

EMPIR



The EMPIR initiative is co-funded by the European Union's Horizon 2020 research and innovation programme and the EMPIR Participating States

MetroRADON

Metrology for Radon Monitoring

An European research project

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LIFE-Respire meeting, 11 December 2018, Rome

EURAMET - The European Association of National Metrology Institutes

- Regional Metrology Organisation (RMO) of Europe
- 37 member countries
- leads cooperation of the National Metrology Institutes (NMI) with nearly 6,000 metrologists
- represents Europe in the international metrology forum of the CGPM (General Conference of Weights and Measures)
- responsible for the elaboration and execution of
 - the European Metrology Research Programme (EMRP) and
 - the European Metrology Programme for Innovation and Research (EMPIR)

which is designed to encourage collaboration between European National Metrology Institutes (NMIs) and partners in industry or academia.

www.euramet.org



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European Metrology Programme for Innovation and Research (EMPIR)

Part of Horizon 2020, the EU Framework Programme for
Research and Innovation

EMPIR calls (2014 - 2020): Total budget of 600 M€
(300 M€ from the participating states and up to 300 M€ from
the European Commission using Article 185 of the European
Treaty)

msu.euramet.org

MetroRADON: Call → PRT → SRT → JRP

- Jan 2016: EMPIR 2016 Call Environment
- Feb 2016: PRT Potential Research Topic
- June 2016: SRT Specific Research Topic

EMPIR
Potential Research Topic
Metrology for Radon Monitoring to Comply with the Requirements of the Directive 2013/59/EURATOM

EMPIR Call 2016 – Energy, Environment,
Normative and Research Potential

Selected Research Topic number: **SRT-v03**
Version: 1.0



Title: Metrology for Radon Monitoring

- Oct 2016: JRP Joint Research Project Proposal
- Nov 2016: **Review Conference Rotterdam**
- Dec 2016: JRP
- May 2017: JRP Contract (EMPIR 16ENV10)
- **June 2017 – May 2020: JRP operation**

17 European partner institutions

JRP effort: 350 PMs, 2.26 Mio EUR



Participants

no.	Participant Type	Short Name	Organisation legal full name	Country
1	Internal Funded Partner	BEV-PTP	Physikalisch-Technischer Pruefdienst des Bundesamt fuer Eich- und Vermessungswesen	Austria
2	Internal Funded Partner	CEA	Commissariat à l'énergie atomique et aux énergies alternatives	France
3	Internal Funded Partner	CMI	Cesky Metrologicky Institut	Czech Republic
4	Internal Funded Partner	IFIN-HH	Institutul National de Cercetare-Dezvoltare pentru Fizica si Inginerie Nucleara "Horia Hulubei"	Romania
5	Internal Funded Partner	MKEH	Magyar Kereskedelmi Engedelyezesi Hivatal	Hungary
6	Internal Funded Partner	PTB	Physikalisch-Technische Bundesanstalt	Germany
7	Internal Funded Partner	STUK	Sateilyturvakeskus	Finland
8	Internal Funded Partner	VINS	Institut za nuklearne nauke Vinca	Serbia



Participants

9	External Funded Partner	AGES	Oesterreichische Agentur fuer Gesundheit und Ernaehrungssicherheit GmbH	Austria
10	External Funded Partner	BfS	Bundesamt fuer Strahlenschutz	Germany
11	External Funded Partner	CLOR	Centralne Labororium Ochrony Radiologicznej	Poland
12	External Funded Partner	IRSN	Institut de Radioprotection et de Surete Nucleaire	France
13	External Funded Partner	JRC	JRC - Joint Research Centre - European Commission	Europe
14	External Funded Partner	SUJCHBO	Státní ústav jaderné, chemické a biologické ochrany, v.v.i.	Czech Republic
15	External Funded Partner	SUN	Sofiiski Universitet Sveti Kliment Ohridski	Bulgaria
16	External Funded Partner	UC	Universidad De Cantabria	Spain
17	Unfunded Partner	METAS	Eidgenössisches Institut für Metrologie METAS	Switzerland



