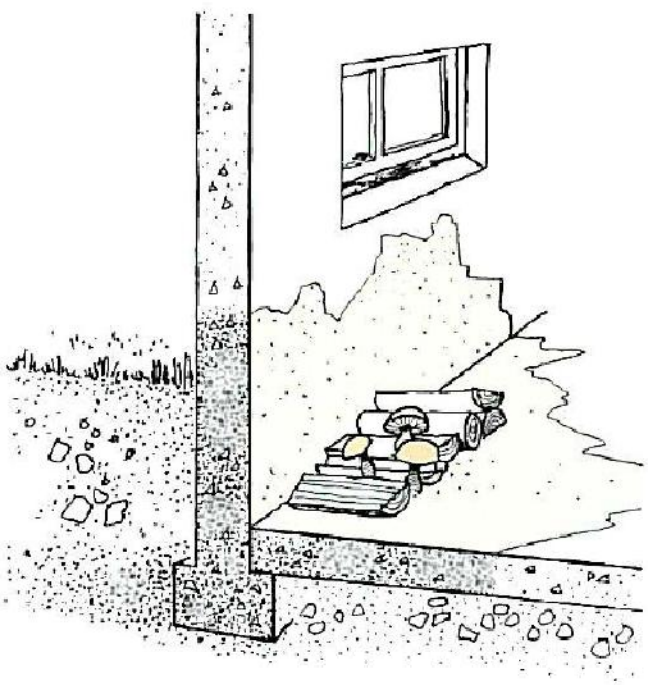

Rehabilitation of basement walls with moisture problems by the use of vapour open exterior thermal insulation

