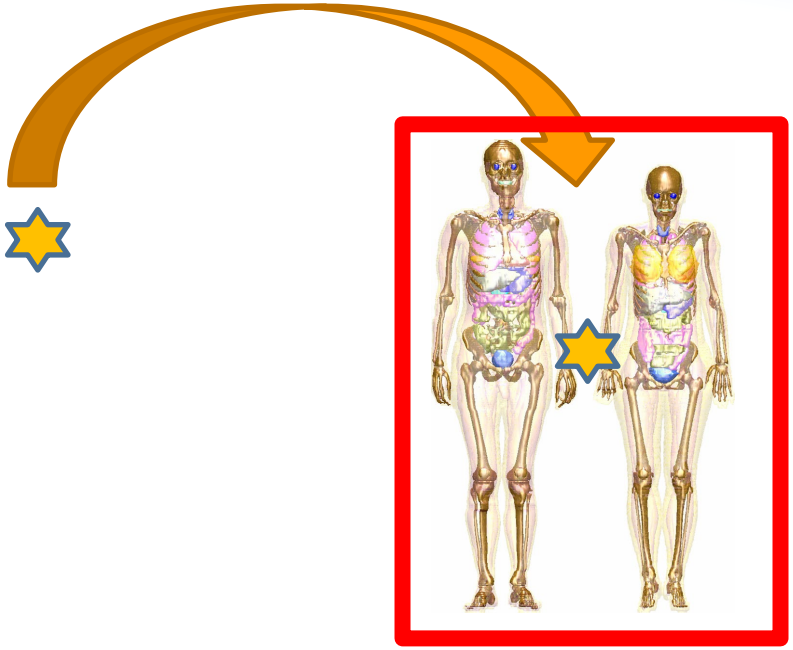
- Averaged “risk related” quantities
- Cannot be measured

Effective dose E…

Protection quantities



- How to move from Physical quantities to Protection quantities?

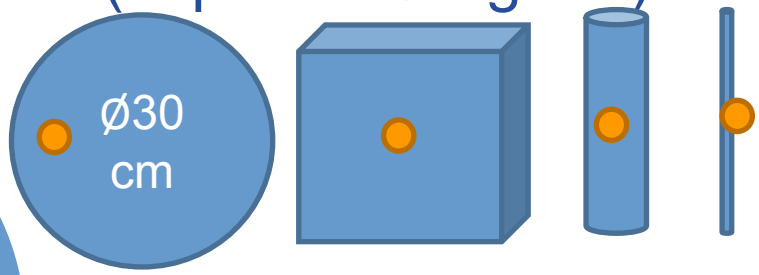


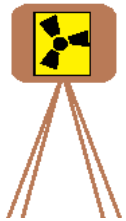
- Possible if exposure parameters (spectra, geometry) are known.
- Not practical

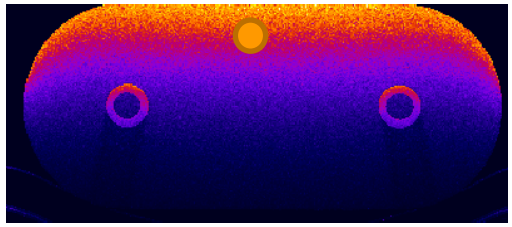
Operational quantities

- A step toward protection quantities

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







- "Measurable"

Personal dose equivalent Hp(d)…

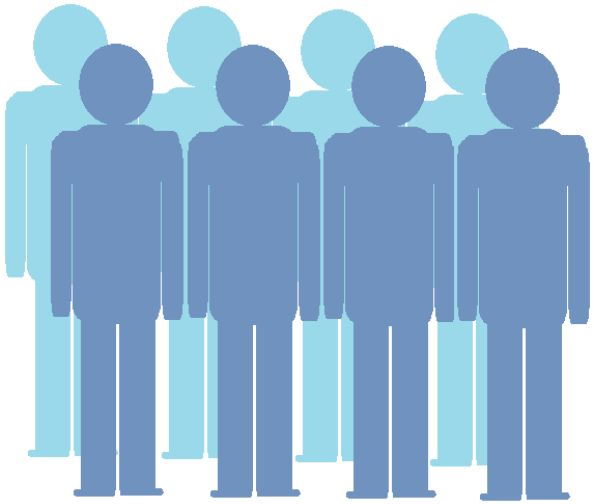
(ICRU 39:1985, 47:1992, 51:1993)

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 considered.

