# Objective of WP4 and its position in Metro Radon

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# Content

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- Structure of Metro Radon
- Metro Rn ↘ WP4
- QA and QA chain
- Tasks of WP4 – for some details see following presentations!

# Logic of Metro Radon

- Metro Rn is a metrological project.
- It shall support protection against exposure to radon (decay products)
- On European level, protection against Rn is regulated by the Euratom BSS, which have to be transposed into National Law by Member States.
  (A number of non-EU countries decided to adopt regulation similar to the Eur. or IAEA BSS)
- To this end, the BSS require establishment of National Radon Action Plans, which include
  - Definition of reference level RL $\leq$ 300 Bq/m³ for dwellings and workplaces;
  - Delineation of Rn priority areas (RPA)
  - Strategy for preventive and corrective action against Rn exposure, including communication to stakeholders.
- Decisions about action and ensuring compliance with regulation must be QAed, i.e. reliable, legally proof and able to be communicated plausibly.
- This implies QA of the entire chain:

**measurement → action and decision**

This motivates logic and structure of Metro Rn.

# b.t.w., what is metrology?

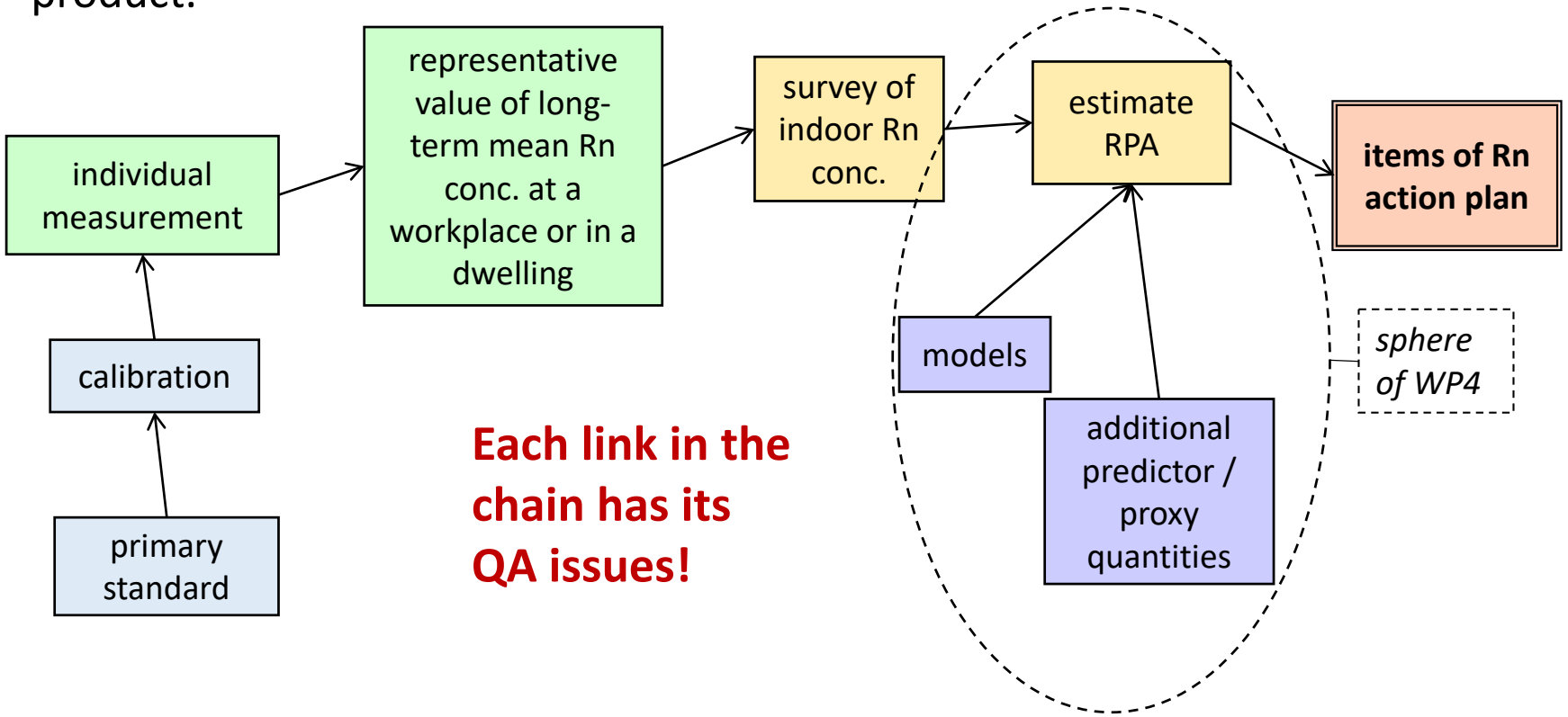
Wikipedia knows everything:

