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Instrumente Structurale  
2014-2020

# SMART SYSTEMS FOR CONTROL AND MITIGATION OF RESIDENTIAL RADON LINKED WITH ENERGY EFFICIENCY IN ROMANIA

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Programul Operațional Competitivitate 2014-2020, Axa prioritară POC-A1-A1.1.4-E-2015

**Titlul Proiectului:** *Sisteme inteligente privind siguranța populației prin controlul și reducerea expunerii la radon corelate cu optimizarea eficienței energetice a locuințelor din aglomerări urbane importante din România - SMART-RAD-EN*

**Nr. contract:** 22/01.09.2016, **cod proiect:** ID P\_37\_229, **cod MySmis2014+:** 103427

**Beneficiar:** Universitatea „Babeş-Bolyai” din Cluj-Napoca

Proiect cofinanțat din Fondul European de Dezvoltare Regională prin Programul Operațional Competitivitate 2014-2020

# Presentation



## ➤ INTRODUCTION

## ➤ THE PROJECT

## ➤ EXPECTED RESULTS



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## REGULATORY FRAMEWORK

2012/27/EU Directive on Energetic Efficiency

2013/59/EU Directive EURATOM

(TO BE IMPLEMENTED IN 2017 AND 2018 RESPECTIVELY)

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# Introduction



## SOME CONSEQUENCES...

### INDOOR ENERGY EFFICIENCY (IEE)

**Reduction of Energy  
Consumption**

**Reduction of ventilation  
(renovation rate of indoor  
air with fresh outdoor air)**

### INDOOR AIR QUALITY (IAQ)

**Accumulation of indoor air  
pollutants**

**Construction material and  
combustion products  
(VOC's, CO<sub>2</sub>, CO, etc..)**

**Radon (<sup>222</sup>Rn)  
concentration**

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# Introduction



Necessity of “harmonization”...