Collaborators

- DiMEILA Centro Ricerche INAIL, Italy
- University of Babes-Bolyai, Romania
- University Coimbra, Portugal
- University of Novi Sad, Serbia
- Istituto Superiore di Sanita (ISS), Italy

- (Life-Respire)

Motivation and Main Goals

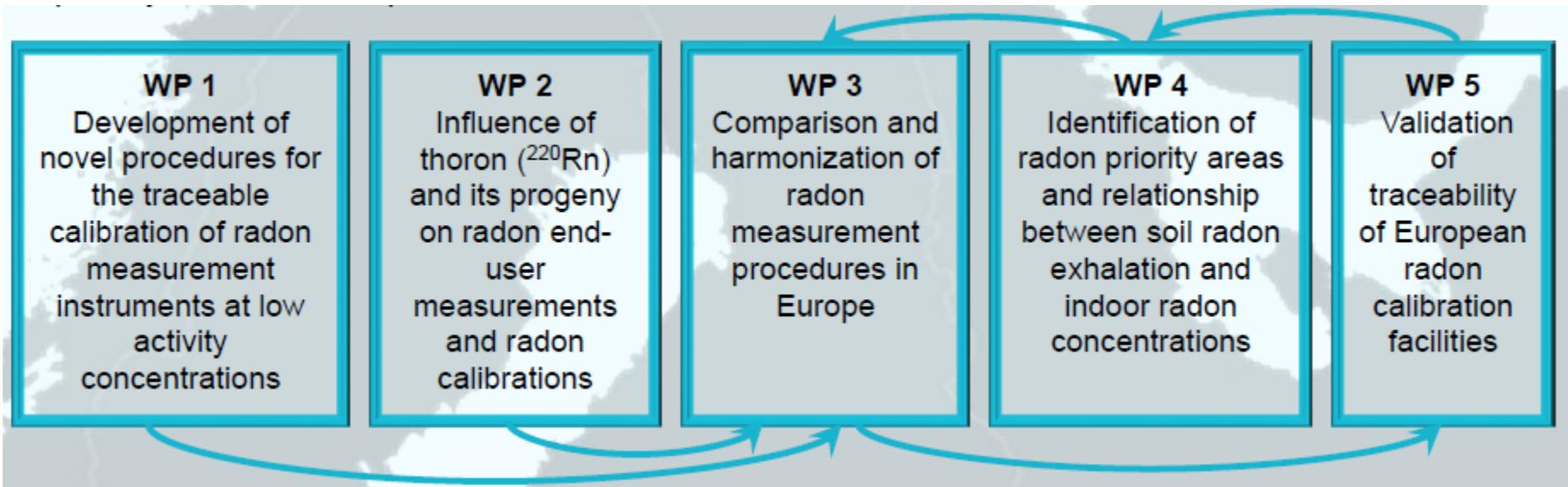
- New EU-BSS require a Radon Action Plan - to reduce radon exposure
- QA from measurements to radon maps
 - Coordinated **metrological infrastructure** for radon monitoring and radon mapping
 - **Traceable monitoring** of radon at low radon activity concentrations ($< 300 \text{ Bq/m}^3$)
 - Investigation of the **influence of thoron** on radon measurements and calibrations
 - **Harmonisation** of indoor and soil radon measurements
 - Development of **new methodologies** for the identification and characterisation of **radon priority areas** in Europa

Impact

The JRP will help

- to **establish** a basic European **metrological infrastructure** so that sound monitoring of radon becomes possible
- to provide **harmonised metrological standards** for radon monitoring and radon protection in Europe, thus allowing **comparison and merging of data sets**
- to provide **reliable radon mapping** methods for the **delineation of potential radon priority areas** in Europe
- to **coordinate** European calibration facilities regarding knowledge exchange
- to develop **the lead of European metrological facilities** in low-level radon monitoring and air-borne radon activity concentrations measurements
- to develop **advanced radon instrumentation**, resulting in a world-wide technological lead of European manufacturers

Workpackages - MetroRADON



WP 1

Development of novel procedures for the traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations (100 Bq/m^3 to 300 Bq/m^3) with relative uncertainties $\leq 5\%$ ($k=1$)

