

# Passive Sub-slab Depressurization System in building, against volatile soil contaminants

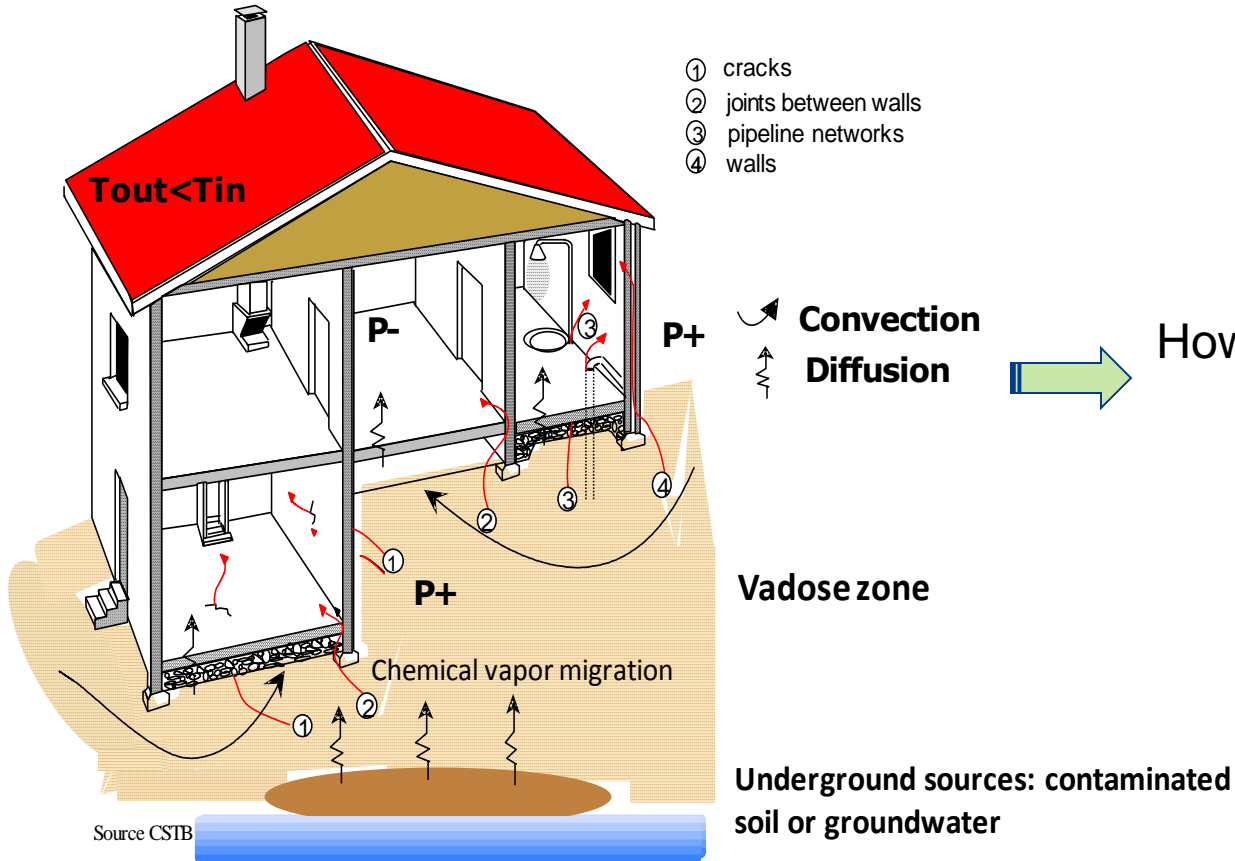
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- FRANCE

- Introduction
- Presentation of experimental dwelling
- Study of Passive S.D.S.
  - Protocol
  - Results and discussions
- Conclusion

