IAEA webinar: TRENDS IN THE APPLICATION OF OPTIMIZATION AND GRADED APPROACH IN INDUSTRIAL PROCESSES INVOLVING NORM

Recommendations for Occupational Control of NORM-Related Industries in Argentina

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Some characteristics of industries involving NORM

- Very **diverse**, **already on-going**, generally big size
- Relatively **low levels** of radiation exposure involved
- Subject to **authorisation**, not for RP
- Experience in risk management but **poor RP culture**
- Often **multi-hazards** and **radiological risk rarely dominant**
- **Ubiquity, variability** of exposures
- NORM introduced in industrial process but **not for its radioactive properties**
- The process in which NORM is **concentrated** is mainly **incidental**

Graded approach

- What are the **risks**? What are the **opportunities**?
- **Understanding** NORM activities in the country: **characterization**
- **Appropriate strategies** so that efforts and resources expended on protection are commensurate with risks
- Involves establishing an **adequate protection** according to circumstances
- **RP integrated** with **conventional** health & safety standards
- Protective **actions** may **not be warranted** or disproportionate
- Applying **some or all requirements of a RP programme** may be appropriate if the **exposures are significant**,
- Actions should reflect a **justified balance of costs and benefits**

National situation (1)

- ARN is not in charge to control activities related with NORM
  - Natural radiation is not included explicitly in Nuclear Law 24804
  - Uranium mining and processing is under scope of ARN
  - Conduct a characterization project in the 2000s to know and inform other authorities
- Several meetings with Labor, Environmental and Health authorities and also industries association to inform/raise awareness

National situation (2)

- Finally, established a memorandum of understanding between Ministry of Labor (2023).
- Try to merge with control mechanisms already existing in other regulations that are not familiar with RP wording, have other concepts (Ex: how to consider a NORM worker, how to harmonize with requisites for other already regulated activities)
- 2 documents prepared together to address control of NORM related industries (Standard and Guide)

In order to implement protection

1- Characterization

2- Justification and optimization principles

3- Regulatory requirements implemented in a graded approach

Characterization

a) **Industry description process and analysis.**

- Probable accumulation sites
- Workplace analysis (spent time, PPE, working conditions)
- Protective measures for conventional contaminants

b) **Workplace monitoring (normal operation and maintenance)**

- External radiation fields
- Potential for internal intake (aerosols)
- Radon gas (closed environments)

c) **Radionuclides and their concentrations** in different **materials**

d) **Surface contaminated items**

To know and understand the risks

To be able to prioritize the industries

RP Principles

Justification

Of a protection strategy, after characterisation

Overall benefit: health, economic, societal, ethical aspects. Stakeholder involvement
(Justification principle of RP in a broader sense)

Optimisation

To select the **most effective** actions for protection

RP **integrated** in conventional health & safety standards

The best under **prevailing circumstances**

Collective protection first and then Individual protection

Dose limitation

A **priori not relevant**/ May be applied for regulatory purpose **when needed** (flexibility)

Optimization process: reasonableness

Reasonableness: the art of understanding the prevailing circumstances and the acceptable level of protection

Tendency to minimization of exposures instead of **optimisation** of RP, in a context of **increasing societal and environmental** concerns:

- **Adaptation of optimized solutions** instead of just minimization of the exposure.
- An **holistic approach to optimizing hazards as a whole**.
- Improving **dialogue** and **understanding** of radiation hazard between operators, regulators and the public: ***Do we have a clear message to deliver***?