Task 1.1: Development of new ^{222}Rn and ^{220}Rn radioactive reference sources with stable and known radon emanation capacity

Task 1.2: Comparison of existing radon gas primary standards at European NMIs/DIs in the few kBq range

Task 1.3: Establishment of constant ^{222}Rn activity concentrations in reference chambers and calibration of radon measurement instruments

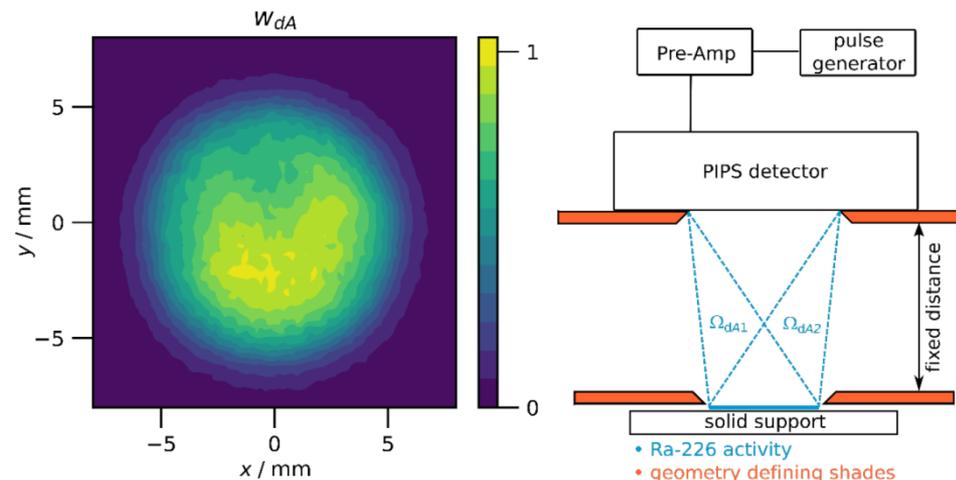


Fig. 1: Absolute activity determination of Ra-226 electrodeposited sources by defined solid angle alpha spectrometry.

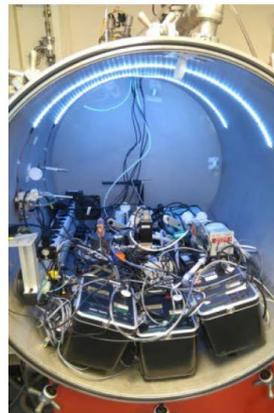
WP 2

Influence of thoron (^{220}Rn) and its progeny on radon end-user measurements and radon calibrations

Task 2.1: Ensuring traceability of the secondary thoron reference instruments used in the experimental research to the primary thoron measurement system at IRSN

Task 2.2: Investigation of the influence of thoron on radon measurements and calibrations

Task 2.3: Development of techniques to reduce the influence of thoron on radon measurements and calibrations



Calibration at Baccara chamber, IRSN

WP 3

Comparison and harmonisation of radon measurement methodologies in Europe

Task 3.1: Overview and analysis of indoor radon surveys in Europe

Task 3.2: Overview and analysis of geogenic radon surveys in Europe

Task 3.3: Comparison of indoor radon and geogenic radon measurements under field conditions

Task 3.4: Development of options for harmonisation of indoor and geogenic radon data including practical examples

The Radioactivity
Laboratory of the
University of
Cantabria (LARUC)



Questionnaire on indoor radon survey (MetroRADON project)

Fields marked with * are mandatory.

Introduction

Metrology for radon monitoring –MetroRADON (16ENV10) is a research project granted 3-years by the main programme for European research on metrology EMPIR.

The aim of this project is to develop reliable techniques and methodologies to enable SI traceable radon activity concentration measurements and calibrations at low radon concentrations. The results of the project will be targeted at the implementation of the European Council Directive 2013/59/EURATOM (EU-BSS), one aim of which is to reduce the risk of lung cancer for European citizens due to high radon concentrations in indoor air. The calibration methods and measurement techniques developed in the project will assist the EU member states in the establishment of their national radon action plan, which is required under the EU-BSS.

Moreover one of the specific objects is to compare existing radon measurement procedures in different European countries and from the results optimise the consistency of indoor radon measurements across Europe.