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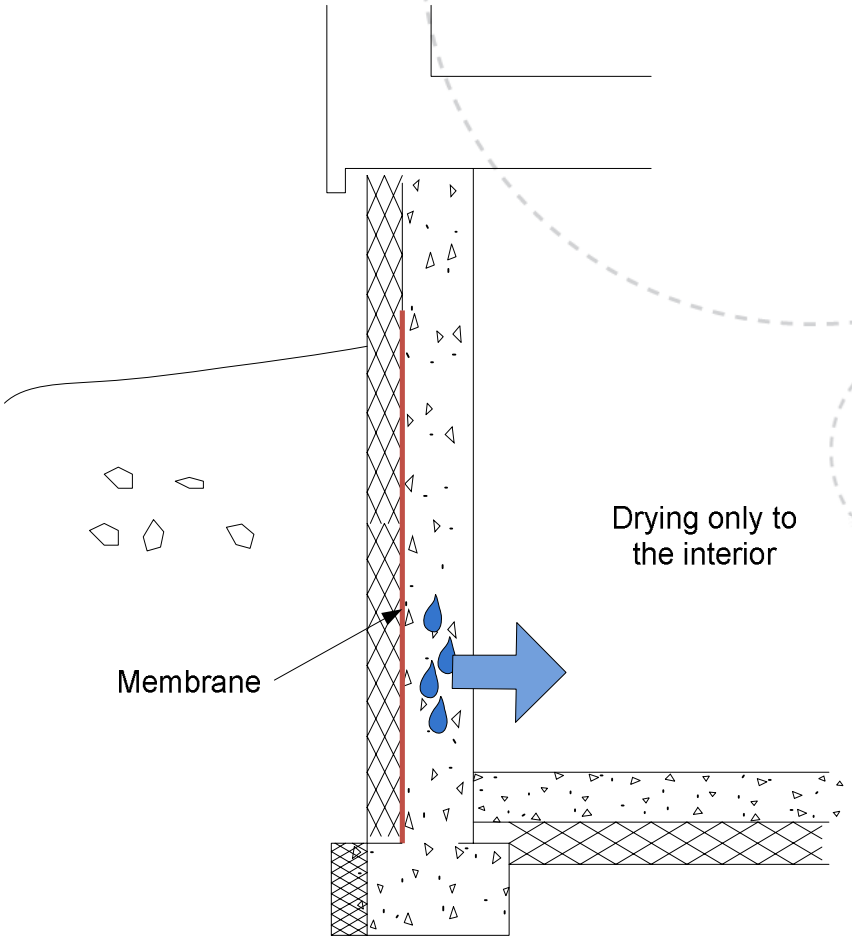
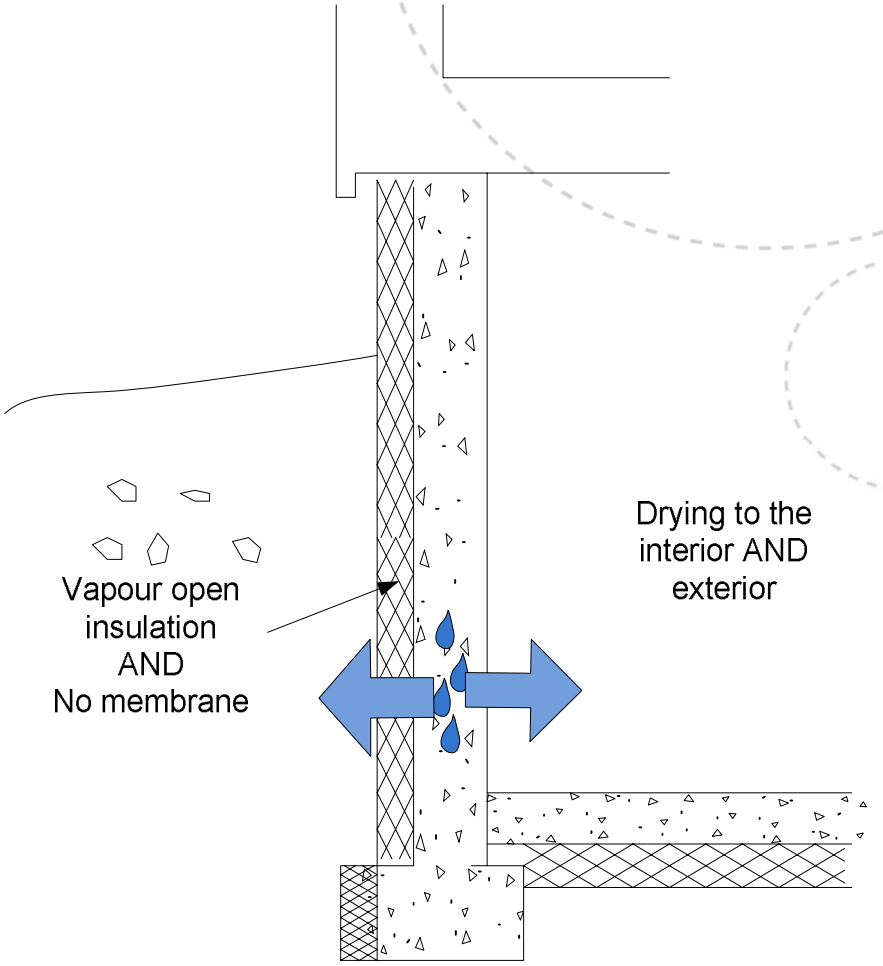
Background

- Many methods for rehablitation of moisture damaged basement walls
- Traditional method:
  - Renew drainage system + new moisture membrane (+ external insulation (typical EPS))
  - Robust method, BUT all existing moisture has to dry to the interior
  - May take very long time before wall is dry