**Integrated system**  
(CO, CO<sub>2</sub>, VOC's, Rn, P, t, H)

**Automatic Smart System**

- **Analyze**
- **Communicate**
- **Take decisions**

**The “radon example”**

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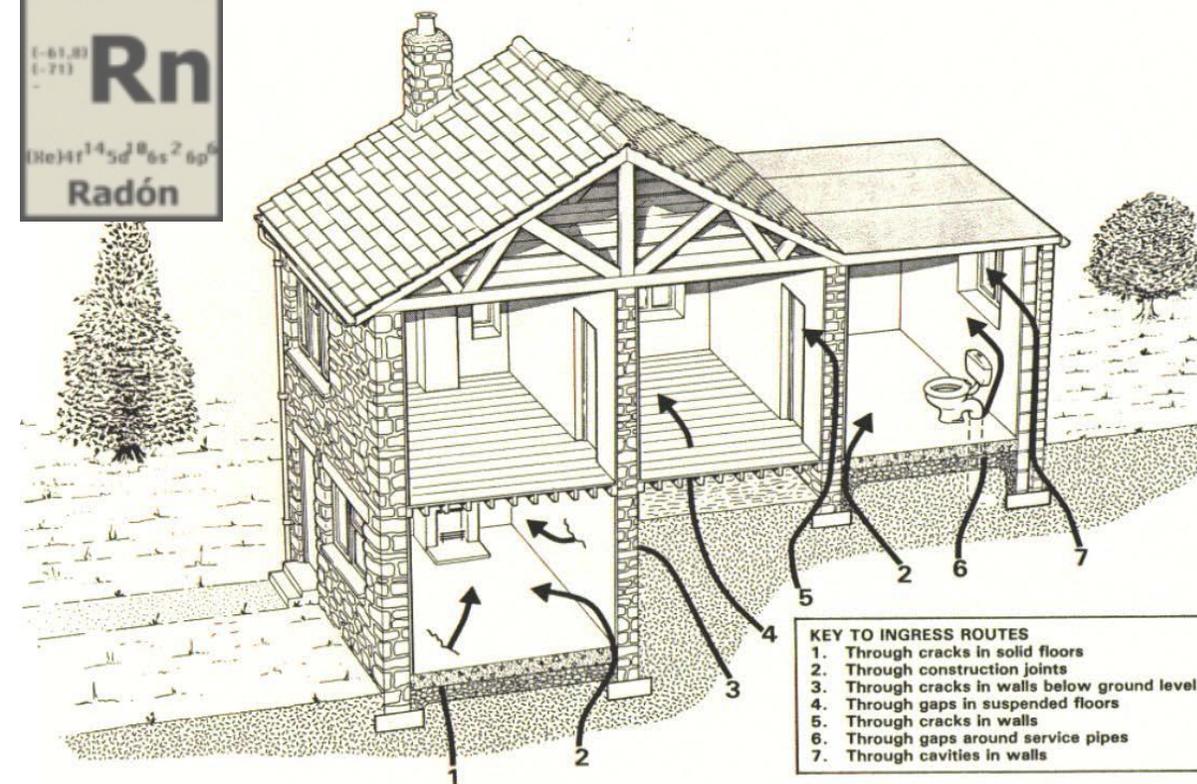
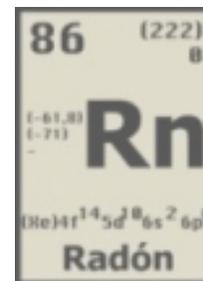
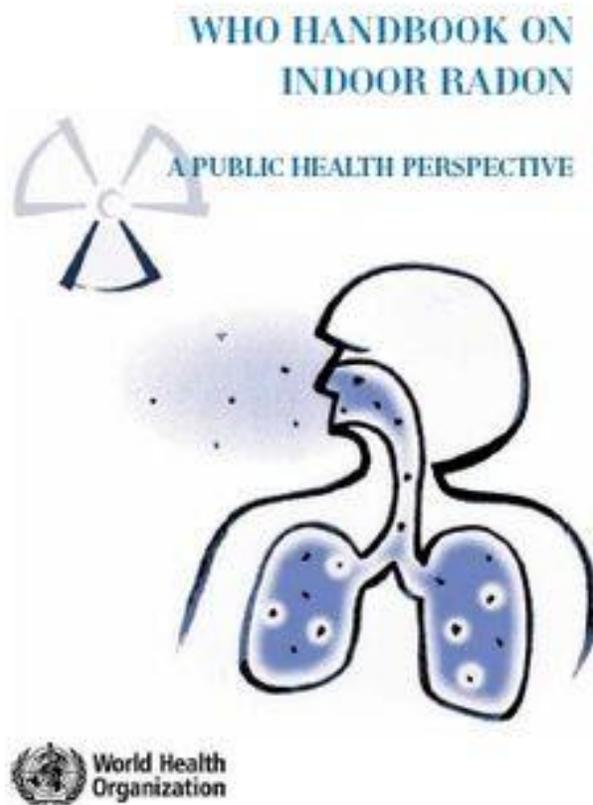
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# Introduction



## 1. Health effects of radon

### KEY MESSAGES

- Epidemiological studies confirm that radon in homes increases the risk of lung cancer in the general population. Other health effects of radon have not consistently been demonstrated.
- The proportion of all lung cancers linked to radon is estimated to lie between 3% and 14%, depending on the average radon concentration in the country and on the method of calculation.
- Radon is the second most important cause of lung cancer after smoking in many countries. Radon is much more likely to cause lung cancer in people who smoke, or who have smoked in the past, than in lifelong non-smokers. However, it is the primary cause of lung cancer among people who have never smoked.
- There is no known threshold concentration below which radon exposure presents no risk. Even low concentrations of radon can result in a small increase in the risk of lung cancer.
- The majority of radon-induced lung cancers are caused by low and moderate radon concentrations rather than by high radon concentrations, because in general less people are exposed to high indoor radon concentrations.

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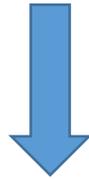


