Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile

Use of outdoor radon activity concentration and radon flux data for radiation protection applications

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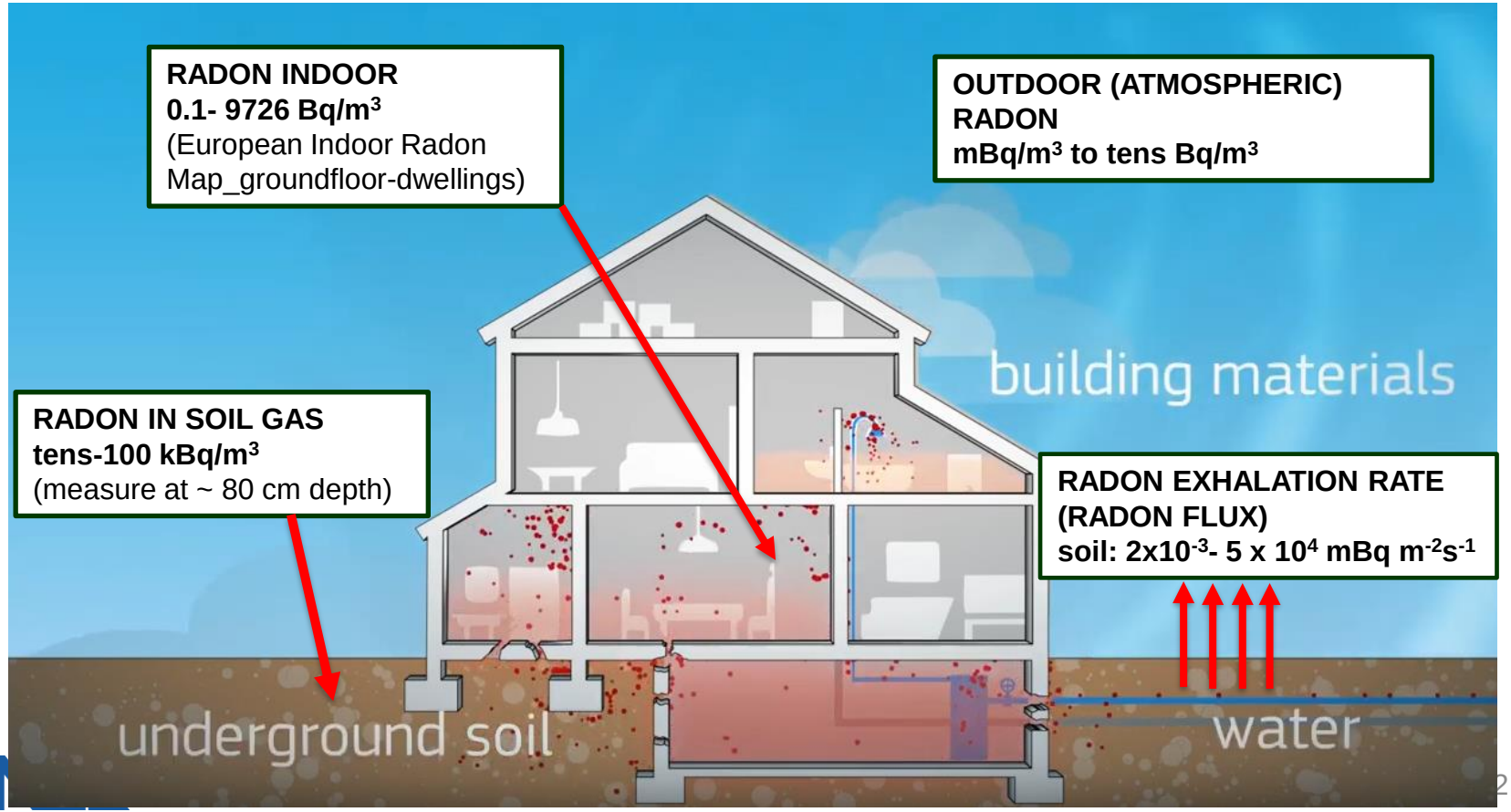
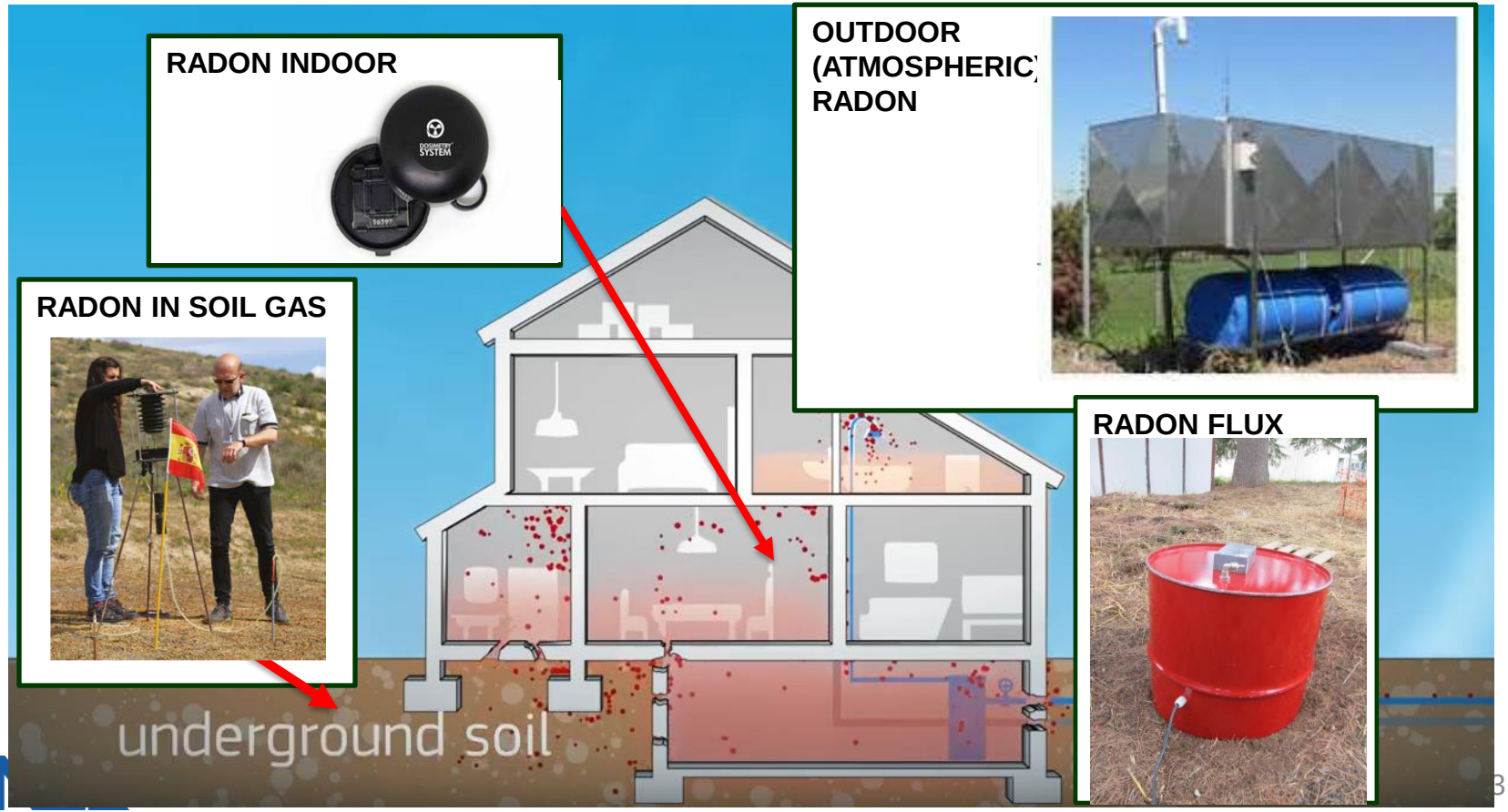
Radon Indoor, Outdoor, in soil gas, flux…



Radon Indoor, Outdoor, in soil gas, flux…



Legal Basis

- Indoor Rn is one of the major cause of lung cancer after smoking_EUROPE'S BEATING CANCER PLAN
- Due to the health risk authorities attempt to regulate its levels.
- Within the European Union, this is laid down in the Basic Safety Standards (BSS). Obligatory for all EU Member States.

