

Executive Summary

The 3-year Research Project MetroRADON (Metrology for Radon Monitoring) started in June 2017 and is funded within the European Metrology Programme for Innovation and Research (EMPIR). The purpose of the project is to develop reliable techniques and methodologies to enable SI traceable radon activity concentration measurements. More information can be found in the [1st newsletter](#) and on the [MetroRADON website](#).

Due to the relevance and topicality of the subject, the consortium of 17 partners from national metrology institutes and research institutes was expanded with currently 4 official collaborating institutions and an Industry Interest Group of 24 companies was initiated. In addition, co-operations with existing networks and research programmes were established. The high interest in collaboration and in the topics of MetroRADON confirms the importance of the project for a variety of European stakeholders in the field of radon. First results were presented on several conferences all over Europe and are available as reports.

This newsletter highlights some actions from the first year of the project and lists some of the dissemination activities at conferences and first reports. Status and details of the project tasks and first results are discussed in the "[Status Report](#)". All the mentioned material is available on the [Document section](#) of the MetroRADON website and directly linked in this newsletter.

If you are interested in collaborating with MetroRADON or want to join the Industry Interest Group, please contact us!

Contact

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MetroRADON Partnership

BEV-PTP: Physikalisch-Technischer Prüfdienst des Bundesamts für Eich- und Vermessungswesen, Austria (coordinator)

BFKH: Budapest Főváros Kormányhivatala, Hungary

CEA: Commissariat à l'énergie atomique et aux énergies alternatives, France

CMI: Cesky Metrologicky Institut, Czech Republic

IFIN-HH: Institutul National de Cercetare-Dezvoltare pentru Fizica si Inginerie Nucleara "Horia Hulubei", Romania

PTB: Physikalisch-Technische Bundesanstalt, Germany

STUK: Sateilyturvakeskus, Finland

VINS: Institut Za Nuklearne Nauke Vinca, Serbia

AGES: Österreichische Agentur für Gesundheit und Ernährungssicherheit, Austria

BfS: Bundesamt für Strahlenschutz, Germany

CLOR: Centralne Laboratorium Ochrony Radiologicznej, Poland

IRSN: Institut de Radioprotection et de Surete Nucleaire, France

JRC: Joint Research Centre - European Commission, Europe

SUJCHBO: Státní ústav jaderné, chemické a biologické ochrany, v.v.i., Czech Republic

SUBG: Sofiiski Universitet Sveti Kliment Ohridski, Bulgaria

UC: Universidad de Cantabria, Spain

METAS: Eidgenössisches Institut für Metrologie, Switzerland

MetroRADON collaborators

[DiMEILA Centro Ricerche INAIL](#), Italy

[University of Babeş-Bolyai](#), Romania

[Universidade de Coimbra](#), Portugal

[University of Novi Sad](#), Serbia



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HIGHLIGHTS

Collaboration between MetroRADON and EURADOS

To establish a long-term impact of the MetroRADON project results on a European level the consortium initiated a relationship with the European Radiation Dosimetry Group ([EURADOS e.V.](#)). EURADOS is an established network of radiation dosimetry experts, dosimetry services and institutions mostly from Europe with colleagues from all over the world actively contributing to the network. EURADOS is organized in working groups which cover a broad range of radiation protection issues. The development of a European research agenda in dosimetry is a main focus of the group.

The connection between MetroRADON, which is more focused on the metrology aspects and the definition of radon priority areas, and EURADOS, which is more focused on radiation doses and radiation protection measures, is given by the recommendation of the [ICRP](#) on the new dose conversion coefficients for radon and, of course, by members of the MetroRADON consortium which are also active members in EURADOS.

A first radon meeting was organized during the EURADOS Annual Meeting 2017 in Karlsruhe (Germany). At the follow-up meeting during the EURADOS Annual Meeting 2018 in Lisbon (Portugal) it was decided that radon is such an important topic for EURADOS that a proposal from Working Group 3 (“Environmental Dosimetry”, WG3) for the EURADOS Council was formulated to implement a subgroup WG3-S3 on “Radon”.

After formal approval by the EURADOS Coun-

cil, the goals of WG3-S3 have been formulated. These include

- harmonisation of radon activity concentration measurements and related dose assessments,
- development of a common strategy to apply the radon dose conversion factors published by ICRP in dose assessment at homes and at workplaces,
- organisation of comparisons for calibration facilities and in-field intercomparisons,
- support of knowledge transfer and scientific cooperation.

