Haute école d'ingénierie et d'architecture Fribourg
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Ventilation methods and radon risk management : a couple we still have to learn !

A case study in Interreg France-Switzerland JURAD-BAT project

Hes·so
Haute Ecole Spécialisée de Suisse occidentale
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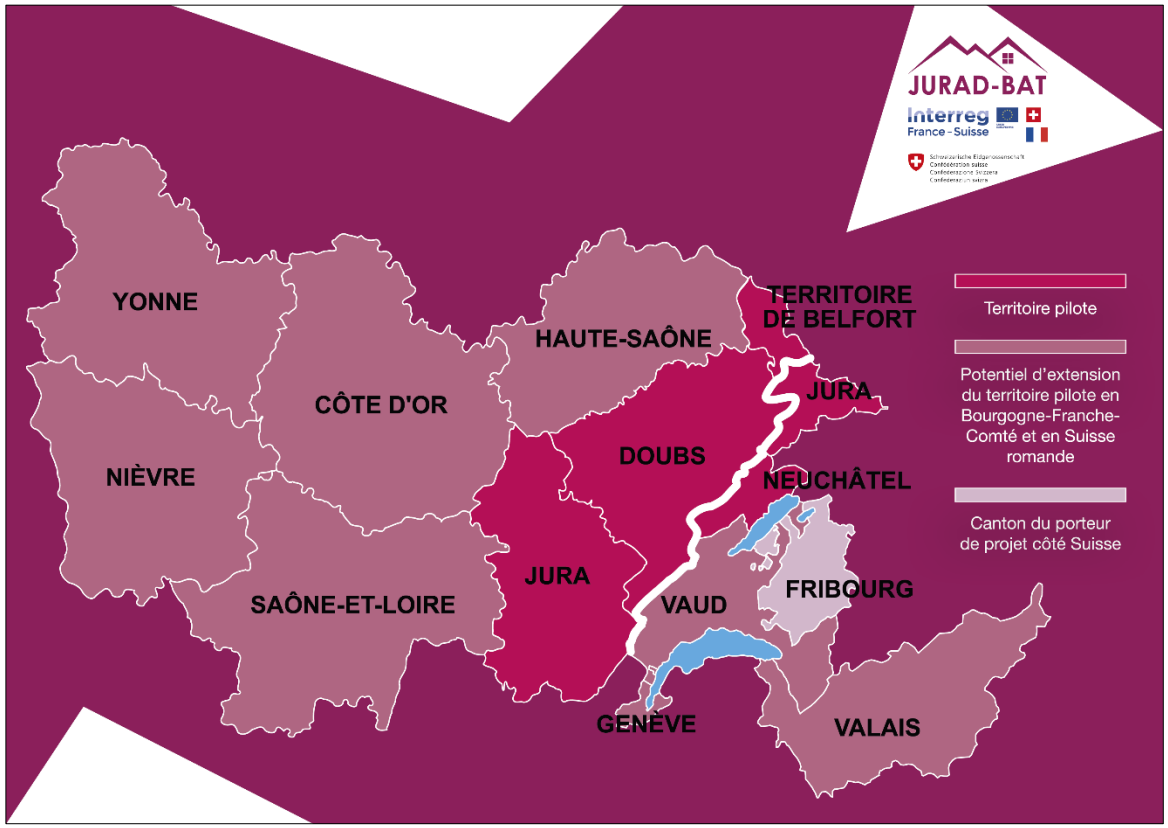
Outline

- An Interreg France-Switzerland JURAD-BAT project
- Case study : monitoring a flat in an old Jura region totally refurbished farm
- Aim of this study: to test 3 different ventilation systems
  1 : Natural ventilation system (windows manually opened)
  2 : Mechanical exhaust ventilation system with air inlets
  3 : Mechanical balanced ventilation system with heat recovery
- Research questions :
  - What is the impact of the ventilation on indoor radon gas concentration?
  - Is there a specific ventilation mode that can guarantee radon concentration lower, in average, than 300 Bq/m^3 of air?
  - What is happening in case of fan breakdown ? Do people feel worsening conditions? Do they change their way of living?
- Next step : a radon risk management simulation tool
- Conclusions

JURAD-BAT project

- Better assessment of radon risk in Jura mountains buildings : a cross-border platform for users and professionals
- FR : Territoire de Belfort, Doubs and Jura; CH : Neuchâtel and Jura



Aim of the study

- To dimensionne ventilation system to maintain radon concentration under the reference value of 300 Bq/m^3 of air in buildings
- What has been done?
  - Continuous measurement of radon and other parameters and analysis of the building
  - Develop a radon risk management simulation tool (semester & bachelor student work)
  - Provide this tool to professionals in order to evaluate radon risk in new buildings and renovated ones assuming one or the other ventilation systems