# Introduction (1/3)

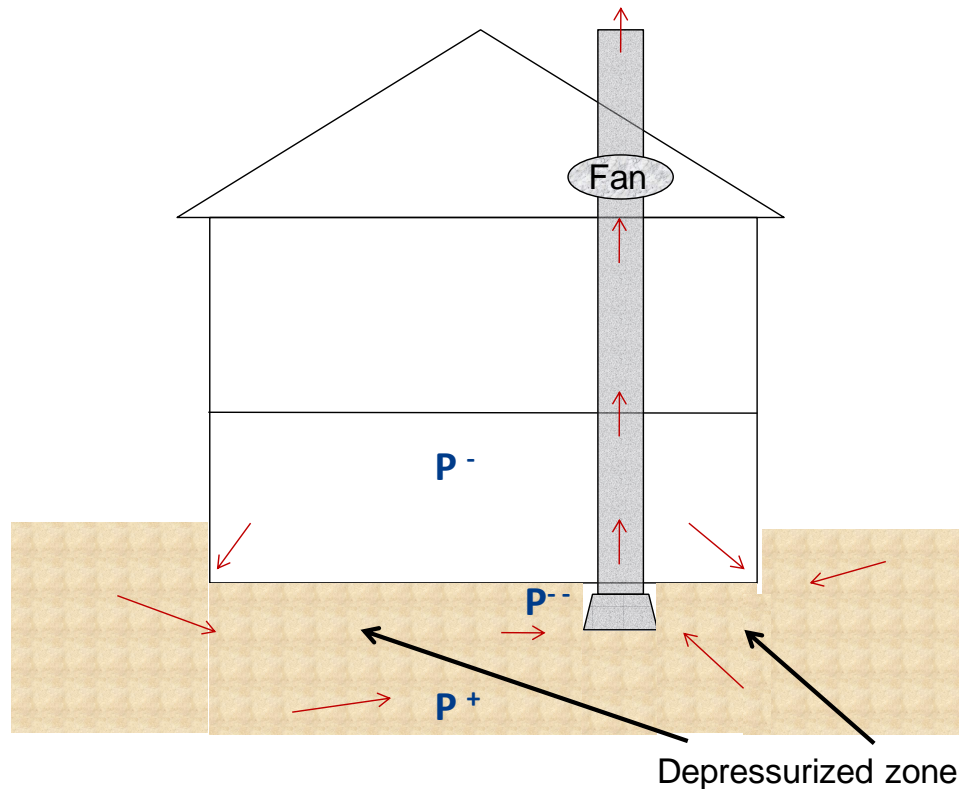


How to prevent the building against entry of the volatile soil contaminants ?

# Introduction (2/3)

## Active S.D.S.

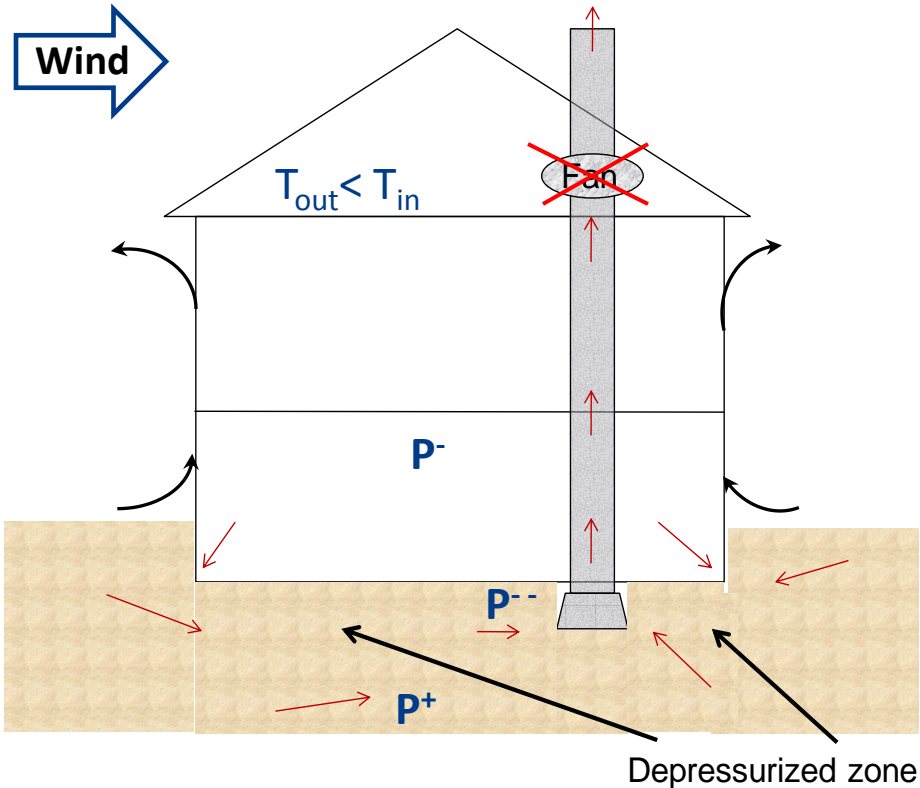
- Well know technology for more than twenty years in radon building protection



Active S.D.S. is one of the most effective methods of lowering volatile soil contaminants levels

# Introduction (3/3)

## Passive S.D.S.



Thermal buoyancy + wind effect → **Passive S.D.S.**



- Ability and efficiency of Passive S.D.S. to maintain the depressurization of the basement : **one year follow-up**
- To study hybrid solutions for basement depressurization using a stato-mechanical extractor