Since MetroRADON has a limited time frame until 2020, the liaison with EURADOS offers the possibility that some of the topics of the MetroRADON project can be pursued in the future. This requires a strong link between MetroRADON and EURADOS, which is expressed by the chairs of the new WG3-S3, Annette Röttger (PTB) and Frank Wissmann (BfS), who are also members of the MetroRADON consortium.

²²⁰Rn calibration exercise at IRSN

In May 2018, a joint thoron (²²⁰Rn) calibration exercise was performed using the primary thoron system at IRSN. The partners’ secondary radon measurement instruments were calibrated at three ²²⁰Rn atmospheres around 5 kBq/m³, 50 kBq/m³ and 400 kBq/m³. The experimental arrangement in the radon chamber just before the start of the calibration is shown in Fig.1. The devices will be used to study and quantify the influence of thoron on radon measurements in laboratory and in-situ settings.



Fig.1: Preparation of the secondary reference instruments for the calibration Arrangement of the detectors in the radon chamber just before the start of the calibration.

Overview of indoor radon surveys in Europe: an updated version is on the way!

Thirteen years after Dubois (2005) published “An overview of indoor radon surveys”¹ MetroRADON partners have been working to update the report. Currently, all the necessary information has been collected through literature review and a dedicated questionnaire.

Journal papers and papers in international and national conference proceedings were reviewed, resulting in data collected from 45 countries. Different steps of the “survey chain”, e.g. from survey design through sampling, measurements to evaluation and interpretation, that yield an output have been explored. For each country the most important details regarding radon surveys were reported.

Moreover, information gleaned from literature has been augmented with results from 55 questionnaire forms on indoor radon surveys duly completed and returned between December 2017 and May 2018 by universities, research institutions and competent authorities on national and regional surveys from 24 European countries. The questionnaire has been designed to identify information missing from literature and to obtain information about how the countries intend to transpose the EU-BSS into national law.

So stay tuned! The report will be available by the end of 2018 on the MetroRADON website!

¹G. Dubois, 2005. An overview of radon surveys in Europe. Report EUR21892, Office for Official Publications of the European Communities, Luxembourg.

Radon mapping exercise

In the framework of the MetroRADON task to harmonise radon priority areas across borders, mapping methods used in various countries are tested and their comparability and usability for other countries are being evaluated. At the moment an exercise is ongoing with participating institutions from all over Europe. The participants will apply their mapping method and definition of delineation of radon areas in their countries to two test data sets. The variability of methods and how the different strategies will influence the results will be discussed. First results will be available in autumn 2018.

Development of emanation sources

One aim of MetroRADON is to develop radon gas activity standards for the realization of reference fields for radon activity concentration in air. After a survey of the technical properties of different calibration chambers in the partner institutes, the development of emanation sources with constant, stable emanations and activity measurements of the emanated radon traceable to primary standards started with the development of new methods for source productions as well as the development of online-measurement systems for the continuous monitoring of the radon emanation from these sources. The results of this development have been presented at [IRPA 2018 Congress](#) in The Hague, Netherlands. The [poster](#) is available in the [Documents Section](#) on the MetroRADON website.

Alongside electrodeposited sources (shown in Fig. 2), several ²²⁶Ra sources have been produced by ion-implantation after non-resonant laser ionization of gaseous ²²⁶Ra. The implantation was carried out at 30 kV acceleration potential into tungsten and aluminum targets. Simulations have shown that the average implantation depths are 10 nm and 20 nm for the respective materials. Lateral ion-beam profile and thus activity profile is estimated to be a 2D-Gaussian-Distribution with a FWHM of 1.5 mm. Radium activity is known from an integration of measured ion-current, but will be verified with defined solid angle alpha spectrometry. The thusly produced sources feature ²²⁶Ra activities ranging from 500 Bq to 1 200 Bq. The emanation of radon from these sources will be investigated shortly in radon chambers specifically developed and adapted for that purpose.

