17th INTERNATIONAL WORKSHOP GARRM

(on the GEOLOGICAL ASPECTS OF RADON RISK MAPPING)

Evaluating the impact of insulation materials applied for energy saving in structures on indoor radon levels. The scale model room approach.

[1]*Università degli Studi ''Roma Tre'', Dipartimento di Scienze, Roma, Italy*
[2]*Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma 1, Roma, Italy*
[3]*Mapei S.p.A., Waterproofing Line, 20158 Milano, Italy*

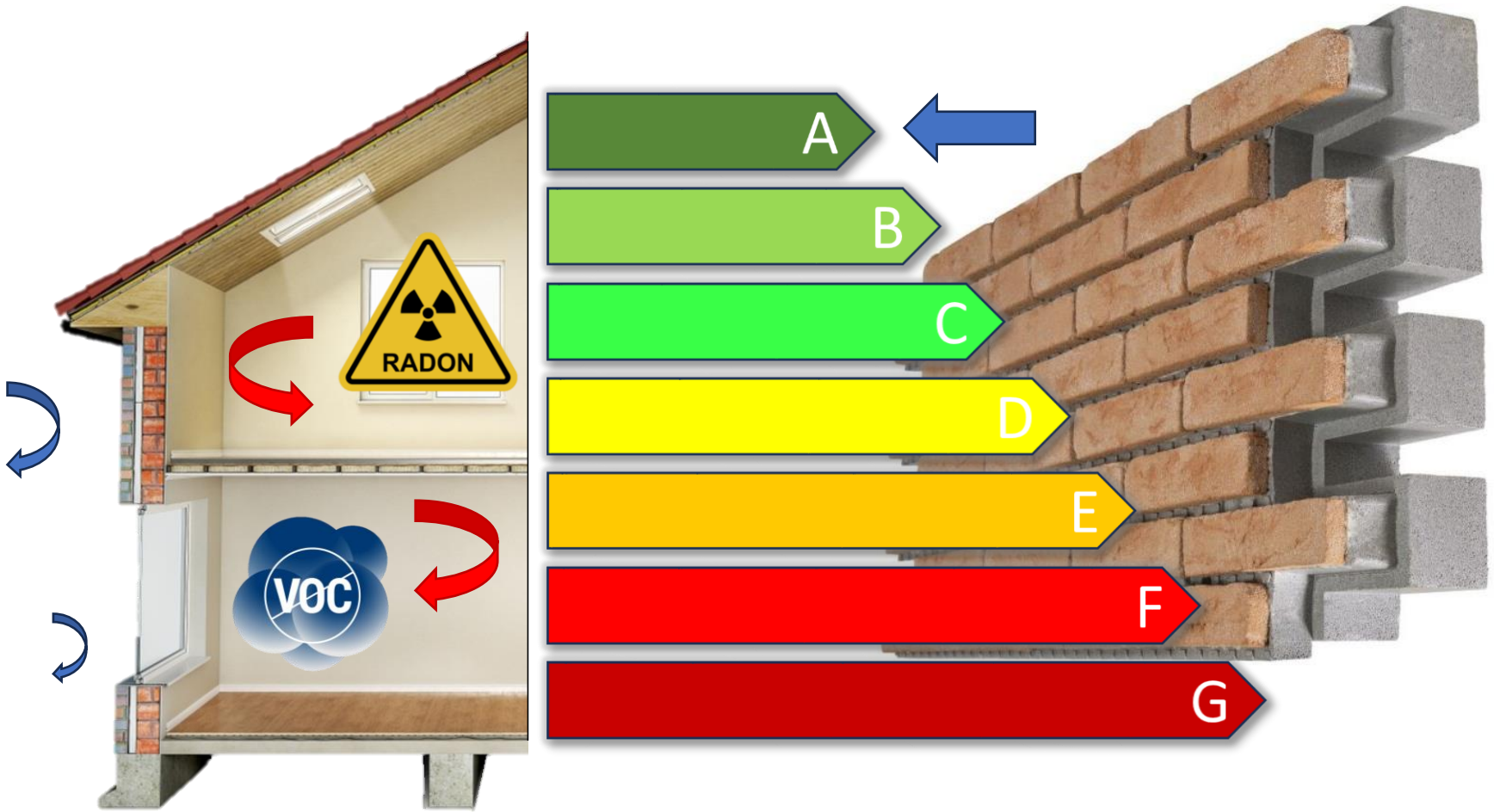
Ilaria Rocchetti[1], Manuela Portaro[1], Paola Tuccimei[1], Gianfranco Galli[2], Michele Soligo[1], Alessandro Rosati[1], Cristina Longoni[3], Dino Vasquez[3]