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Contents

II *Non-legislative acts*

DIRECTIVES

★ Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom 1

Price: EUR 4

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

https://eur-lex.europa.eu/eli/dir/2013/59/oj

Legal Basis

- Sets reference level for dwellings and workplaces:300 Bq/m^3

Requires:

- elaboration of Rn Action Plans;
- **identification** of “Rn priority areas”- RPA
- **remediation** of workplaces;
- **prevention** for residential buildings.

Radon Priority Areas

Art. 103,3; Radon Priority Areas (RPA):

"Member States shall identify areas where the radon concent… nual average) in a significant number of buildings … nt national reference level."

Detect Radon Priority Areas:

There is **not a "fixed" definition**, and different criteria may be applied.

Political decision (and data availability)

C

Art

In a… 103,3. Buildings with public access and workplaces must be mea…red and if above RL, remediated. New buildings: particular Rn prevention. Strategy to reduce Rn in dwellings.

Radon Maps

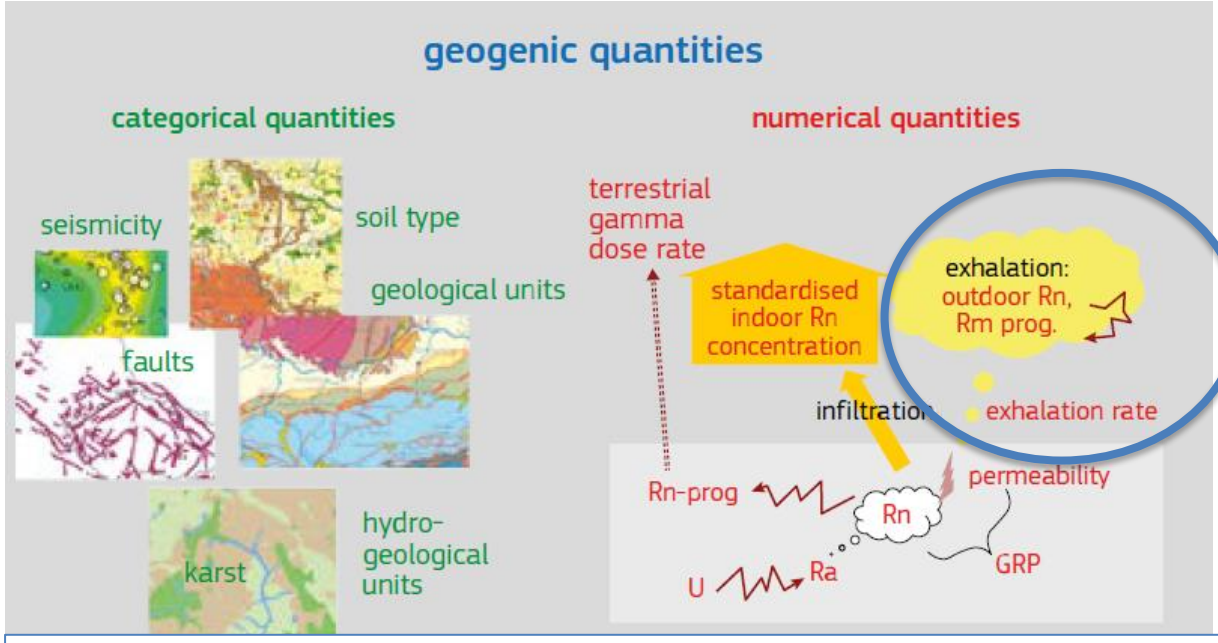
PURPOSE:

- **Display**: describe the actual situation, **Information of stakeholders** (public, legislators, administrations, professionals)

