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

European ALARA Network Webinar – Dec. 8, 2022

Optimization in protection from radon: problems and proposals

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Introduction

- This presentation is aimed to discuss some challenges in the optimization of radon control and to contribute to the evolution of the Radiation Protection System with a proposal for a more effective implementation of the optimization principle.

- Although this presentation is focused on optimization of exposure to radon, some concepts could be considered also for other existing exposure situations and other exposure situations.

The optimization principle

- One of the three fundamental principle of radioprotection, emphasized by ICRP-103, is the "optimization", defined as:

- *"The likelihood of incurring exposure, the number of people exposed, and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors."* (ICRP-103, page 14)

Optimization and Reference Levels

- A good principle as the optimization needs adequate tools to be effectively implemented.

- ICRP-103 has introduced (for existing and emergency exposure situations) the Reference Level, defined as:

- *In emergency or existing controllable exposure situations, this represents the level of dose or risk, above which it is judged to be inappropriate to plan to allow exposures to occur, and below which optimization of protection should be implemented. The chosen value for a reference level will depend upon the prevailing circumstances of the exposure under consideration.*

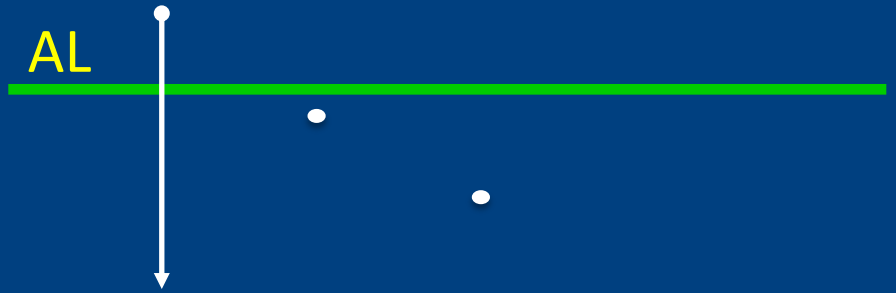
Reference Level vs Action Level

Action Level (AL)

for Interventions

Based on ICRP 60 and 65 (Rn)

Optimisation only for levels > AL
(no action for levels < AL)

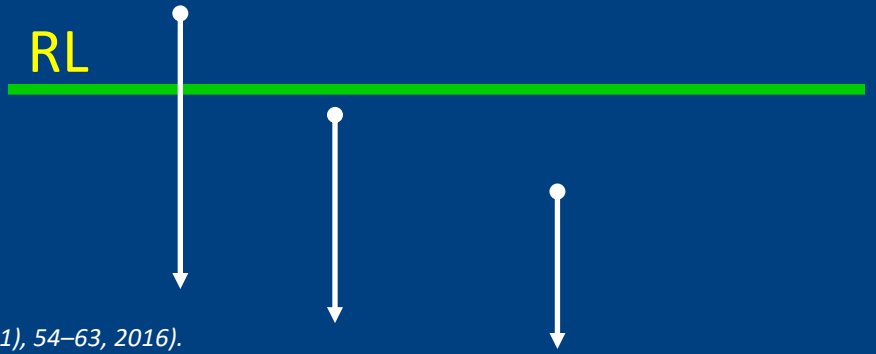


Reference Level (RL)

for Existing Exposure Situations

Based on ICRP 103 and 126 (Rn)

Optimisation with priority for levels > RL
(but to be applied also for levels < RL)



(adapted from Lecomte "Understanding existing exposure situations.", Ann. ICRP 45(Suppl.1), 54–63, 2016).
(See also Bochicchio et al. "Radon reference levels and priority areas considering optimisation and avertable lung cancers", Radiat.Prot.Dosim.177, 87–90, 2017)

The problem

- Despite the clear definition of the RL, the large majority of countries implemented the RL with the same "meaning" of the previous AL, i.e. not requiring any action to optimize levels below the RL.

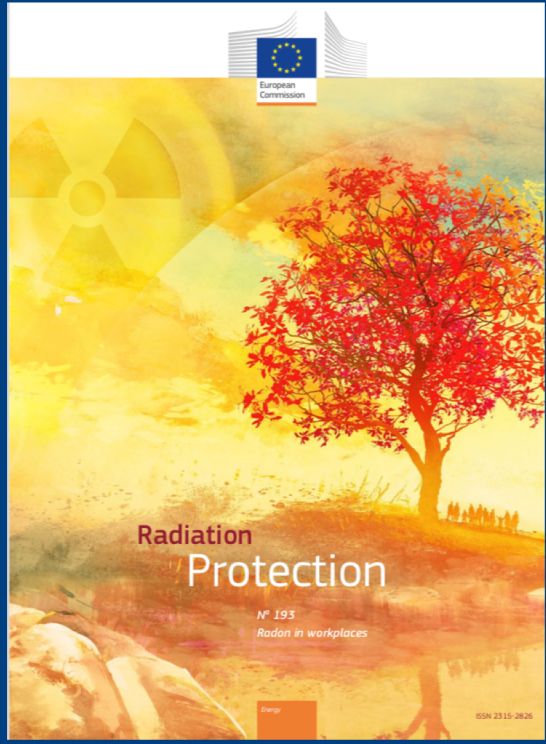
- Moreover, some countries adopted a RL higher (e.g. 300 Bq/m^3) that previous AL (e.g. 200 Bq/m^3).

