

# The Unified Approach for Radiological Protection

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# The System of Radiological Protection

- Recommended by the International Commission on Radiological Protection (**ICRP**), founded in 1928
- With the objective to contribute to an **appropriate level of protection** against the detrimental effects of ionizing radiation exposure **without unduly limiting** the benefits associated with the use of radiation (Pub 103, §26)
- The system aims primarily to protect human health with the objective to manage and control exposures so that deterministic effects (tissue reactions) are **prevented** and the risks of stochastic effects (cancer) are **reduced** to the extent reasonably achievable (Pub 103, §29)
- The system applies to **all radiation exposure** to any **natural or man-made controllable sources** (Pub 103, §44-45)
- Several issues of General Recommendations: ICRP 26 (1977), ICRP 60 (1990), ICRP 103 (2007)

## Historical perspective

- The system of RP was developed gradually during the 20th century integrating advances in **knowledge** about the effects of radiation, the evolution of the **ethical and social values** as well as the feedback **experience** from its practical implementation
- Until the Second World War the Commission was only dealing with the protection of **medical staffs**
- After the war the focus was on **nuclear energy** and radiological protection developed to protect workers inside nuclear installations and the public outside. This resulted in a coherent and effective regime of radiological protection based on solid concepts, principles and norms (ICRP 60)
- The reality of **nuclear accidents** together with the threat of malevolent events and the raising concerns on **natural exposures** and exposure **situations inherited from the past** in the nineties profoundly challenged the ICRP 60 system and resulted in the general principles presented in ICRP 103

# Foundations of the RP System

- **Social and Ethical Principles/Values**

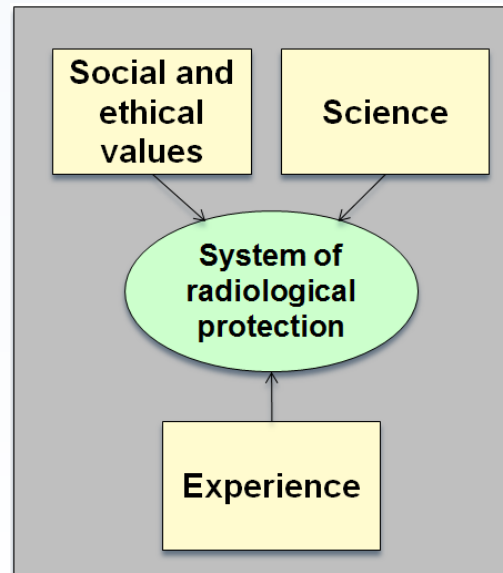
- Beneficence
- Non-maleficence
- Autonomy/Dignity
- Justice
- Prudence
  - Reasonableness
  - Tolerability
    - Peaceful
    - Vigilant
    - Reaction
  - Accountability
  - Inclusiveness
  - Conservation/biodiversity/sustainability