MAPEI ADHESIVES · SEALANTS · CHEMICAL PRODUCTS FOR BUILDING

Roma Tre

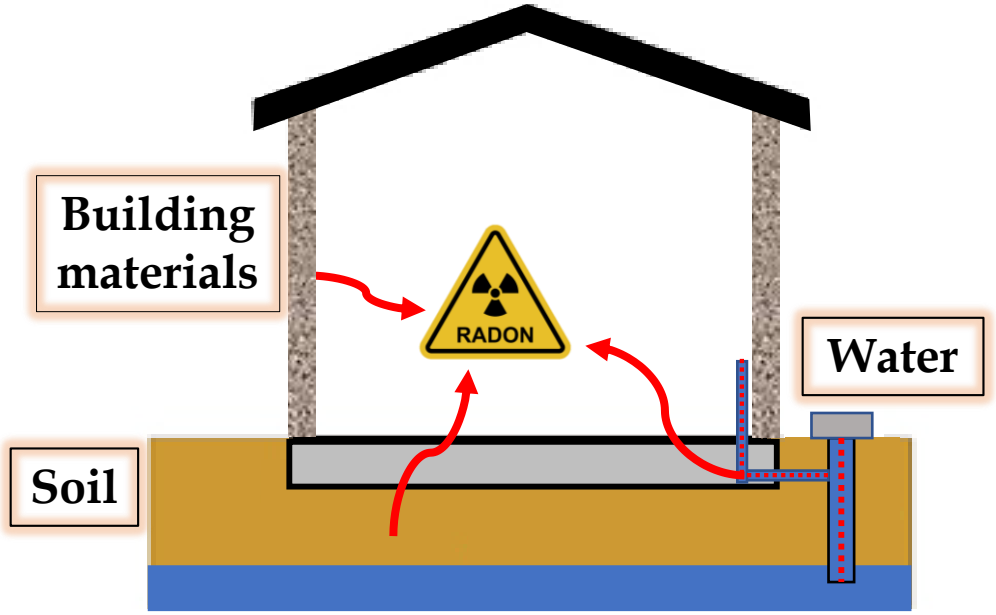
ISTITUTO NAZIONALE DI GEOFISICA E VULCANOLOGIA

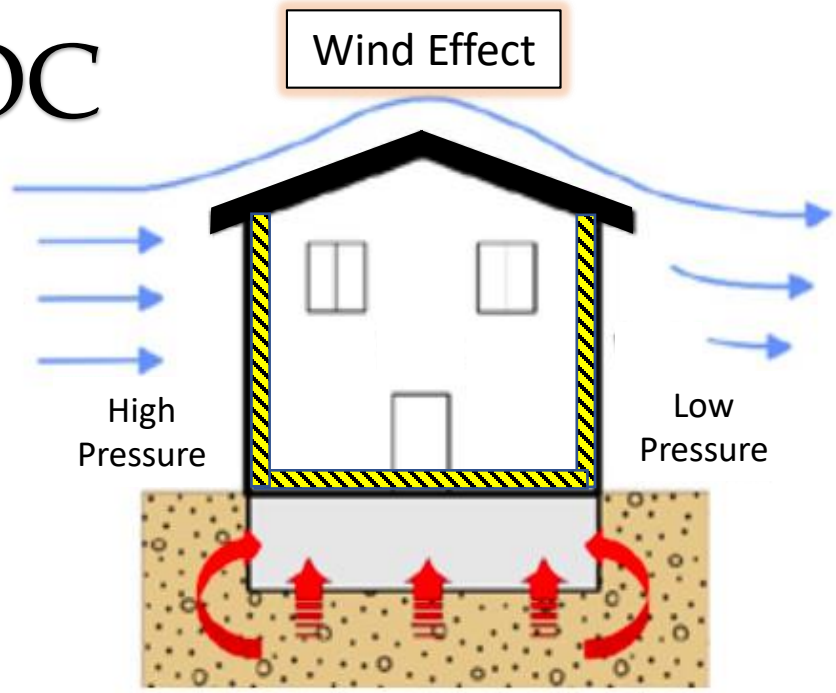
Thermal renovation

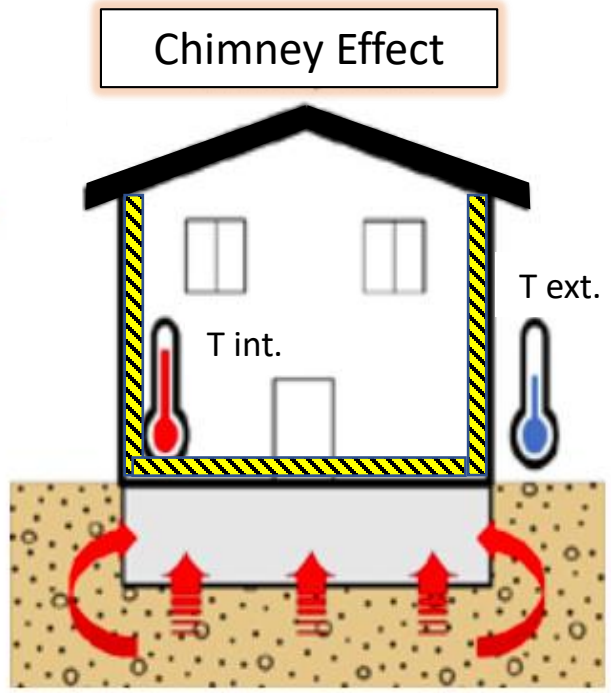


Thermal renovation of existing homes is a highly effective method for short-term reduction of CO_2 emissions

