The overview of a system of

RADON PREVENTION

in the Czech Republic

Státní ústav radiační ochrany, v. v. i.
National Radiation Protection Institute

Kořistka

Navrátilová Rovenská

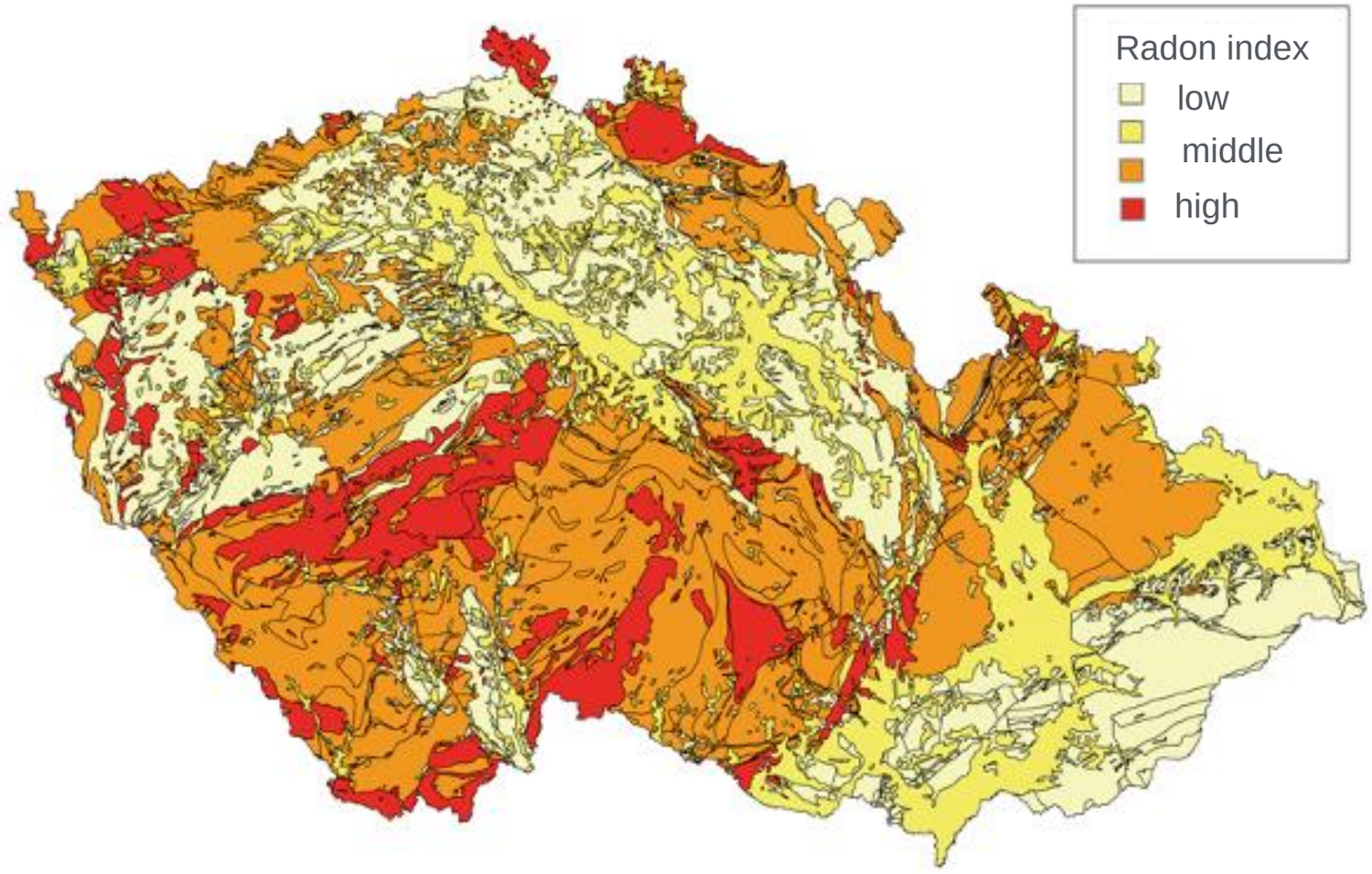
Fojtíková

Czech legislation

Justification and directive 2013/59/Euratom

- basic safety standards must be applied in accordance with European directive 2013/59Euratom
- Czech legislation — stricter from both historical and present reasons
  - dates back to the 90's — radon penetration protection (from both soil and materials)
  - updated continuously

