LIFE RESPIRE

Radon rEal time monitoring System and Proactive Indoor Remediation

Sabina Bigi

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Partnership

Centro di Ricerca, Previsione, Prevenzione e Controllo dei Rischi Geologici

Sapienza Università di Roma

Istituto Nazionale di Geofisica e Vulcanologia

Consiglio Nazionale delle Ricerche

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Budget

Budget totale	2.239.158 Euro
Budget cofinanziabile	2.188.758 Euro
Contributo EU	1.313.254 Euro (= 60.00% del budget)

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Life topics: Environment and Health

Projects improving the use of chemical monitoring data (e.g. environmental monitoring, human bio- monitoring, product monitoring, indoor air monitoring) in the protection of human health and the environment, by making the chemical monitoring data available, accessible, comparable and interoperable, and allowing for linking them with monitoring of human and environmental health and for assessment of exposures from chemical mixtures via various routes of exposure.

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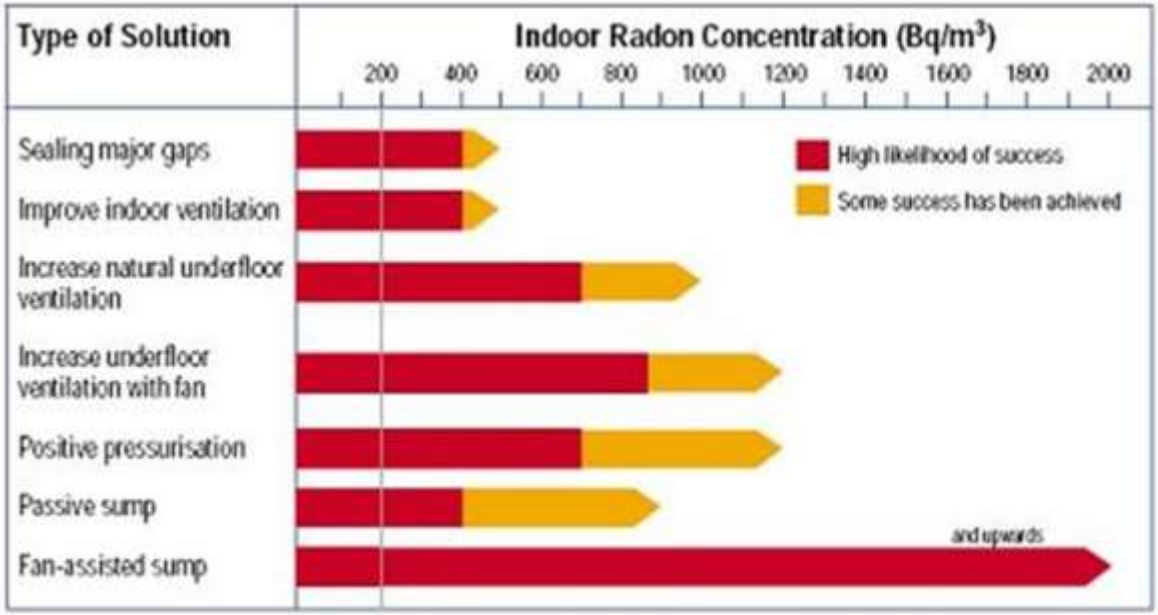
The European Directive 2013/59/EURATOM

- Council Directive 2013/59/Euratom of 5 December 2013 (Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom).
- The new Directive will be in force from February 2018.
- Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with the new Basic Safety Standards Directive by the same date.
- The updated Directive covers the protection of:
  - workers, in particular medical staff and workers in workplaces with indoor radon
  - the public, in particular from radon in houses
  - medical patients, in particular with regards to the avoidance of incidents and accidents in radiodiagnosis and radiotherapy
- It also strengthens requirements for emergency preparedness and response.

The Radon indoor

- Rn concentrations are low in outdoor air, concentrations can become dangerously high indoors due to its accumulation in closed spaces (up to 40000 Bq/m3 in Celleno).