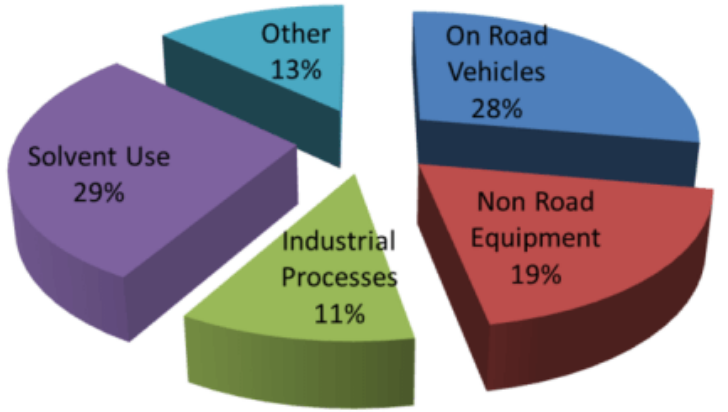
Indoor radon and VOC







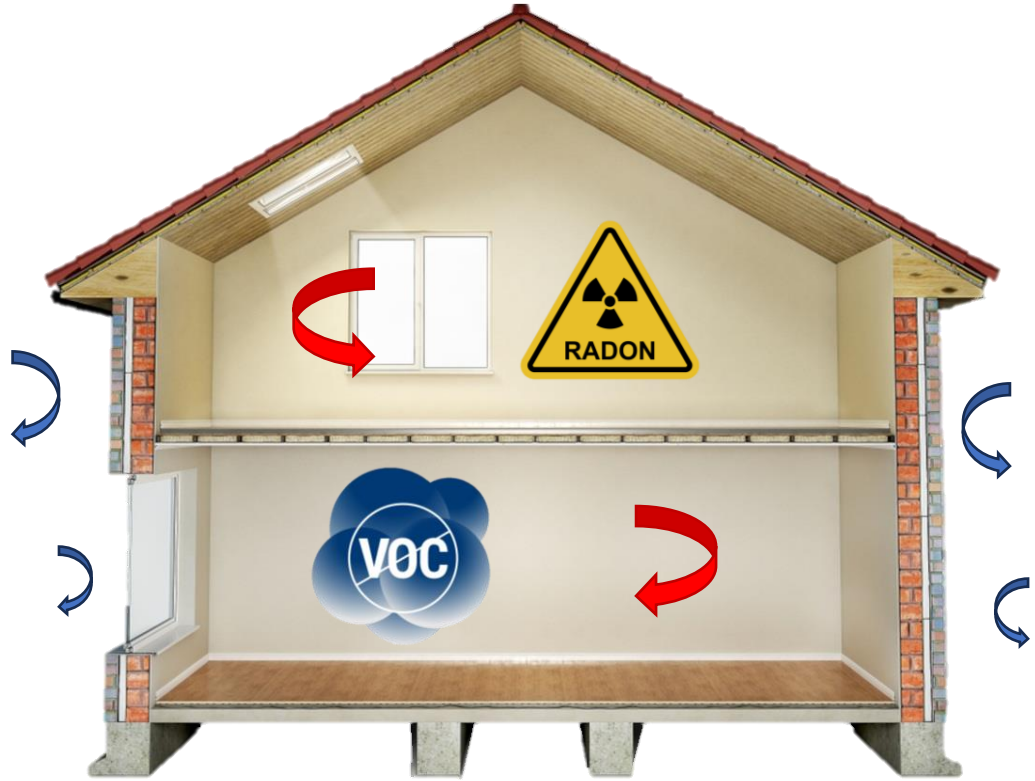
Life-RESPIRE, 2021



Source: epa.gov

-ilaria.rocchetti@uniroma3.it-

Goal

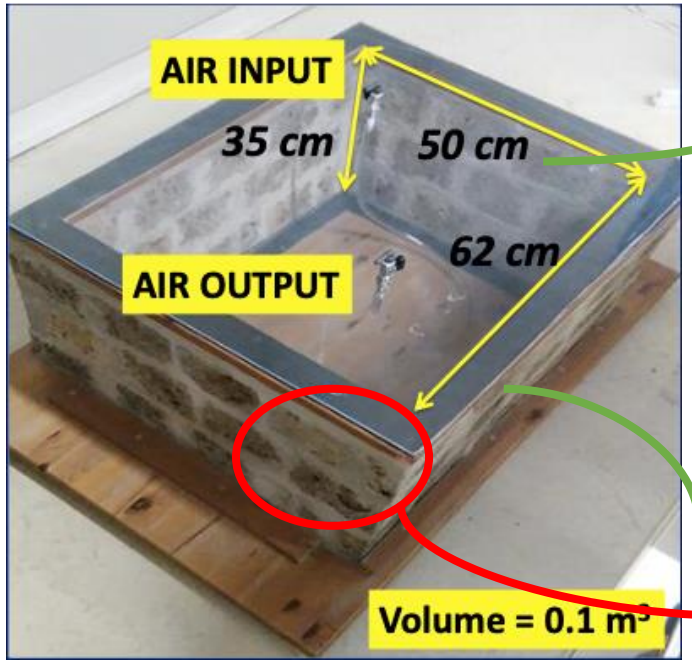


The goal is to investigate the effect of energy efficiency measures on indoor radon and VOC concentrations with the scale model room because their capacity to avoid air exchange between the inside and outside can influence them.