Czech legislation



- geological subsoil is rich in radionuclides — almost half of the Czech average citizen's exposure comes from radon
- building material rich in radium (slag concrete) in 60's and 70's
- historical uranium mining industry

State Office for Nuclear Safety

- **regulatory authority**, central radiation protection office for nuclear energy use and ionizing radiation use
- on the ministry level, the chairman in responsible directly to the Prime Minister
- responsible for the elaboration and coordinating the **National Action Plan for the Radon Exposure Regulation** in the Czech republic

CZECH **ATOMIC LAW** (263/2016 COLL.)

DEFINES

EXISTING EXPOSURE SITUATIONS

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Exposure to radon on workplaces

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EXPOSURE TO RADON ON WORKPLACES

- In workplaces with **potentially increased exposure** to radon is obligatory to ensure measurements to establish effective doses to workers (if presence > 100 h per year)

- **workplaces e. g.:**
  - underground workplaces (caves, mines, …)
  - workplaces where handled with underground water (water treatment facilities, spa, …)
  - underground or 1st floor workplaces located on RPAs

CZECH **ATOMIC LAW** (263/2016 COLL.)

EXPOSURE TO RADON ON WORKPLACES

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NORM workplaces are described in Planning exposure situations

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DEFINES

EXISTING EXPOSURE SITUATIONS

Exposure to radon on workplaces

Indoor exposure to natural sources of radiation

CZECH **ATOMIC LAW** (263/2016 COLL.)

EXPOSURE TO NATURAL SOURCES OF RADIATION

1. **Prevention of indoor penetration of radon**

   Anyone proposing the siting of a new building or extension with residential rooms shall ensure the building site radon index assessment

2. **Protection from natural natural indoor radiation**

   If reference level (300 Bq/m^3) has been exceeded, the owner shall endeavor the reduction of the persons' exposure following the ALARA principle

CZECH **ATOMIC LAW** (263/2016 COLL.)

DEFINES

EXISTING EXPOSURE SITUATIONS

- Exposure to radon on workplaces
- Indoor exposure to natural sources of radiation
- Water and building materials

CZECH **ATOMIC LAW** (263/2016 COLL.)

WATER AND BUILDING MATERIALS

- reference level for radon concentration (300 Bq/l) and total alpha and beta activity indicators are set for drinking water for public use
- **indicative dose** expresses exposure to water — if reference level is exceeded, supplier must ensure measures for its reduction

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WATER AND BUILDING MATERIALS

- reference level for radon concentration (300 Bq/l) and total alpha and beta activity indicators are set for drinking water for public use
- **indicative dose** expresses exposure to water — if reference level is exceeded, supplier must ensure measures for its reduction
- Building materials may not be made available on the Czech market if the effective dose to the representative person from external exposure to gamma radiation could exceed the reference level when using a building

CZECH **ATOMIC LAW** (263/2016 COLL.)

DEFINES

EXISTING EXPOSURE SITUATIONS

- Exposure to radon on workplaces
- Indoor exposure to natural sources of radiation
- Water and building materials

A **subsidy** may be provided in **some existing exposure situations!**

CZECH **ATOMIC LAW** (263/2016 COLL.)