# Presentation of experimental dwelling (1/3)

## Preliminary experiments



MARIA: Mechanized house for Advanced Research on Indoor Air



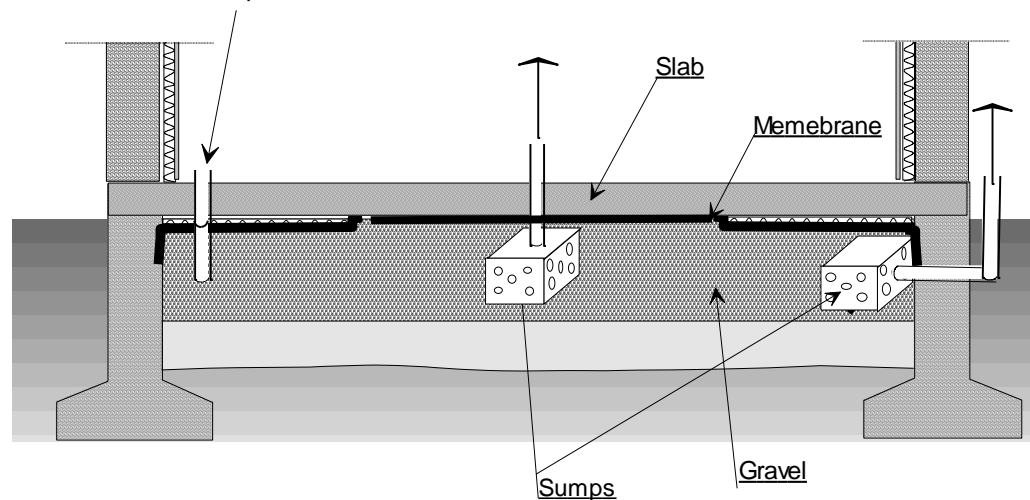
To study relations between ventilation and indoor air in housing sector

# Presentation of experimental dwelling (2/3)

## Installation of S.D.S.



10 holes drilled through the concrete slab  
to measure pressure



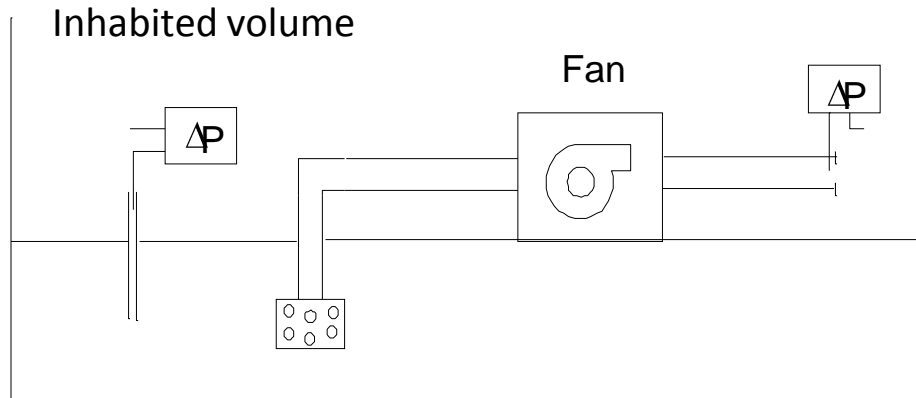
- Installing S.D.S. during the construction
- 10 holes managed through concrete slab to measure pressure



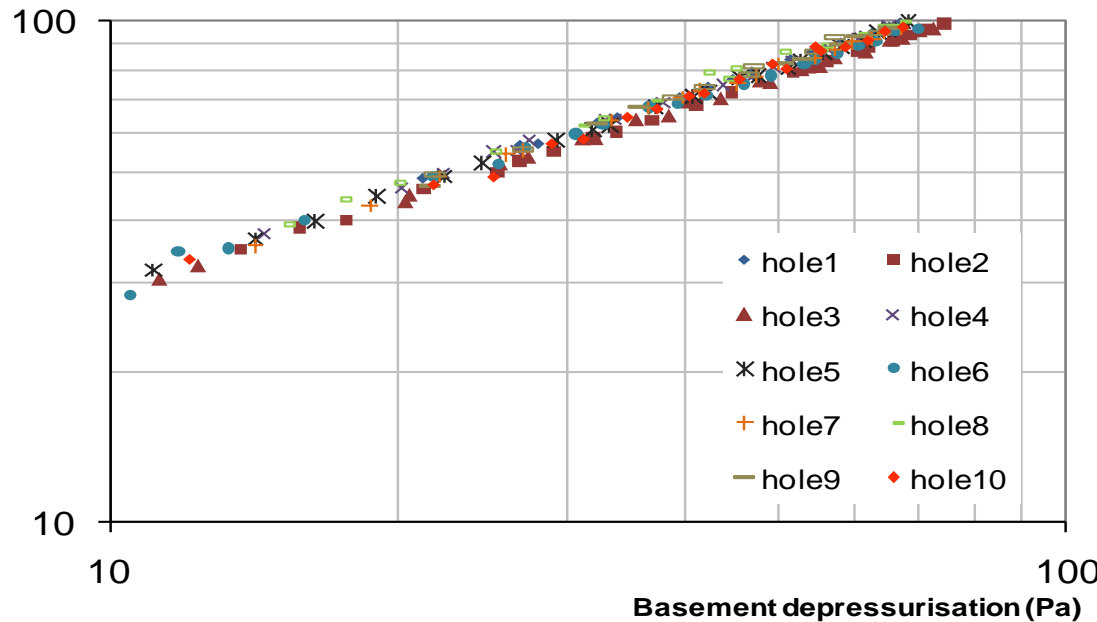
# Presentation of experimental dwelling (3/3)

## Characterisation of basement permeability

### Preliminary experiments



Basement exhaust  
flow ( $\text{m}^3/\text{h}$ )