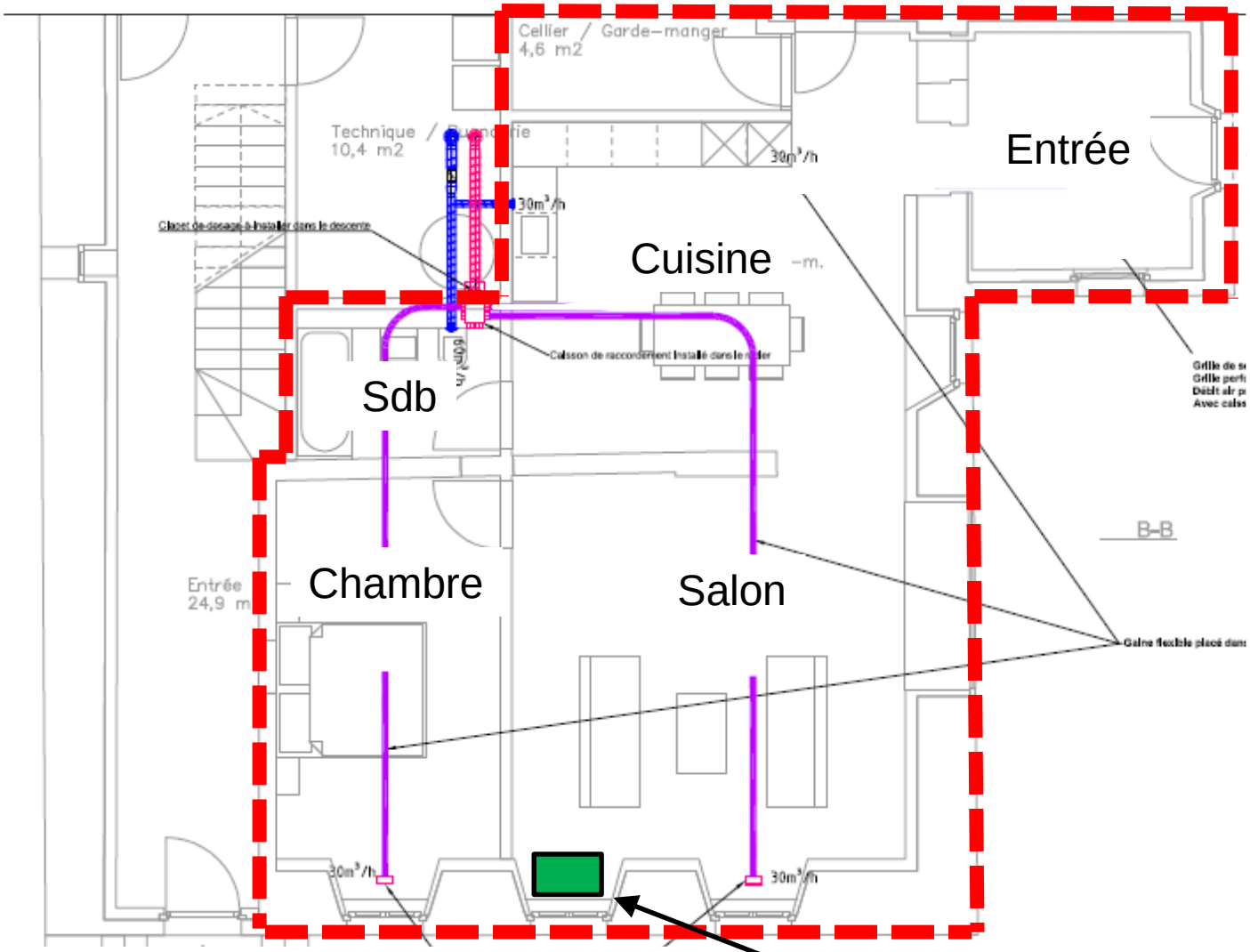
Flat location

- Old farm from Jura , Minergie-P rehabilitation (high performance label)