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Information/knowledge



Prevention / Diagnosis



Remediation

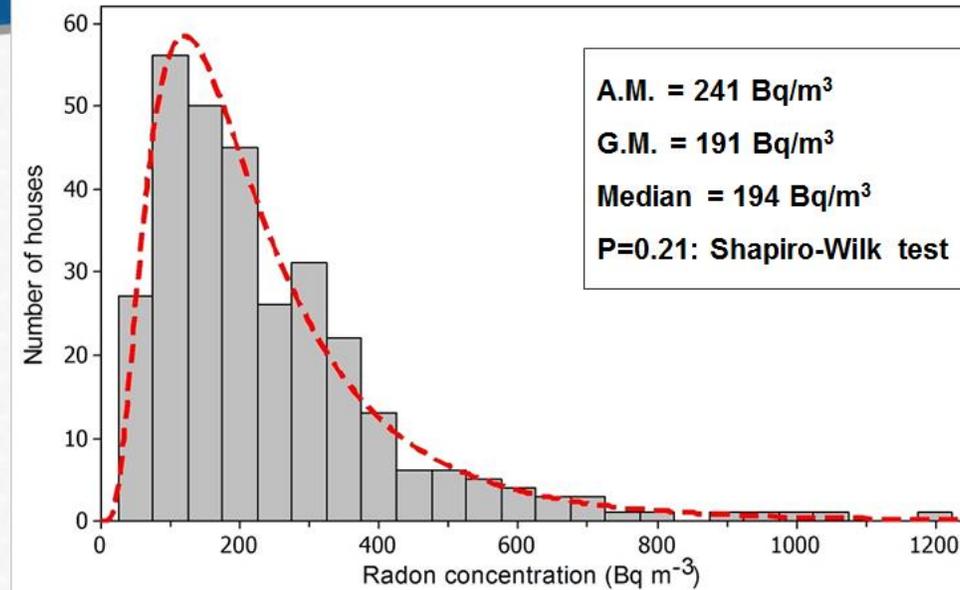
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IRART PROJECT  
(2010-2013)



*Log-normal distribution of average concentration in 303 houses*

A. Cucos (Dinu), C. Cosma et. al, (2012), Thorough investigation on indoor radon in Băița radon-prone area (Romania), *Science of The Total Environment*, 431, 78–83.

**We got  
the information...**

# Introduction



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## STUDIES ON MITIGATION METHODS IN PILOT HOUSE

The diagram shows a floor plan of a house with the following rooms: Street, Dormitory no 2, Dormitory no 1, Living, Bathroom, Hall, and Cellar. Four fans are positioned at different points: Fan no. 1 is at the front entrance, Fan no. 2 is at the street entrance, Fan no. 3 is at the back entrance, and Fan no. 4 is in the living area. A cellar is located between Dormitory no 1 and the living area. A house entrance is also marked. The collage includes several photographs: a hand holding a yellow handheld device, a photograph of the pilot house exterior, a photograph of a large orange barrel, a photograph of a fan being installed in a wall, a photograph of a fan being installed in a roof, a photograph of a fan being installed in a wall, and a photograph of a fan unit on a wooden pallet.



IRART PROJECT  
(2010-2013)

**We made  
the diagnostic...**

# Introduction



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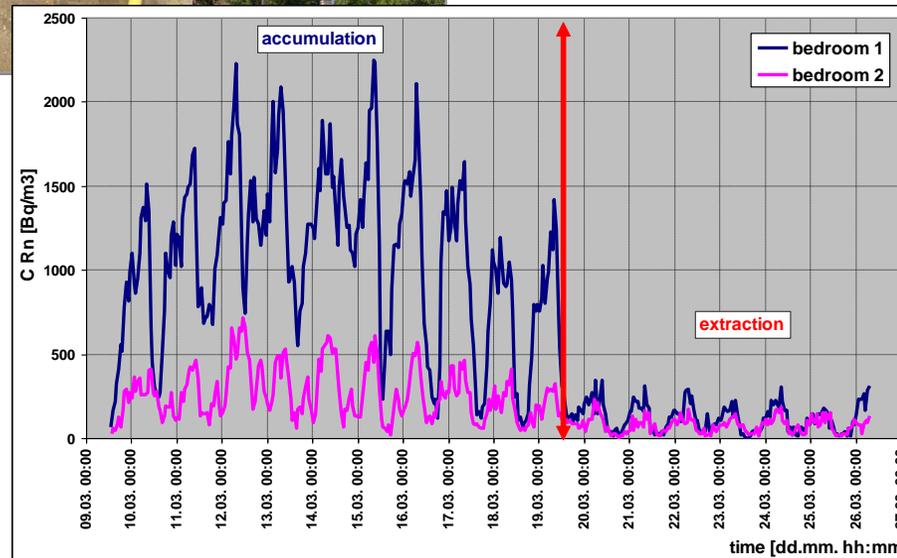
## DEMO: THE MITIGATION SOLUTION an active sub-slab ventilation system



Ventilator/Fan  
Radon sump  
Pipes  
Membrane  
Automatic surveillance  
system  
Accessories



IRART PROJECT  
(2010-2020)



**... and we reduced  
radon exposure...**



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# The project

# The project



## General objective

Improve the Indoor Air Quality in houses with energy saving systems, thus contributing to increase the safety and health of the population.

