

Reference levels at existing exposure situations

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Outline

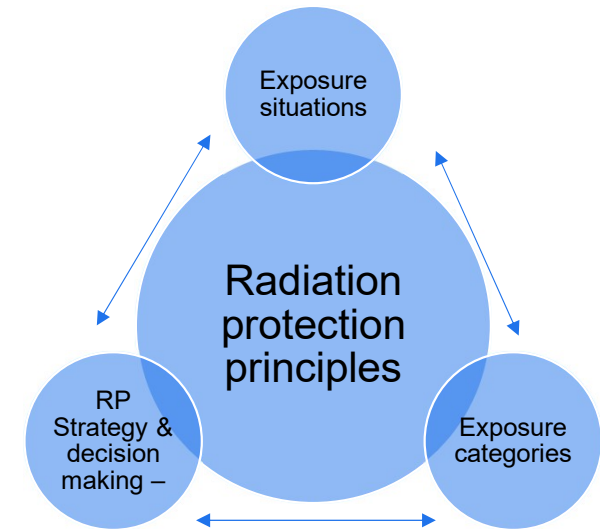


- ❑ Legislative framework – background from EU BSS
- ❑ Existing exposures – identification of different exposure situations
- ❑ Protection strategies and decision making – public exposure, possible occupational exposure, environmental exposure
- ❑ Questions for discussions

Putting things in perspective – legislative framework

- ❑ Directive 2013/59/Euratom (EC, 2014)
- ❑ ICRP Publication 103 (ICRP, 2007),
- ❑ IAEA GSR Part 3 (IAEA 2014)
- ❑ + many more useful international documents

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- Planned, **emergency and existing exposure situations**
 - Exposure categories – occupational, public, environmental
 - Principles of RP – **justification, optimization** and dose limitation – **reference levels, dose constraints, dose limits**
 - Radiation protection strategy and decision making – requisites, assessment methodology, accountability, transparency, engagement and involvement of stakeholders wherever possible



Reference levels – Directive 2013/59/Euratom

- Term 'Reference Level(s) – 54 times in EU BSS
- (42) The introduction of reference levels in emergency and existing exposure situations allows for the protection of the individual...
- (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;
- **Article 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
(2) The values chosen for reference levels shall depend upon the type of exposure situation. The choices of reference levels shall take into account both **radiological protection requirements and societal criteria**. For public exposure the establishment of reference levels shall take into account the **range of reference levels set out in Annex I**.

Reference levels – Directive 2013/59/Euratom

□ **Article 73: Contaminated areas**

1. Member States shall ensure that optimised protection strategies for managing contaminated areas shall include, where applicable, the following: (a) objectives, including long-term goals pursued by the strategy and corresponding reference levels, (b-e);
2. For areas with long-lasting residual contamination in which the Member State has decided to allow habitation and the resumption of social and economic activities, Member States shall ensure, in consultation with stakeholders....
(a) establishment of appropriate reference levels;

Reference levels – Directive 2013/59/Euratom

□ **Article 100: Programmes on existing exposure situations**

1. Member States shall ensure that measures are taken, upon indication or evidence of exposures that cannot be disregarded from a radiation protection point of view, to identify and evaluate existing exposure situations taking into account the types of existing exposure situations listed in Annex XVII, and to determine the corresponding occupational and public exposures
2. Member States may decide, having regard to the general principle of justification, that an existing exposure situation warrants no consideration of protective or remedial measures

□ **Article 101: Establishment of strategies**

1. Member States shall arrange for the establishment of strategies to ensure the appropriate management of existing exposure situations commensurate with the risks and with the effectiveness of protective measures
2. Each strategy shall contain (a) the objectives pursued; (b) **appropriate reference levels**, taking into account the reference levels laid down in Annex I.

- ## □ **Article 102: Implementation of strategies** (for the management of existing exposure situations) -
3. The distribution of doses that has resulted from the implementation of a strategy shall be assessed. Further efforts shall be considered with the aim of optimising protection and reducing any exposures that are still above the reference level.

Reference levels – Directive 2013/59/Euratom

□ Annex I: Reference levels for public exposure as referred to in Articles 7 and 101

1. Without prejudice to reference levels set for equivalent doses, reference levels expressed in effective doses shall be set in the range of 1 to 20 mSv per year for existing exposure situations and 20 to 100 mSv (acute or annual) for emergency exposure situations.
2. In specific situations, a reference level below ranges referred to in point 1 may be considered, in particular:
(a) a reference level below 20 mSv may be set in an emergency exposure situation where appropriate protection can be provided without causing a disproportionate detriment from the corresponding countermeasures or an excessive cost; (b) a reference level below 1 mSv per year may be set, where appropriate, in an existing exposure situation for specific source-related exposures or pathways of exposure.
3. For the transition from an emergency exposure situation to an existing exposure situation, appropriate reference levels shall be set, in particular upon the termination of long-term countermeasures such as relocation.
4. The reference levels set shall take account of the features of prevailing situations as well as societal criteria...