Flat inside view

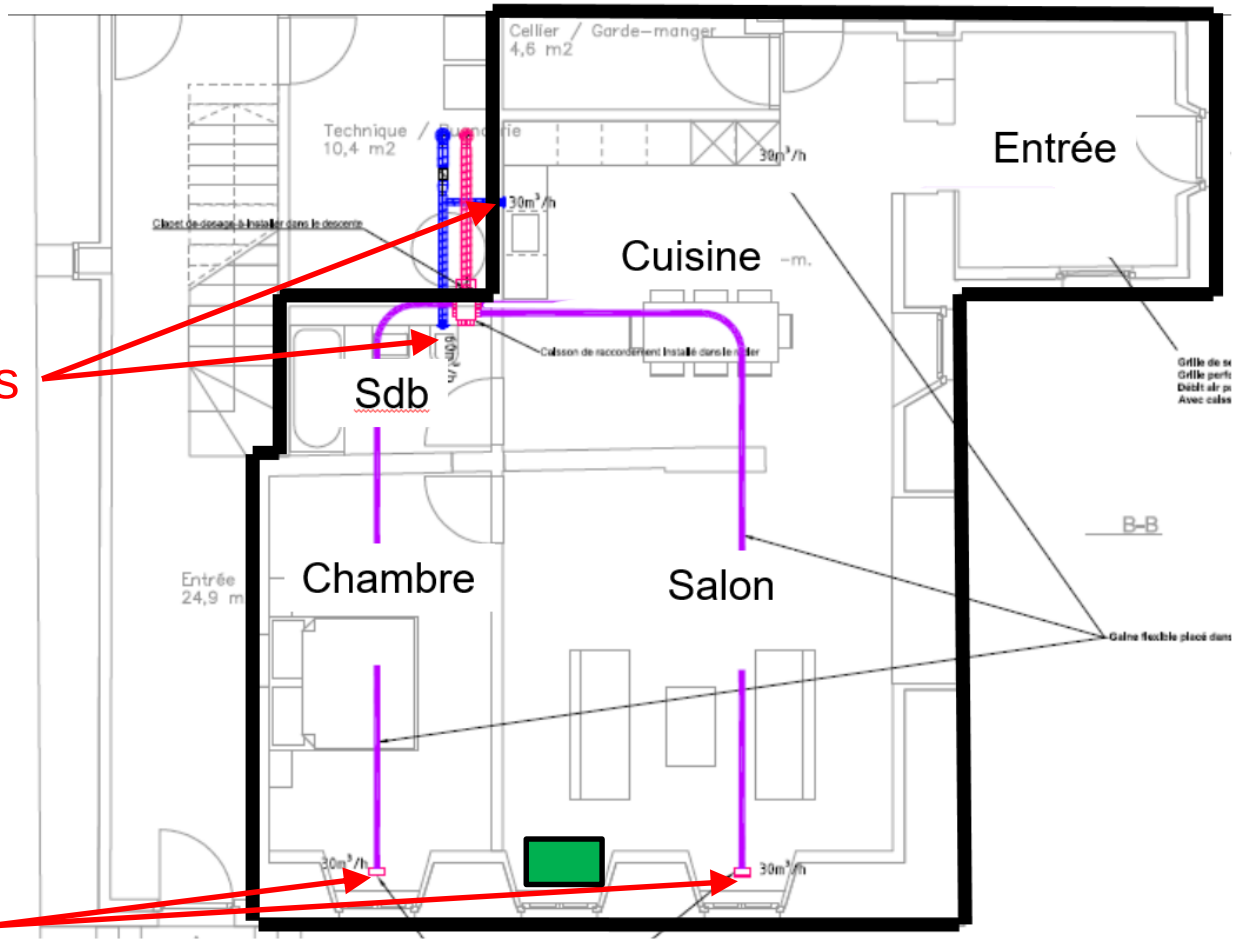
- Living room

Flat location



Ventilation system description

- Mechanical balanced ventilation system with heat recovery



The Radon mapper monitoring system

Differential pressure

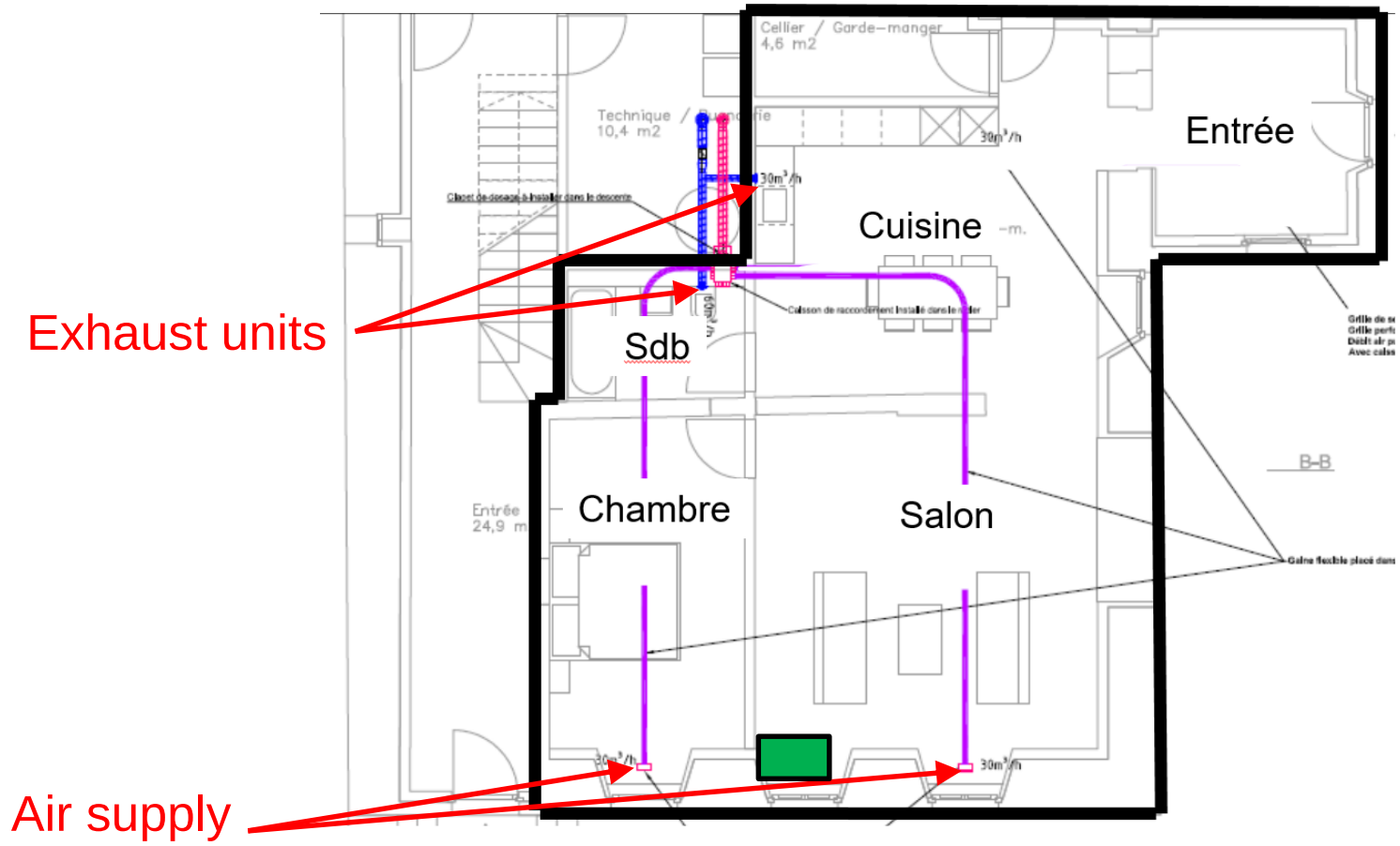
Radon

Temperature
Relative humidity
Pressure

CO_2

Ventilation system adaptation

- The mechanical balanced ventilation was adapted to test 2 others scenarii of ventilation in the same flat