Remediation systems (*Source UK Building Research Establishment)*

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LIFE-RESPIRE demonstration project objective

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LIFE-RESPIRE demonstration project objective

1 **To demonstrate in 4 significant areas**, with different Geogenic Radon Potential in Italy and Belgium, a cost-effective and eco-friendly solution for Rn real-time measurement and remediation **to keep indoor Rn levels below 100 Bq/m3 level** (as indicated in European Directive 2013/59/EURATOM).
RESPIRE project will implement an intelligent, adaptable and versatile hybrid Rn remediation system composed by sensors, an Air Quality Balancer (SNAP) and an external additional fan-system (eolian and/or electric) working on positive pressure method.

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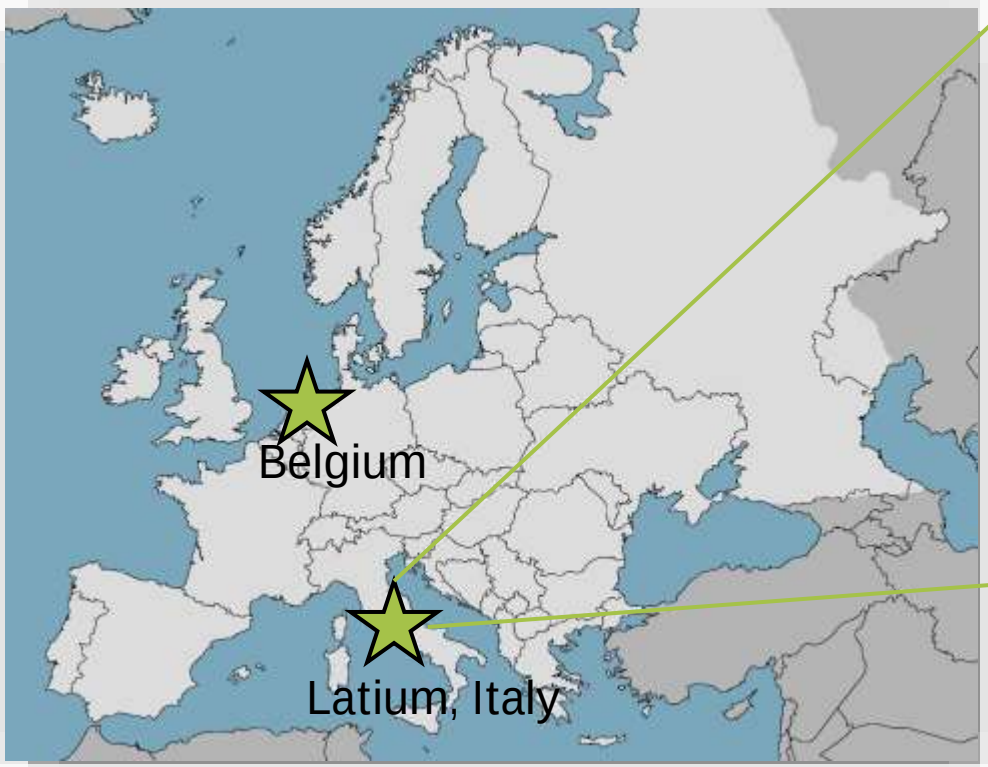
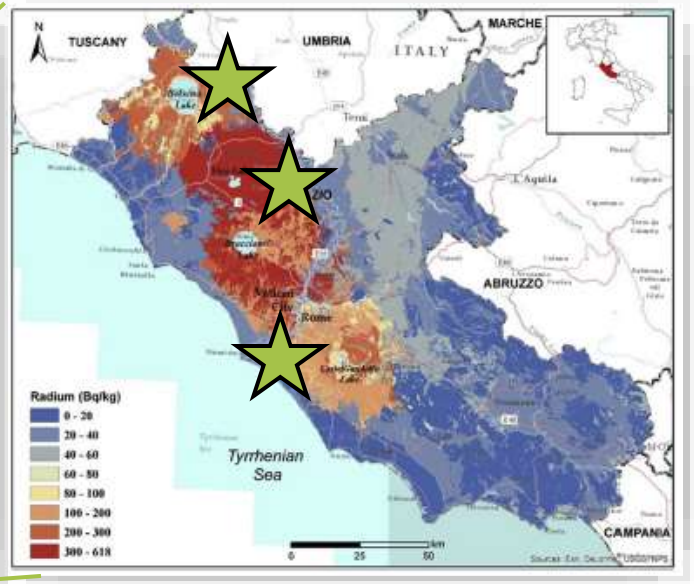
WHERE





