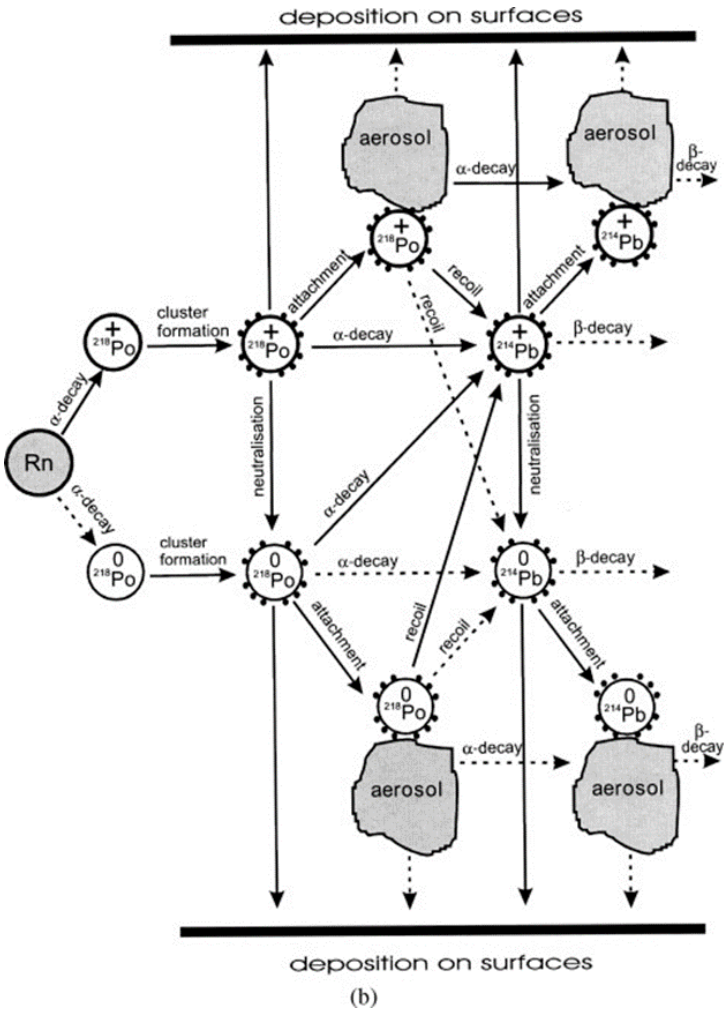
Assessment of Air Purification Technologies for Reducing Dose from Inhaled Radon Progeny

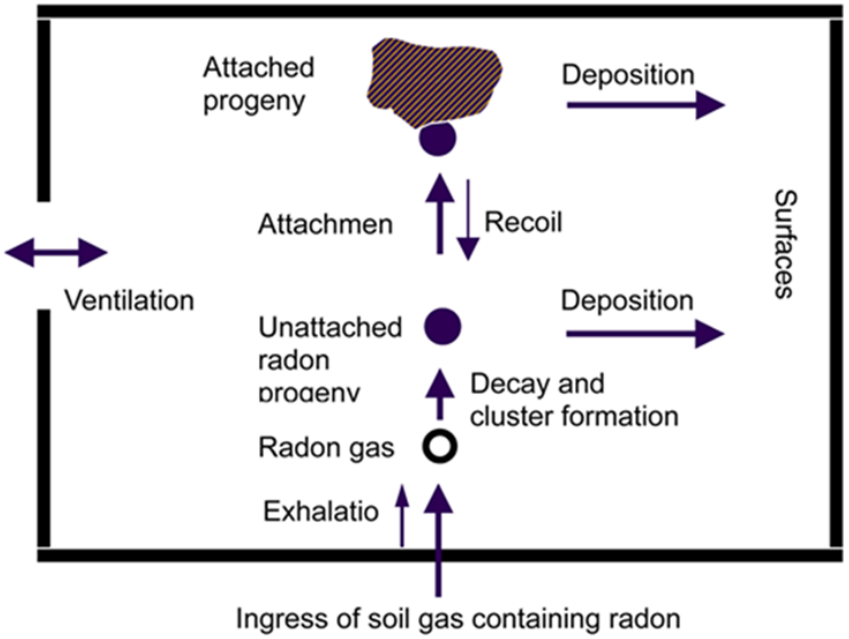
Petr Otahal, Eliska Fialova, Josef Vosahlik