- Metrology is the science of measurement.
- Metrology is divided into three basic overlapping activities.
  1) definition of units of measurement,
  2) realisation of these units of measurement in practice,
  3) traceability, which is linking measurements made in practice to the reference standards.
- 3 basic sub-fields of Metrology:
  1) Scientific or fundamental metrology, which is concerned with the establishment of units of measurement,
  2) Applied, technical or industrial metrology, the application of measurement to manufacturing and other processes in society,
  3) Legal metrology covers the regulation and statutory requirements for measuring instruments and the methods of measurement.

https://en.wikipedia.org/wiki/Metrology

# QA chain

- Pathway from correctly measured individual Rn concentrations to a reliable end-user product, i.e. items of Rn action plans aimed to reduce Rn exposure.
- For the overall purpose of reduction of Rn exposure, one is not interested in actual Rn concentrations; but these being correctly measured, is a condition of the validity of all subsequent aggregation steps, which serve the end-user product.



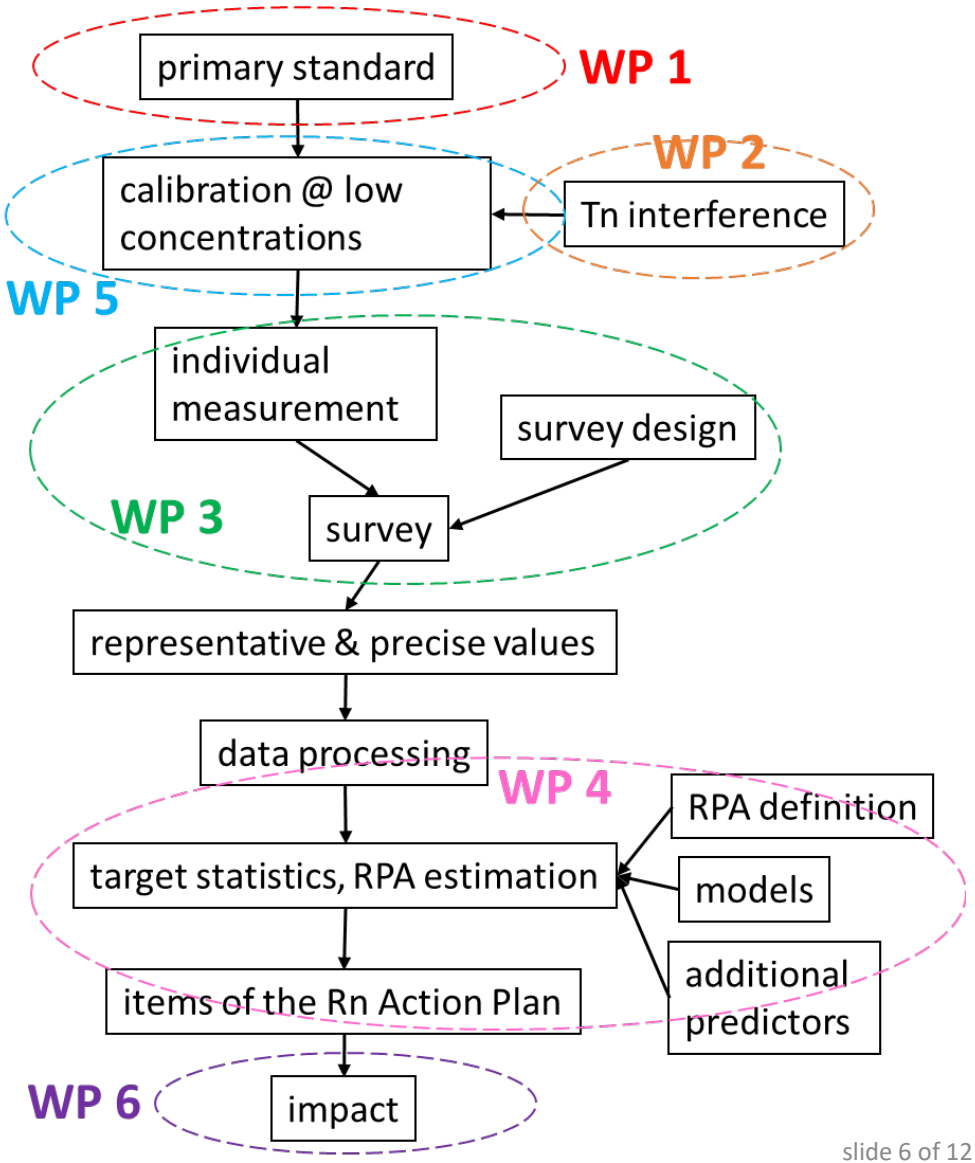
# QA chain ⇒ Metro Rn structure

"supply chain" which leads to a QAed "end product", e.g.,

- Decision about compliance with Reference Levels;
- Delineation of Radon Priority Areas satisfying a certain level of confidence;
- …
- general: Items of Rn Action Plan

⇒ **All links of the chain must be quality assured!**

From the point of view of BSS, not a particular value of Rn conc. is the requested end product, but certain action.