-ilaria.rocchetti@uniroma3.it-

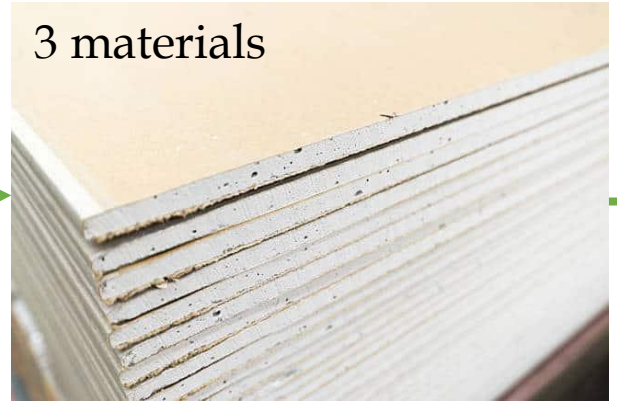
Materials and methods

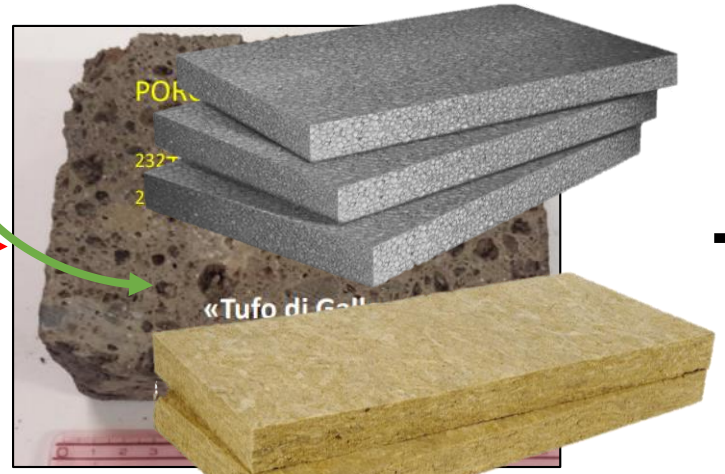
Model Room



Portaro et al., 2023

3 materials





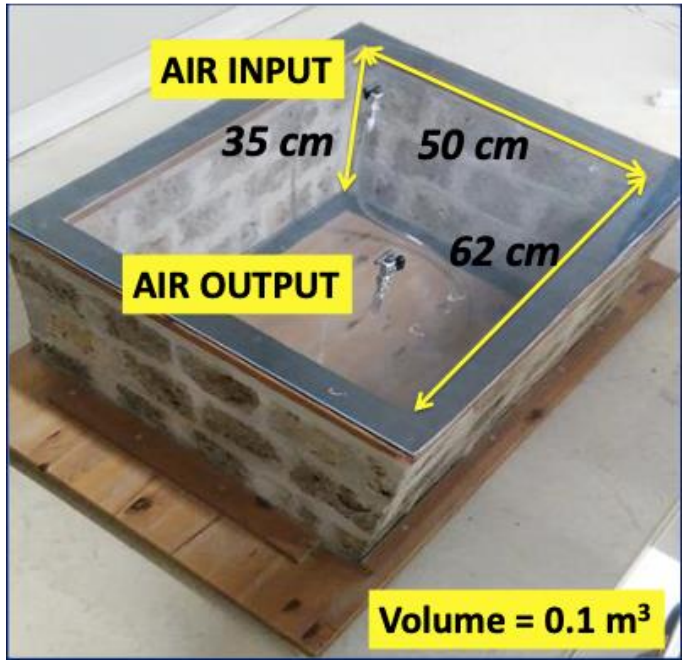
Tuccimei et al., 2021,
Final Conference LIFE-Re

+

-ilaria.rocchetti@uniroma3.it-

Materials and methods

Model Room



Portaro et al., 2023

Mapethene LT → Self-adhesive bitumen membrane made from a mixture of bitumen and polymers bonded to a film of HDPE (high density polyethylene)

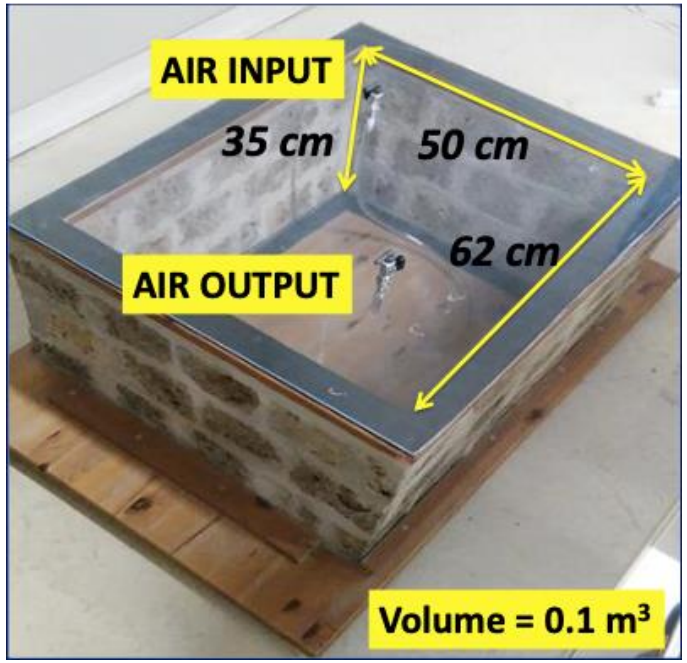
Aquaflex S1K (no charges) → One-component, solvent free, based on silane-terminated polymers

Mapesil BM (hardened) → One-component, solvent-free neutral silicone sealant

-ilaria.rocchetti@uniroma3.it-

Materials and methods

Model Room



Portaro et al., 2023

AER+

Algade Instrumentation, Bessines-sur-Gartempe, France

AER+ 2

Algade Instrumentation, Bessines-sur-Gartempe, France

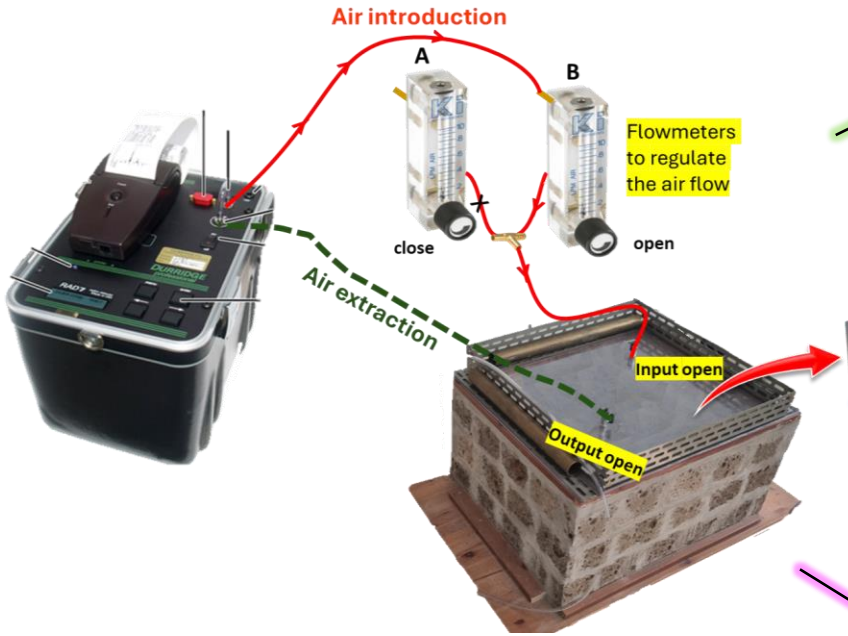
Metal oxide based sensor ->IAQ

RAD7

Durridge Company Inc., Billerica, MA, USA

-ilaria.rocchetti@uniroma3.it-

Materials and methods



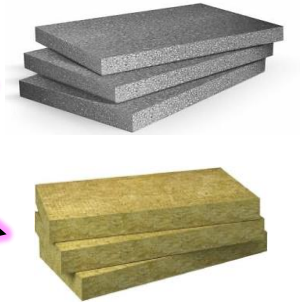
Part 1 (no waterproofing material, no thermal coats)

Part 2 (material and thermal coats)

Part 3-4 (like 2 but with flow rate 0.2 and 0.8 L/min)

Part 5 (no material, just thermal coats)