Ciotoli et al, 2016

Comuni di
Caprarola,
Celleno
Ciampino

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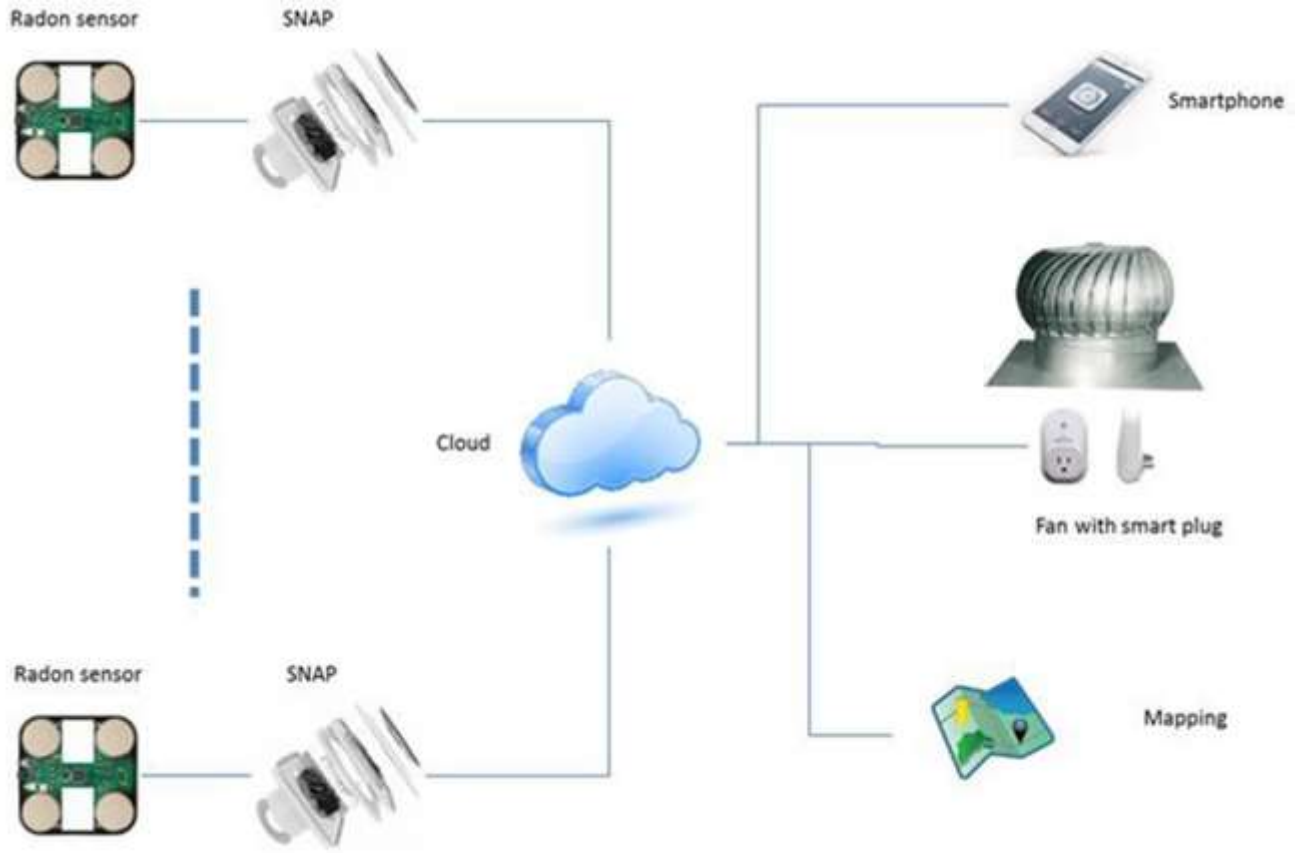