National Institute for NBC Protection

otahal@sujchbo.cz

Introduction

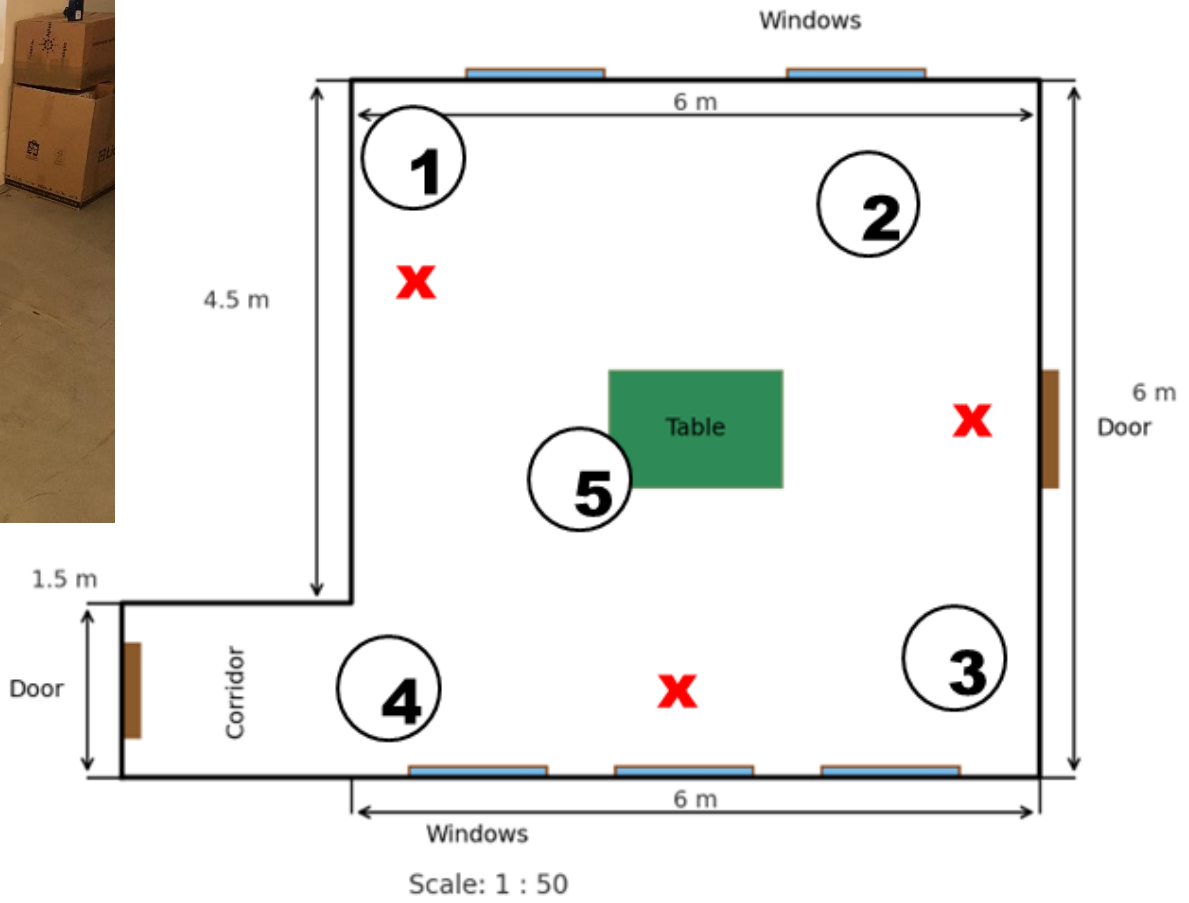




Main mechanisms

Environmental factor	Typical effect on F	Mechanism	Typical effect on f_p	Mechanism (f_p)
Increased ventilation	↓	Faster removal of RnDP compared to the parent radon gas.	↑	Aerosol particles are removed more efficiently than unattached RnDP, slightly increasing their relative share.
Smoking, cooking (increased aerosol concentration)	↑	Aerosols reduce plate-out of RnDP onto surfaces, increasing airborne concentration.	↓↓	A large number of aerosol surfaces promotes rapid attachment of unattached RnDP, strongly reducing their fraction.
Air filtration (HEPA or electrostatic)	↓	Filtration effectively removes aerosols together with the attached fraction of RnDP.	↑↑	Removal of aerosols prevents attachment; unattached RnDP remain longer in the free state.
High humidity	↑	Hygroscopic growth of aerosols leads to larger particles, which deposit more slowly on surfaces.	↓	Larger and more adhesive aerosols capture unattached RnDP more efficiently.

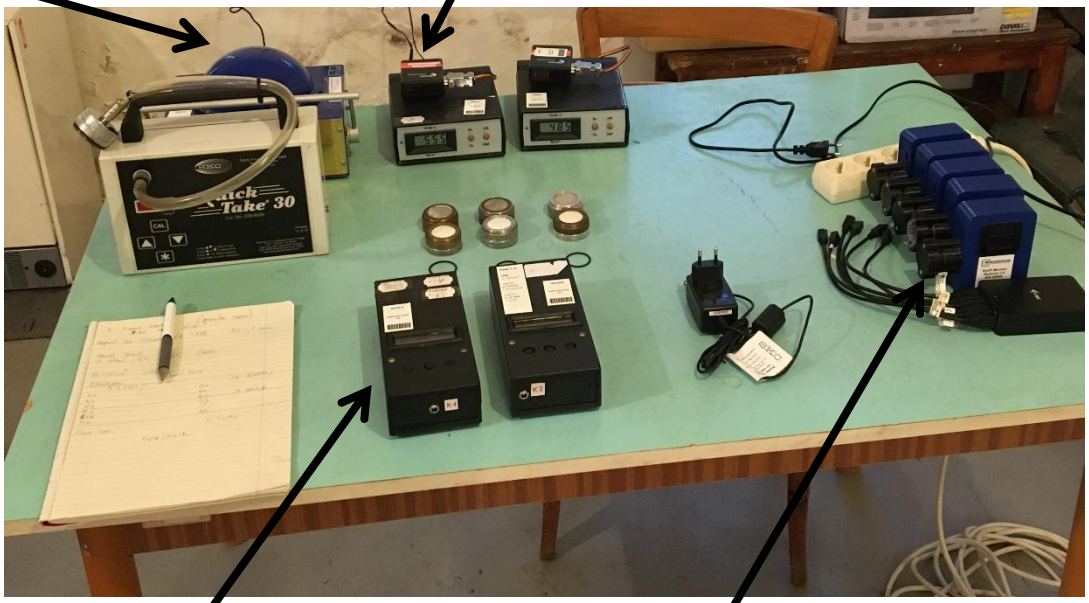
Office


Windows
6 m
1
2
4.5 m
X
Table
5
X
6 m
Door
1.5 m
Door
Corridor
4
X
3
6 m
Windows
Scale: 1 : 50