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

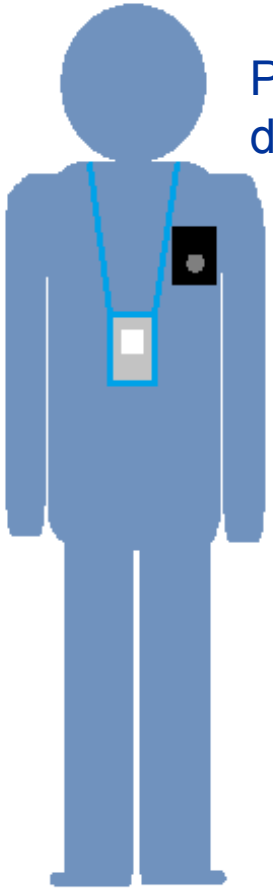
Equipment



Area monitoring

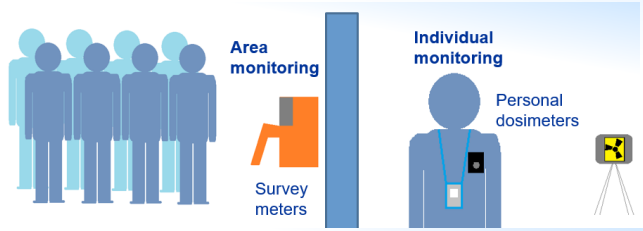
Survey meters

Individual monitoring

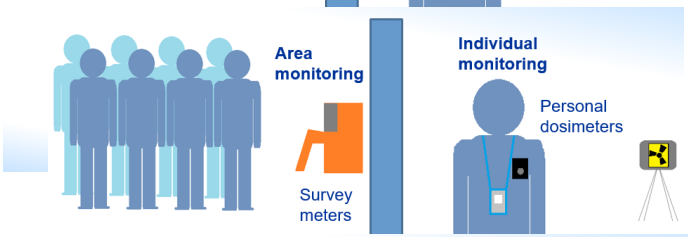


Personal dosimeters