MINISTRY OF FINANCE MAY PROVIDE A SUBSIDY FOR:

1. the identification of the risks arising from the exposure to radon in indoor air of residential and public buildings

2. the adoption of a measure reducing the level of radon exposure in the indoor air of housing and public buildings

3. the adoption of a measure reducing the content of natural radionuclides in drinking water intended for public use

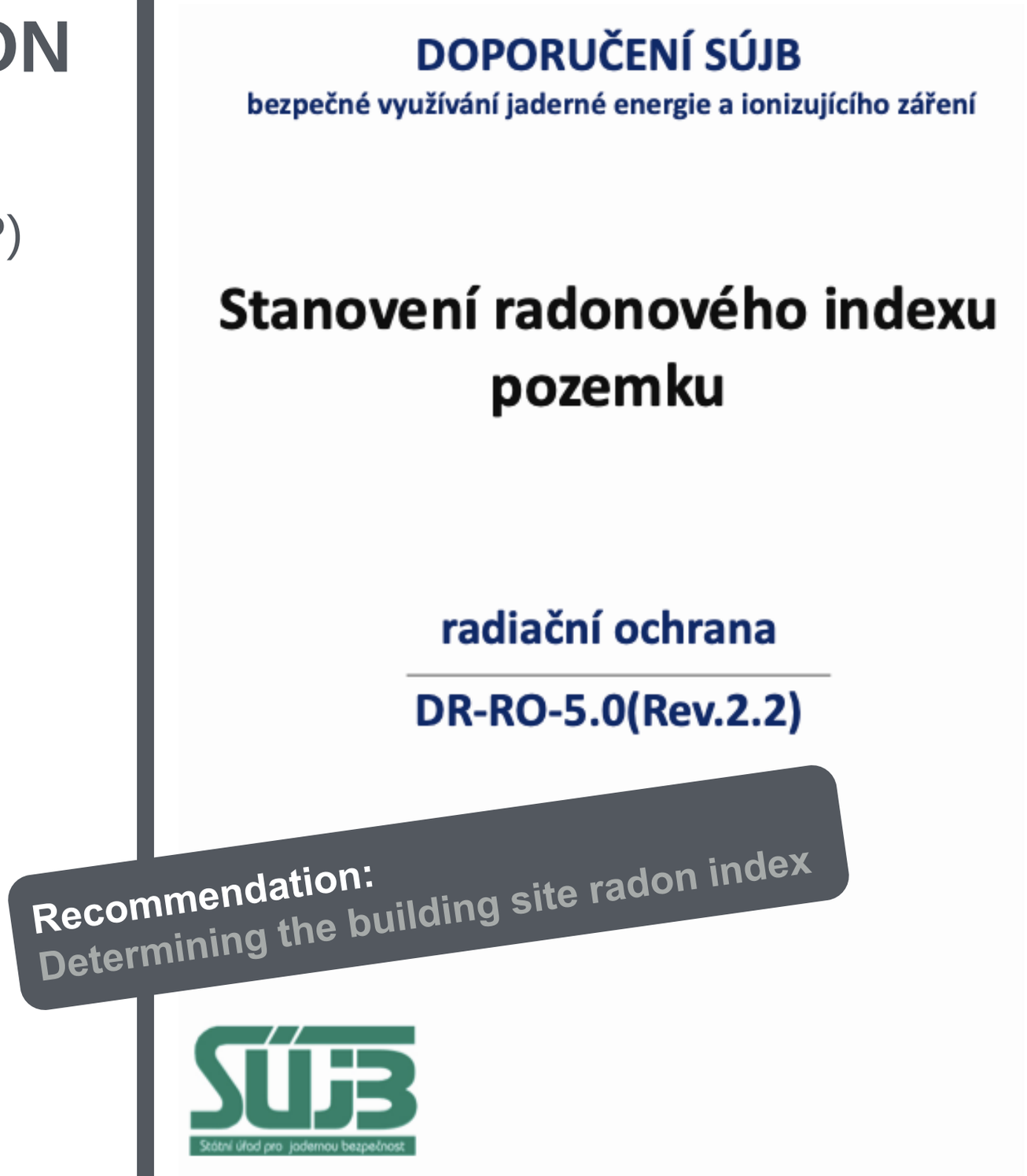
part of **National Action Plan for the Radon Exposure Regulation**

Mr. Novák wants to build a house. Which radon precautions shall be undertaken?