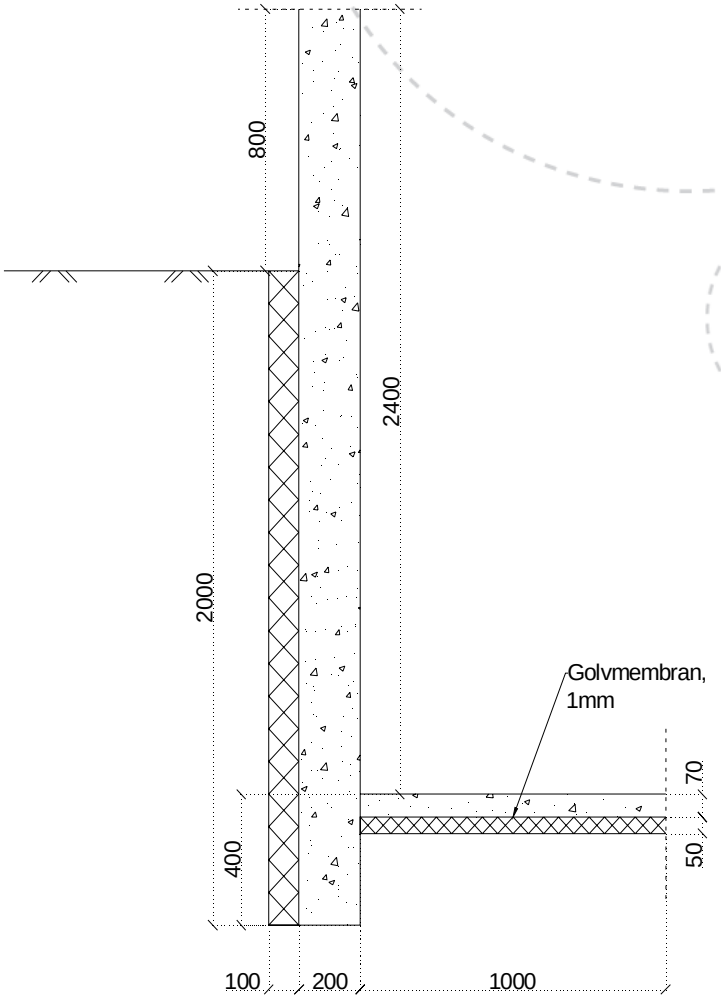
Background

- Alternative method:
  - Renew drainage system + external vapour open insulation
  - May allow existing moisture to dry both inwards AND outwards
  - Rising damp may also dry outwards
  - Materials:
    - Hard rockwool
    - Special products (glued EPS pellets)
- Purpose:
  - analyze drying speed with alternative metod compared to traditional method



Hygrothermal simulations

- WUFI 2D
  - vapour diffusion + capillary conduction
- Reference basement wall
  - 200 mm B15 concrete
  - 100 mm vapour open external EPS (μ = 4)



- Boundary conditions:
  - Indoor :
    - 22 °C
    - RH from measured moisture supply Δv
    - Δv = 2,2 g/m^3 (winter), 0,5 g/m^3 (summer)
  - Outdoor,
    - above ground: Oslo
    - RH below ground: 98%
    - T, below ground:
      - Used HEAT 2 to calculate sinus-curves for different depths