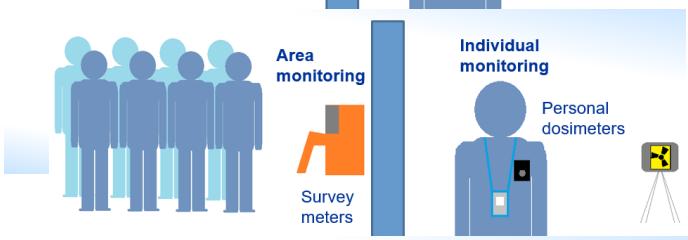
Need for calibration



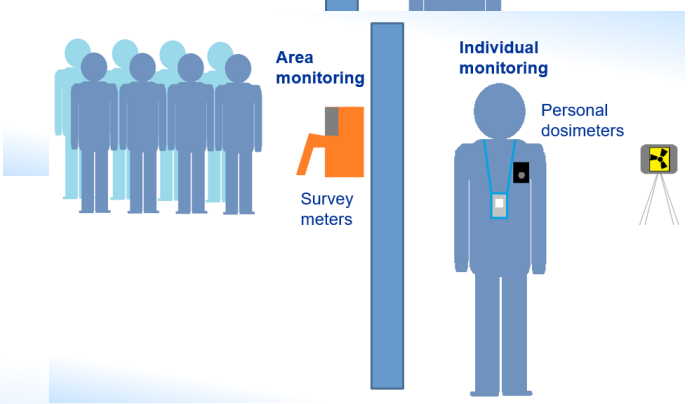
Country 1, Institute 1



Country 1, Institute 2



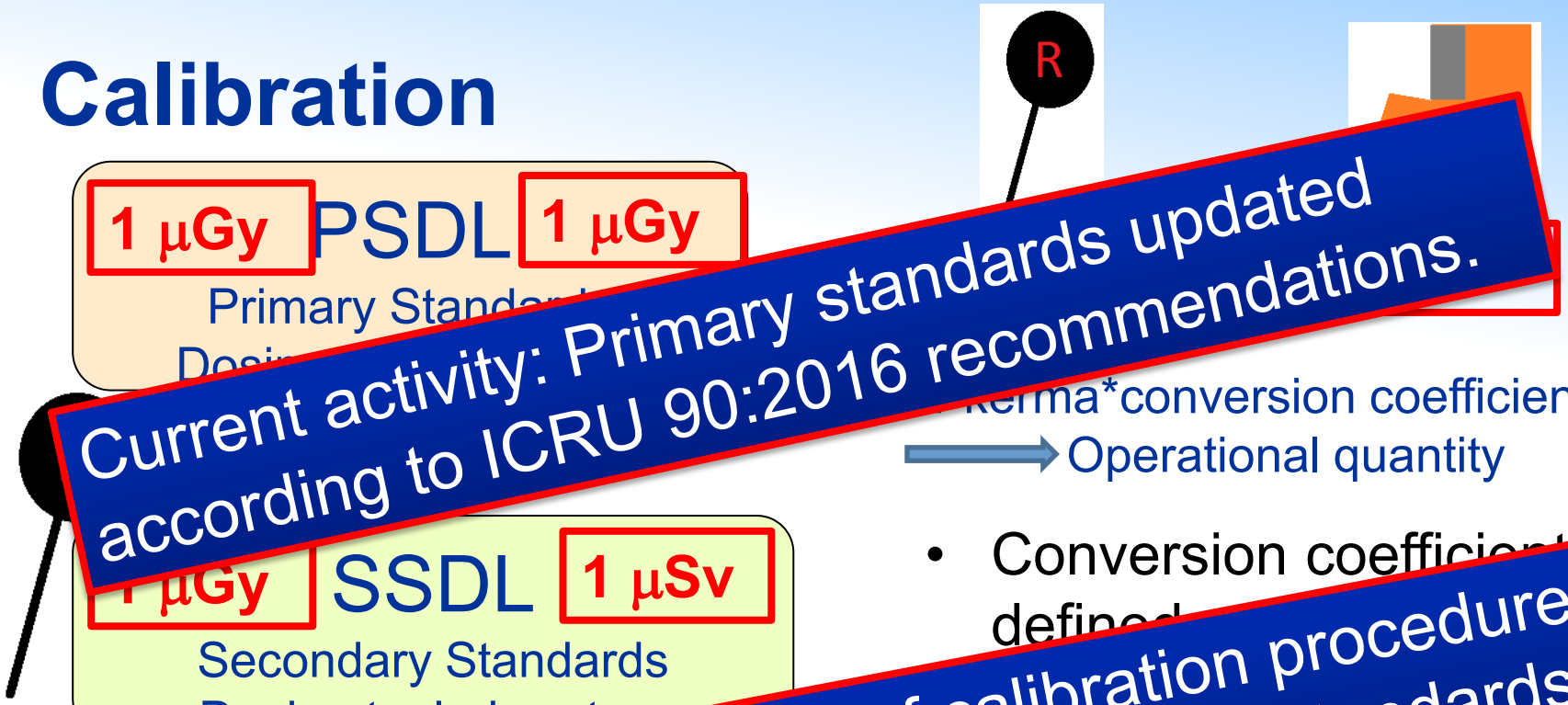
Country 2, Institute 1



Country 2, Institute 2

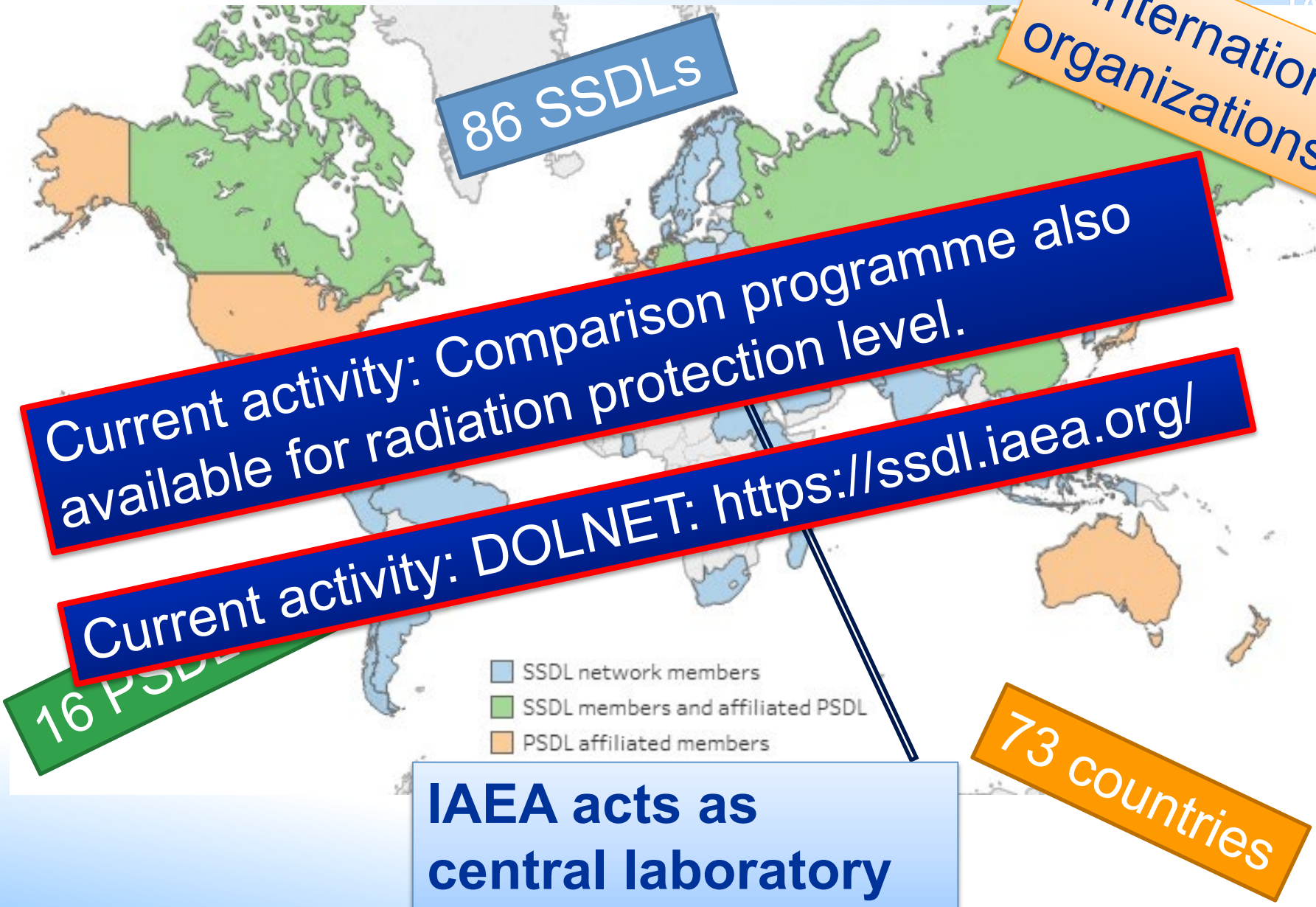