BUILDING SITE RADON INDEX

(“radon index of the land” — RIP)

- Part of the prevention of indoor penetration of radon as defined in the Atomic Law
- A risk indicator of radon penetration from the geological subsoil into the building
- Category – low, medium, high (determined from the parameter called Radon potential — RP)



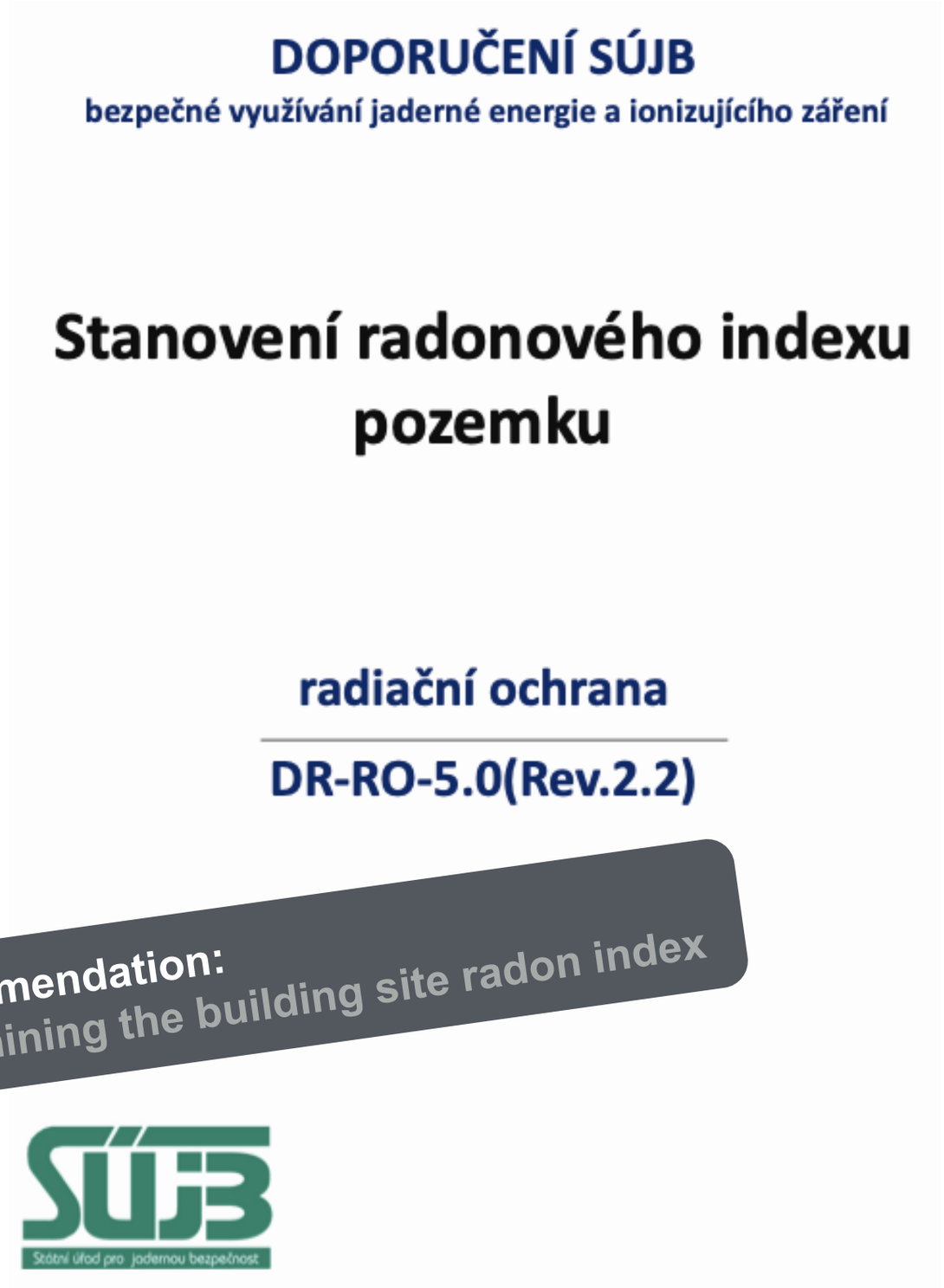
BUILDING SITE RADON INDEX

(radon index of the land — RIP)

- Mr. Novák has to hire a **Holder of a licence** for RIP assessment

- the licence is given by the regulatory authority, if the holder meets the requirements of **Special Professional Competence**