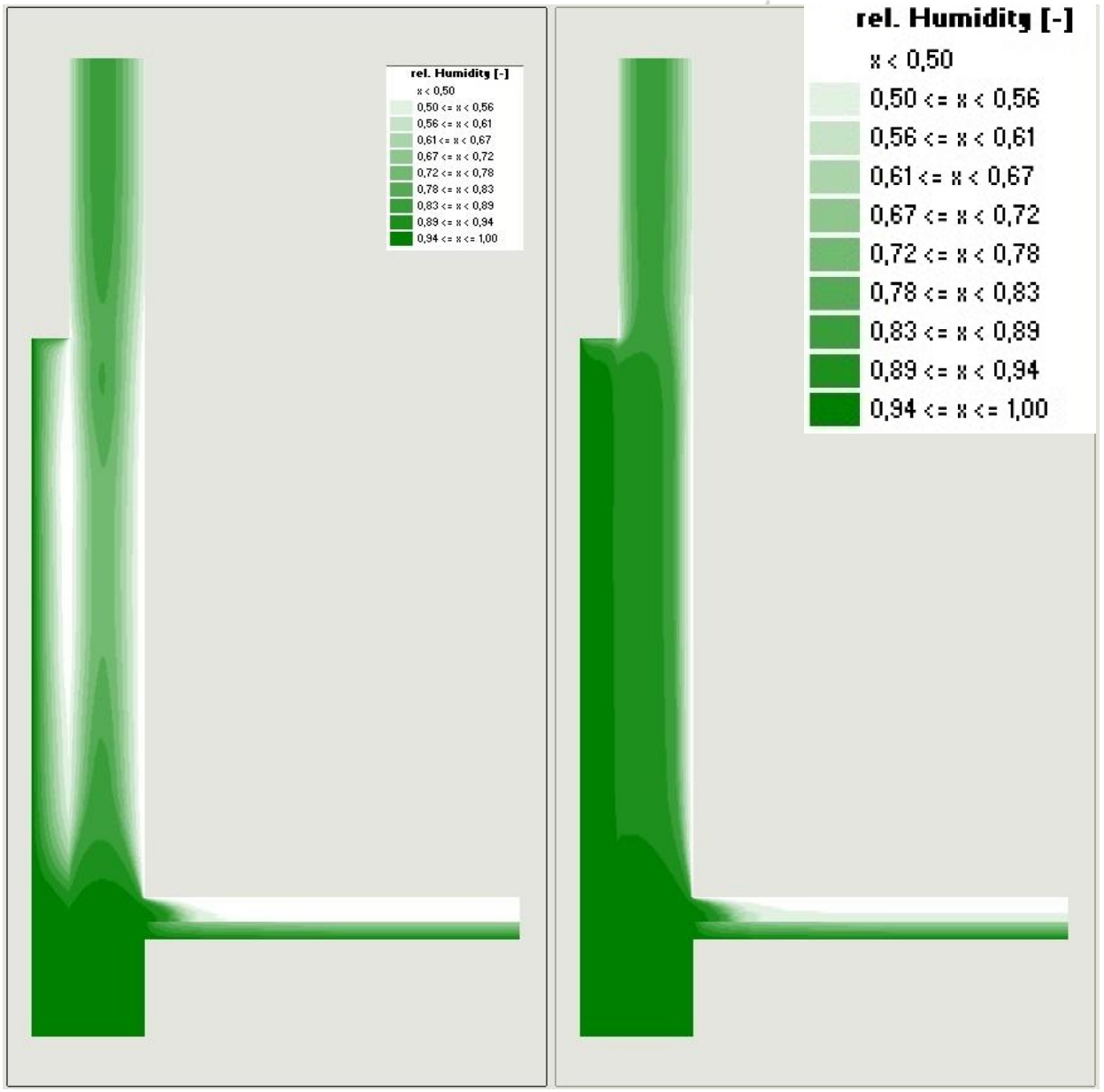
- Initial conditions:
  - Pre-simulations with WUFI without external membrane/insulation
    - RHground = 100-97 %
    - Indoor: 10 °C/ 80%

Parameter variation

- Vapour permeability insulation
- Thickness of insulation
- Indoor temperature
- Build-up/insulation on interior side
- Other wall material
- Bottom of wall in contact with water
- Insulation above ground

Results

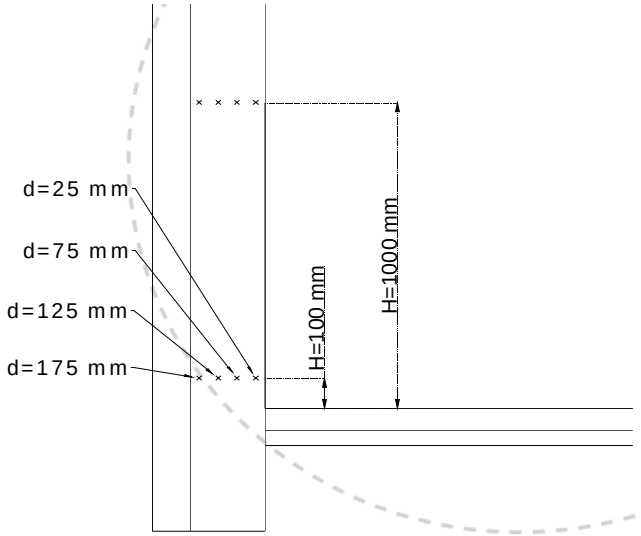
1. Jan, After 1 year simulation (two cases)