Radiological protection measures

- **According to risks**: not imposing unnecessary burdens
- **Raise awareness** and **close dialogue with industry. Information.**
- **Integration** of specific RP actions **to complement protection in place**.
- **Significant** radiological hazards may **need to use requirements** that are typically associated with **radiological protection programmes.**
- Control of **workplace conditions first** (ventilation, shielding, engineering controls, signals, working procedures), **then individual control** (PPE, individual monitoring, health surveillance)
- For workers protection **apply dose limits and occupational requirements,** only if needed**, in a graded approach.**
- **Education and training**

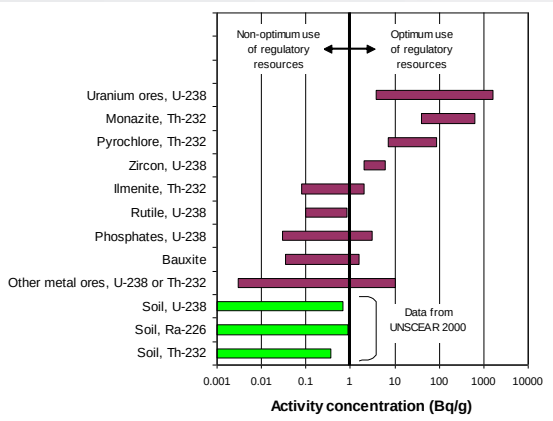
Criteria for graded approach (Excluding radon)

Materials below 1 Bq/g could be considered excluded from regulatory control.

Materials above 1 Bq/g *need dose assessment to define if are exempted or regulated*

Exposure scenarios, real dose assessment,

Materials above 1 Bq/g and above 1 mSv/y, *are controlled applying graded approach, if the control produces a net benefit*



Radiological criteria for workers approach

Dose assessment (excluding radon and background):

Graded approach:

- ✓Gamma emitters and aerosols < **1 mSv/y** (no regulation necessary - verification every 5 years)
- ✓ Gamma emitters and aerosols: > **1 mSv/y and ≤ 2 mSv/y** (Characterization once a year)
- ✓ Gamma emitters and aerosols: > **2 mSv/y and ≤ 6 mSv/y** (General RP requirements apply)
- ✓ Gamma emitters and aerosols: > **6 mSv/y** (Specific requirements of occupational RP apply)