Measuring instruments

TS – 96 (RnDP)

Radim 3A x AlphaGuard (radon)



Maaf (RnDP)

PAEC integral monitor – Radonis 1.0 (RnDP)

Modification of indoor atmosphere

- **Conservative conditions** – upon stepping into the workplace, no ventilation had been applied; the indoor atmosphere was influenced solely by the air purifiers. No aerosol source.
- **Atmosphere modification** - using an air cleaning and humidifying.

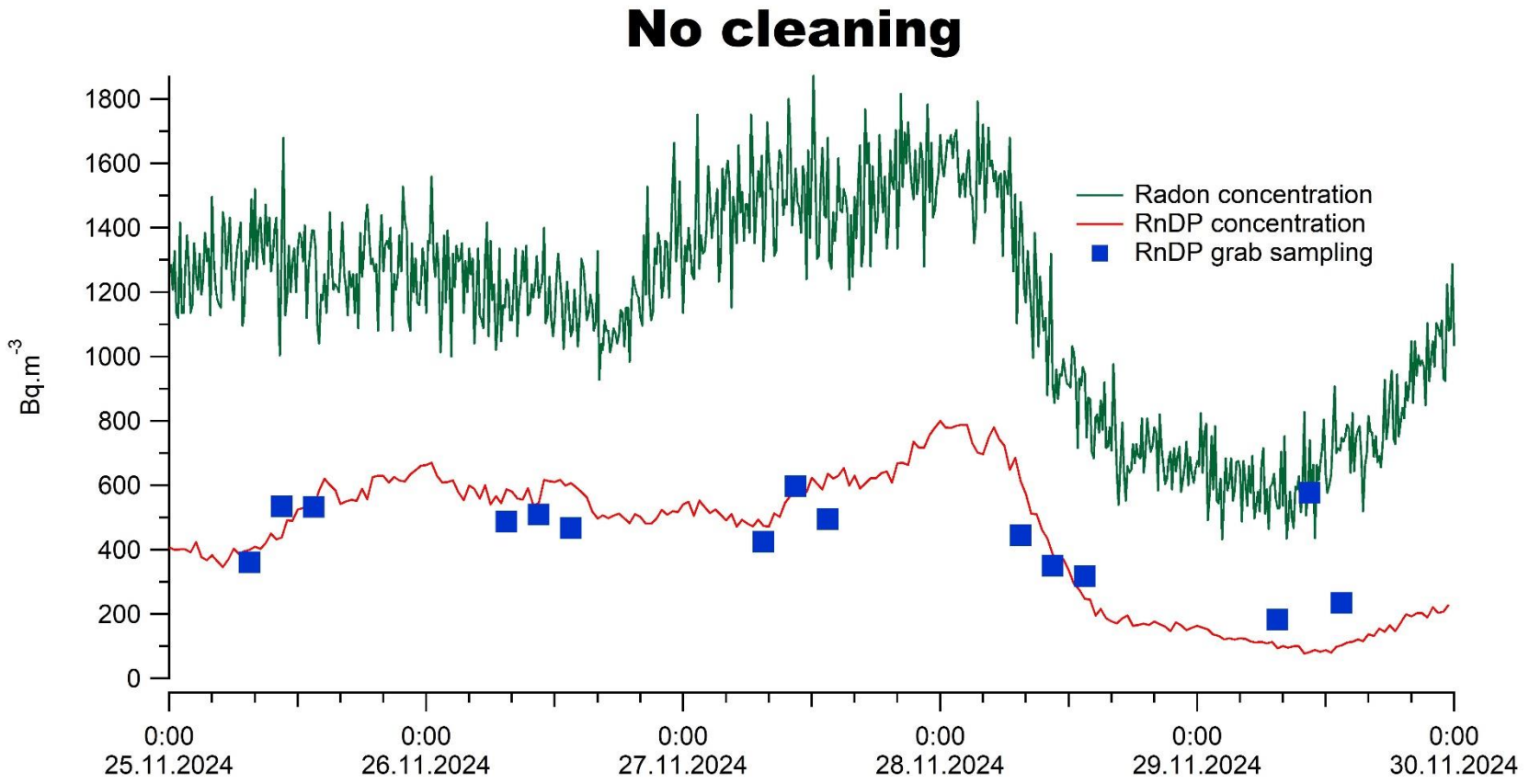
Atmosphere modification

AirgoClean® 350 E

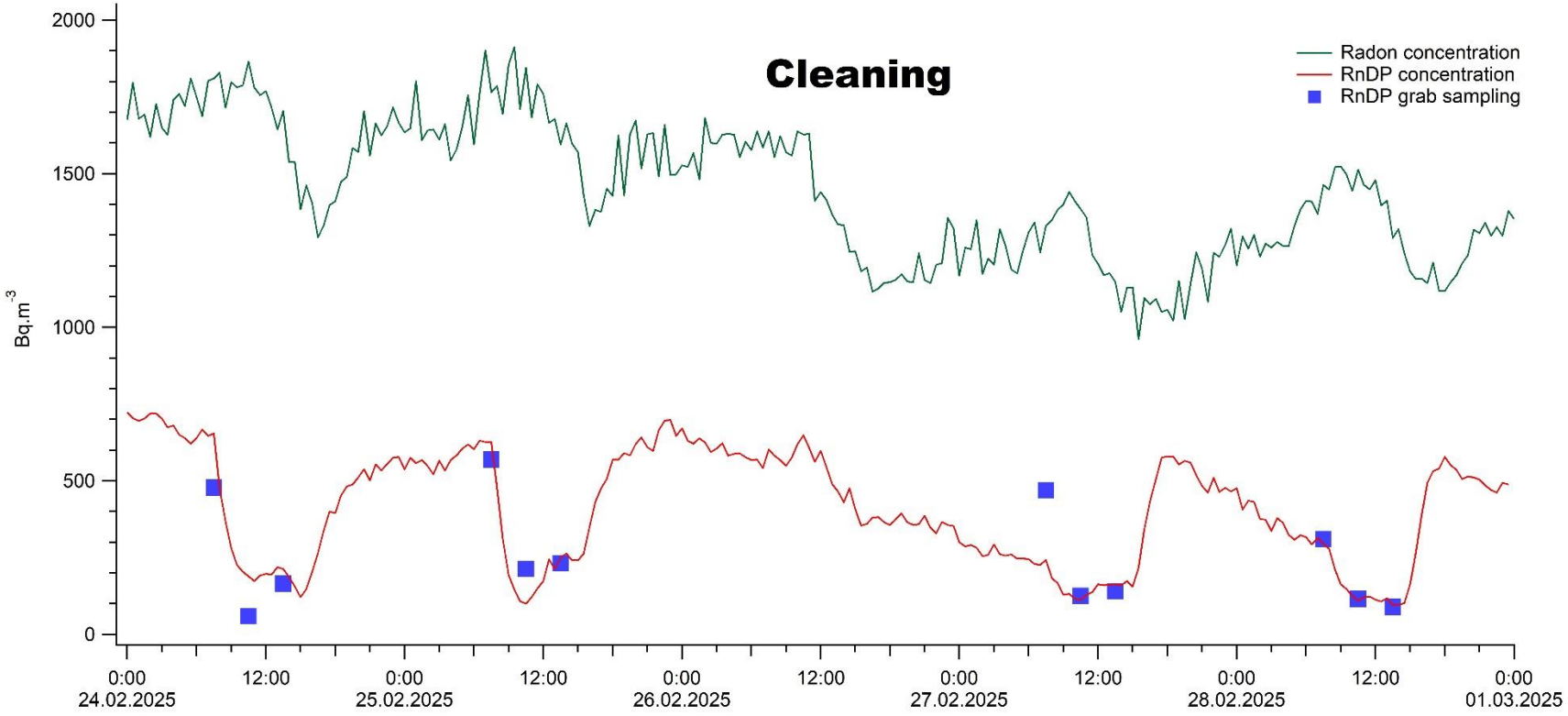
Humidifier

Ionic-CARE

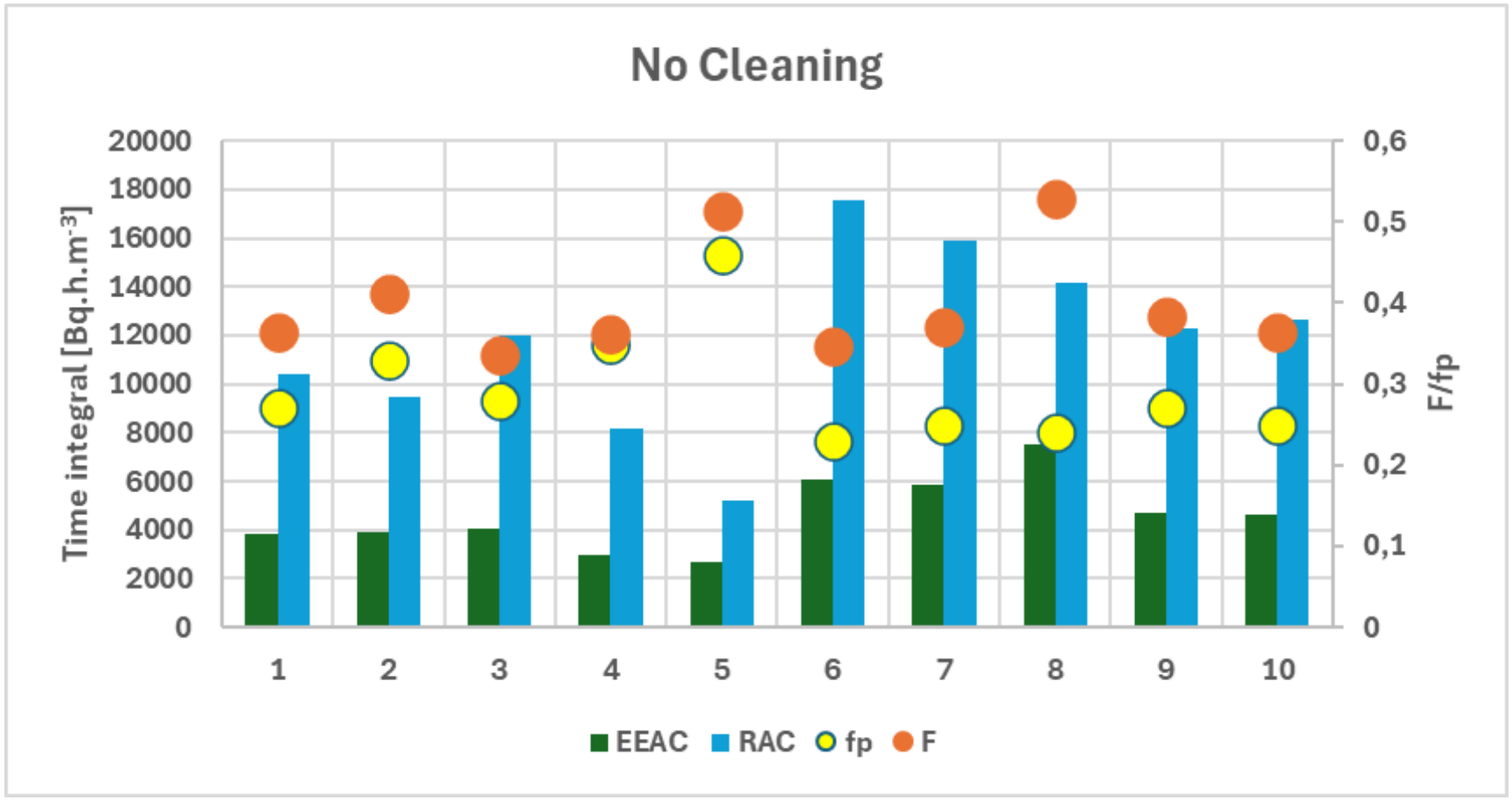
No cleaning


No cleaning
Bq.m-3
1800
1600
1400
1200
1000
800
600
400
200
0
Radon concentration
RnDP concentration
RnDP grab sampling
0:00 25.11.2024
0:00 26.11.2024
0:00 27.11.2024
0:00 28.11.2024
0:00 29.11.2024
0:00 30.11.2024