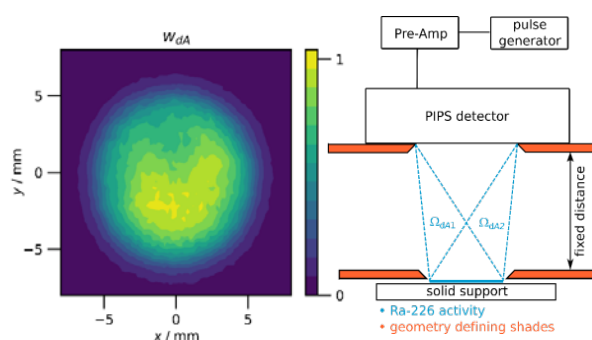


Fig. 2: Absolute activity determination of ²²⁶Ra electro-deposited sources by defined solid angle alpha spectrometry

Radon calibration facilities intercomparison

To validate the traceability of existing European calibration facilities, international comparisons will be performed within MetroRADON.

Based on a questionnaire survey, 14 relevant European radon calibration facilities have been identified, evaluated and selected for validation and traceability exercises in the radon activity concentration ranges from 100 Bq/m³ to 300 Bq/m³ and from 300 Bq/m³ to 10 000 Bq/m³. In May 2018 the intercomparison for the validation of European radon calibration facilities in the range from 300 Bq/m³ to 10 000 Bq/m³ (Radon intercomparison) has started. Hereto, the German Federal Office for Radiation Protection (BfS) provides an electronic radon instrument AlphaGUARD as transfer comparison device since it is commonly used. The device will be sent consecutively to each of the participating laboratories. In order to cover a wide range of typical exposures, the device should be exposed in three radon atmospheres at levels of 400 Bq/m³, 1 000 Bq/m³ and 6 000 Bq/m³. Because of the large number of laboratories that request participation the intercomparison will be carried out in two stages. In the first stage, mainly the national metrological institutes are involved. The second stage will expand the intercomparison to the other laboratories. It is intended to accomplish the first stage by June 2019.

As a result of the intercomparison, the precision and performance of European radon calibration facilities as well as differences in traceability will be identified. It thus contributes to further harmonisation of radon metrology in Europe. The results and findings will be a part of the guideline and recommendations on calibration and measurement procedures for the determination of radon concentration in air that will be published in 2020.



Fig. 3: MetroRADON consortium at progress meeting, Braunschweig, February 2018

MetroRADON – publications

First MetroRADON results were presented at several conferences, e.g. 5th European IRPA Congress ([IRPA 2018](#)), 2nd International Workshop on the European Atlas of Natural Radiation ([IWEANR 2017](#)), 12th Conference on Geostatistics for Environmental Applications ([geoENV 2018](#)).

Two reports are available on the MetroRADON website: “[Review of potential techniques and materials to reduce the influence of thoron on radon measurements and calibrations](#)” and “[The Geogenic Radon potential in Europe](#)”.

Presentations, posters and reports can be found in the [Documents Section](#) on the MetroRADON website.

MetroRADON – upcoming events

MetroRADON presentations are confirmed for several conferences in the next months, e.g. 14th International Workshop on the Geological Aspects of Radon Risk Mapping, Prague, ([GARRM](#)), Nuclear Science Symposium and Medical Imaging Conference, Sydney ([IEEE NSS-MIC](#)), Annual Conference of the International Association for Mathematical Geosciences, Olomouc ([IAMG 2018](#)), 9th International Conference on High Level Environmental Radiation Areas, Hiroasaki ([ICHLERA 2018](#)). More details can be found in the [Upcoming Activities Section](#) on the MetroRADON website.

Further information and contact

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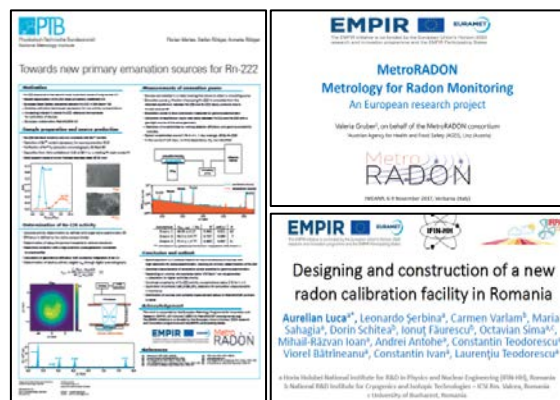


Fig. 4: Examples for MetroRADON-work presented at IRPA congress, June 2018 and IWEANR, November 2017