

“Reasonableness” in the implementation of the ALARA principle in existing exposure situations (radon and radiological legacy sites)

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Introduction

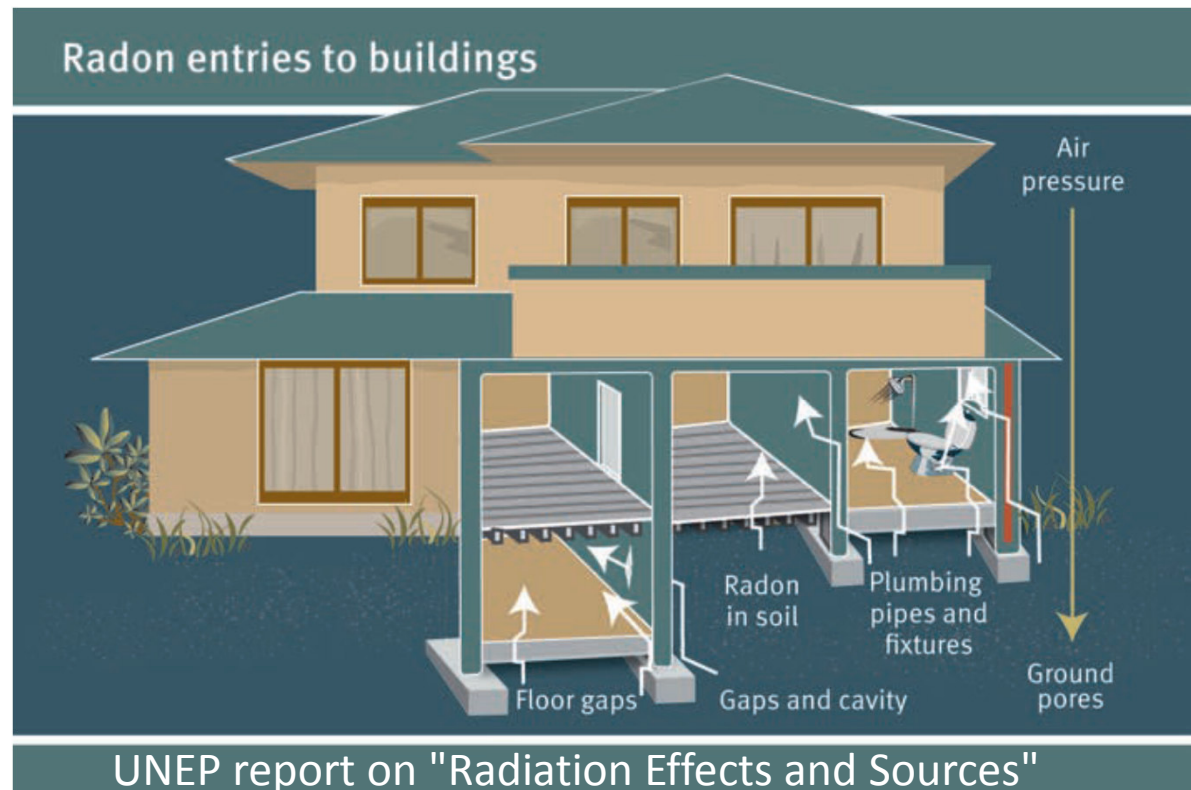
- Existing exposure situation (EES): *a situation that already exists when a decision on control has to be taken (ICRP 103)*
- Are concerned notably:
 - Background radiation
 - Residues from past practices
 - Long-term contaminations from a radiological accident (M. Kai)
- ICRP proposed strategy for EES
 - No dose limit
 - Justification of protective measures
 - Optimisation (Reference level: between 1 and 20 mSv/a)
- Analysis of reasonableness of optimisation
 - Exposure to domestic radon
 - Exposure to the radiological legacy of the Swiss watch industry

Exposure to domestic radon

- Presence of radon in dwellings (from soil, walls, water)
- Risk associated with inhalation of daughter products