# Study of passive S.D.S. (1/9)

## Adaptation of basement

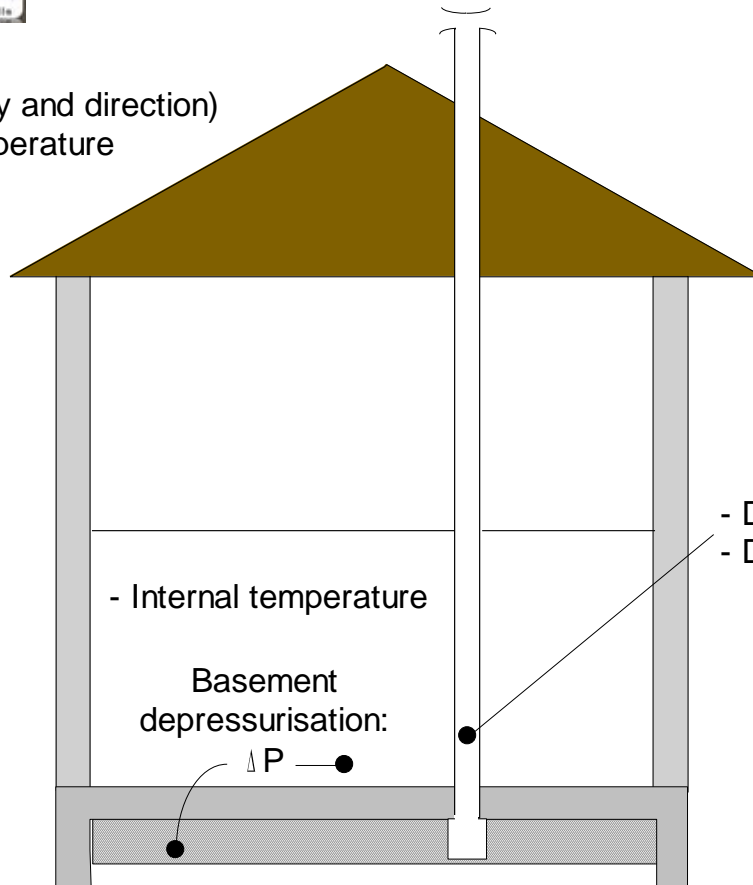
Preparation of  
basement : need to  
install a new sump  
with 200 diameter