ANNEX XVII

Indicative list of types of existing exposure situations as referred to in Article 100

- (a) Exposure due to contamination of areas by residual radioactive material from:
 - (i) past activities that were never subject to regulatory control or were not regulated in accordance with the requirements laid down by this Directive;
 - (ii) an emergency, after the emergency exposure situation has been declared ended, as provided for in the emergency management system;
 - (iii) residues from past activities for which the undertaking is no longer legally accountable;
- (b) Exposure to natural radiation sources, including:
 - (i) indoor exposure to radon and thoron, in workplaces, dwellings and other buildings;
 - (ii) indoor external exposure from building materials;
- (c) Exposure to commodities excluding food, animal feeding stuffs and drinking water incorporating
 - (i) radionuclides from contaminated areas specified in point (a), or
 - (ii) naturally-occurring radionuclides.

Common features of existing exposure situations

- ❑ Radiation may affect all or several exposure situations
- ❑ Multiple contaminants exposure (multiple exposure situations)
- ❑ Exposure situations may be complex

Nowadays, radiological protection in these situations is closely connected to prevailing conditions regarding source, but also very much to social, economic, political, or ethical factors

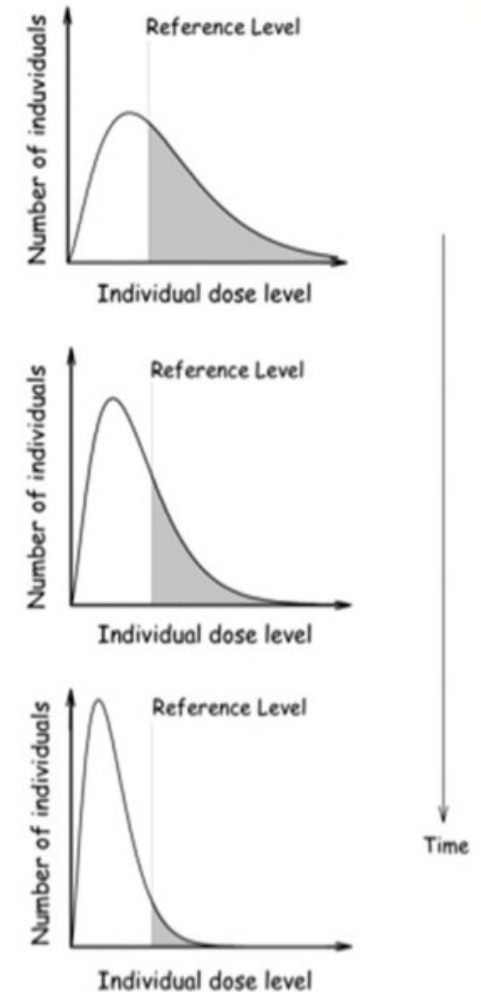
- ❑ Exposure situations may be based on graded exposure situations, but as such do not pose a risk for health
- ❑ Specific protection levels to be applied (if needed)
- ❑ Remedial actions → situation may be sensitive regarding the *status quo*, remedial actions and optimisation

Regulatory approach at existing exposure situations

- ❑ EU BSSjust as examples: Medical exposure - requirements, radon requirements, NORM requirements, Exemption & Clearance levels, Graded approach - planned exposure situations, **BUT existing exposure can mean far more different situations and, thus, approaches may be very different.** Still, some commonalities:
- ❑ At existing exposure, one must start with site characterisation & problem formulation (an initial screening)
- ❑ When results of initial screening require → more rigorous risk assessment
- ❑ ***Risk assessment – methodology issue? Multiple hazards, human health risk, but biota & environment too?*** Harmonisation of methodologies internationally – but in the end too many different exposure situations and prevailing conditions must be considered
- ❑ Solution in a holistic, site-specific assessment
- ❑ Based on assessment results → measures for control, dose and risk reduction and optimisation using **REFERENCE LEVELS**

Strategy for radiation protection

- ❑ To plan a strategy for RP at each of the different exposure situations various things must be considered: levels of the dose, reductions to be achieved, costs, technical feasibility, transparency as well as experts and public engagement, periodical review of results. Considering all these will give us an answer on **JUSTIFICATION** of measures to be conducted
- ❑ If RP measures are justified – strategy for remedial/protective actions should be made considering **OPTIMISATION & REFERENCE LEVELS**
- ❑ **Remediation & optimisation commonly not urgent thing, but must be planned and reviewed after some time**
- ❑ Assignment of responsibility is an important step in management and regulatory control and should be clear from the beginning