URBAN APPROACH: Bucuresti, Cluj Napoca, Iasi, Sibiu and Timisoara.

48 months (2016 – 2020)

Total budget: 8 925 250 lei

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# The project



## 1. Developing integrated risk maps – cities Cluj-Napoca, Bucuresti, Iasi, Timisoara, Sibiu

- **2017: RADON SCREENING** - passive monitoring of indoor radon concentration **in 1,000 energy efficient houses** during 1 year
- **2018: THE DETAILED EVALUATION OF INDOOR AIR QUALITY** (radon, CO<sub>2</sub>, CO, VOCs) and **THERMAL CONFORT** (temperature, humidity) in relation to energy efficiency in **100 houses with high exposure to radon (CRn > 300 Bq/m<sup>3</sup>)**

## 2. Developing a prototype system for continuous monitoring and remote data transmission on radon levels and other household air pollutants - CO<sub>2</sub>, CO, VOCs and temperature, pressure and humidity sensors:

- 2018: **100 houses beneficiaries** with high exposure to radon (CRn > 300 Bq/m<sup>3</sup>)

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# The project



### 3. Developing energy efficient solutions for controlling and reducing exposure to radon and other household air pollutants in residential buildings:

- (1) An integrated system for advanced numerical modelling aided by experiment
- (2) A prototype system of energy-efficient solutions

-2019 – 2020: **10 houses beneficiaries** with high exposure to radon (CRn > 300 Bq/m<sup>3</sup>)

### 4. Technology transfer activities

- Evaluation of efficiency
- Exploitation of results

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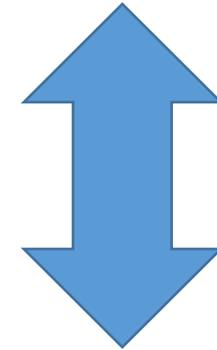
# The project



## HUMAN RESOURCES

- SCIENTIFIC: 23 researchers**
  - UBB (Cluj): 7 + 2 technicians + 3 PhD students
  - UTCB (Bucharest): 3 + 1 PhD student
  - UTC (Cluj): 6 post doc
  - US (Cluj): 1 post doc
  - UC (Santander, Spain)
  
- FINANTIAL/ADMINISTRATIVE**
  - UBB (Cluj)
  - Primainvest (Cluj)

**Multidisciplinary team**



**Communication**

**Afford complex project**

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# The project

## HUMAN RESOURCES

## Prof. Cosma's legacy

## High level team

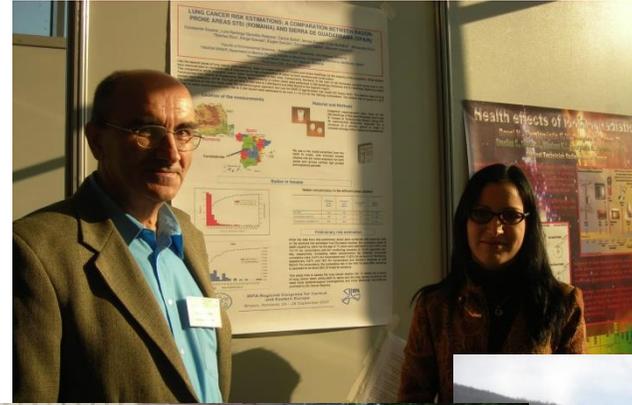
(radon metrology, prevention, remediation, mapping, communication, biological effects, etc...)

## Know how

(Science, teaching and management)