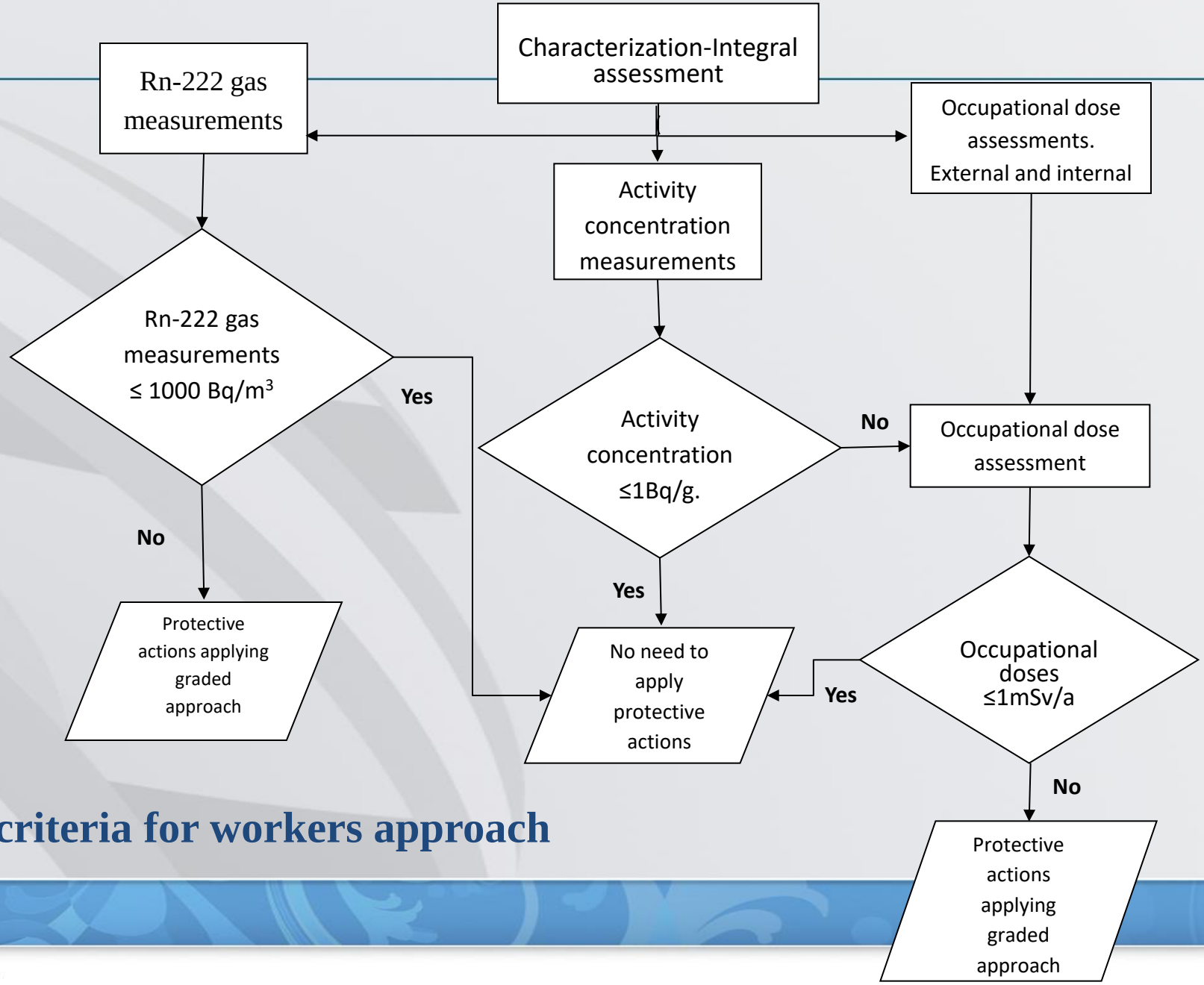
Radon and graded approach

(1) *optimising* protection using a *derived reference level of 1000 Bq/m^3*

(2) *optimising* protection using *real parameters* of exposure, such as occupancy, to verify *reference level of 10 mSv/y*

(3) applying relevant *requirements for occupational exposure* when *exposure remains above 10 mSv/y*.

Radiological criteria for workers approach



Residue management and sustainability

Diversity of activities generates NORM residues and wastes. Should be managed in a safe and sustainable manner

- Minimizing generation and disposal of waste
- Minimizing the use of land, potential soil degradation
- Minimizing the potential impact on aquifers and the environment,
- Proper use of resources
- Encouraging the reuse and recycling of material *(moving linear to circular economy)*
- Analyzing possibilities of conditional clearance
- Addressing and balance all risks simultaneously applying a graded approach.

UN Sustainable Development Goals

Graded approach for NORM residues

Generic clearance (1 Bq/g ^{238}U -^{232}Th -10 Bq/g ^{40}K),

Conditional clearance (< 1mSv/y),

Reuse/recycle (moving linear to circular economy)

Disposal at conventional/hazardous landfill,

Disposal as Radioactive Waste

Residues with activity concentration > 1 Bq/g could be still related to irrelevant risks to ionizing radiation

NORM residue may be or not a NORM waste
Not all NORM waste is a radioactive waste!

Implementation of graded approach needs:

- To collect all history of NORM related industries operating within the country
- To have appropriate staffing, enough infrastructure for measurements/radiation protection expertise for characterization and control (also costs involved)
- To involve stakeholders in the development of regulations:
  - explain why and what to regulate
  - understand the impact of regulations, cost/benefits
- To take advice from other regulators, professional associations.

Conclusions

- **Assure** the **best protection** within the prevailing circumstances, beyond it is treated as EES or PES
  - ✓ applying an **all hazard, graded approach** and **reasonableness** when implementing **optimization**.
  - ✓ in practice, **a range of tools can be used**, including reference levels, dose constraints and dose limits, based on the **characteristics, circumstances and risks** of the situation.
- Improve **dialogue** and **understanding** of radiation hazard between operators, regulators and the public
- Focus on **practicability, pragmatic attitude, avoiding overregulation!**

Thank you!

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