From Lecomte, ICRP, 2015

Reference levels, international considerations

- ❑ **Reference levels** - level of individual dose above which it is judged to be inappropriate to allow exposures to occur, and below which the goal is to reduce all doses ALARA (ICRP, 2007) (international standards)
- ❑ EU BSS – Article 7: *Member States shall ensure that reference levels are established for emergency and existing exposure situations...The values chosen for reference levels shall depend upon the type of exposure situation.....*
- ❑ Range of reference levels for projected dose is 1-20 mSv/a (ICRP)

EU BSS, Annex I

- Without prejudice to reference levels set for equivalent doses, reference levels expressed in effective doses shall be set in the range of 1 to 20 mSv per year for existing exposure situations
- Reference level below 1 mSv per year may be set, where appropriate, in an existing exposure situation for specific source-related exposures or pathways of exposure.

Table 1. Reference levels for existing exposure situations adopted or proposed to date.

Exposure situations	Occupational exposure	Public exposure
Cosmic radiation	5–10 mSv y ⁻¹	5–10 mSv y ⁻¹
Radon	10 mSv y ⁻¹	10 mSv y ⁻¹
NORM	20 mSv y ⁻¹ *	1–10 mSv y ⁻¹ *
Contaminated sites	Not yet defined	Not yet defined
Contaminated areas	20 mSv y ⁻¹ *	Lower part of 1–20 mSv y ⁻¹ * Long term = 1 mSv y ⁻¹ *

NORM, naturally occurring radioactive material.

From Lecomte, ICRP, 2015

Reference levels and optimisation at legacy sites

- ❑ Holistic, but step wise characterization, and thus, if needed control
- ❑ Issue: legacy site is a term for many, not necessarily same things....old contaminated sites, lost ownership, in environmental but also urban areas, once regulated in the past or never regulated.....multiple hazards, different exposure pathways and scenarios. Not emergency, but may be a risk for public, and even workers if/when remediation started
- ❑ Examples: NORM affected legacy site (e.g., old closed mining sites, phosphogypsum pills, even old disposal sites – parts of currently working facilities)
- ❑ Potentially exposed categories: workers (if clean-up or remediation ongoing), public, environment
- ❑ Assessment methodology: characterization always needed → decision on measures, optimization with remediation or other measures
- ❑ Commonly reference levels at the lower part of the band 1-20 mSv



Reference levels and optimisation at post emergency sites

- ❑ Exposures in a long-term contaminated territory – any measures conducted may affect inhabitants by changing in the dietary habits of the affected inhabitants
- ❑ The multiplicity of exposure pathways and the importance of individual behaviour may result in exposure situations that are difficult to control
- ❑ The objective in these situations is to implement a progressive range of strategies that are as good as possible adapted to inhabitants and their needs
- ❑ An endpoint for the optimisation process must not be fixed a priori and the optimised level of protection will depend on the situation
- ❑ Regulatory body is responsible to set the reference levels for each specific exposure situation of this type and to use them, retrospectively as benchmarks to assess the effectiveness of RP measures

Reference levels and optimisation of public exposure due to radon indoors

- ❑ The exposure route differs from that of other natural sources, and there are dosimetric and epidemiological issues specific to ^{222}Rn
- ❑ Radon at home, radon at workplaces – approaches to control; Homeworking as a new issue
- ❑ For many individuals ^{222}Rn is an important source of exposure which, in principle, can be controlled (but is it at satisfying level?)
- ❑ International and national requirements/recommendations that authorities should set a **national reference level as low as reasonably achievable in the range of 100 – 300 Bq m⁻³**. Radon concentrations are compared to the reference level to help control radon in homes and most workplaces

- ❑ However, using standard assumptions and new DCF, exposure to radon at the upper end of the recommended range for a national reference level of 300 Bq/m³ May produce different difficulties
- ❑ Still, Member States should ensure that in cases where the exposure of workers is liable to exceed an effective dose of 6 mSv per year or a corresponding time-integrated radon exposure value, they are managed as a planned exposure situation and that dose limits apply, and determine which operational protection requirements need be applied

Questions for discussion

- Parr(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
Hence, some judgement is necessary. Expert/regulatory judgement? And define what is appropriate or inappropriate

- In the application of the Reference levels, priority shall be given to the optimization of protection (article 7), in the sense to prioritize exposures above the reference level and shall continue to be implemented below the reference level.

On the other hand, the directive in article 100. 2. Programmes on existing exposure situations, says: "Member States may decide, having regard to the general principle of justification, that an existing exposure situation warrants no consideration of protective or remedial measures".

When/what are the conditions for an existing exposure to situation to warrant no consideration? When an exposure level can be allowed/considered appropriate? What are the conditions to continue to implement remedial actions? When to stop?

- Reference levels – 1-20 mSv/a....does each exposure need to be considered as site-specific, is that the most accurate approach?

Thank you for your attention!

Questions, discussion welcomed