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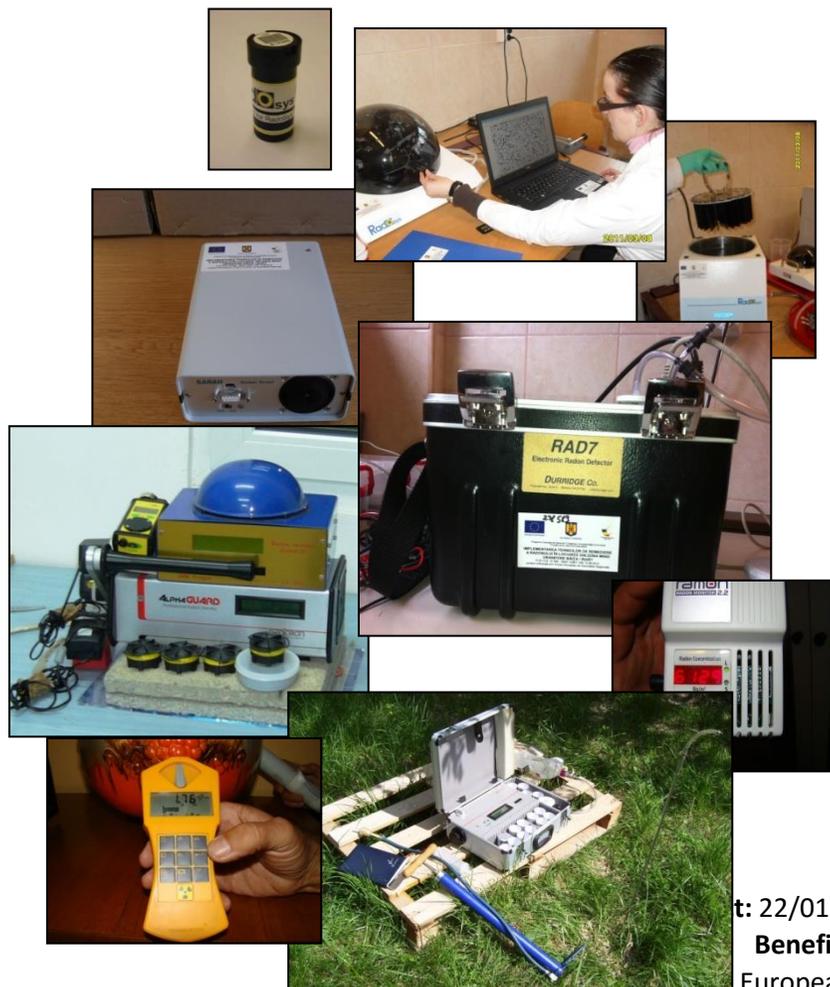
# The project



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## MATERIAL RESOURCES

## Radon laboratory (UBB, Cluj Napoca)



- Reference laboratory in the implementation of Romanian Radon Program
- All main radon measurement techniques available

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# The project



## MATERIAL RESOURCES

## Radon laboratory (UBB, Cluj Napoca)

### CAPACITIES

- Radon metrology (high quality control)
- Radon diagnosis and remediation
- Risk communication



- NEXT: Rn and Indoor Air Quality



Proiect POS CCE ID 586 - SMIS 12487/ 160/ 15.06.2010  
derulat in perioada 15 IUNIE 2010 - 14 IUNIE 2013



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# Expected results

# Expected results



## SCIENTIFIC IMPACT

- Integrated information (book/map) of radon + IAQ + IEE from 1000 houses located in major urban agglomerations
- Intelligent prototype for continuous monitoring and data transmission in 100 houses with high radon concentrations
- Prototype for controlling exposure (10 houses)
- Numerical model based on experiments for optimization of remedial actions

One step forward to the integration of radon into IAQ concept

# Expected results



## SOCIAL IMPACT

### People participating in the implementation phase of the project

#### Persons participating in the data collection phase

1000 houses X 2,4 persons/house  
=  
**2400 persons**

#### Persons participating in the remote monitoring and remediation phase

110 houses X 2,4 persons/house  
=  
**264 persons**

### Beneficiary institution

#### University Babeş-Bolyai

-23 Romanian researchers qualified in the field of the project  
They will be the direct beneficiaries of the project research outcomes and of the transfer of knowledge generated by the foreign specialists recruited to perform the project activities.  
The project contributes to the employment of qualified personnel and to combating social exclusion by attracting young scientists in research and innovation actions.

#### University Babeş-Bolyai

- approx. 10 specialists with advanced expertise in implementing POC 2014-2020 programs dedicated to Research and Development actions.

### Beneficiaries related to the dissemination activities

#### The academic community related to the field of radiology and air quality management

There will be conducted scientific communications and general dissemination of results activities such as:  
- 9 international conferences  
- 20 ISI articles  
- dissemination through the project website  
- dissemination through the European Radon Association website  
- the evaluation reports published by the international specialists recruited for the data validation activities

#### Public and private organizations and institutions invited to participate in the public information campaigns

The project team has established an official cooperation agreement with the Institute of Public Health which will participate as an external collaborator in the dissemination of results campaigns.  
We also aim to attract other relevant institutions.

**Contribution to the increase of life quality/expectancy by reduction of risk of chronic heart and respiratory diseases.**



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**Mulumesc!**  
**Thank you!**  
**Gracias!**