1 : Natural ventilation system (windows manually opened)

- Closing air supply and exhaust units

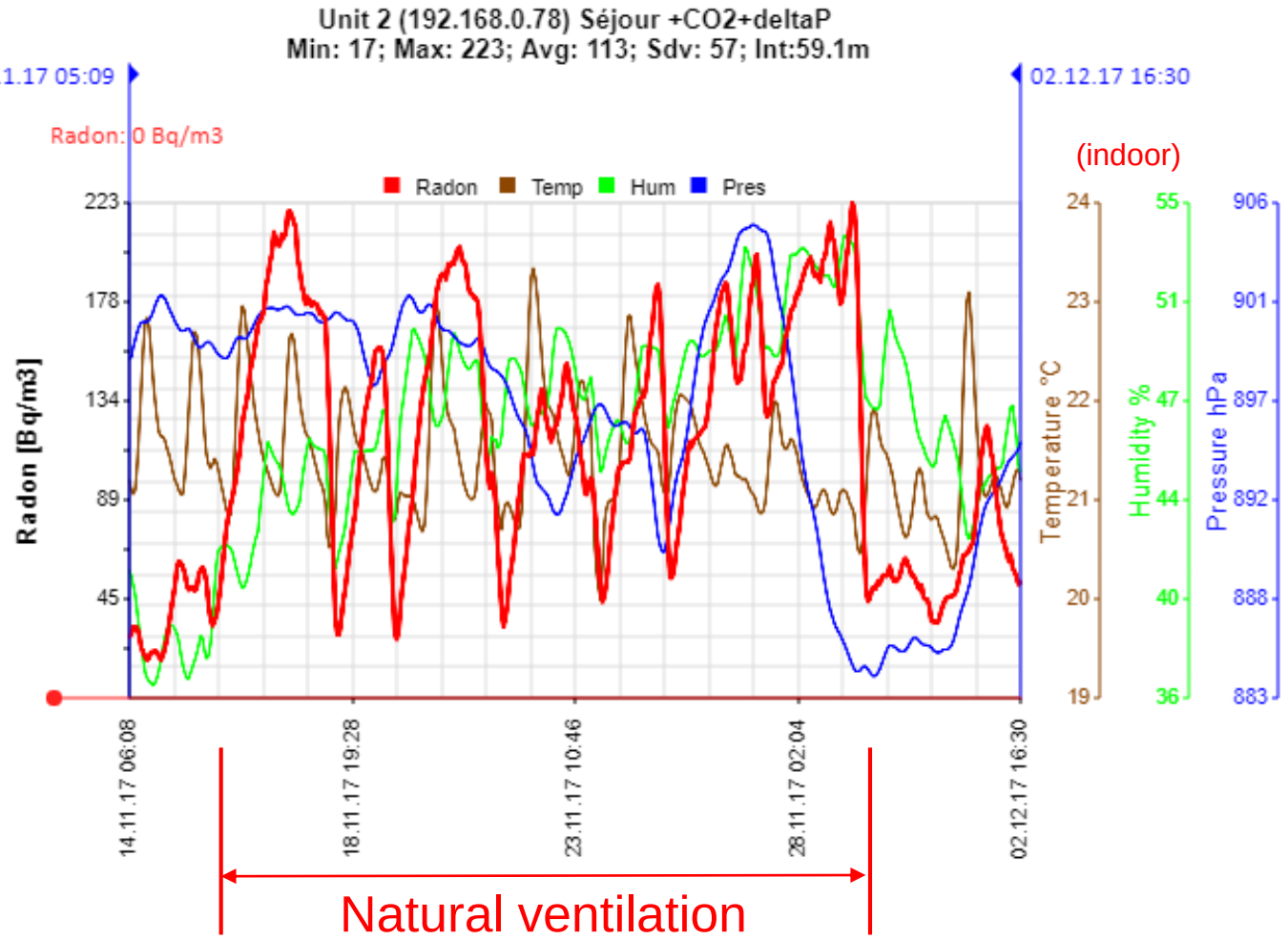
Closure of exhaust units

Air supply closure

1 : Natural ventilation system (windows manually opened)