- the holder must follow the Recommendation

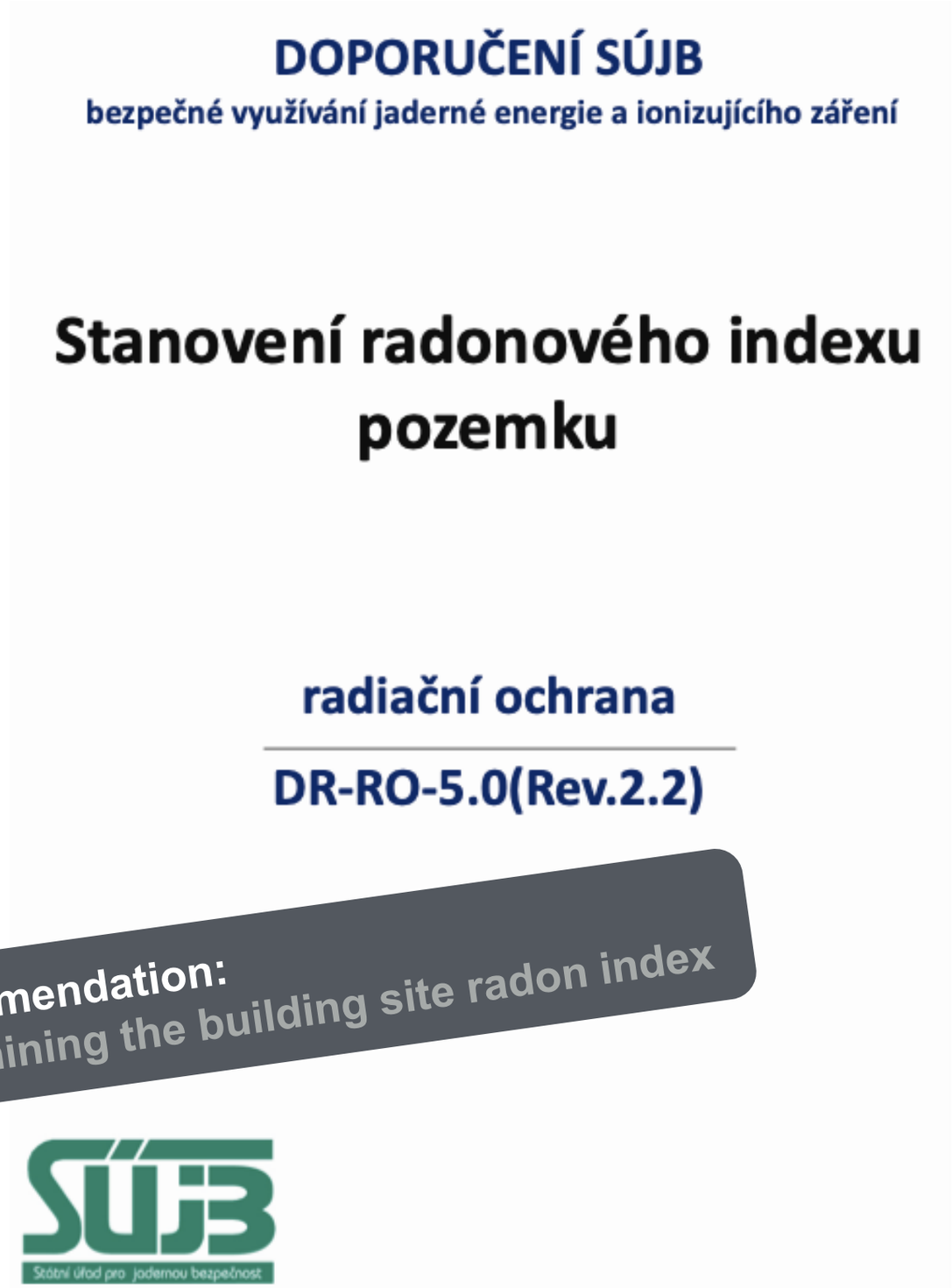


RADON POTENTIAL

- consists of two parameters which must be measured