- **Identify** radon priority areas (as in article 103), **decision support**

Radon maps: Input Quantities

- Indoor radon
- **geogenic parameters** (radon in soil gas, soil permeability, geology, faults, soil type, Ra-U concentrations in soil/rock, **outdoor radon, radon flux** etc…)



European Commission, Joint Research Centre – Cinelli, G., De Cort, M. & Tollefsen, T. (Eds.), ***European Atlas of Natural Radiation****, Publication Office of the European Union, Luxembourg, 2019.*

Radon Maps:

MAPPING METHODS: Display observed (raw) data
Basic statistics (e.g. AM)
Geostatistics and Machine Learning

SPATIAL RESOLUTION: Grid (1x1 km, 100x100 m, 10x10 km)
Municipalities
Postal code
Geological unit, lithological or stratigraphic

OUTPUT QUANTITIES: Arithmetic mean or expectation in cell
% above reference level
Classes 4-5-6...10
Geogenic Radon potential,
Geogenic Radon Hazard Index - GHRI
Status RPA yes / undecided / no

RPA_Objective in traceRadon project

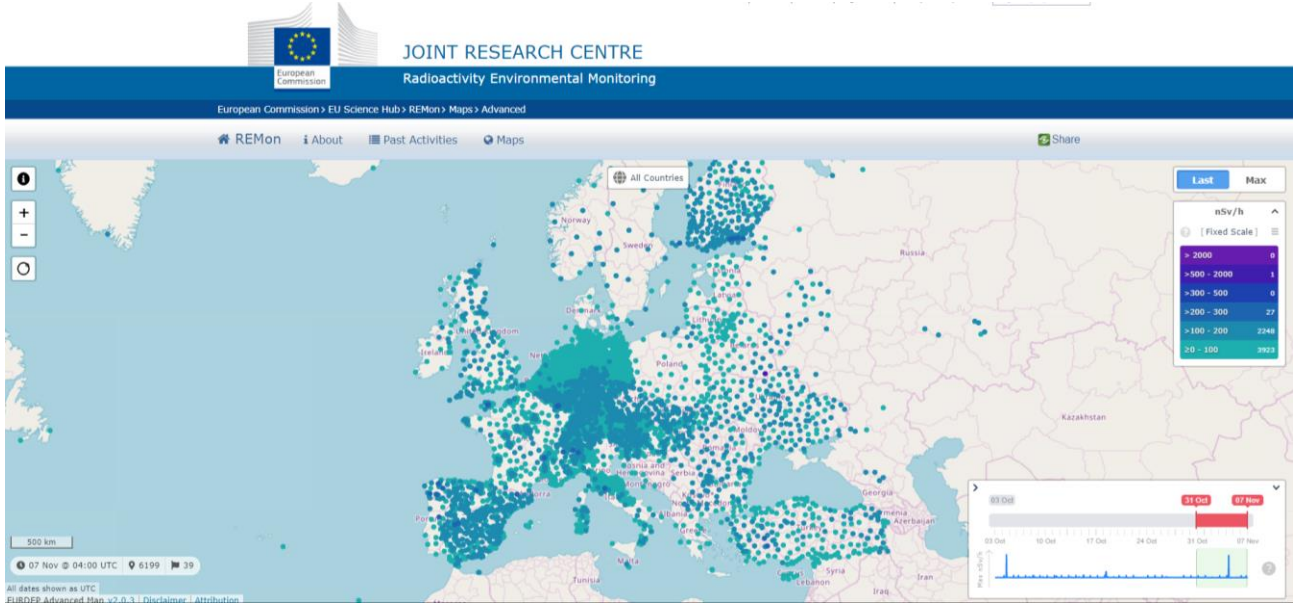
Develop improved methods for the identification of RPA using outdoor radon activity concentration data, radon flux data and radon flux maps

- ✓ literature review on the use of radon flux data for estimating indoor and outdoor radon activity concentrations as well as the use of the geogenic radon potential.
  - Čeliković, I. *et al.,* Outdoor Radon as a Tool to Estimate Radon Priority Areas—A Literature Overview. Int. J. Environ. Res. Public Health 2022, 19, 662. https://doi.org/10.3390/ijerph19020662
  - *Paper on radon flux IN PROGRESS*
- ✓ test the use of **radon outdoor and radon flux** as input quantities to estimate the GHRI and consequently a tool to estimate the RPA_ON GOING

Gamma dose rate - GDR

Gamma Dose Rate (GDR) measurements mainly fulfil an early warning or emergency preparedness task in case of a major nuclear and radiological accident with atmospheric release of radioactivity.
Its short sampling and reaction time allow the fastest identification of anomalies.

