A first version of a European Geogenic Radon Map (EGRM)

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www.jrc.ec.europa.eu
Objectives:
- Increase **public** (and indirectly political) **awareness** and familiarize the public with its (radioactive) environment;
- Visualize the situation on a **European level**
- Provide **reference material**, contribute to methodology and scientific aspects.
- **Support and stimulate communication** within scientific community on a complex issue (e.g. radon mapping, risk definition and estimation)
- Generate **harmonized data** for the scientific community
- Potential support to EU Member States for the **radon action plan** (draft European BSS, art. 103) – “radon prone areas”

**REM** is not dealing directly with **health issues**!

The EC’s European Atlas of Natural Radiation will not substitute for, or compete with **national activities** in the field!

**Planned Maps/Topics:**
- **Radon** (Indoor, Geogenic, Outdoor?)
- Others: Cosmic radiation, terrestrial gamma dose rate, water?, exposure?
- Goal: Total dose by natural radiation
25 countries
→ 18,791 non-empty cells
→ 818,791 measurements
Geogenic Rn map = independent of anthropogenic factors

- **indoor Rn**
  - subject to human activity, temporally variable
  - variability at different time scales
  - temporal variability e.g. through upgrading insulation

- **outdoor Rn**

- **living habits**

- **meteo**

- **building materials**

- **house construction**

- **geogenic Rn**
  - defined everywhere on solid earth
  - “what earth delivers”, without influence of human interference, temporally constant over geologic timescale

- **European Geogenic Radon Map (EGRM) Background**
Problems for a harmonised European map:

Heterogeneity of datasets
almost every country has input datasets different from the others

Heterogeneity in definition of operational quantities
- different geological classification systems,
- different sampling protocols
⇒ Harmonization!

Which RP definition is feasible?
If a definition adopted: how to deal with missing input variables?

Estimation methods?
**European Geogenic Radon Map (EGRM)**

**Start:** Radon mapping symposium and workshop, Oslo, IGC33, 2008

→ expert group

→ 3 workshops/experts meetings (Ispra, Prague), extended expert group, discussions of national approaches and methods how to come to an harmonized European map

**Workshop, Ispra, November 2011 and ongoing:**

- Follow a **classification (multivariate)** and **continuous approach** in parallel
- **Target variable** for continuous scheme: “Neznal” \( RP := C / (\log_{10} k - 10) \); input variables to be transformed via transfer models.
- Use **input quantities** for classification scheme: standardized indoor radon, soil gas radon, permeability, eU, dose rate, geology class, presence of special geological feature - classified \([0,1]\) and weighted →
- Create **Geogenic Radon database** - based on a radon-relevant geological classification (use OneGeology where possible, some countries as example; include geology like quaternary) and fill with data
- Collect **sampling** and **measuring protocols** from the countries for standardisation
- Prepare **first classification maps**

Intermediate step – this presentation

Round table, Thursday
• Insert a **first step**: Geogenic radon map based on **geology** only

• Each geological type is assigned an **index value 1 – 4**
  (low, moderate, elevated, high)
  → definition of intervals: only “geological” or “radiological” (risk related – e.g. probability that C(Indoor radon) > 100 Bq/m³)

• Establish list of **geological types**:
  - so far German geo-types used for “calibration” of the model;
  - try to translate this (as well as we can) into the “OneGeology” scheme

• **Apply** to geological units in other countries by **analogy**

• **Iterative improvement** by feedback from experts.
  (In course e.g. for Belgium.)
Steps for First Trial
EGRM

OneGeology Data

- 20 countries
- map 1:1mio
- 1 shp-file per country for download
Steps for First Trial

EGRM

Geo-types

Details – Peter’s presentation

Tried/Started to translate Geo-types into OneGeology-geology units “calibrated” on German data

Problems (Missing in trial map):

- Geology units which do not exist in Germany (e.g. Scandinavia: Fennoscandic and Baltic shield; Britain: Caldeonian; Central Alps; etc.)

- Complicated geology (in particular quaternary) – geologists needed

- OneGeology classification not detailed enough → no assignment possible to certain units

- Countries not part of OneGeology

- OneGeology shp-files incomplete or differently classified (SE, NO, FI)
First Trial EGRM Geo-types
First Trial EGRM

Radon Classes
“radiological”

Europe
Radon Classes (cl-rad)

- not classified
- 1
- 2
- 3
- 4

Joint Research Centre
First Trial EGRM

Radon Classes “geological”
Example Belgium

Classification according to the described method (radiological classification) based on German “calibration”

Re-classification by Boris
First Trial EGRM

Examples and “Problems”

Example Czech Republic

Classification according to method based on German “calibration”

underestimated

overestimated

Classification by I. Barnet et al., Czech Geological Survey, Special Paper 19
First Trial EGRM

Example Germany

Classification based on OneGeology

not sufficiently classified in OneGeology

Classification based on German geology map/Geo-types

Example and “Problems”
• **OneGeology** – seems sometimes not be classified detailed enough for radon classification – Useable? How adapt it?

• Not all European countries participate in OneGeology – **how to include these countries**?

• Used method works only for **geo-types** which have been calibrated = the ones which exist in Germany; we need RP data for geo-types not included so far (e.g. Alpine orogeny; Baltic / Fennoscandian shield; Caledonian orogeny)

• **Geo-types** must be identified and validated in the countries with the ones which have already been classified

• **Iterative improvement** of the classification by expert’s input

• **Workplan** (Timescale?, Who?)
European Geogenic Radon Map (EGRM)  The database

For classification and continous approach – collect statistics of radiometric data for all „input variables“ for each radon relevant geology unit of the countries in a database

**GM, GSD, AM, Med, Min, Max, Number** of measurements for all „input variables“ (standardized indoor radon, soil gas radon, permeability, eU, dose rate, RP) per geology unit

Details about geology (Age, Lithology, Orogeny, Genesis, presence of special geological features (natural and anthropogenic))

**Metadata** for comparability and harmonisation of data (used methodology, data selection, data treatment, spatial distribution)

First filled by countries which have sufficient number of measurement data available to characterize a geological unit

Use geology information in database to identify similar geological units in other countries and regions where no data are available, and use existing data as default values

Needs knowledge and co-operation of geologist experts
European Geogenic Radon Map (EGRM) The database

>100 fields to fill per geology unit → **excel template** → Oracle database is waiting for data already

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geological unit’s name</td>
<td>text</td>
</tr>
<tr>
<td>Geological unit’s size</td>
<td>$0 - 10^3$ km$^2$</td>
</tr>
<tr>
<td>Geological sub-unit</td>
<td>text</td>
</tr>
<tr>
<td>Geological sub-unit’s size</td>
<td>$0 - 10^2$ km$^2$</td>
</tr>
</tbody>
</table>

According to OneGeology Classification/terminology

EGRM roundtable, Thursday
„Summary of discussions and „Status of knowledge in the field“

>40 authors > 360 pages

→ Restructuring and proofreading necessary

→ Next version postponed to autumn 2012, should be publish as JRC report

→ Contributions, ideas for restructuring, proofreading still welcome
Thank you!

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