# Study of passive S.D.S. (2/9)

## Experimental protocol

- Wind (velocity and direction)
- External temperature



- Duct air velocity
- Duct temperature



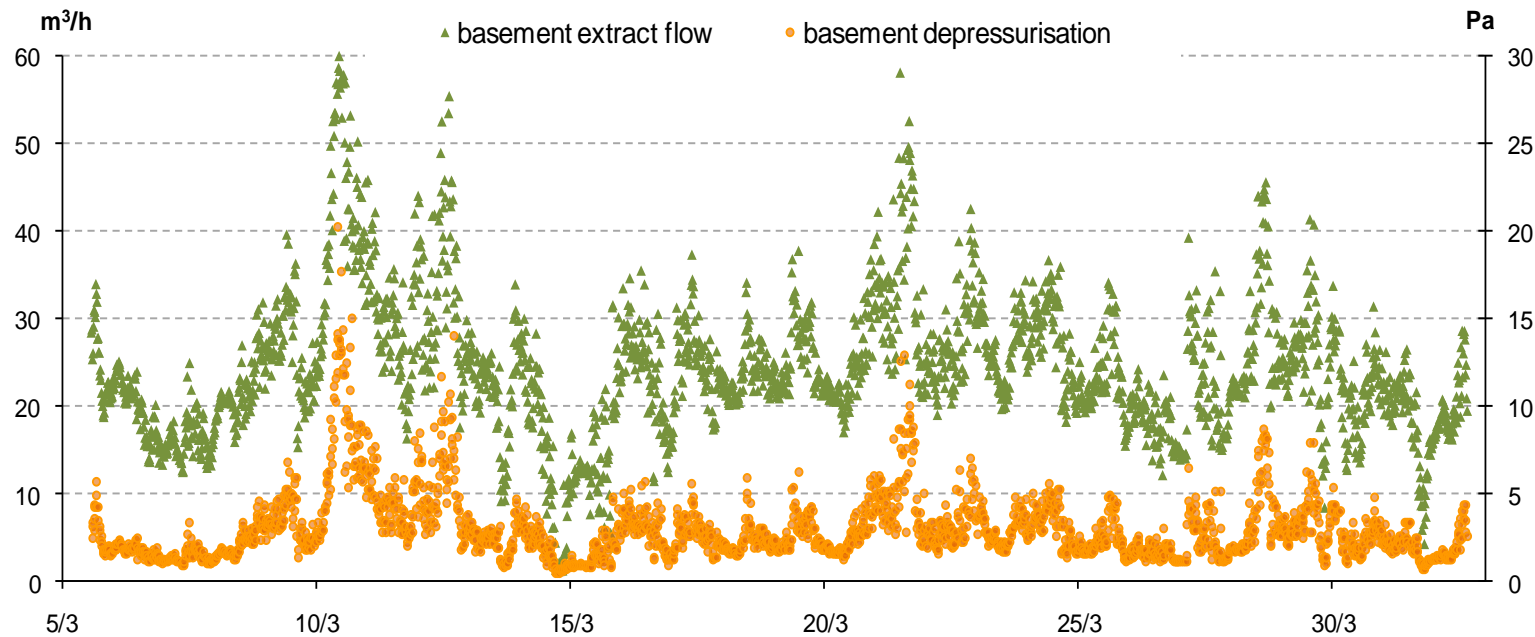
Basic extractor



Stato-mechanical  
extractor

# Study of passive S.D.S. (3/9)

## Monthly Results

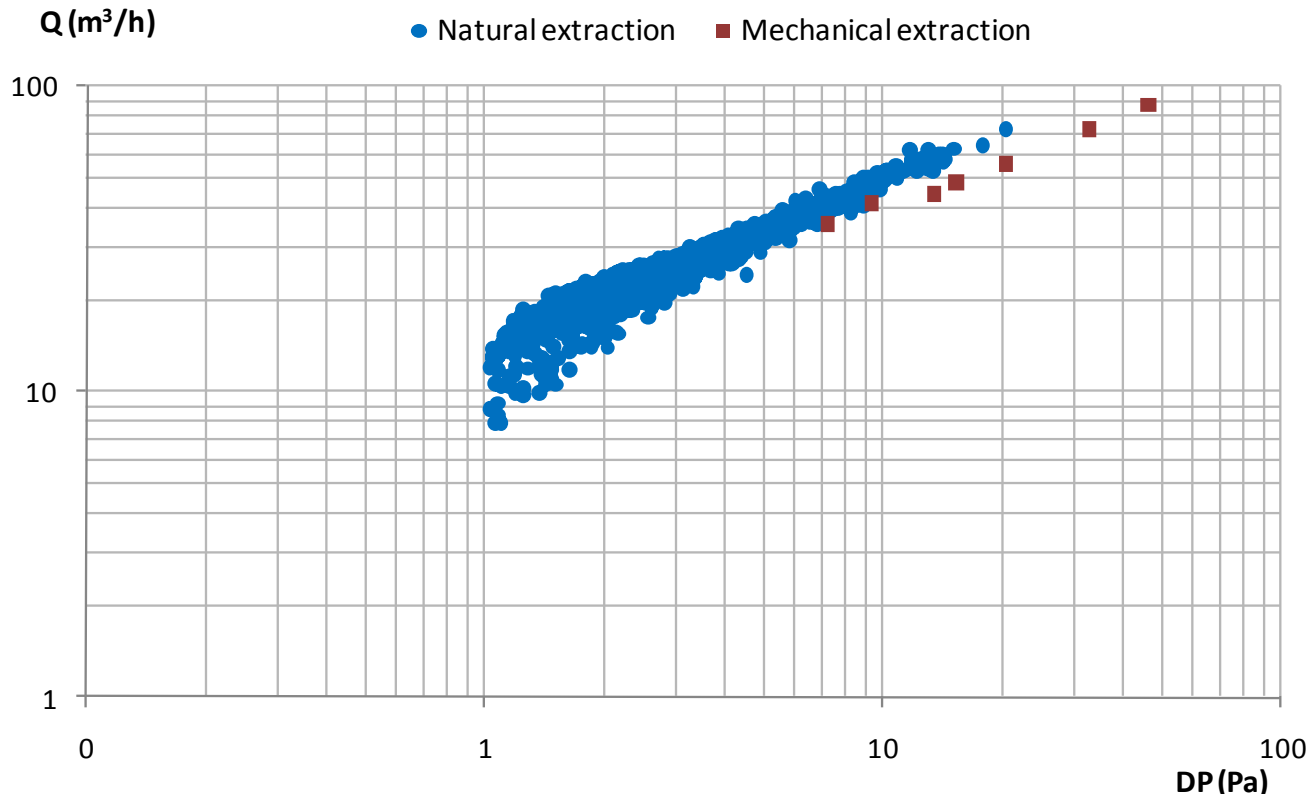


- High variability of running during a day  
→ natural forces highly variables
- Flow rate rises → the depression of the basement also rises