Period:
15.11-29.11.17

	Radon	CO_2
	[Bq/m³]	[ppm]
min	23	450
max	227	2'100
mean	133	



2 : Mechanical exhaust ventilation system with air inlets

- Window adaptation and air supply closure

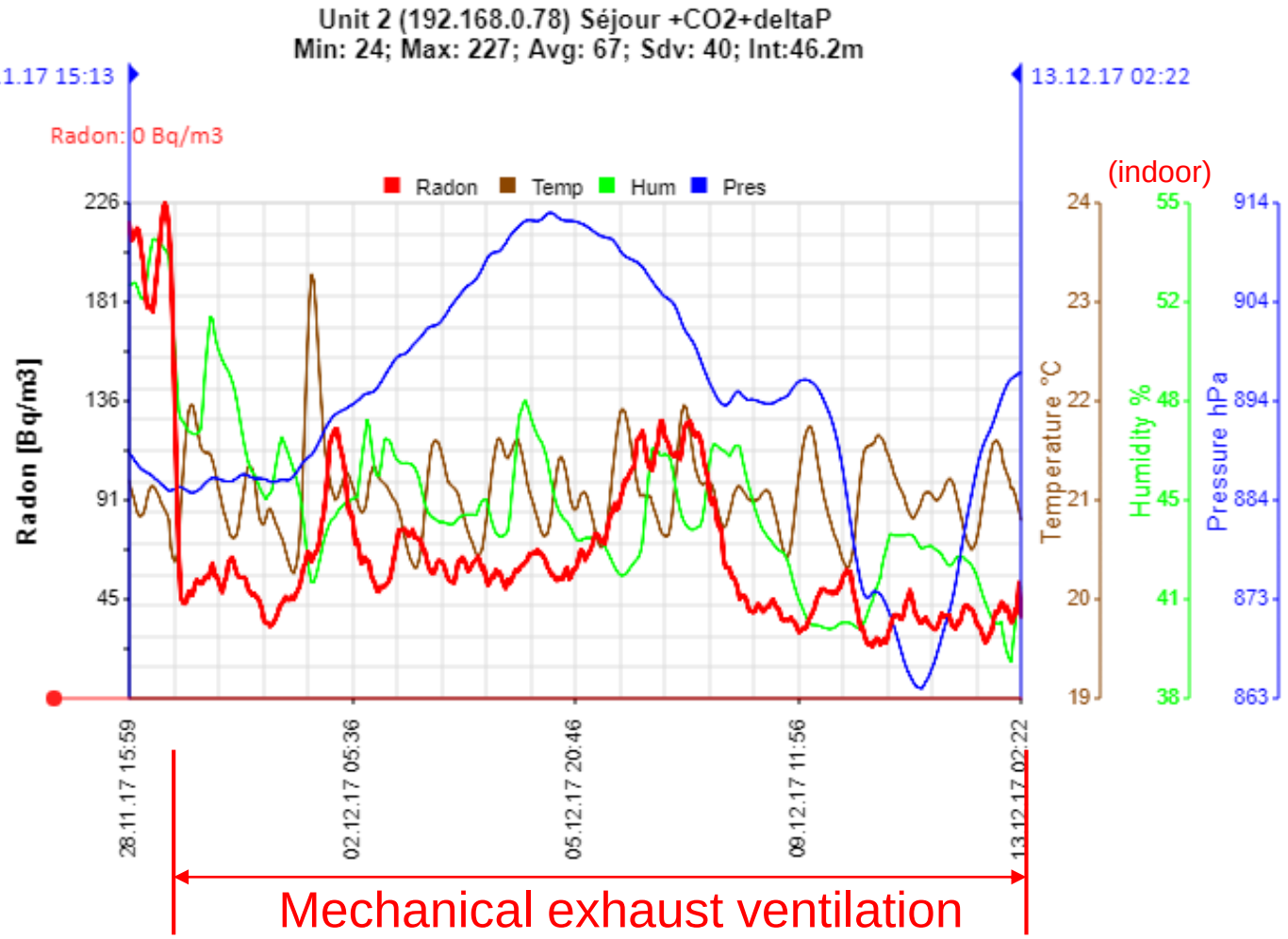
Air supply closure

Adaptation to provide some air inlet

2 : Mechanical exhaust ventilation system with air inlets

Period:
29.11-13.12.17

	Radon	CO_2
	[Bq/m³]	[ppm]
min	23	400
max	130	1’200
mean	60	



3 : Mechanical balanced ventilation system with heat recovery

- Total supply air : 93m³/h
- Total exhaust air : 70m³/h

Air supply

Exhaust unit

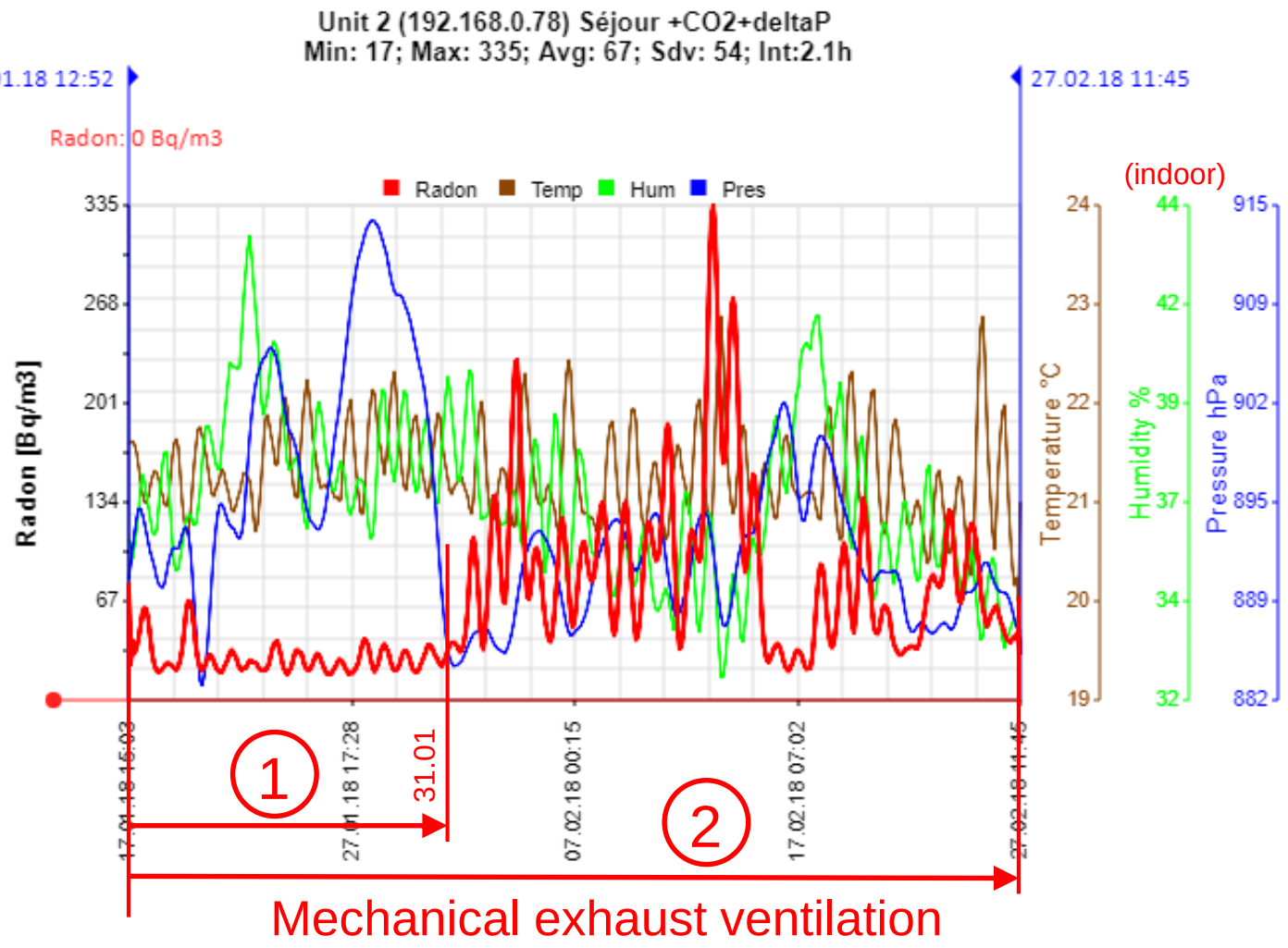
3 : Mechanical balanced ventilation system with heat recovery