directly on the Mr. Novák's land according with the methodology

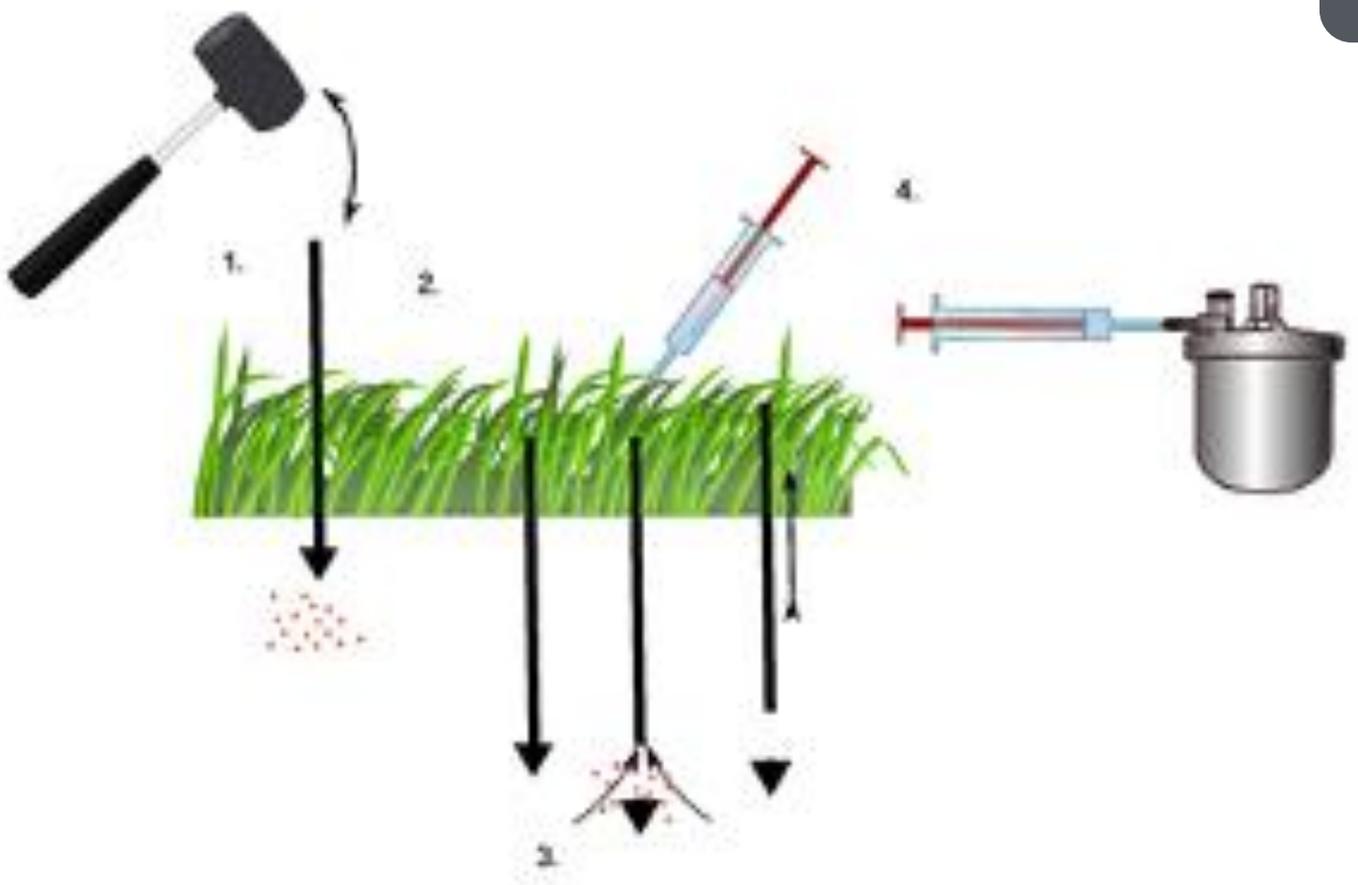
1. radon concentration in the soil air [kBq/m^3]