**Figure 1:** Evolution of basement extract flow and basement depressurization during time

# Study of passive S.D.S. (4/9)

## Monthly Results

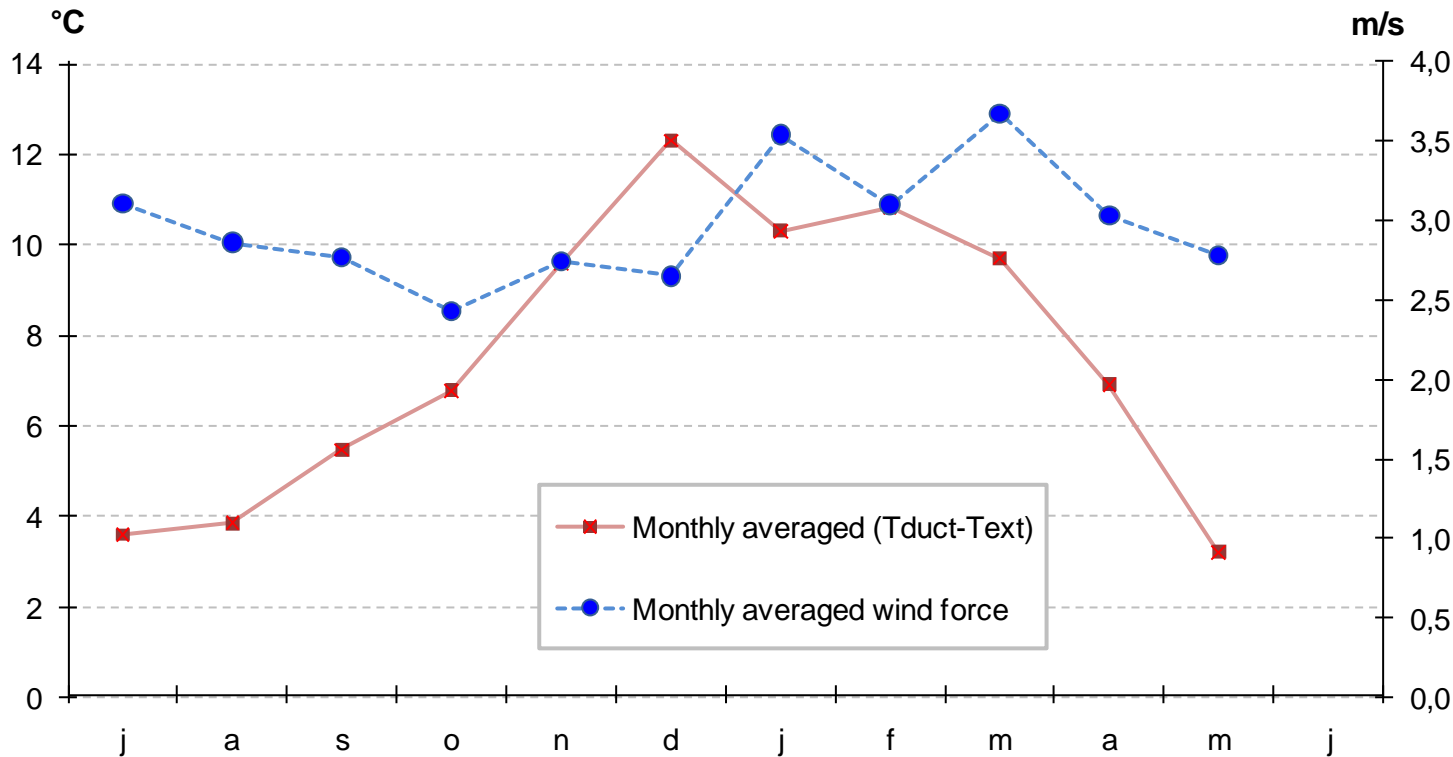


- The difference of the slopes is due of the Installation of the centred sump
- Basement depressurization is always homogenous

Figure 2: Comparison of basement extract flow function of basement depressurization for natural and mechanical extraction