# 4 levels of QA

1) **Design QA:** An investigation, experiment or survey has to be designed such that the target can be met with given tolerance. This concerns geographical or demographic survey designs, where the criterion of the design are representativeness (affecting accuracy, related to positioning of observations) and precision (implying sample size).
2) **Data QA:** This concerns “classical” metrological QA, i.e. correct experimental procedures, in particular calibration and measurement, proper consideration of uncertainty that occurs in different stages of the procedure and of detection limits.
3) **Evaluation QA:** This part deals with selecting proper evaluation methodology, selection of adequate models, correct statistics, considering - as far as feasible (because this can be complicated!) - model-induced uncertainty.
4) **Decision QA:** A correct decision shall be taken about which action to take. Correctness of a decision is based on the quality of preceding steps. The probability of a wrong decision shall be below a threshold; however, assessing such "mis-decision" chance seems to be a complicated problem, beyond the scpoe of Metr Radon.

# Specifically: QA in the context of WP4

- Definitions should be as clear and unambiguous as possible;
- For numerical output quantities, an uncertainty budget should be attempted;
- For categorical output, assessment of misclassification probability should be attempted;
- Where possible, reproducible rules or flow schemes for establishing these should be given;
- The possible impact of uncertainty to the "product" of a task – a map, a decision about action, a statement about compliance with a legal item etc. – should be addressed.

*Ideal world….  how far we can achieve this: ?????*

# Roles of WP3 and WP4

- Although the subjects of WP3 and WP4 are not metrological ones in a strict sense, they are the links between measurement proper and actions & decisions.
- Actions and decisions should be QAed (= reliable, legally proof, communicable). Objective of WP3+4 is to add to the scientific foundations which enable QA on the action & decision level.
  (A decision is reliable if the chance of wrong decision is below a set probability threshold.)
- Naturally, QAed action & decision rests on QAed measurement $\Rightarrow$ WP1,2,5.

# Tasks of WP4

**4.1 Concept, purpose and definition of RPA**

- Motivation, legal background (4.1.1.0)
- RPA from dwellings // workplaces (4.1.1.2)
- role of stakeholders in RPA definition (4.1.1.3)
- case studies (4.1.1.5)

**4.2 Relation geogenic – indoor radon**

- Radon potential, Geogenic radon potential (4.2.1, 4.2.2)
- Physical and statistical relationships between variables (4.2.1)

**4.3 Recent developments in RPA definition**

- Estimation and uncertainty of RPAs (4.3.1)
- Retrospective RPA estimation, CD/DVD method (4.3.2)
- RPA based on extremes (4.3.3)
- Geogenic Radon Hazard Index GRHI (4.3.4)

**4.4 Harmonization of RPAs across borders**

- Consistency across borders, case studies (4.4.1)
- Mapping exercise (4.4.2)
- Obstacles against RPA harmonization and possible ways to overcome them (4.4.3)
- European RPA map (4.4.3)

# Following presentations

- Rosabianca Trevisi & Federica Leonardi:
  **Study on possible different distributions of indoor radon levels in dwellings and workplaces - preliminary results**
  WP 4.1.1, “Concepts and definitions of RPA”
- Claire Greau, Carlos Sainz, Géraldine Ielsch:
  **Estimation of Rn priority areas based on Rn extremes, with case studies in France and Spain**
  WP 4.3.3, “Classification based on occurrence of extremes”
- Valeria Gruber, Sebastian Baumann:
  **The radon mapping exercise**
  WP 4.4.2, “Mapping exercise”
- Claire Greau, Carlos Sainz, Géraldine Ielsch:
  **Harmonization of radon priority areas across borders: focus on some West European borders**
  WP 4.4.1, “Consistency across borders”
- Giorgia Cinelli:
  **Overview of radon maps and data in Europe: differences and challenges for harmonization.**
  WP 4.4.3, “Obstacles against RPA harmonization and possible ways to overcome them”
- Giancarlo Ciotoli & Peter Bossew:
  **The geogenic radon hazard index**
  WP 4.3.4, “Radon hazard index”

Wrap-up:

- José Luis Gutiérrez-Villanueva, Giorgia Cinelli, Valeria Gruber, Peter Bossew: **Impressions of WP 4**

# Thank you!

WP4 participants (unusually many! – shows high interest):

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