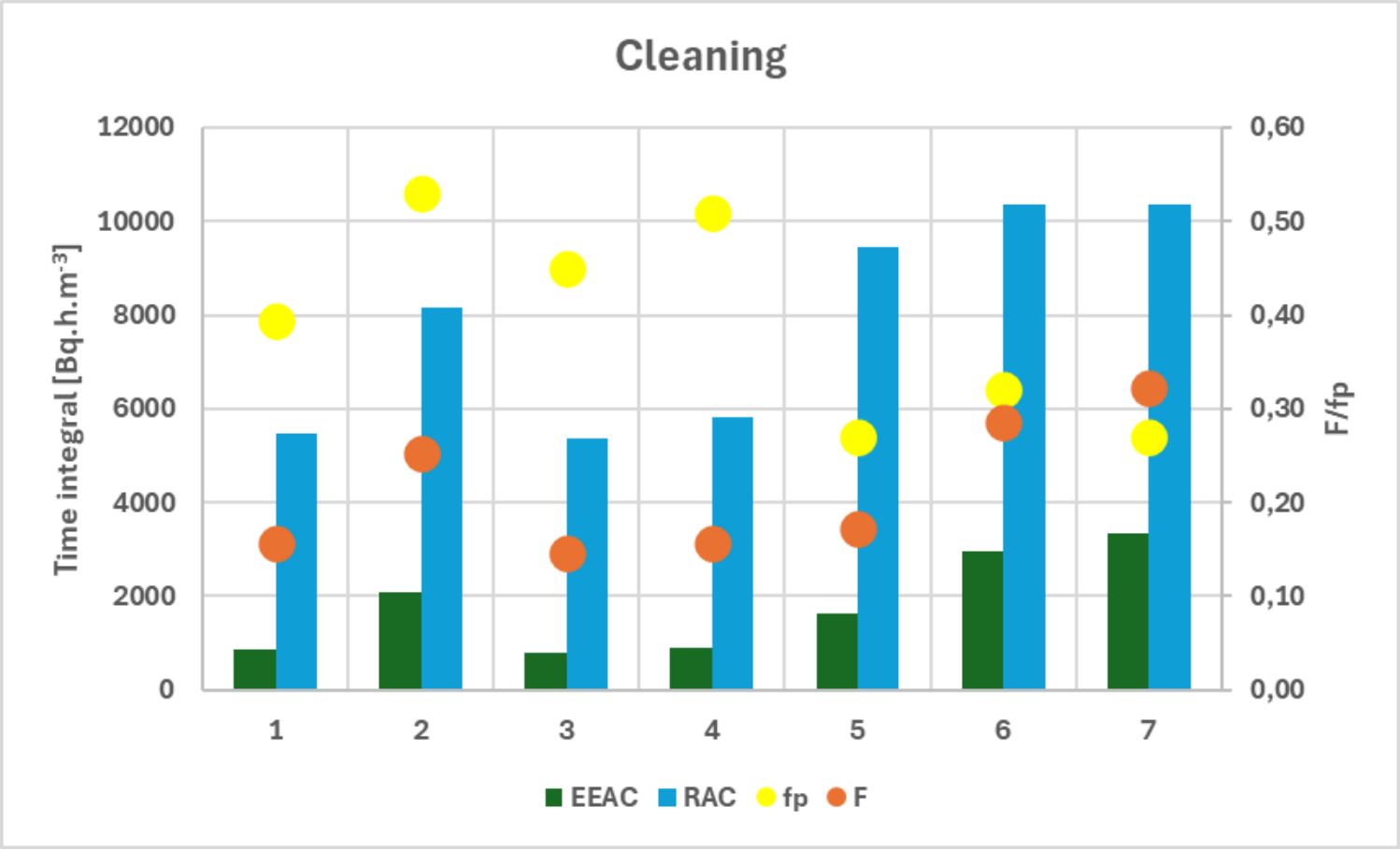
Cleaning


Cleaning
Radon concentration
RnDP concentration
RnDP grab sampling
Bq.m-3
2000
1500
1000
500
0
0:00
24.02.2025
12:00
0:00
25.02.2025
12:00
0:00
26.02.2025
12:00
0:00
27.02.2025
12:00
0:00