2. gas permeability of the soil



RADON POTENTIAL

- inhomogeneous radon distribution in soils
- local deviations



- at least **15 point** measurements of both radon concentration and gas permeability
- area of the **future building and the nearest surroundings**
- statistical evaluation of data

RADON POTENTIAL (RP) AND RADON INDEX (RIP) RELATION

- Inputs for RP assessment:
  1. the third quartile from the radon concentration data set

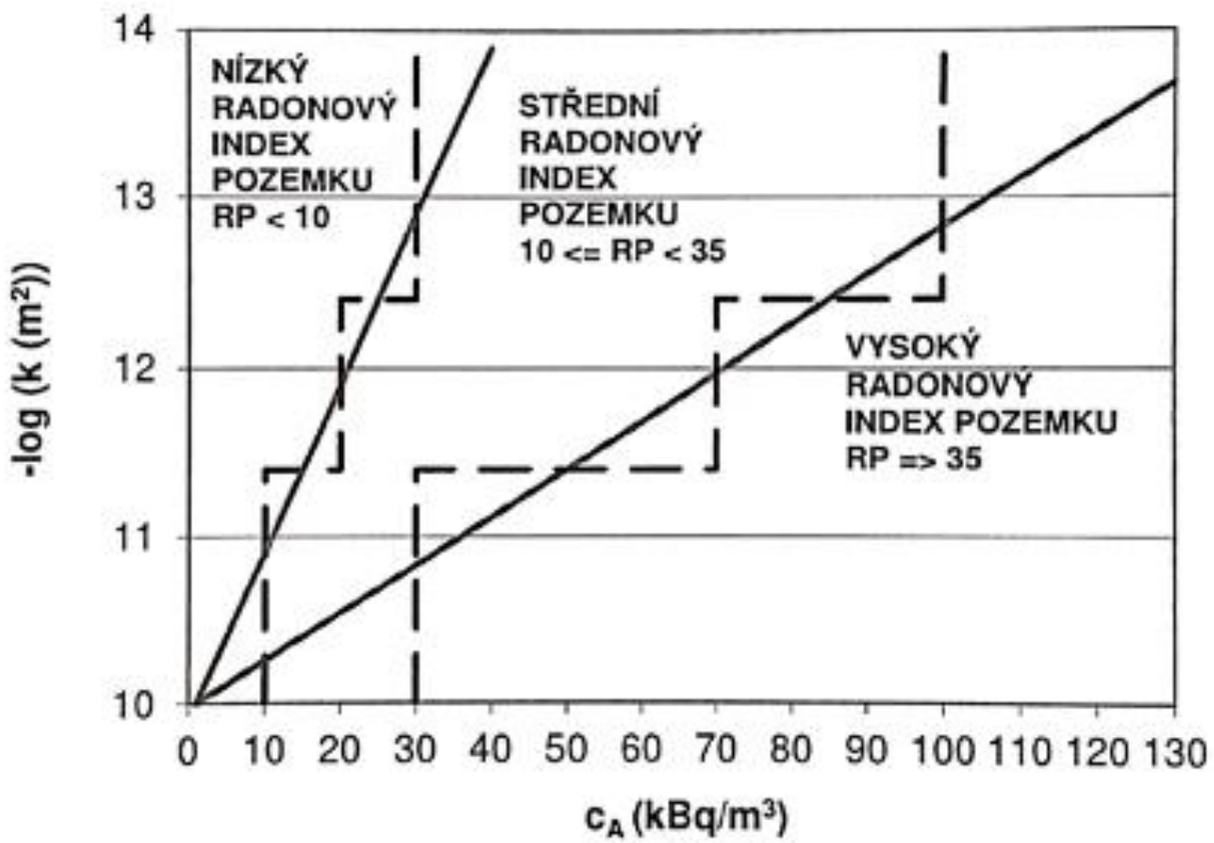
     (if local anomaly > 3 x c_{A75}, the maximum value from the data file becomes the input)
  2. the third quartile from the soil gas permeability data set