EURDEP
(EUropean Radiological Data Exchange Platform)



https://remon.jrc.ec.europa.eu/About/Rad-Data-Exchange

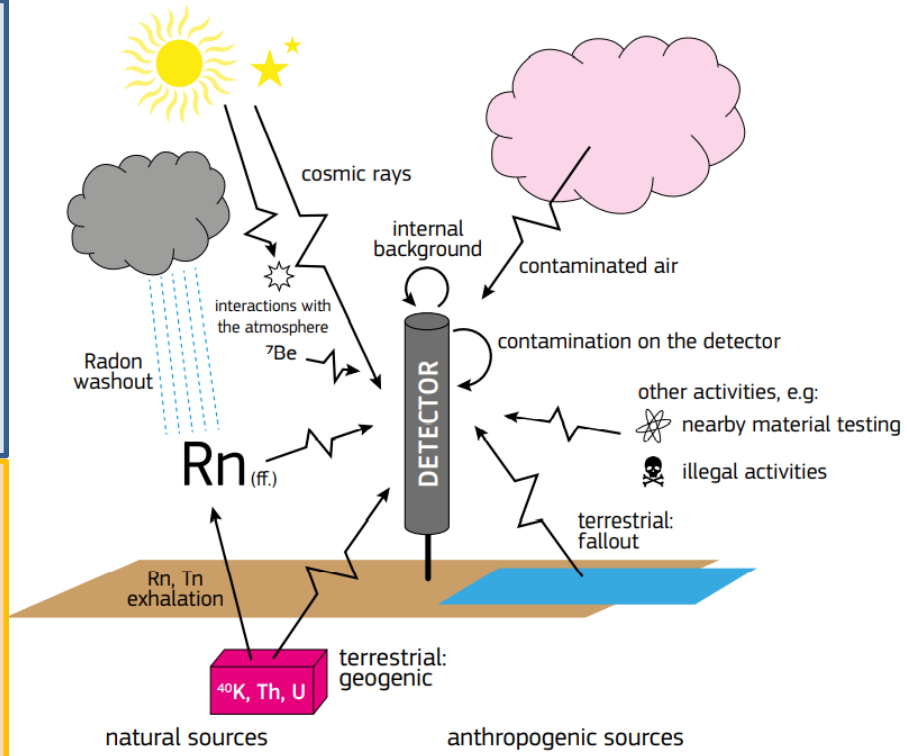
Gamma Dose Rate_components

Constant:

- internal background or self effect of the probe
- cosmic radiation (mainly muons)
- antropogenic radionuclides (in case of radiological event or accident)
- terrestrial gamma radionuclides (U and Th series, 40K)_TGDR