1. RADON SENSORS
2. INTEGRATED NETWORK OF SENSORS AND PROACTIVE FANS
3. ADAPTABLE TO MOST NEEDS VIA IMPLEMENTATION OF AN EXTERNAL FANS
4. HYBRID EOLIC SNAP
5. POSITIVE PRESSURE APPROACH INCLUDING PASSIVE HEATING EXCHANGER
6. HIGH AIR FLOW AND LOW ENERGY CONSUMPTION

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LIFE-RESPIRE demonstration project objective

2 **To construct a real time LIFE-RESPIRE geodatabase** of collected continuous Rn measurements, coupled with other geological, geochemical and building characteristics data, within the framework of the European Atlas of Natural Radiation (promoted by the Joint Research Centre-JRC of the European Commission).

The European Atlas of Natural Radiation is a collection of maps displaying the levels of radioactivity caused by different natural sources in Europe.

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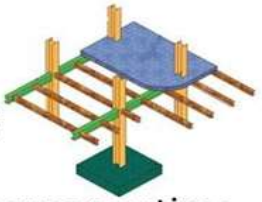
Building selection

Considering the size of the urban settlements and the number of inhabitants at Celleno (about 1500) and Caprarola (about 5000) municipalities, and also considering the densely populated zones characterised by strong gas emissions in the municipality of Ciampino (about 5000 inhabitants), the 10-15 selected cases in each municipality represent a good compromise both from statistical point of view (as regards the sample number) and in relation to the time and economic impact of the project (to comply with the RESPIRE project timetable for the construction and the implementation of the new monitoring stations for the demonstration). Furthermore, also the procurement and permissions for about 10-15 public buildings is reasonable.

The building selection will be designed in order to take into account:

1. The geographical distribution within the area in order to obtain representative results;



2. The different structural characteristics of buildings;

3. The different destination of usage (i.e., different occupancy time, presence of ventilation systems, people permanency, etc.)

4. The possible presence of multi-store building.

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LIFE-RESPIRE demonstration project objective 3

To provide local authorities with Rn hazard guidelines and real-time WebGis radon maps for land use planning and health risk assessment, helping to prepare relevant national action plans (Articles 54, 74 and 103 in 2013/59/EURATOM)