- Measurements should be comparable.
- Equipment needs a traceable calibration

Calibration

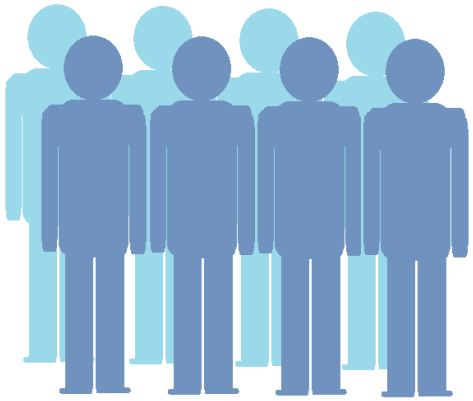


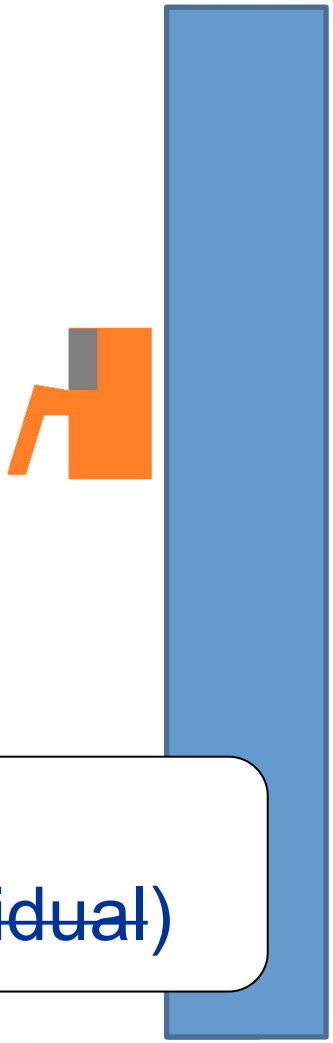
- Conversion coefficient defined
- Cs-137
- +other radiation qualities (ISO4037:2019).