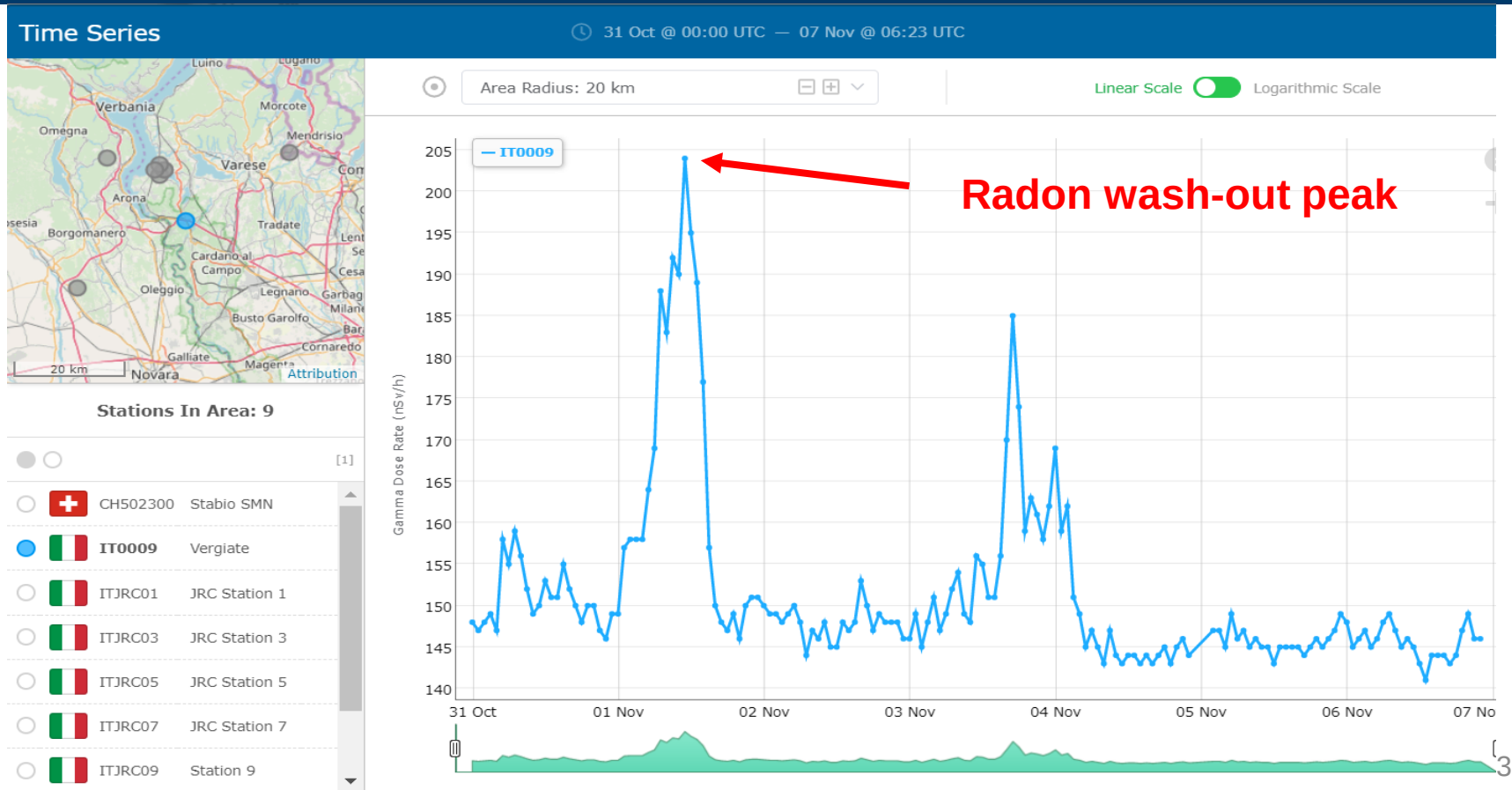
Variable:

- Natural airborne (Rn, Tn and progenies, cosmogenic radionuclides)
- **Wet deposition of Rn progenies *(Radon peak)***
- Fluctuation of TGDR due to different soil humidity
- Anthropogenic: Radiological release



European Commission, Joint Research Centre – Cinelli, G., De Cort, M. & Tollefsen, T. (Eds.), ***European Atlas of Natural Radiation****, Publication Office of the European Union, Luxembourg, 2019.*

The identification of the right origin of **GDR peaks** is a crucial issue to prevent the impact of false alarm in the population.



GDR_Objective in traceRadon project

Develop methods for estimating radon wash-out peaks from total gamma dose rate data measured in the EURDEP early warning system

- ✓ Identify and characterise GDR peaks

(exercise to compare different methods ONGOING, collaboration with EURADOS)

- ✓ Study correlation between ADER peaks, meteorological parameters and Rn progenies concentration (using outdoor radon and radon flux data)

Thanks, Bedankt, Grazie

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