Waterproofing material applied on the plasterboard support panel



$$RIR\ (\%) = \left(Rn_{parts\ 2,3,4\ or\ 5} - Rn_{part1}\right) / Rn_{part1} \times 100$$

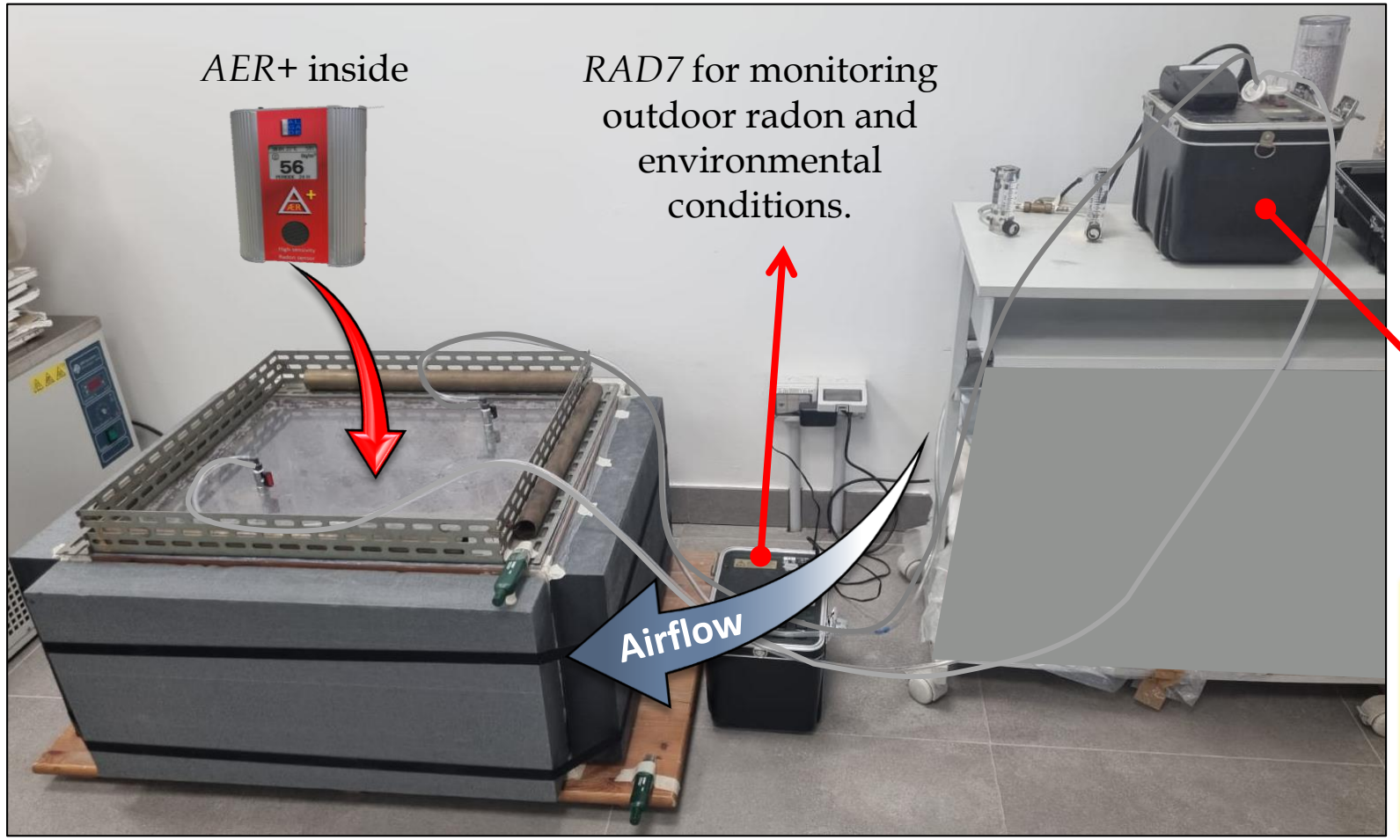
$$Rn_{23} = \frac{Rn\ x\ 23}{T_{ambient}}$$

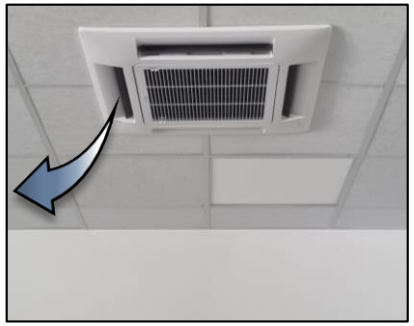
Rn_{23}= radon on a temperature of 23°C (Bq/m^3)

