The philosophy of the ICRP system applied to radon and NORM

Challenges in applying the RP system in management of NORM and radon

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ICRP Publications 126 (Radon, 2014) and 142 (NORM, 2019)
The ICRP System of Protection

- **Principles of protection**
  - Justification
  - Optimisation
  - Limitation

- **Situations**
  - Existing
  - Planned
  - Emergency

- **Categories**
  - Medical (patients)
  - Occupational (workers)
  - Public (all others)
  - Environment (biota)

- **Dose criteria**
  - Reference levels
  - Dose constraints
  - Dose limits

- **Requisites**
  - Assessment
  - Accountability
  - Transparency
  - Inclusiveness
Characteristics of the Rn & NORM exposures

- Natural radionuclides **already existing** and not used for their radioactive properties (Rn + NORM)
- **No real prospect of emergency** leading to tissue reaction or immediate danger of life (Rn + NORM)
- **Ubiquity** and **variability** of the exposures (Rn + NORM)
- Exposure can be anticipated but its level cannot without a **characterisation** (Rn + NORM)
- **Internal exposure** difficult to prevent (Rn + NORM)
- **Lack of RP culture** (Rn + NORM)
- Often **multi-hazards** and radiological risk rarely dominant (NORM)
- There are **limited options** for management of residues and waste (NORM)
Exposure Situations & Categories of exposures

- ICRP considers Radon and NORM exposures as existing Exposure Situations

- They can lead to:
  - **Occupational** exposure, but not for all workers
  - **Public** exposure
  - **Environmental** exposure (NORM only)

- An approach both **integrated** and **graded** is recommended
RP Principles

• **Justification**
  - Of the protection strategy
  - After characterisation
  - Priorities: Radon prone areas/buildings & National list (NORM)

• **Optimisation of the protection**
  - Driving principle (prevention & mitigation ALARA)
  - Prevailing circumstances (options may be more limited)
  - Use of reference levels (in concentration for Radon)

• **Application of the dose limits**
  - A priori not relevant
  - May be applied for regulatory purpose
Integrated approach – Radon

- Management of radon exposure as far as possible at the level of the building whatever its occupants
  - Dwellings, workplaces, mixed-use buildings
  - In a public health perspective (WHO)
  - Unique reference level
- **Straightforward** and **realistic** approach
  - No distinction smokers / non-smokers
  - No specific requirement for children
- Combination with **Indoor Air Quality** and **Energy saving** policies
- Address health, economic, architectural and educational issues
- General ambition: address both the highest exposures and the global risk
Graded approach – Radon

- Selection of the **reference level**: between 100-300 Bq/m³
- National action plan: set **priorities**: radon prone areas/buildings
- **Prevention** and **mitigation** (existing and new buildings)
- **Incentive** or **mandatory** requisites, **long-term** strategy
- **Graded** approach for workers
  - At the level of the building with RL in concentration (Bq/m³)
  - At the level of workers with a RL of the order of 10 mSv/y
  - Occupational exposure:
    - In some activities and facilities (national list)
    - When the dose remain > RL
  - Other workers treated in the same way as mb of the public, with arrangements
- Recommendation to manage radon and other radiation **separately** (pragmatism)
Integrated approach – NORM

• Workers:
  • Starting with the protection strategy already in place or planned to manage other workplace hazards (hygiene & safety at work) and integrating, as necessary, specific radiological protective actions to complement

• Environment:
  • All hazards: radiological and non-radiological stressors
  • All impacts: human and ecological (non-human species)
Graded approach – NORM – Workers

- Select a relevant **Reference Level** reflecting the distribution of exposures
  - Less than a few mSv/y in most cases; above a few mSv/y in some cases but very rarely exceeding 10 mSv/y

- Start with appropriate **collective protective actions** and continue with **individual** ones (2 series)
  - **Collective**: related to workplaces and working conditions
  - **Individual**: related to each worker individually

- More or less thorough **implementation** of protective actions
Graded approach – NORM – Public

- **Characterisation** (who is exposed, when, where, how)

- **Optimisation** within a *graded approach* through the control of discharges, waste, recycled residues (including building materials)

- Selection of a relevant **Reference Level**
  - Generally less than a few mSv/y

- **Stakeholder involvement** (including multidisciplinary approach)
Graded approach – NORM – Environment

- **Step by step** approach
  - Generic assessment
  - Specific assessment
  - Detailed Environmental Impact Assessment (EIA) as necessary

- Use of tools (RAP…) and criteria (DCRL…) established by ICRP (Pub 124) *as appropriate*

- **Stakeholder involvement**
Ethical considerations

- See Pub 138

- Tolerability is challenging (what means unacceptable?)
Conclusions

• Many similarities between Radon and NORM (Rn is the main exposure in several processes involving NORM)

• The key recommendations are:
  • **Characterisation** of the situation
  • **Justification** of the protection strategy
  • **Optimisation** of the protection through an approach both **integrated** and **graded**