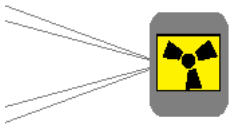
IAEA/WHO SSDL network

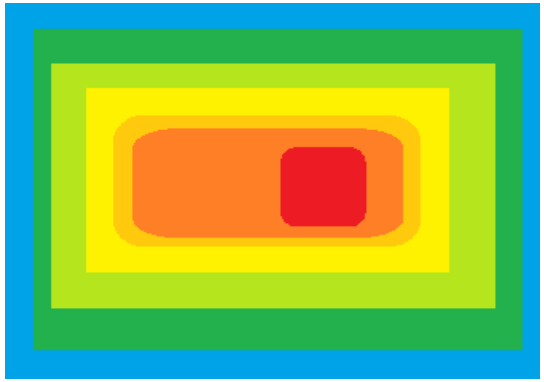


Measurements: area monitoring



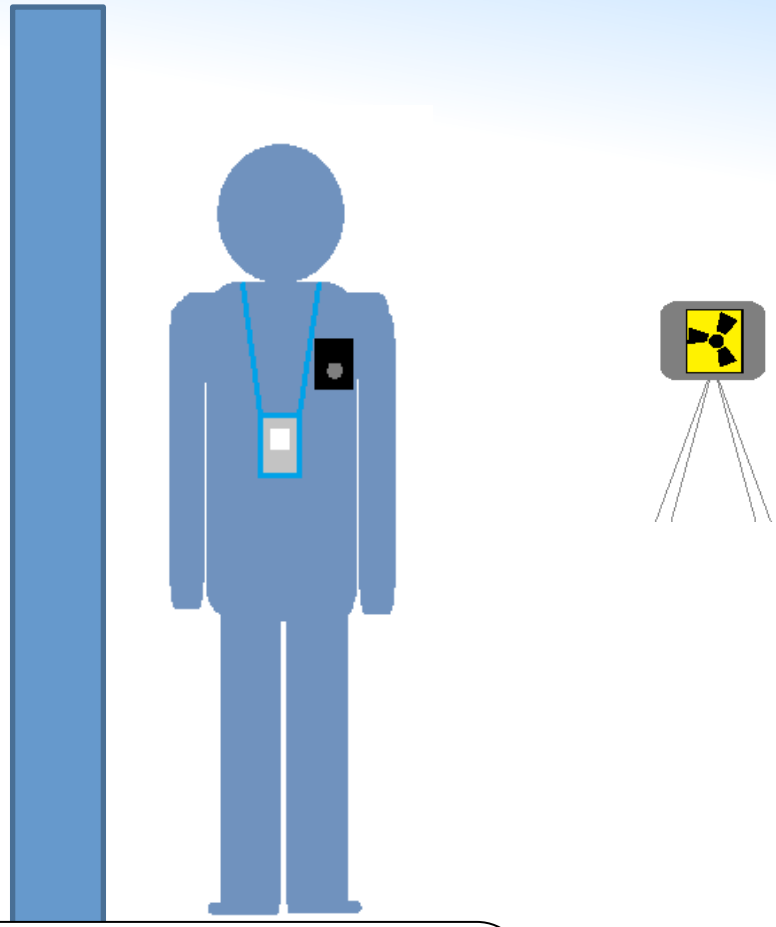






- Worst case scenario (spectra, geometry, ~~individual~~)

Measurements: Individual monitoring

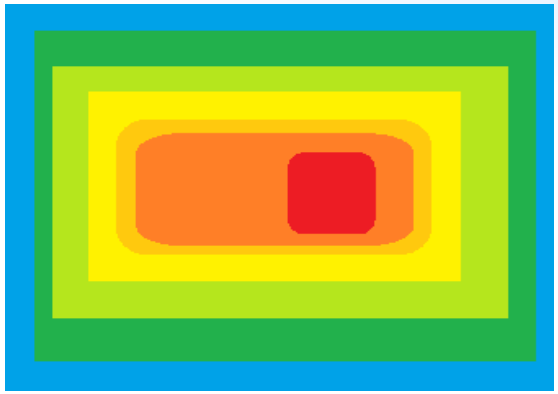


- “Real” geometry + uncertainties.
- Real-time reading
- Spectral information?

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
- Publications: Dosimetry Codes of Practices, Guidelines, technical reports, IAEA Safety Standards (GSR Part 3:2014, GSG 7 and 8: 2018) www.iaea.org/publications
- Technical cooperation
- Training, conferences
  - Next week IDOS2019!

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Thank you!