Period 1:
17.01- 31.01.18

	Radon	CO_2
	[Bq/m³]	[ppm]
min	12	400
max	84	970
mean	29	

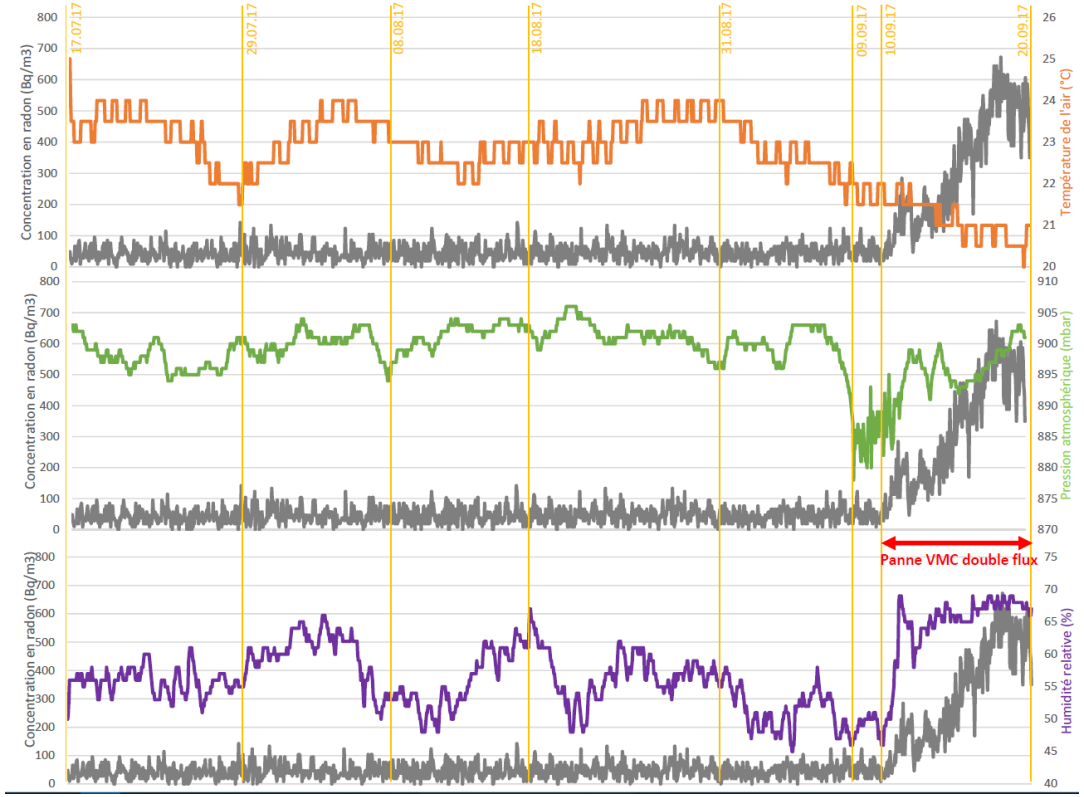
Period 2:
17.01-27.02.18

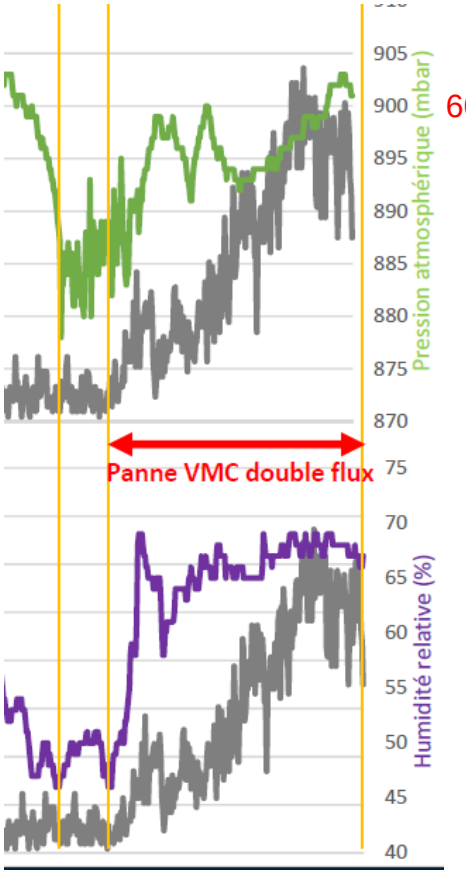
	Radon	CO_2
	[Bq/m³]	[ppm]
min	12	400
max	337	1'000
mean	67	



What is happening in case of fan breakdown ?

- End of Summer 2017, fans have stopped. Tenant didn't open often the windows → radon reached up to 600 Bq/m^3 in 10 days