Important parameters

- *Tightness of the building shell*
- *Air exchange in buildings*





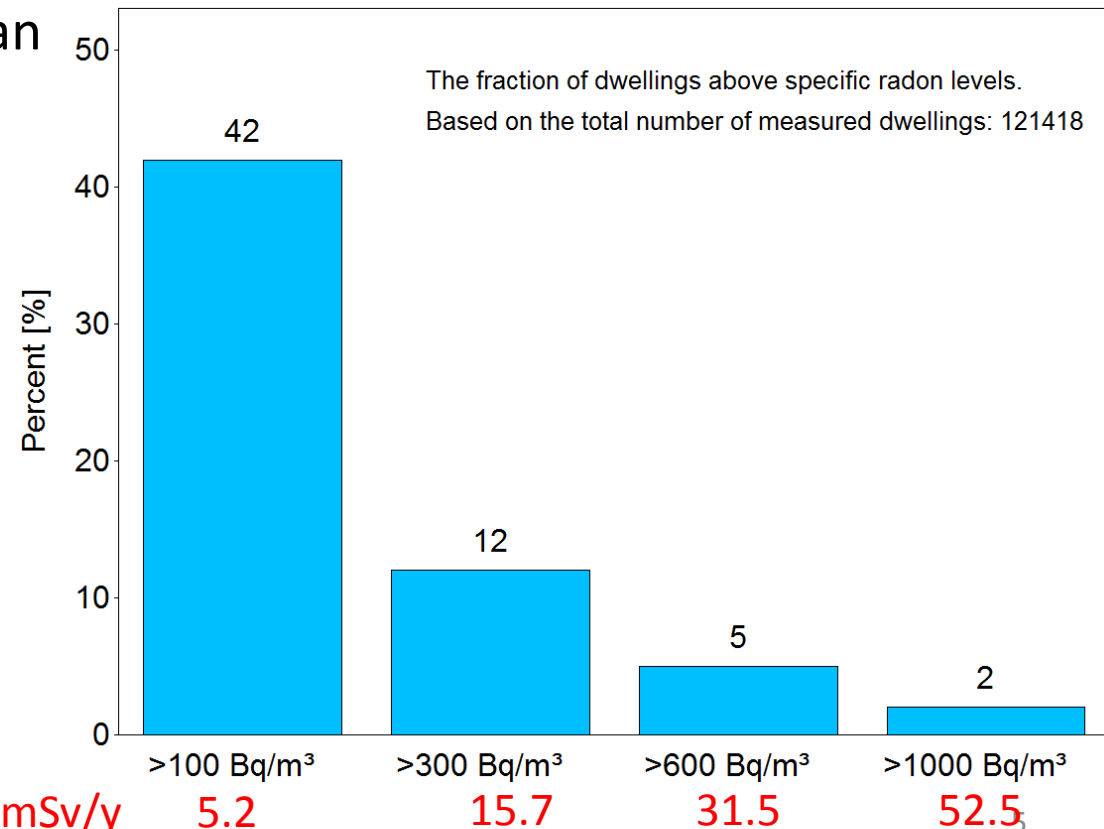
Radon Reference level

- Quantity on which the reference level is fixed:
annual average concentration of the premises
- Link to the effective dose:
 - Equilibrium factor (admitted to 0.4 in living rooms)
 - E_{inh} (conversion convention) : $7,5 \cdot 10^{-6}$ (mSv/Bqhm⁻³)
- BSS and EU directive proposal: $RL < 300 \text{ Bq/m}^3$
- Associated dose (7000 h/a; $F=0,4$) : **$E \sim 16 \text{ mSv/an}$**



Parameters involved in the choice of radon RL

- Public perception
 - Very low awareness of the risk, «Natural» exposure
 - Old presence, sense of security of place of life
 - Contestation of the plan (benefit to smokers)
- Number of dwellings concerned & associated cost depending on RL
- Necessity of a "reasonable" choice, e.g. % of the number of buildings $>$ RL