$T_{ambient}$ = °C

-ilaria.rocchetti@uniroma3.it-

Arrangement of the set up in the laboratory



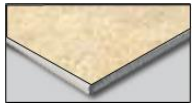


Conditioner

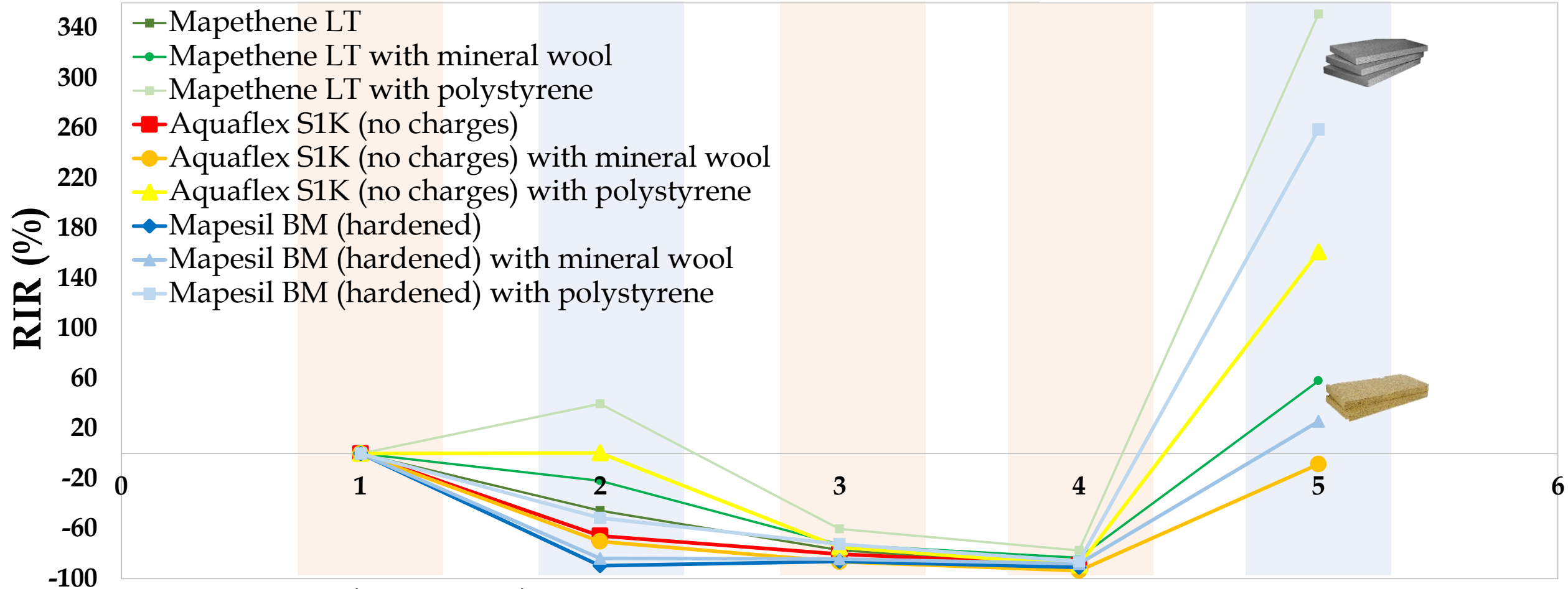
RAD7 for the monitoring of Radon in the model room.