➢ Taking into account also the log-normal distribution of Rn levels, this results in a lower (instead of a higher) protection and in a non-effective implementation of the optimization principle.

The problem (cont.)

- This is also recognized in some way in the RP-193 “Radon in workplaces” (page 18, footnote 10):

- *“Considering that optimisation of protection shall give priority to exposures above the reference level and shall continue to be implemented below the reference level (Article 7(1)), this chapter (on Regulatory control of radon in workplaces) will focus on optimisation of exposures **above** reference levels, although some consideration on optimisation below reference level will also be carried out.”*



Rationale

- The problem is probably due to difficulties in implementing optimization below the RL without a guidance on which level should not require an optimization (i.e. when to stop in optimizing?).

- Moreover, from a practical point of view, an additional level below which no action is required is much more easy to be implemented than an unconstrained reference level only.

- Quite different distribution of Rn levels and remediation capabilities among countries would imply different capability to reduce Rn levels to any target value.

The proposal

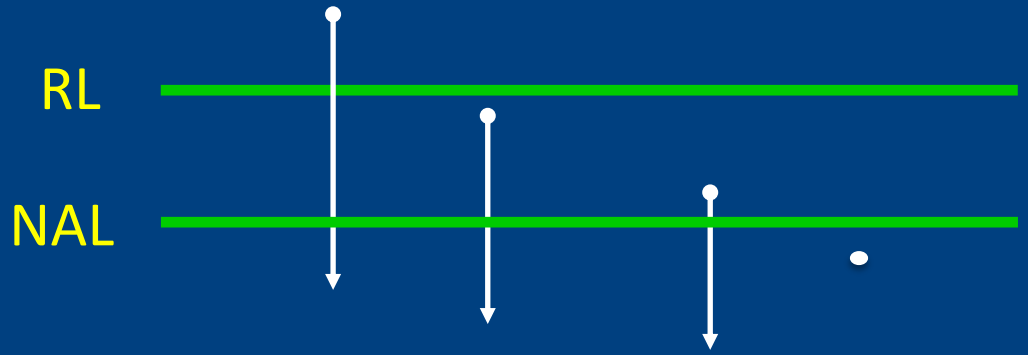
- The proposal is to adopt a two-level approach:
  - a Reference Level (RL), with the same meaning as ICRP-103, to be chosen by each Member State (≤ a maximum RL established in the European Directive);
  - a No Action Level (NAL), to be chosen by each Member State.
- In this proposal, optimization shall be carried out with priority for Rn levels > RL (as the present approach), but also for Rn levels between RL and NAL.
- Remedial actions shall be aimed to reduce Rn levels below the NAL.

The proposal (cont.)

- This approach allows for large flexibility in implementation within and among countries, e.g.:
  - it can be better adapted to MS with different Rn level distribution;
  - the urgency of remediation could be different for levels>RL compared to NAL<levels<RL);
  - the NAL could be reduced with time with the improving of remediation capabilities; ...
- This approach will be more in agreement with the optimisation principle and it will promote remediation in a significantly higher number of situations, considering the typical log-normal distribution of Rn levels.

Reference Level + No Action Level

Optimisation with priority for levels > RL
but to be applied also for levels < RL and >NAL)



Is this a real new proposal? No!

- This proposal has been actually already considered (although not very developed) in ICRP-103 (par.297, page 115):

"Responsibility for taking action against radon in houses and other premises will often fall on the individual owners, who cannot be expected to carry out a detailed optimisation exercise for each property. Therefore, in addition to reference levels, regulatory authorities may also wish to specify levels at which protection against radon-222 can be considered optimised, i.e., where no further action is needed."

Conclusions

- The revision of the System of Radiological Protection should possibly contain tools for an effective implementation of the optimization principle.

- This proposal is aimed to obtain a practical implementation of the optimization principle in agreement with its definition, and it can be adapted to different remediation capabilities.

- Finally, similar consideration could be probably be applied to other exposure situations requiring reference levels.

Thank you
for your attention