- **Science**

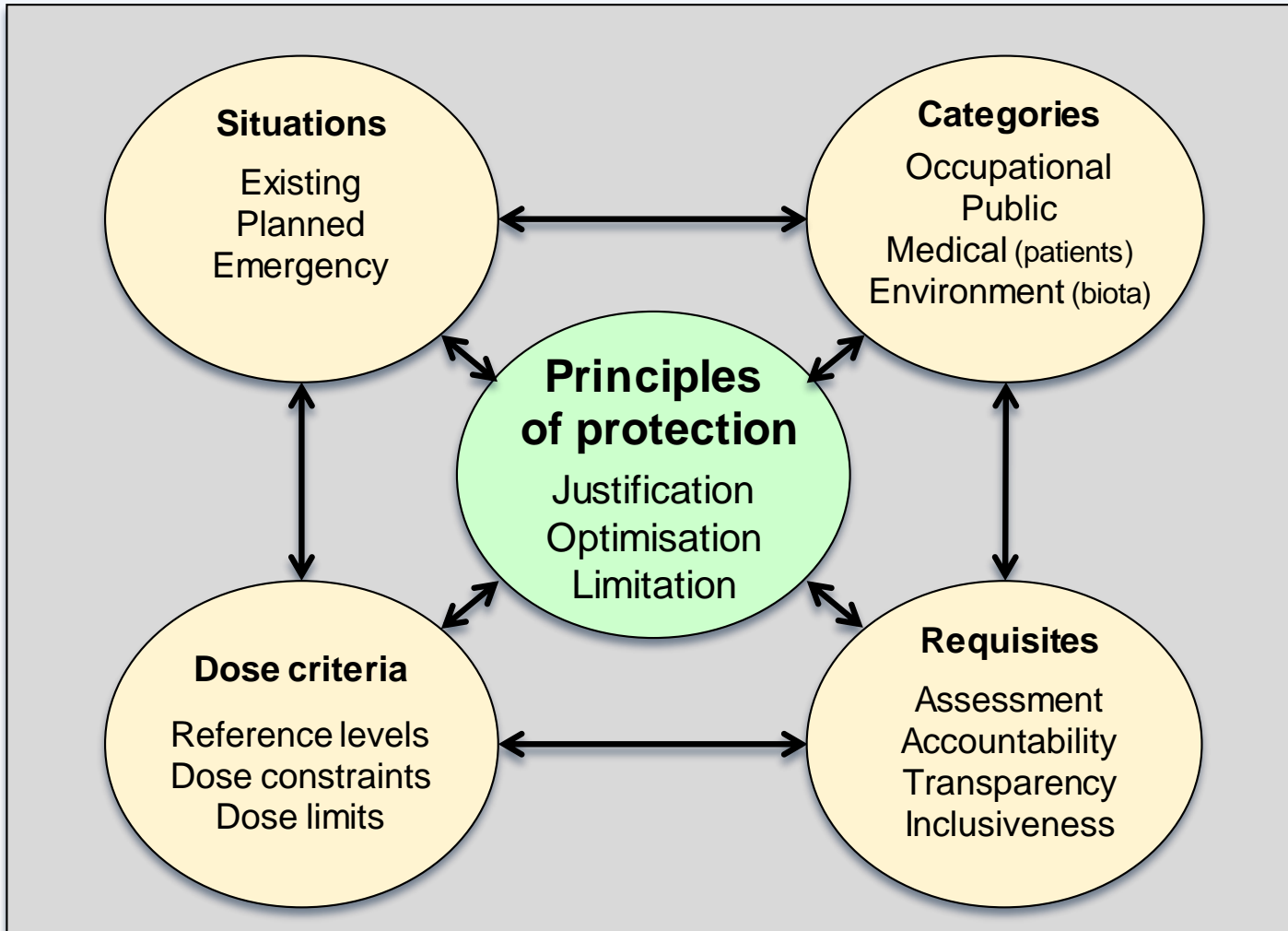
- Epidemiology
- Radiobiology
- Anatomy
- Physiology
- Metrology
- .....

- **Experience**

- Hiroshima/Nagasaki
- Nuclear Installations
- Industrial/Medical
- Chernobyl
- Fukushima
- .....



# Structuration of the System of Protection



# The exposure situations

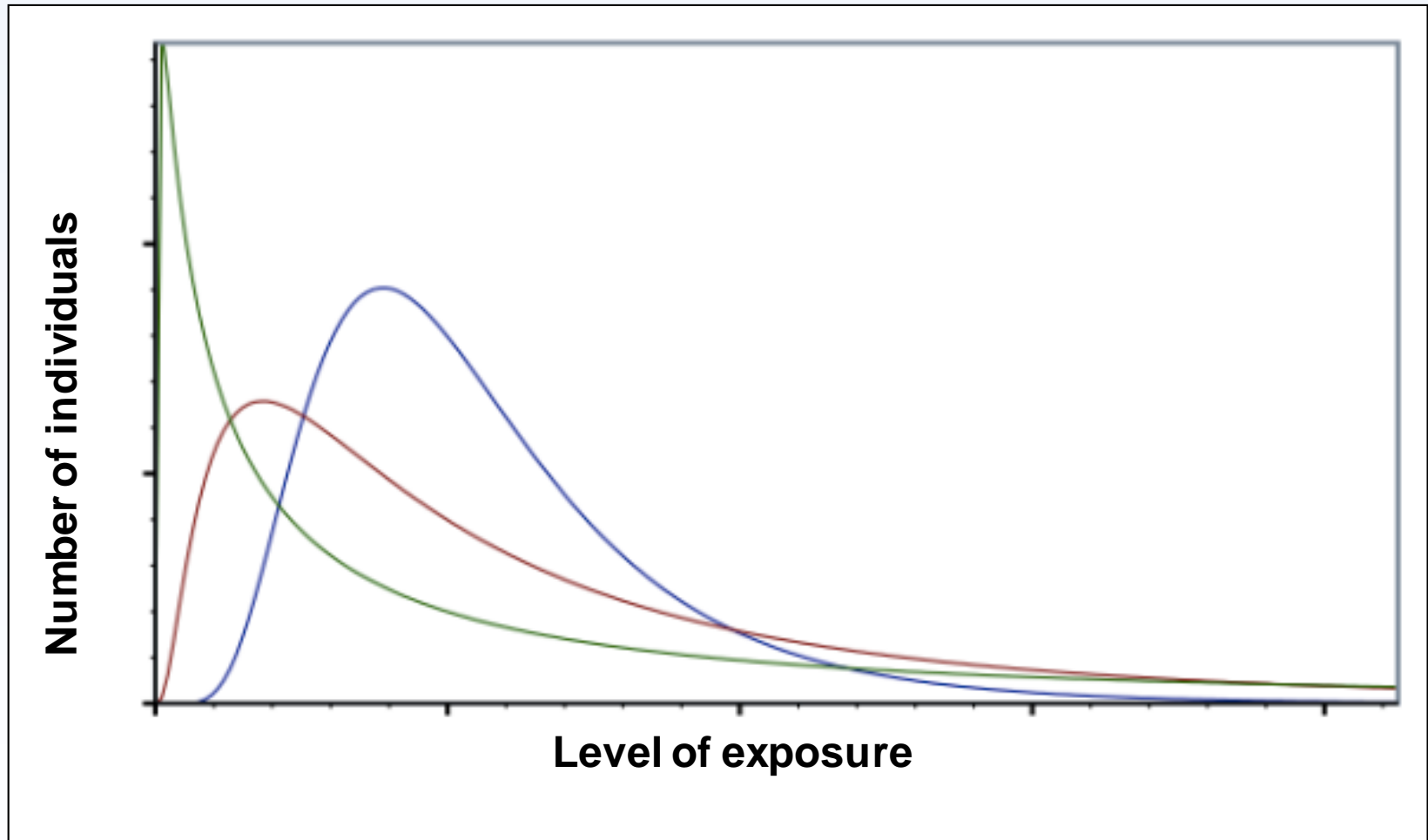
- **Existing exposure situations** : ...sources that **already exists** when decisions to control them are taken.
- **Planned exposure situations** : ...**deliberate introduction and operation** of sources...
- **Emergency exposure situations** : ...from the **loss of control** of a source.