Then the scope of the present questionnaire is to collect information to analyse and evaluate indoor radon surveys in order (i) to identify the rationale and methodologies used, (ii) to identify the extent and possible sources of inconsistencies in the results of indoor radon surveys and (iii) to propose approaches to reduce inconsistencies and improve harmonisation of indoor radon data.

Follow the progress of the project at <http://metroradon.eu/>

WP 4

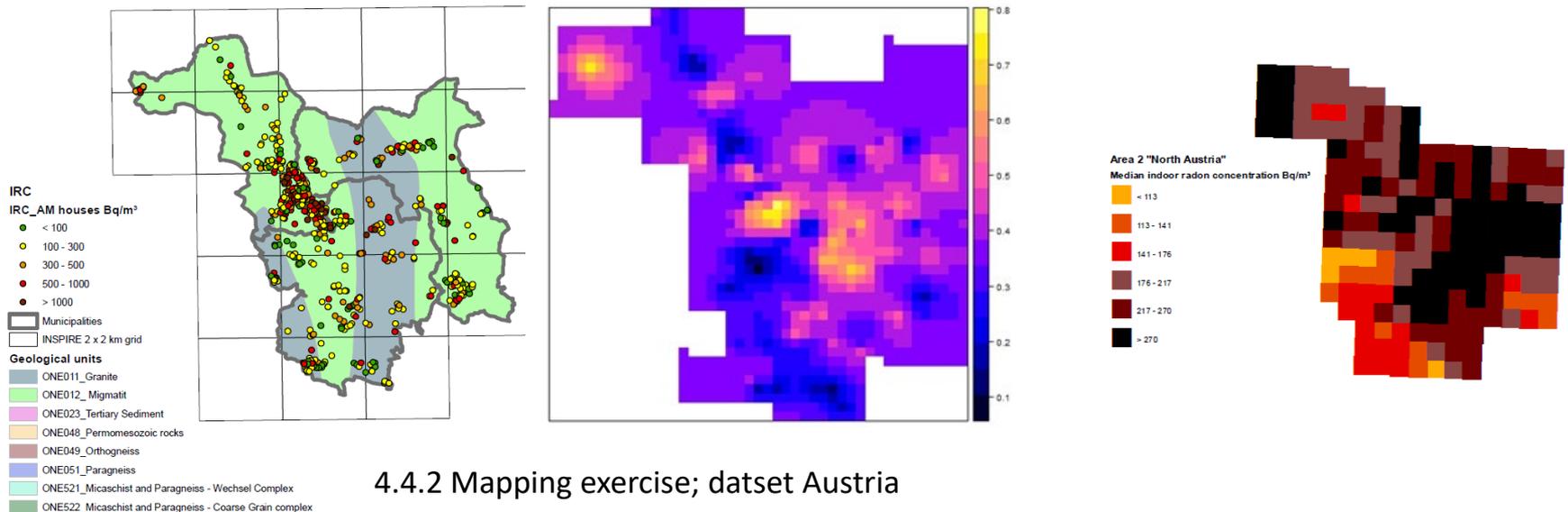
Radon priority areas (RPAs) and the development of the concept of a “geogenic radon hazard index” (RHI)

Task 4.1: Evaluation of the concepts for the definitions of radon priority areas

Task 4.2: Relationship between indoor radon concentration and geogenic radon

Task 4.3: New developments in estimation of radon priority areas

Task 4.4: Harmonisation of radon priority areas across borders



4.4.2 Mapping exercise; dataset Austria

WP 5

Validation of traceability of European radon calibration facilities

Task 5.1: Selection and evaluation of European radon calibration facilities for validation of traceability

Task 5.2: Validation of traceability, performance and precision of European radon calibration facilities in the range from 300 Bq/m³ to 10 000 Bq/m³

Task 5.3: Validation of traceability of European radon calibration facilities at stable radon atmospheres in the range from 100 Bq/m³ to 300 Bq/m³

WP6: Creating impact

Three main pathways

- Knowledge transfer (website, newsletter, reports, papers etc.)
- Training (workshops and training - early 2020)
- Uptake and exploitation (guidelines, cooperation with international organisations (IAEA, WHO, ERA))