28.02.2025
12:00
0:00
01.03.2025

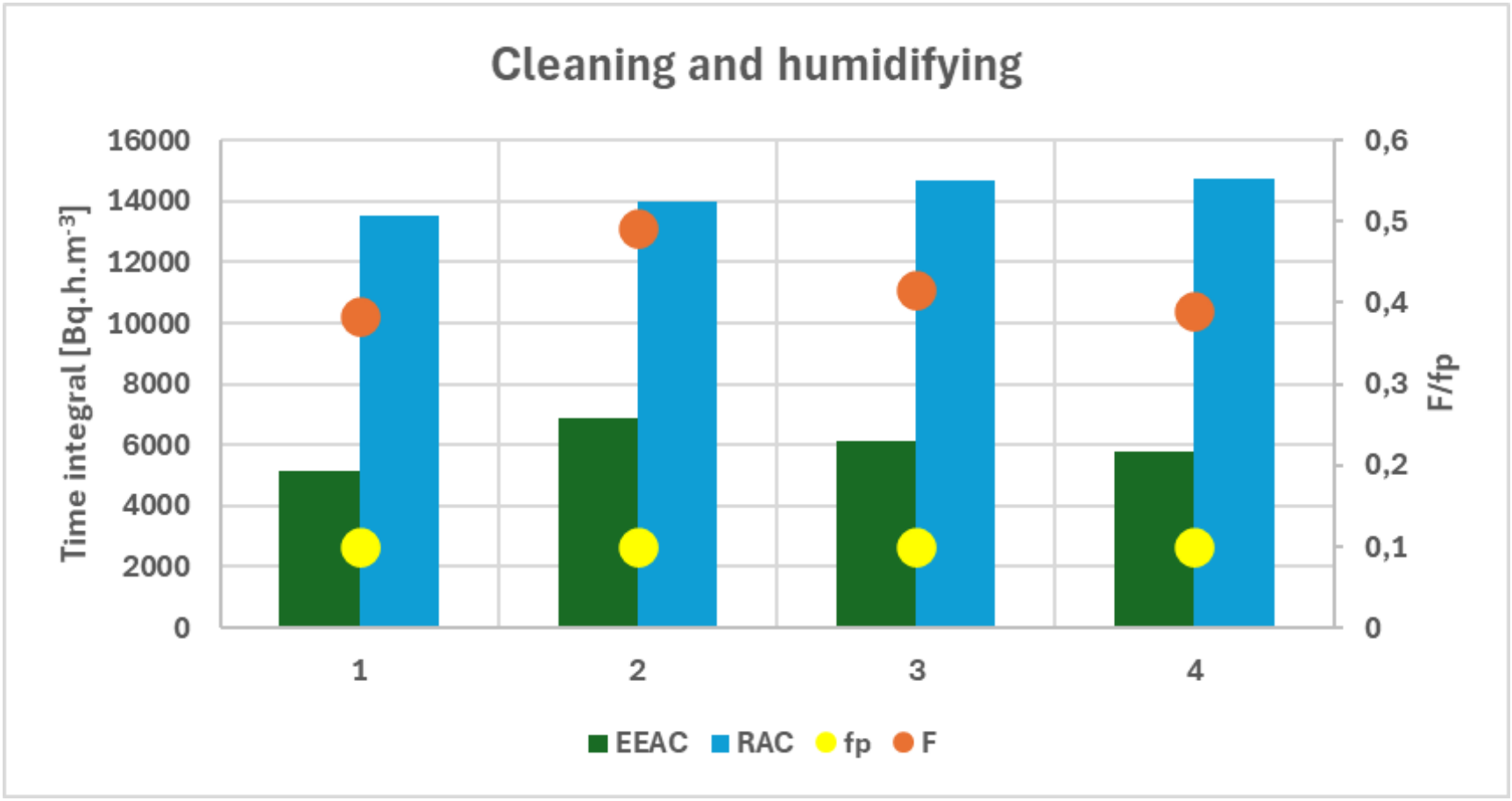
No cleaning


No Cleaning
Time integral [Bq.h.m-3]
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0,6
0,5
0,4
0,3
0,2
0,1
0
F/fp
1
2
3
4
5
6
7
8
9
10
EEAC
RAC
fp
F