$$RP = \frac{C_A - 1}{-\log k - 10}$$

RP < 10 —> low RIP

10 < RP < 35 —> middle RIP

RP > 35 —> high RIP



Mr. Novák is given the protocol from RIP assessment. What next?

RADON INDEX OF THE BUILDING

- RIP protocol is passed to the building designer who determines the **Radon index of the building** considering:
  1. Building site radon index
  2. Height of the house foundation
  3. Gas permeability and radon concentration in soils at the level of the house foundation
  4. Subsoil modifications (compaction, establishment of permeable gravel-sand layers etc.)

- ČSN 73 0601 (2006) — Protection of buildings against radon from the subsoil

Manual:
Radon in construction context

BUILDING PROTECTION

1. radon isolation
2. subsoil depressurization
3. combined

- the building protection is designed on the basis of the **radon index of the building** and **technical parameters**
- e. g. the presence of underfloor heating requires combined protection regardless the index

Manual:
Radon in construction context

Mr. Novák now has to visit the Building Authority. Tooooo much bureaucracy. Let's skip it and let the house be built.

“A building must not endanger life and health of people and animals, safety, environment, interests of state monument care, archaeological findings and neighboring.”

The Building Authority may request the radon measurement in the house before the final approval of operation

MEASUREMENT IN THE NEW BUILDING

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- Was the reference level exceeded?
- at least 7 days
- electrets detectors and continual monitors

MEASUREMENT IN THE NEW BUILDING

- Average radon concentration assessment
- 2 months during the heating season or 12 months
- alpha-track radon enclosed detectors


Radon monitor
RADIM 3
RS232
SMM Prague


ALPHAGUARD
Professional Radon Monitor
GENITRON


Detektor Radonu
RAMARN

MEASUREMENT IN AN EXISTING BUILDING

- average radon concentration > 1 000 Bq/m^3 —> remedial measures may be subsidized up to 150 000 CZK (6 000 euros)
- **to be given a subsidy:**
    1. all-year measurement must be done to assess the average radon concentration
    2. house must had been build before 1991
    3. control measurement must be done after the measure (300 Bq/m^3 or 75 %)
- the radon measurement is recommended before a house reconstruction (attention should be taken if windows are to be replaced)

CONCLUSION

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Preventive measures since early 90's
RIP must be assessed for every new house

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Preventive measures since early 90's
RIP must be assessed for every new house
Everyone can request a free radon measurement

THANK YOU FOR YOUR ATTENTION

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