# Study of passive S.D.S. (5/9)

## Annual Results

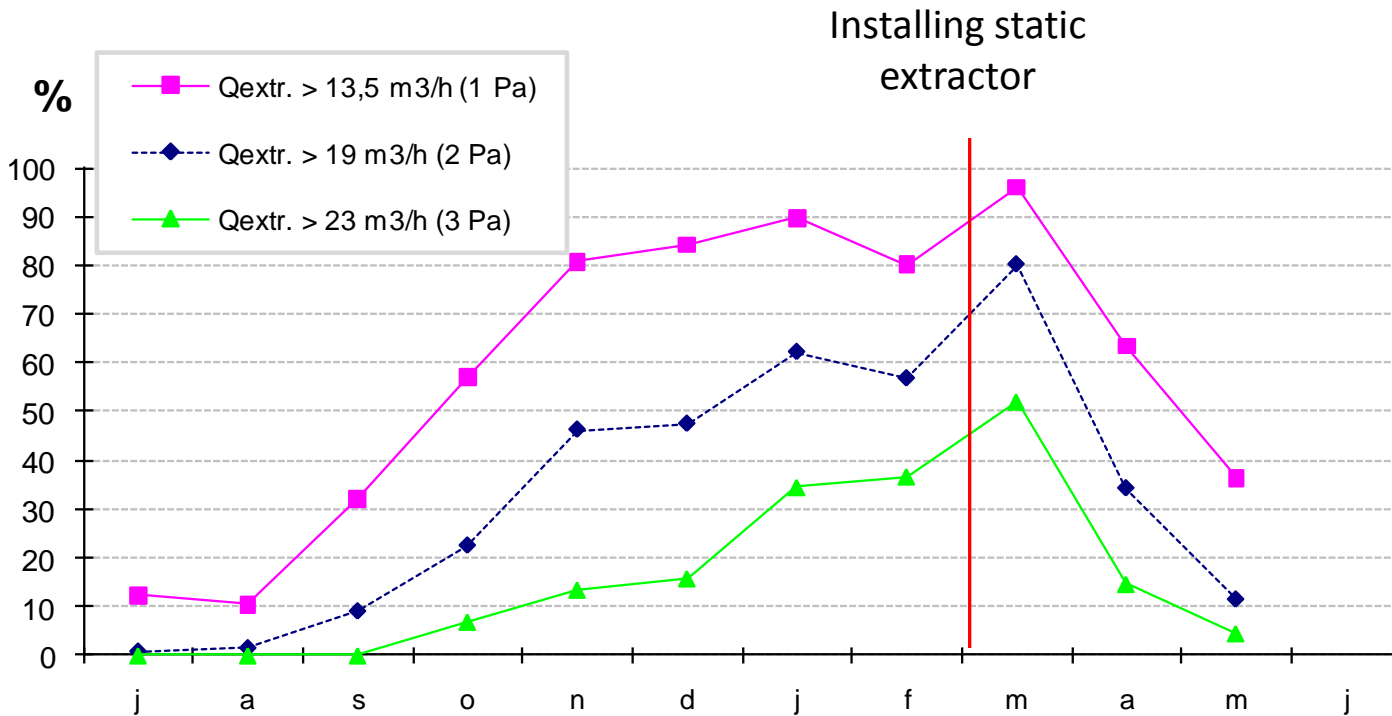


Thermal and wind forces induce the extracted air flow rate from the basement.

**Figure 3:** Monthly averaged temperature difference between air duct and external air and monthly averaged wind force along year

# Study of passive S.D.S. (6/9)

## Annual Results

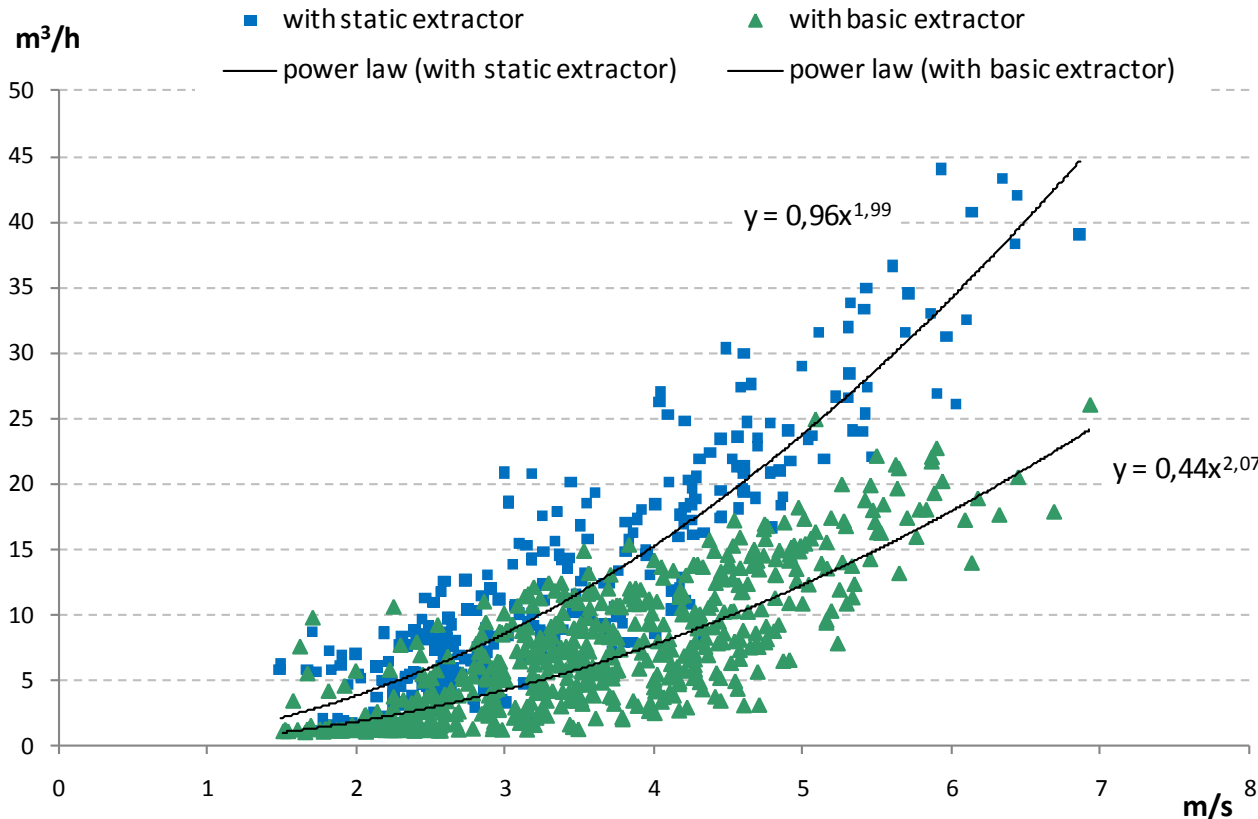


- Significant percentage of running along year and mainly during winter season
- Efficiency is better from March → installation of static extractor

Figure 4: Percentage of running time of the system along year above three thresholds

# Study of passive S.D.S. (7/9)

## Effect of static extractor



- Relative dispersion of experimental points → obstacles around a dwelling (trees, other buildings)
- Extract flow with static extractor is around twice the value of extract flow with basic extractor