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Respire project structure

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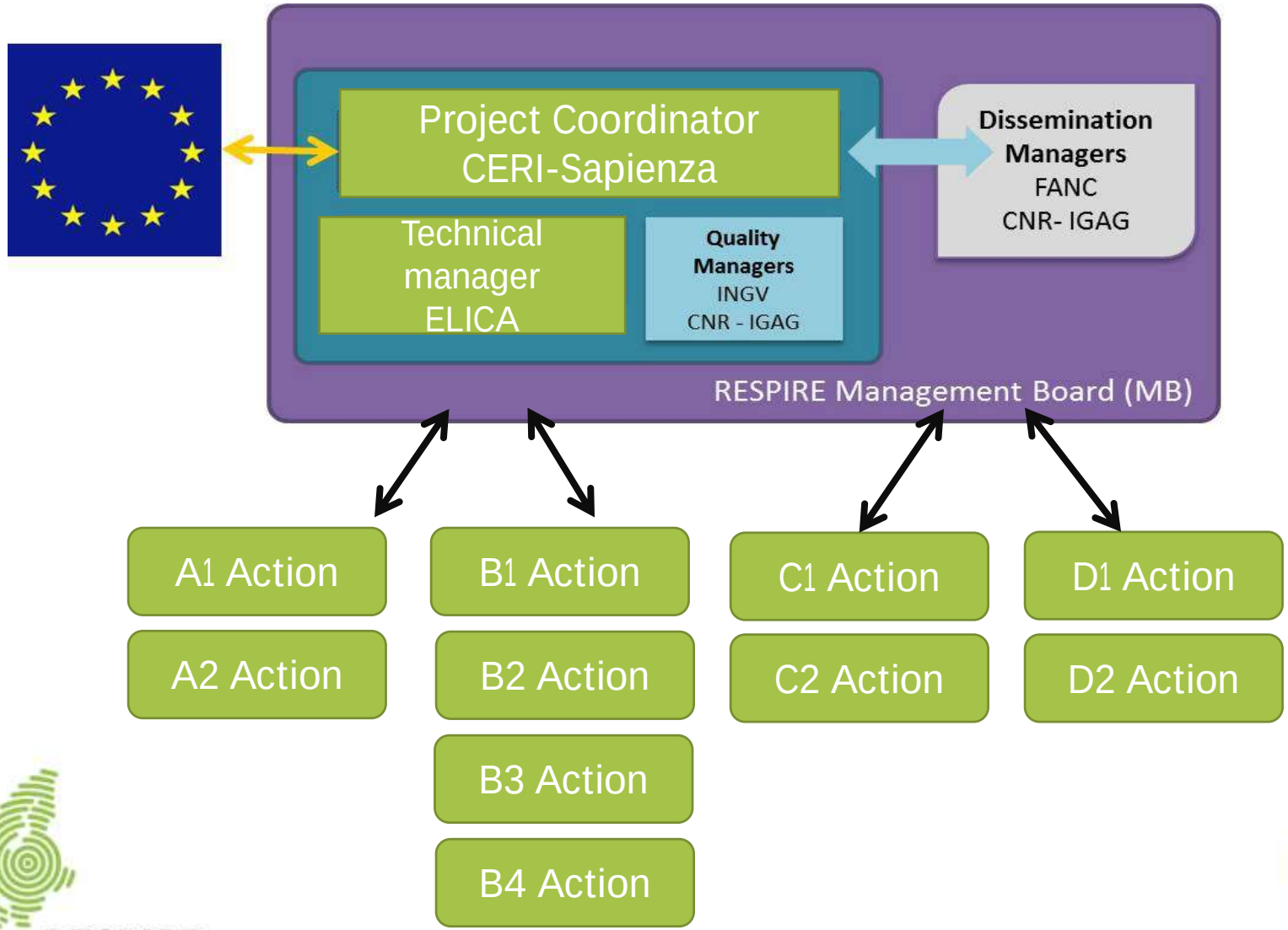
Project structure



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Preparatory actions

A1
Caprarola Site Characterization

A2
Permissions for Demonstration cases implementation

Implementation actions

B1
Prototype assembly and tests

B2
Implementation of demonstration cases including remediation measures

B3 Monitoring and WebGis

B4
Replicability potential evaluation and demonstrative case in Belgium

Monitoring of the impact of the project actions

C1
Monitoring of project impact indicators and LCA

C2
Socio-economic impact assessment

E
Management

Public awareness and dissemination of results

D1
Dissemination planning and execution

D2
Networking

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Respire results

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Results: Rn measurements

Define Geogenic Radon Potential of the 4 areas.

- geological-geochemical characteristics (uranium, thorium and radium content, permeability, gamma dose rate, emanation coefficient of rocks, fracturing, etc.) of the geological units

- Soil gas Rn activity, Rn flux from soil, dissolved Rn in groundwaters and public waters, as well as mean Rn concentration for lithologies with as potential result the map of the GRP and Rn Prone Areas (RPA)

- Building characteristics (i.e., including year of building construction, building materials, type of foundations, floor, ventilation, etc.) to make more comparable the entire survey.

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Results: remediation

LIFE RESPIRE will demonstrate and validate:

- **An integrated system RESPIRE remediation system will reduce indoor Rn concentration at demonstration sites below 100 Bq/m3, more than 400 Bq/m3** less than current value (500 Bq/m3).
- **RESPIRE innovative system is able to recover ~80% of heat from the air expelled and reduce energy consumption**
- The integrated system RESPIRE will be installed in 10-15 selected cases in each municipality
- >80% of population at Demonstration sites will be informed about the project and Rn risks. This knowledge will be widespread in Europe, and manuals and guides for dealing with Rn risks will be produced and distributed.
- **Information and dissemination material integrating field data and modeling results,** to inform local authorities with respect to Rn and Rn-prevention measures during remediation activities and new construction.
- The RESPIRE WebGis Rn map will be a precious instrument both for Researchers and Policy - makers to evaluate the extension of Rn risks, real time and thus implement effective counteraction.

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Welcome to the kick off meeting of the Life Respire Project!

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