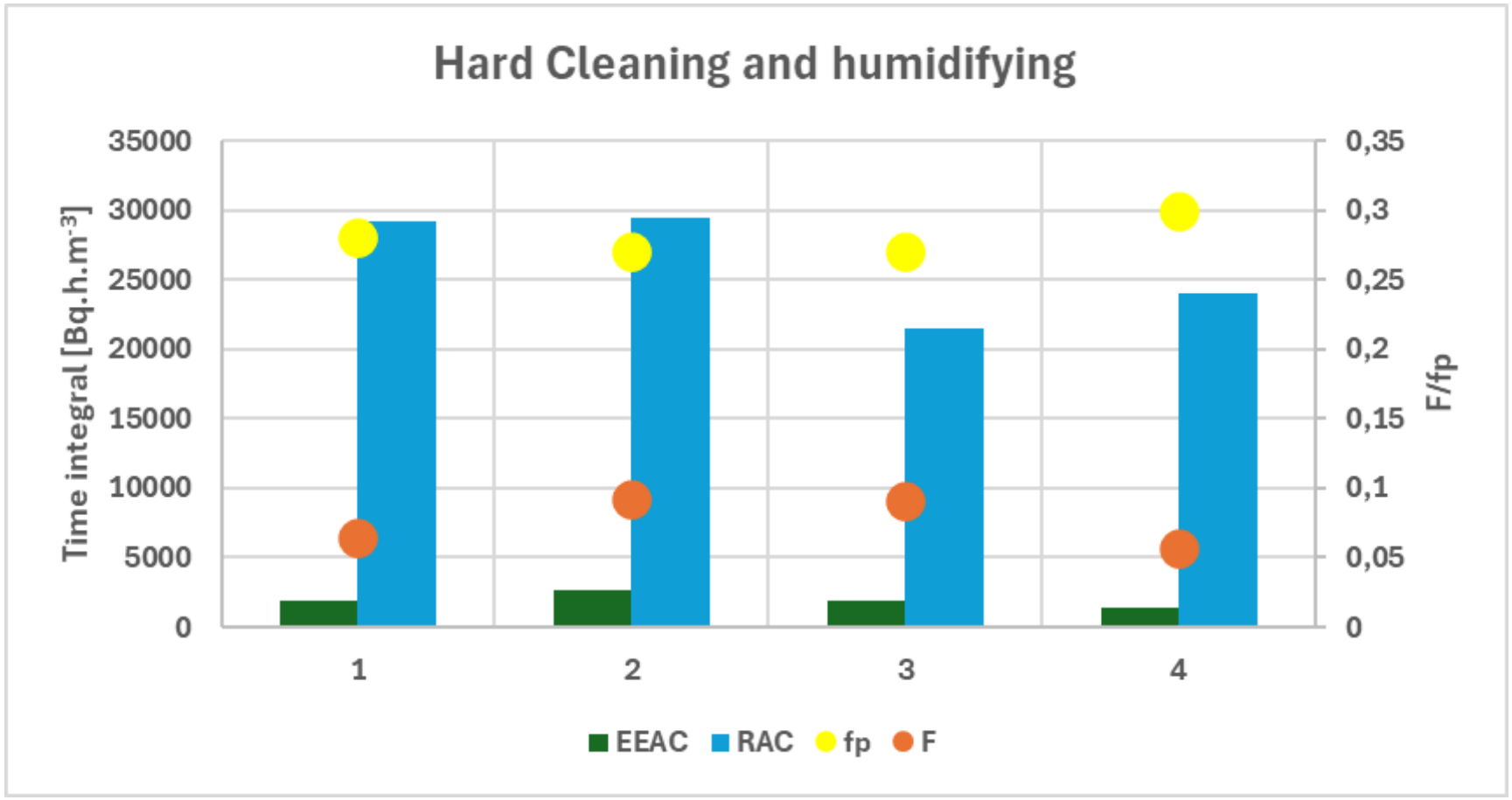
Cleaning


Cleaning
Time integral [Bq.h.m-3]
12000
10000
8000
6000
4000
2000
0
0,60
0,50
0,40
0,30
0,20
0,10
0,00
F/fp
1
2
3
4
5
6
7
EEAC
RAC
fp
F