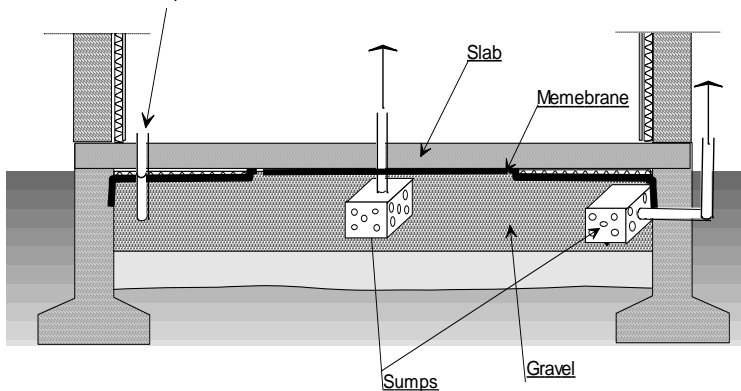
**Figure 5 :** Comparison of extract flow from basement function of wind velocity for system with static extractor and with basic extractor (temperature difference  $< 4^{\circ}C$ )



## Effect of the mechanical operation of the extractor

### Hybrid solutions

10 holes drilled through the concrete slab  
to measure pressure



**Fan on**

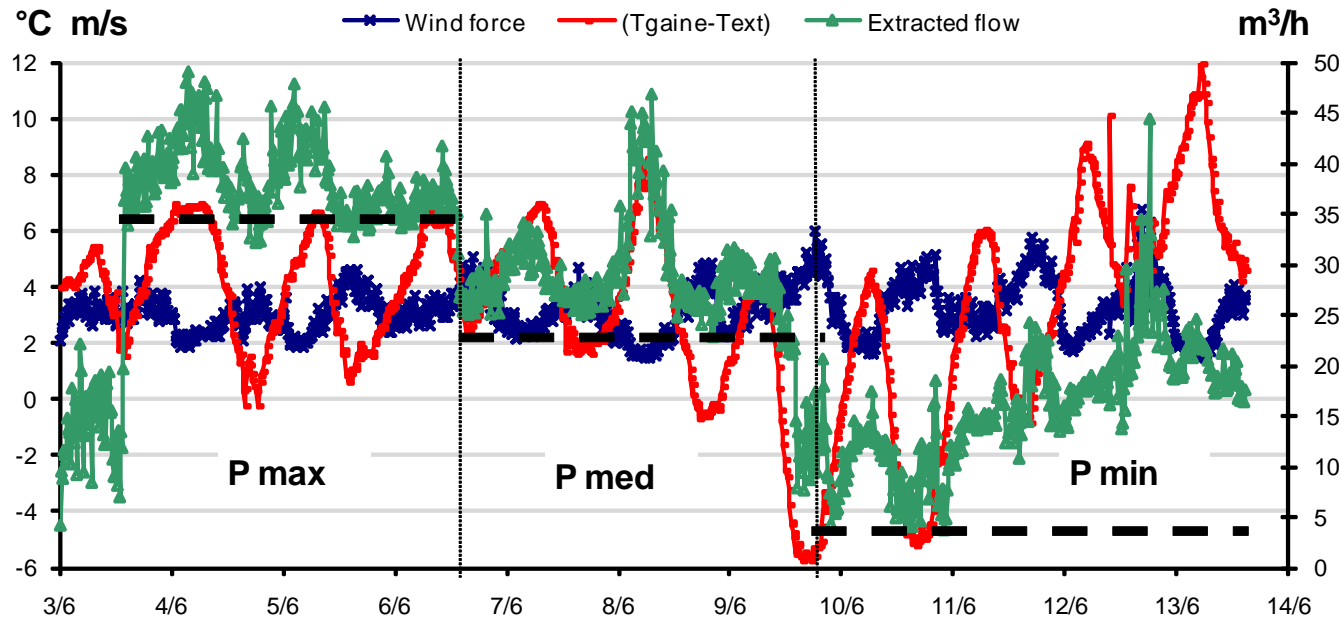
### Mechanical operation of the extractor for three regimes

Maximum power (20- 25 W)	03/06/2008 at 1pm30
Medium power (10- 15 W)	06/06/2008 at 1pm30
Minimum power (2- 4W)	09/06/2008 at 1pm30



# Study of passive S.D.S. (9/9)

## Effect of the mechanical operation of the extractor



Natural forces are negligible  
→ the mechanical running  
ensures a flow of minimum  
extraction

**Figure 6** : Time evolution of wind force, temperature difference between the air duct and the outside and airflow extracted from the basement for three regimes of mechanical operation of the extractor (Maximum, Medium, and Minimum)

- The natural running of S.D.S. is highly variable along the year but percentage of running time could be significant and mainly during winter season
- Using two different extractors: a basic one and other with shape optimised to benefit of the impact of wind on extraction flow 'static extractor'
- Natural forces are insufficient → use of an optional mechanical operation of the static extractor can generate a minimum rate of extraction
- Advantage of passive S.D.S.:
  - ✓ Protect the building against volatile soil contaminants
  - ✓ This system is a low cost of operation and it requires low maintenance

# Thank you for your attention