Airflow on during the week and off at the weekend

-ilaria.rocchetti@uniroma3.it-

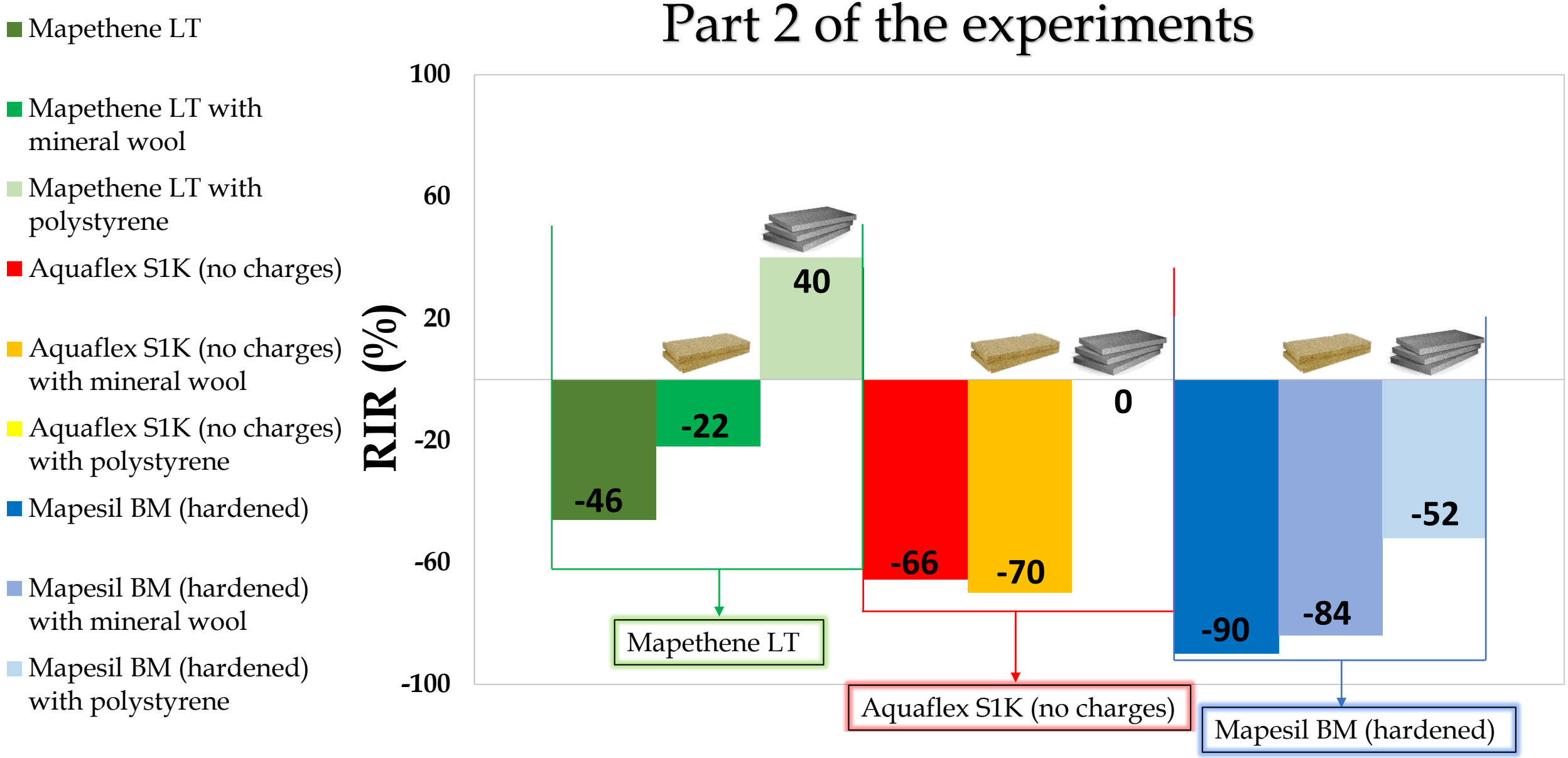
No waterproofing material inside



$$\text{RIR (\%)} = \frac{(Rn_B - Rn_A)}{Rn_A \text{ x } 100}$$

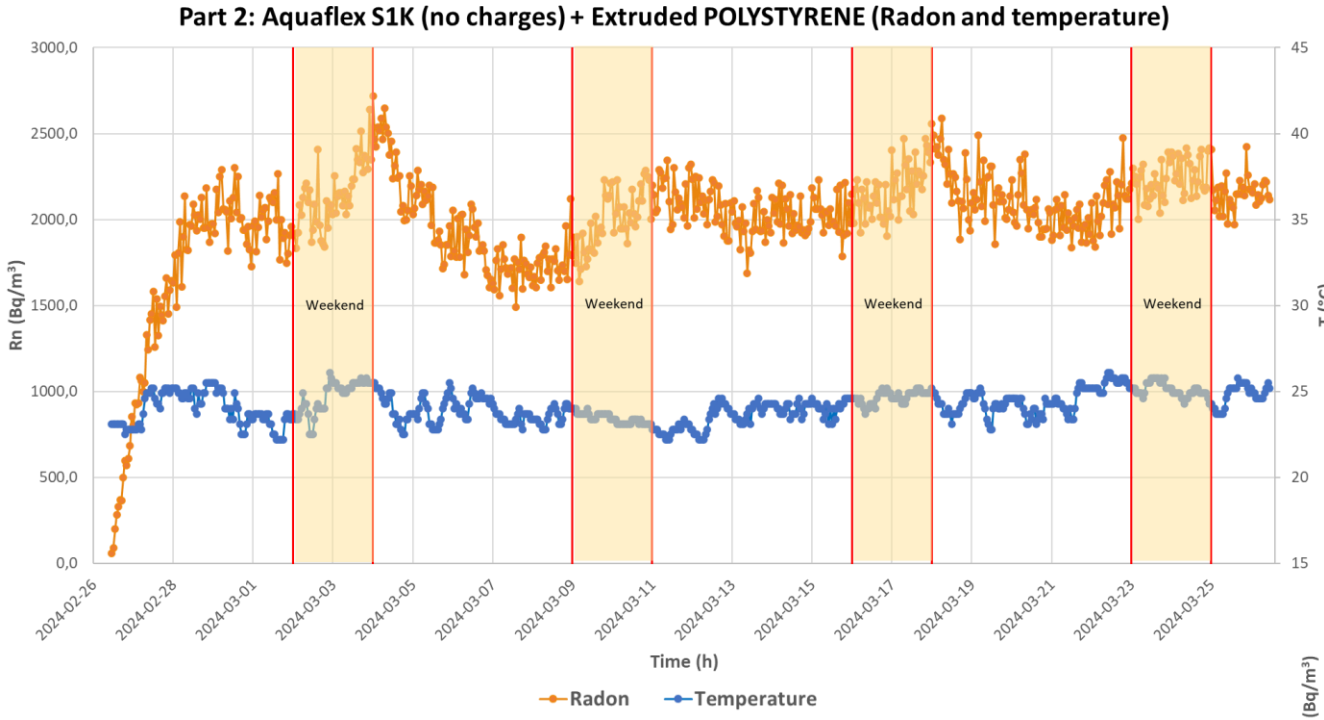
-ilaria.rocchetti@uniroma3.it-

Part 2 of the experiments

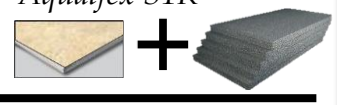


-ilaria.rocchetti@uniroma3.it-

Results and discussion

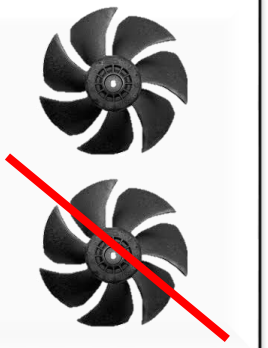


Aqualfex S1K



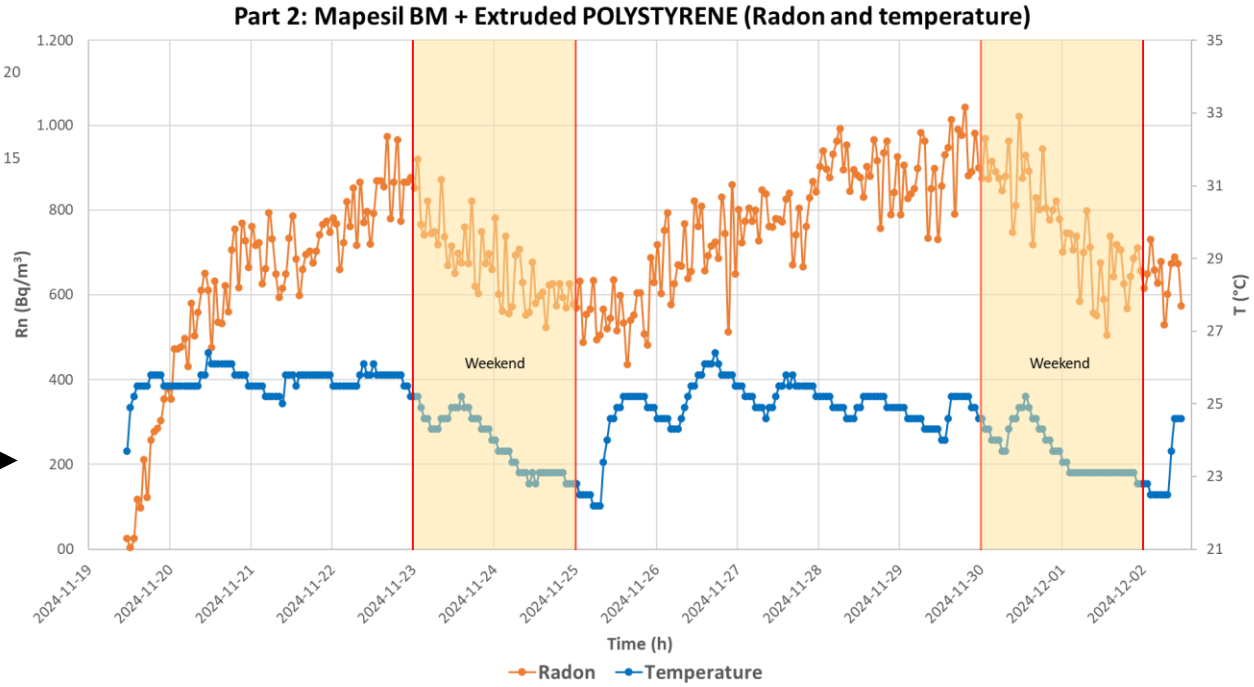
Week ON

Weekend OFF



Always OFF

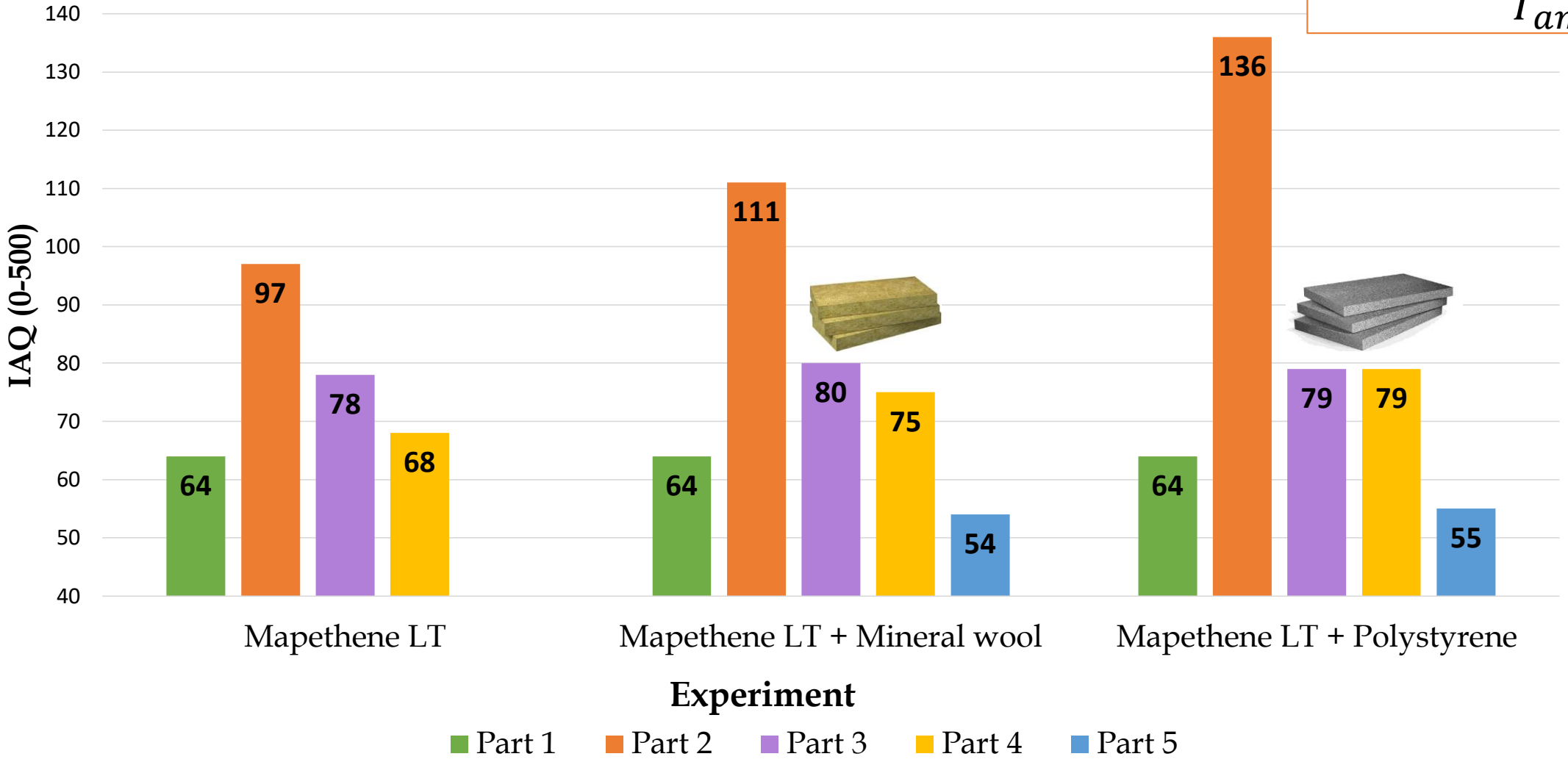
Mapesil BM



-ilaria.rocchetti@uniroma3.it-

Average VOC value

$$IAQ_{23} = \frac{IAQ\ x\ 23}{T_{ambient}}$$



-ilaria.rocchetti@uniroma3.it-

Conclusion

- Thermal coats are useful for avoiding heat dispersion, but their presence can increase indoor radon. This can change based on which thermal coat is used because if the coat has a higher porosity the radon indoor is lower.

- If the mineral wool is coupled with a material with good efficiency to reduce radon, the effect of the thermal coat of increasing radon indoor is reduced

- Equilibrium radon concentration can be modified due to changing concentration gradients between the coat and the outdoor and temperature gradients.

- The results of the model room could be useful for studying in real conditions the effects of pressure, temperature, and wind in the presence of an external thermal coat.

-ilaria.rocchetti@uniroma3.it-

Conclusion

- For the VOC, instead, their behavior is influenced more by the presence of the membrane than by the thermal coat because of their chemical interaction with the tuff and also because of the sources.

- In fact, radon is exhaled directly from the walls of the model room, while the VOC's source is put inside the chamber.

- In this case, the only way to reduce both the indoor pollutants from the model room is with the introduction of forced ventilation.

-ilaria.rocchetti@uniroma3.it-

Thank you for your attention!

-ilaria.rocchetti@uniroma3.it-