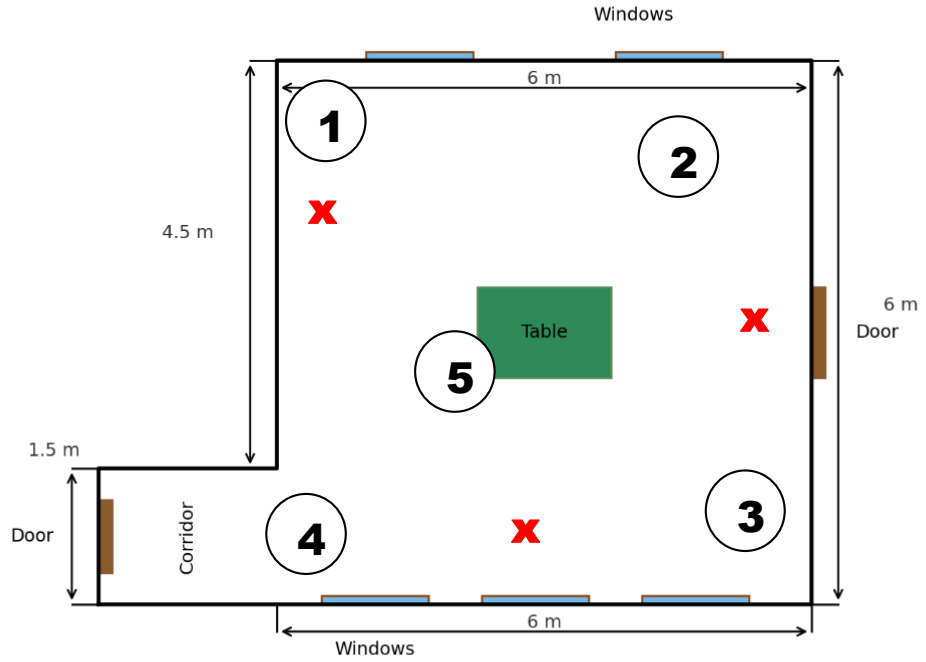
Cleaning and humidifying



Hard cleaning and humidifying



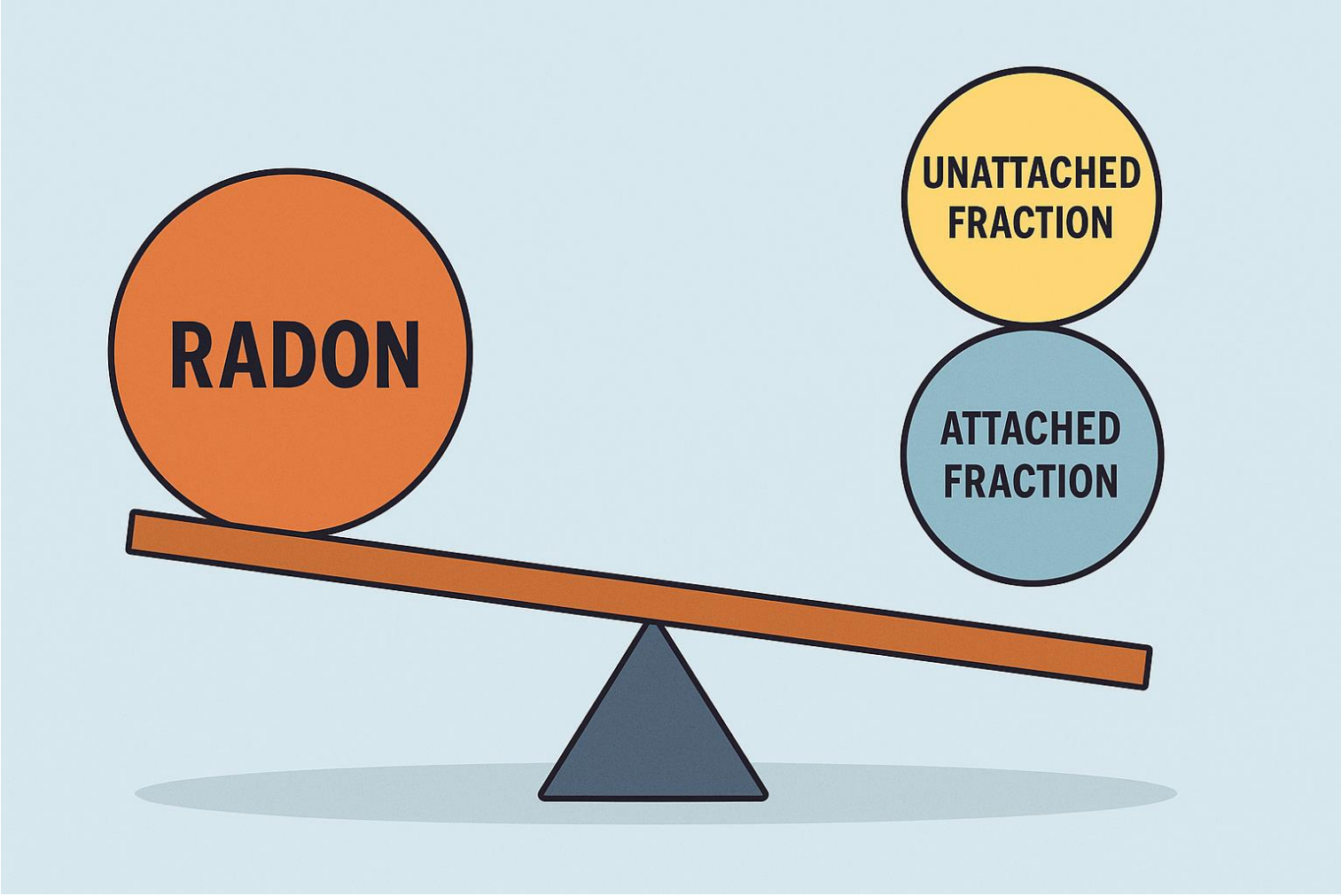
Spatial distribution of EEAC



Scale: 1 : 50

	No action	No action	No action	Cleaning	Cleaning	Cleaning + humidifying	Hard cleaning + humidifying
1							
2							
3							
4							
5							

Thanks for your attention.



Stay in balance!