

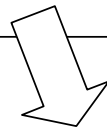
Radon hazard vs. radon risk consequences for radon abatement policy

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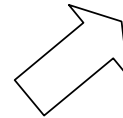
Radon:

1. Health risk
2. Natural origin, enhanced by anthropogenic factors
3. \Rightarrow Controlling anthropogenic factors for Rn abatement.



Tasks of radiation protection:

1. Protect individuals \Rightarrow priority action in regions where high individual risk can be expected
2. Protect society as a whole
 \Rightarrow control collective exposure / dose = Σ individual exposures / doses



Individual and collective risk:

1. Exposure to individuals; risk = probability to suffer detriment
2. Σ exposure \propto detriment to society = number of lung cancer fatalities

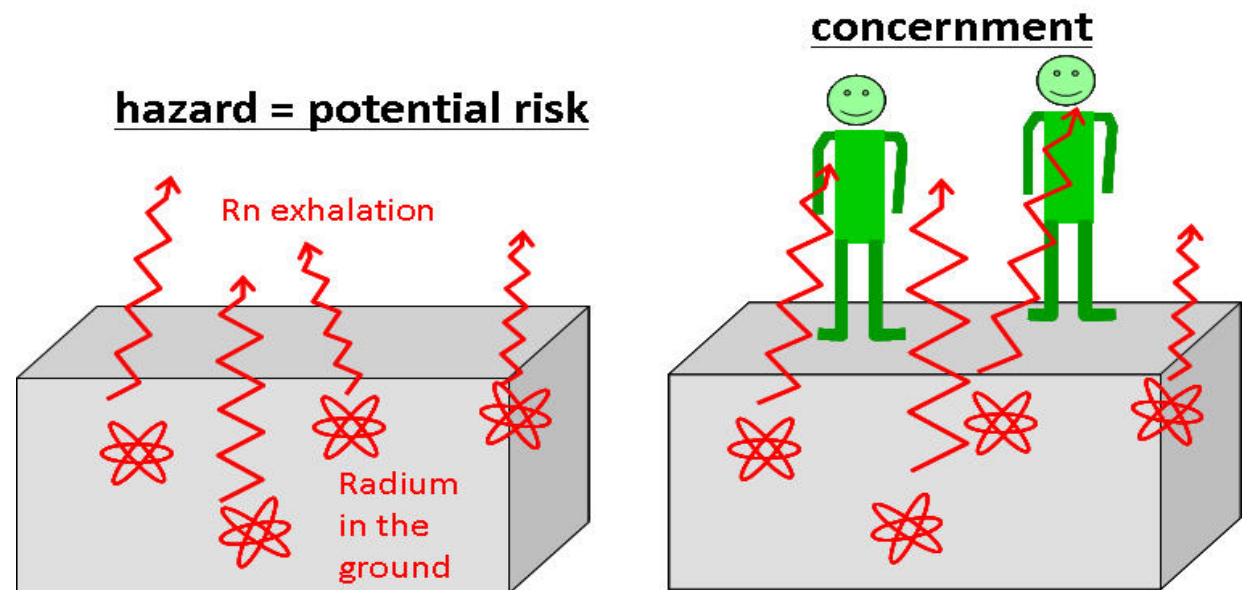


Regulation shall serve both!

Hazard and risk

- **Hazard** exists also if nobody is affected, exposed or concerned;
- It becomes a **risk**, (= a certain probability or size of damage or detriment), if there is somebody who can be harmed. If there is nobody, evidently there is no risk, even if a physical cause exists.
(Or in general, any being or thing whose damage or detriment should be avoided.)

$$\text{risk} = \text{hazard} \times \text{concernment}$$



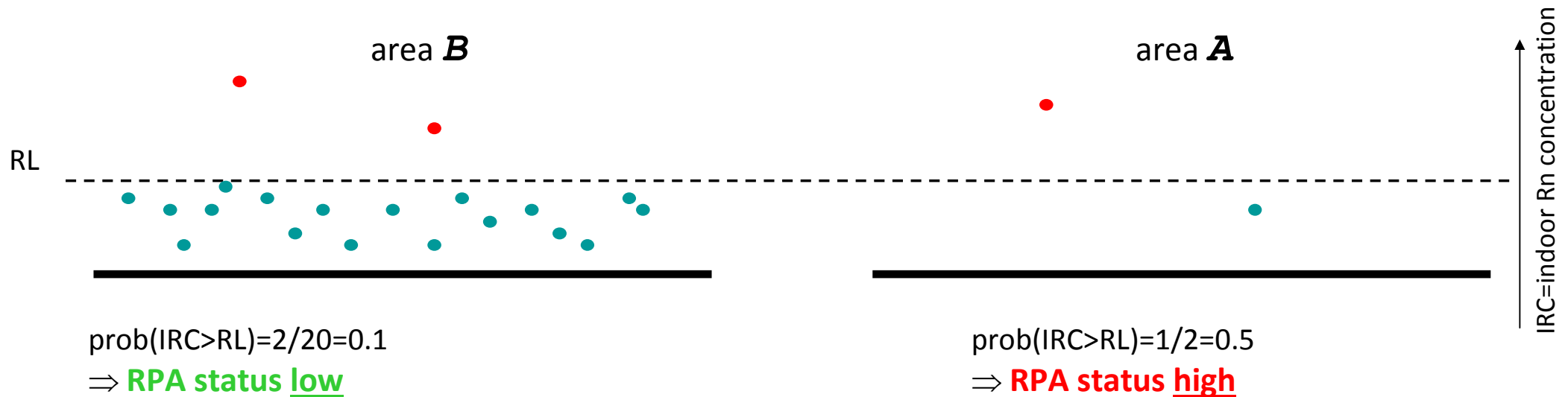
Hazard and risk, 2

Rn risk:

Risk =	probability of detriment, size of detriment	Lung cancer rate, number of cases
Hazard ×	Physical cause: Probability of occurrence or size of a potentially harmful phenomenon	GRP
Vulnerability ×	Conditions (environmental, social, economic,...) which determine the susceptibility of the good which can be harmed (people, community, infrastructure, material assets,...)	Building type, flor level, living habits, social factors, climate
Exposure	Presence of this good	number of people, population density

concernment

- In the previous scheme, “concernment” \approx vulnerability \times exposure
- Maps:
 - > Hazard map = GRP map
 - > Risk map = overlay (hazard, vulnerability, demographic maps)



also mean(IRC) in **B** < mean(IRC) in **A**.

but:

collective risk \sim exposure $\sim \sum$ IRC = **high**

most cases
occur in B,
not in A!

but:

collective risk = low

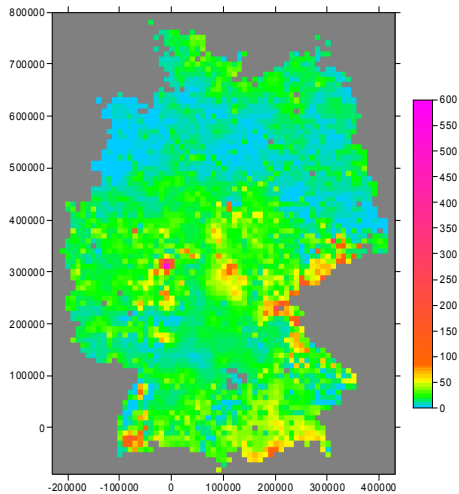
According to the conventional interpretation of EU-BSS, Art. 103/3 and Annex XVIII (6), one would concentrate Rn policy on area **A**, but not on **B**, although the collective risk due to Rn is higher in **B**.

\Rightarrow **Question:**

**Which could or should be the adequate action in area B with low individual but high collective risk ?
 To be discussed !**

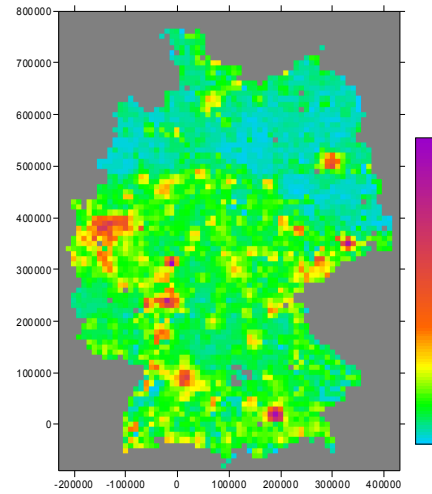
Example Germany:

Geogenic radon potential (GRP) =
hazard



different patterns!

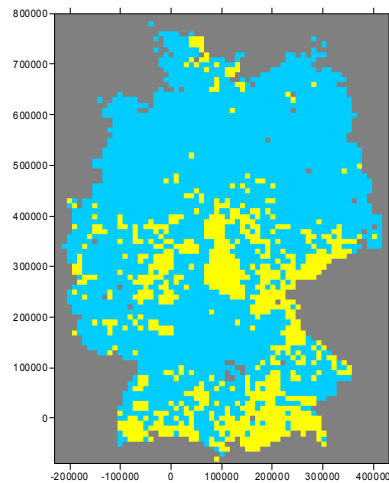
collective exposure
per unit area \approx **risk**



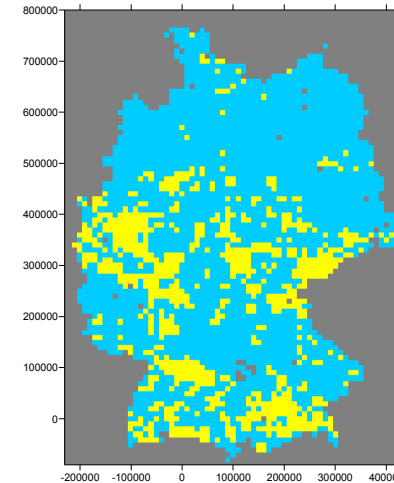
Overlay GRP and
population density (sqrt
rescaled to [0,1]) = **risk minus
vulnerability**

suggestion for action
Rn priority area =
hazard area

GRPA map, defined:
 $\text{prob}(\text{IRC} > 300) > 0.1 =$
hazard



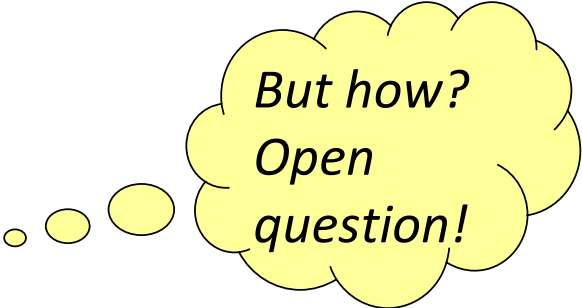
different patterns!



Map of the areas in
which 80% of the risk is
located (assuming that
IRC < 25 is trivial or irreducible
exposure) = **risk minus
vulnerability**

Consequence:

- If the detriment to the society caused by Rn exposure shall be reduced, Rn abatement policy must address **risk areas**.
- So far mainly **hazard areas** considered.
(Of course also important)



*But how?
Open
question!*