Optimisation within the action plan 2012 - 2020

- Prioritisation of measurements :
 - New buildings; not creating new cases to avoid exhaustion of the problem (responsibility on the builder/architect)
 - During transformations requiring a permit (building codes)
 - In schools and kindergartens (emotional component)
- Urgency for remediation depending on the radon level
- Radon introduction in the training plans of building professions
- Approval of radon measurement services
- Public information effort (major problem)

Radiological legacies of the watch industry in Switzerland

- Use of Radium-226 in luminescent paint between 1920 and 1960
- After the 2nd war, increase of private work at home
- Very limited precautions => apartment/garden/landfill contamination
- Back to the problem after work on a motorway site (former landfill)



Radium action plan

2015 - 2019

- The 4 axes of the action plan:
 - Historical research to identify potentially contaminated sites
 - Radium-diagnostic of identified sites
 - Remediation of contaminated buildings and gardens
 - Surveillance of landfills (workers & environment protection)
- Major problems: establishment of RL for Ra & communication

		Diagnostics effectués	Cas sans nécessité d'assainissement	Cas nécessitant un assainissement	Assainissements terminés (ou en cours)
Total	Nombre de bâtiments	200	159	41	25
	Détails	1051 appartements	1017 appartements	34 appartements 21 jardins	21 appartements 15 jardins
Bienne	Nombre de bâtiments	64	49	15	10
	Détails	361 appartements	347 appartements	14 appartements 7 jardins	10 appartements 6 jardins
La Chaux-de-Fonds	Nombre de bâtiments	61	49	12	9
	Détails	406 appartements	394 appartements	12 appartements 5 jardins	9 appartements 3 jardins
Autres communes*	Nombre de bâtiments	75	61	14	6
	Détails	284 appartements	276 appartements	8 appartements 9 jardins	2 appartements 6 jardins

RL of the radium action plan 2015 - 2019

- Quantity on which a RL is fixed:
 - effective dose of "potential " inhabitants
- Parameters involved in the choice of the RL:
 - Rather negative attitude of the public (surprise, unacceptable exposure in the place of life, due to an industrial source)
 - Search for a "definitive" treatment of the problem
 - Financing of remediation (difficult to apply the polluter-pays principle);
 - Current legislative framework not familiar with EES
- Selected level: 1 mSv / year (limit of the population exposure)

Optimisation within the action plan (I)

- Historical research supported by a university (up to 1000 sites)
- Radium-diagnostic measurements in buildings and gardens:
 - Screening: at 1 m and at 10 cm above ground on a 1m x 1m grid
 - Conservative modeling of the effective dose: room occupancy rate, average position of persons, various exposure pathways
- Criteria for clean-up/remediation of places of life
 - Effective dose above the reference level
 - > 1000 Bq/kg for the soil of outdoor areas
- Support for decontamination taken by the inhabitants for cases below the remediation criteria

Optimisation within the action plan (II)

- Waste management
 - Temporary waste storage with regulatory authorization
 - Incinerators (combustible waste/ wood) & landfills (inert waste/soil) under regulatory control
 - Elimination as radioactive waste
- Landfill monitoring
 - Integration of the Action Plan into the General Program for the remediation of Landfills (chemical pollutants)
 - Measurement of the radium-activity in core samples from potentially contaminated landfills
 - Protection of workers on landfills & monitoring of leaching water

Comparison of the optimisation of EES radon ↔ radium

	Radon	Radium
Reference level	15 mSv/a (top of ICRP range)	1 mSv/a (bottom of ICRP range)
Time horizon	30 – 100 years (several generations)	4 years (short-term action)
Nature of the source	"natural"	industrial
Public attitude	conciliatory	critical
Financing	The owners	The State (mainly)

Why such differences in the treatment ? Are they reasonable ?



THANK YOU FOR YOUR ATTENTION AND YOUR REASONABLENESS

- *Optimisation takes into account the many factors specific to the situations encountered. Thus it incorporates the notion of "reasonability", but leads to very different public exposures*
- *ICRP RL range for ExES (1 to 20 mSv/y) allows flexibility, that can be used to be reasonable in the optimisation*
- *External constraints as Media and Political pressure can oblige to act with less reasonability / wisdom*