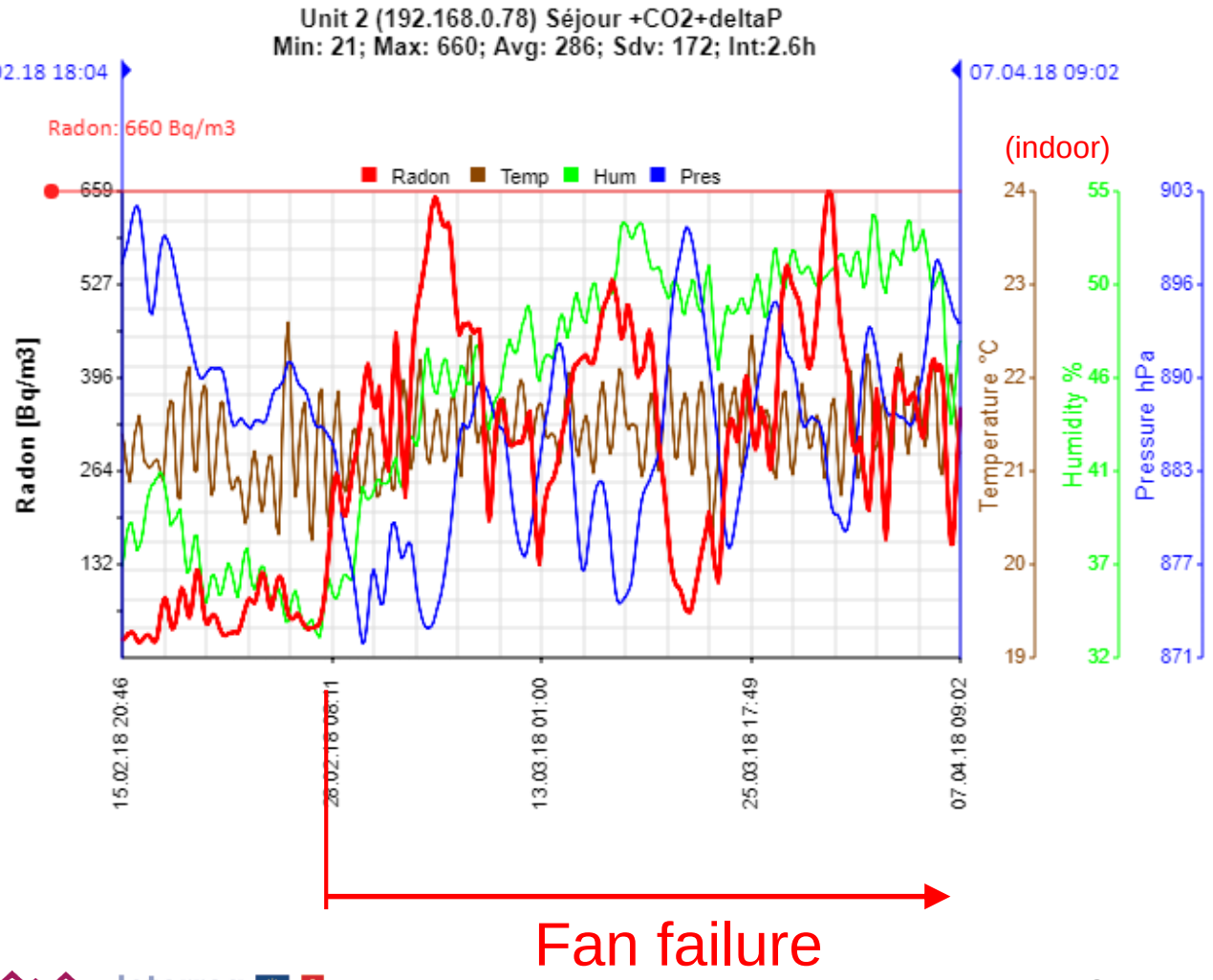




600 Bq/m^3

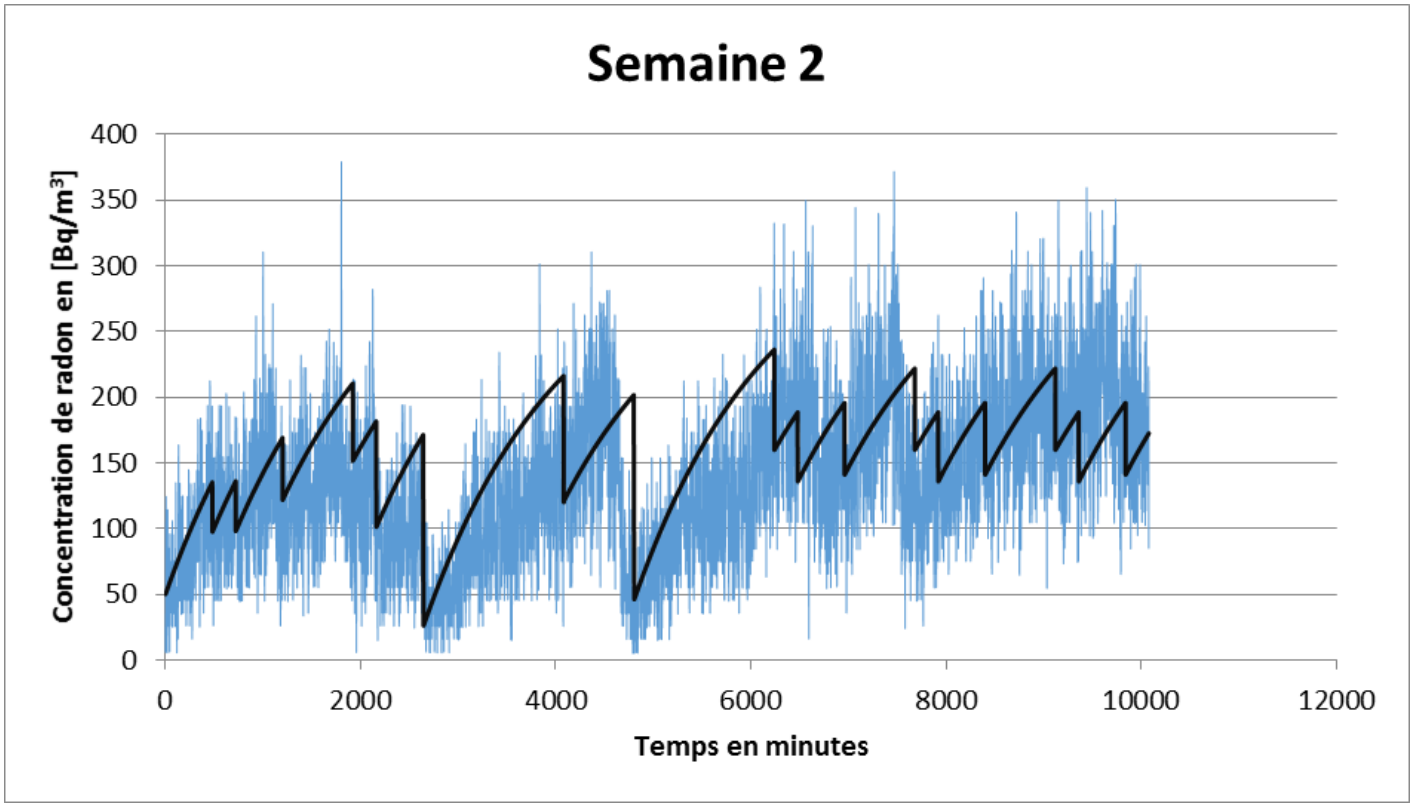
What is happening in case of fan breakdown ?

- Because of frost a new breakdown happens since 28.02.18 (freezing of heat exchanger). Again tenant didn't open often the windows → radon get up to 660 Bq/m³ in 7 days



Development of a radon risk management simulation tool

- The objective is to simulate radon concentrations inside a building before the construction or after a rehabilitation
- The aim is to give professionals an indicative value of the potential radon risk



Concluding remarks 1/2

- Two weeks are too short to evaluate one specific type of ventilation system. Actually weather is largely influencing radon concentration variability.
- Maintaining radon concentration under a defined value with a mechanical ventilation system depends of the initial radon concentration, the type of ventilation, its way of working and the air permeability of the building

Concluding remarks 2/2

- As long as it isn't possible to quantify the inlet flow of radon, it is very difficult to calculate the necessary air supply to maintain radon under 300 Bq/m^3 (reference value in Switzerland)
- To solve the problem, the radon must be stopped before it comes into the building
- Minergie-P label demands to measure airtightness, but it's not a warranty against radon entry. The tightness with the soil must be carefully controlled with specific methods against radon

THANK'S FOR YOUR ATTENTION !

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