Stakeholders:

- regulators, radiological protection bodies and policy makers
- standards developing organisations
- accredited laboratories and instrumentation manufacturers
- universities, researchers, institutes working in the field
- (interested) public

Work Packages Summary

WP No	Work Package Title	Active Partners (WP leader in bold)	Months
WP1	Development of novel procedures for the traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations (100 Bq/m ³ to 300 Bq/m ³) with relative uncertainties $\leq 5\%$ ($k=1$)	PTB , BEV-PTP, BfS, CEA, CMI, IFIN-HH, IRSN, MKEH, JRC, SUJCHBO, METAS	148,6
WP2	Influence of thoron (^{220}Rn) and its progeny on radon end-user measurements and radon calibrations	SUN , BEV-PTP, CEA, IRSN, STUK	30,6
WP3	Comparison and harmonisation of radon measurement methodologies in Europe	JRC , AGES, BEV-PTP, BfS, IRSN, , MKEH, SUN, UC, VINS	24,9
WP4	Radon priority areas (RPAs) and the development of the concept of a “geogenic radon hazard index” (RHI)	BfS , AGES,, IRSN, MKEH, JRC, SUN, UC	32,3
WP5	Validation of traceability of European radon calibration facilities	CMI , BEV-PTP, BfS, CLOR, IFIN-HH, IRSN, JRC, MKEH, STUK, SUJCHBO, UC	50,4
WP6	Creating impact	AGES , all partners	32,7
WP7	Management and coordination	BEV-PTP , all partners	30,8
Total months			350.3

www.metroradon.eu

metroRADON

Metrology for radon monitoring



Welcome to MetroRADON

The European Council Directive 2013/59/EURATOM (EU-BSS) evokes new challenges for the metrology of radon measurements and calibrations in Europe. For the first time, the exposure of the public caused by radon will be part of legal metrology in Europe. Since the EU member states' levels of relevant activity concentration that are laid down in the EU-BSS shall not exceed 300 Bq/m³, new calibration procedures for existing commercial radon monitors with their limited counting statistics have to be developed.

The JRP will provide SI traceable metrological resources (calibration and measurement) for the monitoring of radon, which essentially facilitate the harmonised implementation of the new EU-BSS in Europe. In addition, the composition of the partners will contribute to the creation of metrological infrastructure for radon in Europe suitable for the requirements of the radon action plan requested by the new European Directive.

Need

Radon is estimated to cause between 3 % and 14 % of all lung cancer cases, depending on the average radon level in the country (WHO, Fact sheet N°291, 2014). For Europe, this corresponds to about 15 to 20 thousand people dying per year by lung cancer caused by radon exposure. The legal implementation of the new EU-BSS claims a metrological sound basis of radon protection for European citizens. This is one of the main objectives of the new EU-BSS, which have to be implemented by national legislatures in the coming years.



metroRADON events

- 1st Progress Meeting

Shared point

If you are a project member, you can access metroRADON internal documents here: [Shared point metroRADON](#)

Latest news

Click [here](#) to access the last news of the project

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- Reports, Presentations in the framework of MetroRADON
- Upcoming events (conferences, workshops etc.)
- Registration for newsletter
- etc

You are invited to collaborate or to follow the project!

- Email to Hannah Wiedner, Franz Josef Maringer (hannah.wiedner@bev.gv.at, franz-josef.maringer@bev.gv.at)
- MetroRADON website: <http://metroradon.eu/>
- Project newsletter: Next December/January 2018 (registration at website)
- ResearchGate:

MetroRADON - Metrology for Radon Monitoring (EMPIR 16ENV10)

 F. J. Maringer ·  Philippe Cassette ·  Nathalie Michielsen · [Show all 41 collaborators](#)

Goal: 1. Development of novel procedures for the traceable calibration of radon (^{222}Rn) measurement instruments at low activity concentrations (100 Bq/m³ to 300 Bq/m³) with relative uncertainties $\leq 5\%$ ($k=1$)

Metro
RADON

AGES



Thank you for your attention!

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