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(Radon real time monitoring system and proactive indoor remediation)

Protection from radon: The international framework and perspectives in Italy

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Introduction (1)

- Dir. 2013/59/Euratom deals with both radon at work (initially and partly covered in Dir. 96/29/Euratom) and (finally) radon at home (previously covered in 1990 Recommendations only).
- Requirements on Rn have been harmonized in the general framework of radioprotection.
- However, considerable specific flexibility have been introduced for several radon issues. Besides the requirements in the main text, a great role is given to the National Radon Action Plan (NRAP).
- Moreover, recommendations to consider the interaction of radon programs with other programs (on cigarette smoking, indoor air quality, energy conservation) are included in recitals and NRAP.

Introduction (2)

- Doses from radon exposure are usually higher than doses from other exposures (for both workers and population).
- The number of exposed persons and regulated environments is much larger than for any other source of exposure to ionising radiation.

In summary: new regulations, harmonisation, large flexibility, high doses, high number of regulated environments...

=> Many challenges for an optimised implementation of the BSS (i.e. for optimized protection from radon exposure)

A “basic” consideration

- The Directive 2013/59/Euratom deals with basic safety standards:

  Recital 5:

  “...does not preclude, unless explicitly stated in the standards, a Member State from providing for more stringent measures of protection.”

  “As this Directive provides for minimum rules, Member States should be free to adopt or maintain more stringent measures in the subject-matter covered by this Directive, without prejudice to the free movement of goods and services in the internal market...”

- This applies also to requirements on exposure to radon

Optimisation and Reference Levels

Optimisation in Directive 2013/59/Euratom

Art. 5(b) - Optimisation: Radiation protection of individuals subject to public or occupational exposure shall be optimised with the aim of keeping the magnitude of individual doses, the likelihood of exposure and the number of individuals exposed as low as reasonably achievable taking into account the current state of technical knowledge and economic and societal factors.

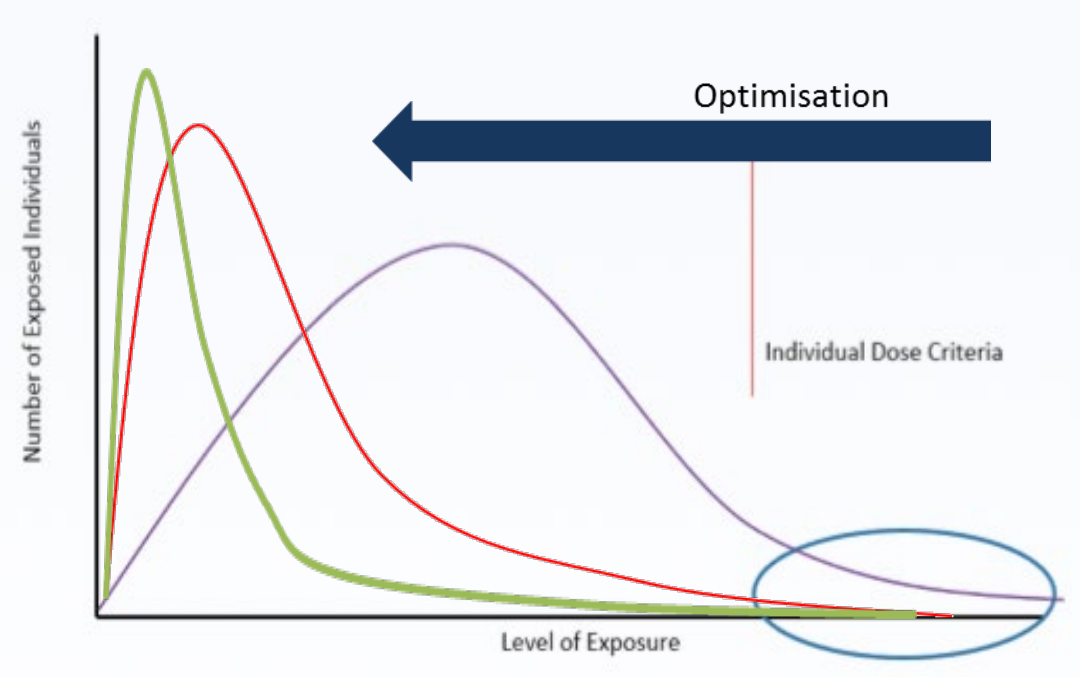
Reference Levels in Directive 2013/59/Euratom

Definition 84: "reference level" means in an emergency exposure situation or in an existing exposure situation, the level of effective dose or equivalent dose or activity concentration above which it is judged inappropriate to allow exposures to occur as a result of that exposure situation, even though it is not a limit that may not be exceeded.

Art. 7(1): Member States shall ensure that reference levels are established for emergency and existing exposure situations. Optimisation of protection shall give priority to exposures above the reference level and shall continue to be implemented below the reference level.