# The categories of exposure

- **Medical exposure:** radiation exposures received by **patients** in the course of diagnostic, interventional, and therapeutic procedures.
- **Occupational exposure:** radiation exposures incurred **at work** as a result of exposure situations that can **reasonably** be regarded as being the **responsibility** of the operating management.
- **Public exposure:** all radiation exposures of the public other than occupational and medical exposure. From **natural** and **artificial** sources

*Remark: although individuals may fall into the 3 categories respectively as workers, patients or members of the public, the management of each category is kept **separated***

All exposure situations are characterized by a particular individual dose distribution





# The principles of radiological protection

- **The principle of justification:** Any decision that alters the radiation exposure situation **should do more good than harm** individually or collectively (beneficence; non-maleficence)
- **The principle of optimisation of protection:** All exposures should be **kept as low as reasonably achievable**, taking into account economic and societal factors (prudence, justice) **involving stakeholders** as far as possible (respect, dignity)
- **The principle of application of dose limits:** The total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients **should not exceed** the appropriate limits (justice).

**Dose limits traditionally apply only in  
planned exposure situations**

# ICRP 60: a two-speed system

## Practices

**Dose limit**  
(multi-sources **ceiling** level)

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**Dose constraint**  
(single-source **ceiling** level)

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*Optimisation*

## Intervention

**Action/Intervention levels (floor levels)** *Optimisation*

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*What happens below AL/IL?*

*No further optimisation?*

# ICRP 103: a unified approach

Planned exposure situations

Dose limit

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Dose constraint

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*Optimisation*

Emergency and existing exposure situations

Reference level (ceiling level)

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*Optimisation*



# The unified approach should be graded: Why?

- **Controllability** of the exposures
- Approach **proportionate** to the expected **level of risk**
  - **Distribution** of individual doses
  - Prospect of **deterministic** effects (notably the use or not of radionuclides for their **radioactive properties**)
  - Prospect of a radiological **emergency**
  - **Multi-hazard** situation: what is the dominant hazard?
- **Benefit**: societal/individual; direct/indirect
- Possible **counterparts** for groups of exposed individuals (in terms of protection): e.g. workers
- **Economic** and **societal** considerations

# Graded approach: How?

- **Characterisation** at the beginning of the process (ExES + EmES)
- **Justification**
  - Of the introduction of a new activity (or category of) (PES)
  - In making the decision as to whether to take action to avert further exposure (ExES + EmES)
- **Optimisation** (cornerstone of the RP system)
  - According to prevailing circumstances
  - RP integrated in conventional health & safety standards
  - Collective / Individual protection
- **Dose criteria**
  - Dose limit: traditionally only in PES
  - From regulatory perspective, flexibility should be considered to use DL when appropriate in ExES
  - DC/RL: selected on a case by case basis according to the characteristics of the exposure situation (Pub 103, Table 5: 3 bands)

ICRP

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