Optimisation steps for ICRP

1. Identify exposures which warrant specific attention to reduce their magnitude
2. Influence the entire dose distribution and shift exposures towards lower values
3. Reduce inequity



(adapted from Lecomte "Understanding existing exposure situations.", Ann. ICRP June 2016)

Action Level vs Reference Level

Action level
for Interventions

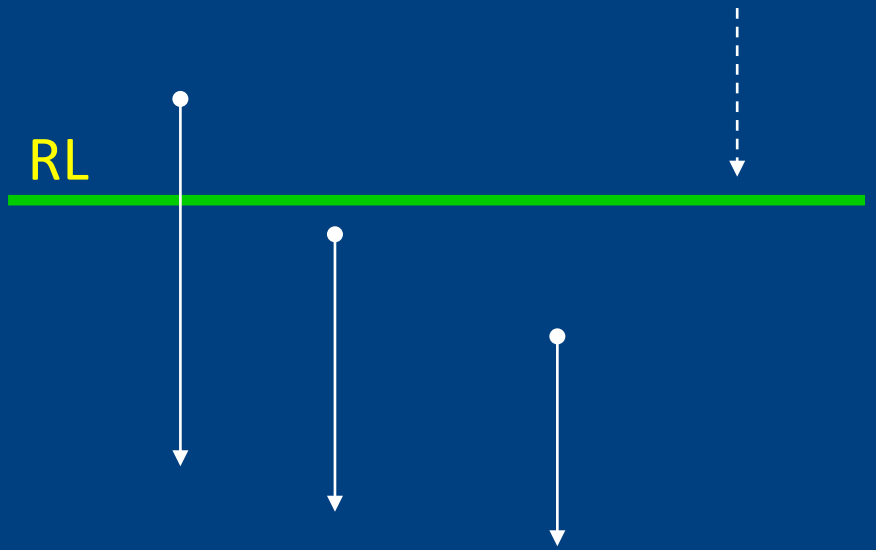
Based on ICRP 60 and 65 (Rn)
(Dir. 96/29/Euratom + RP88)

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

Reference level
for Existing Exposure Situations

Based on ICRP 103 and 126 (Rn)
(Dir. 2013/59/Euratom)

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



(adapted from Lecomte "Understanding existing exposure situations.", Ann. ICRP June 2016)

Challenges for radon in workplaces (1)

Setting RL

- Cost/effectiveness evaluations show that higher RL have a lower effectiveness (global risk reduction) and higher cost/effectiveness.
- Depending on Rn level distribution, low RL can be difficult to be implemented, especially for existing buildings.
- Possible approaches:
  - a lower RL could be set for future buildings compared with RL for existing ones;
  - some requirements (or recommendation, promotion) could (should, considering the meaning of RL) be introduced also for levels <RL, e.g. for levels >50% of RL.

(this challenge applies also to radon in dwellings)

Challenges for radon in workplaces (2)

Rn concentration measurement

- Problem: Passive detectors tend to overestimate radon concentration during working hours

  => inexpensive (to be applied in many workplaces for a long exposure period) active detectors could be developed to take into account worker occupancy (someones already available).

- Problem: Medium and high Rn levels occour also in areas with lower average Rn levels (although with a lower frequency)

  => measurements should be prioritised in selected areas, but not limited to them.

Challenges for radon in workplaces (3)

Requirements for notified workplaces

- Notification (especially for levels >RL but <6 mSv/y) should include information on (failed) remedial actions, so that competent authority can verify appropriateness (but also to avoid a “no action” mis-approach).
- Information on all Rn conc. measurements and remedial actions should be sent to a National Radon Archive, i.e. also for non notified workplaces as well as for dwellings.
  - In fact, these data are necessary to evaluate effectiveness of the regulation (including the National Radon Action Plan).

Challenges for radon in workplaces (4)

Requirements for notified workplaces with Rn exposure correponding to doses > 6 mSv/y

- Requirements should continue to promote optimisation of worker exposure, including further/stronger attempts to reduce radon concentration and/or exposure.
- Considering the strong synergism between radon and smoking, information about elevated risk for smokers should be given to workers of all notified workplaces and (at least for doses >6 mSv/y) quitting smoking could be promoted too, as an effective method to reduce lung cancer risk from radon exposure, especially if it is difficult to reduce radon levels.

Challenges for radon in dwellings

Level of protection and effective policy

- Problem: same RL corresponds to a lower protection than in workplaces (due to higher occupancy in dwellings)

  => a lower RL could be set for dwellings than for workplaces

  => a lower RL could be set for future buildings than for existing ones

  => remedial actions could be required/promoted also for Rn levels < RL

- Problem: experience show that encouragement and information have usually a low effect on the rate of remedial actions

  => consider a compulsory approach (instead of a recommandatory one) at least for some situations, e.g. rented houses (recommended by Int.BSS);

  => availability of sufficient (and proficient) local services for remedial actions is essential (recomended by RADPAR).

Some other examples of challanges for optimised protection

- **Preventive measures: in all the new buildings**

  This approach, compared with requiring preventive measures against Rn only in some areas, is quite effective in reducing global exposure in the long-term (and does not require area classification).

- **Remedial actions in existing buildings: necessary**

  Prevention in new buildings is important but protection in existing buildings is necessary as well (also due to low rate of new construction or renovation/reconstruction in European countries).

- **Building materials: a possible source of radon**

  The relative contribution of building materials as source of indoor radon concentration is more and more significant as RL decreases.

Some final considerations

- Final goal: optimisation means to persue the reduction of both individual and collective risks, i.e. the reduction of the number of lung cancers attributable to radon exposure in workplaces and dwellings.
- Regular evaluation and validation of policy effectiveness by mean of indicators related to such goal is necessary (and required by EurBSS for NRAPs).

Thank you for your attention