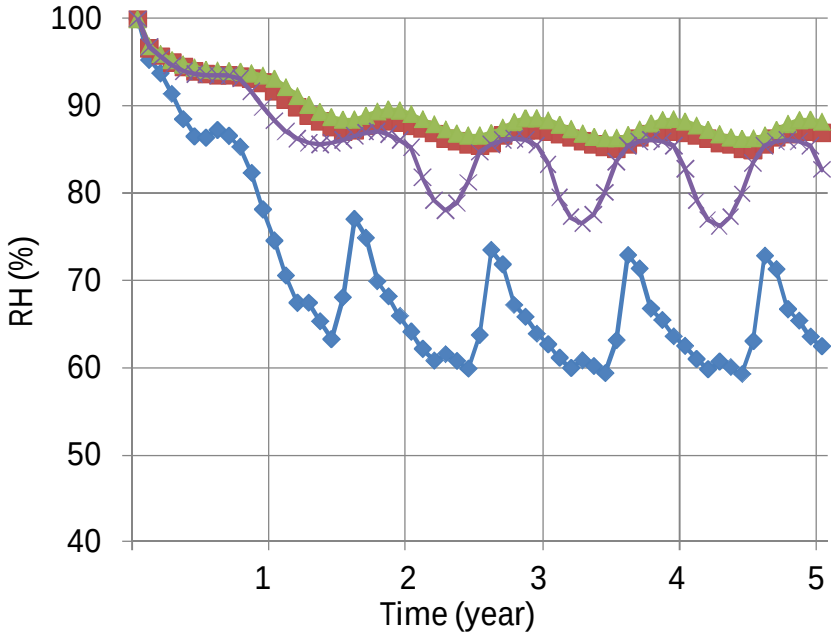
Ref: vapour open insulation

vapour tight insulation

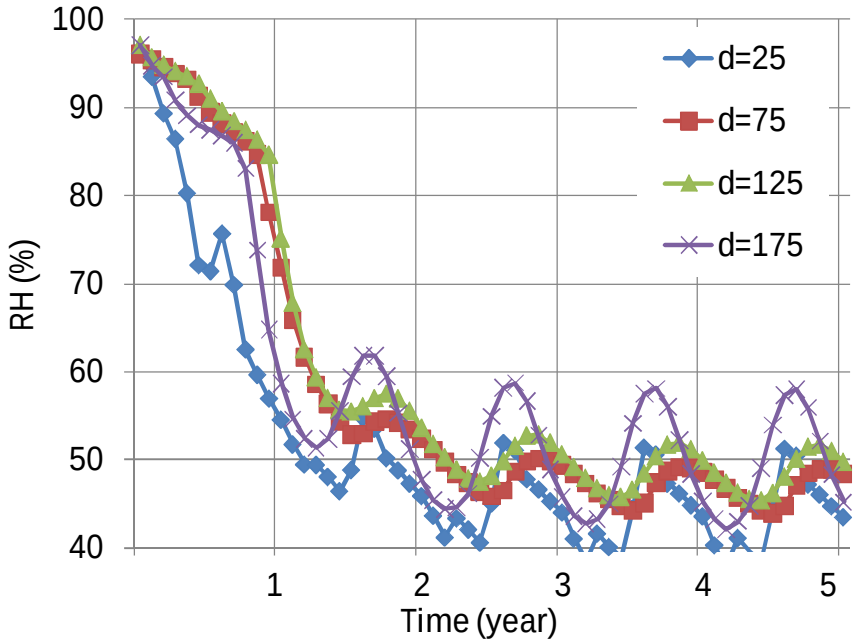
Reference wall (No. 1) - Vapour open insulation



RH for two heights and four different depths.

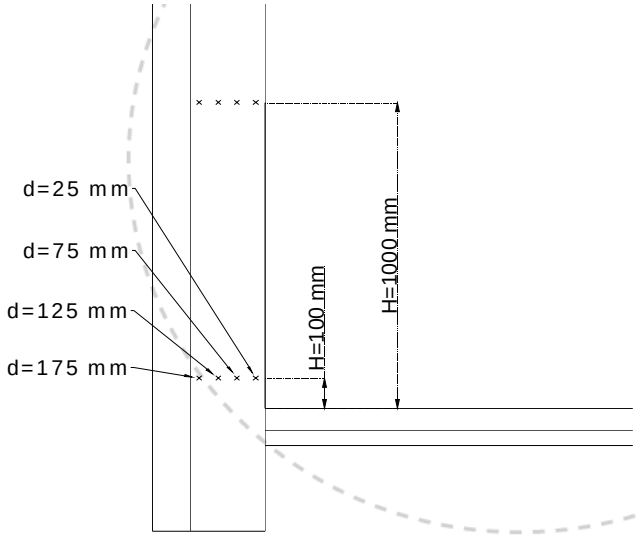


H = 100 mm

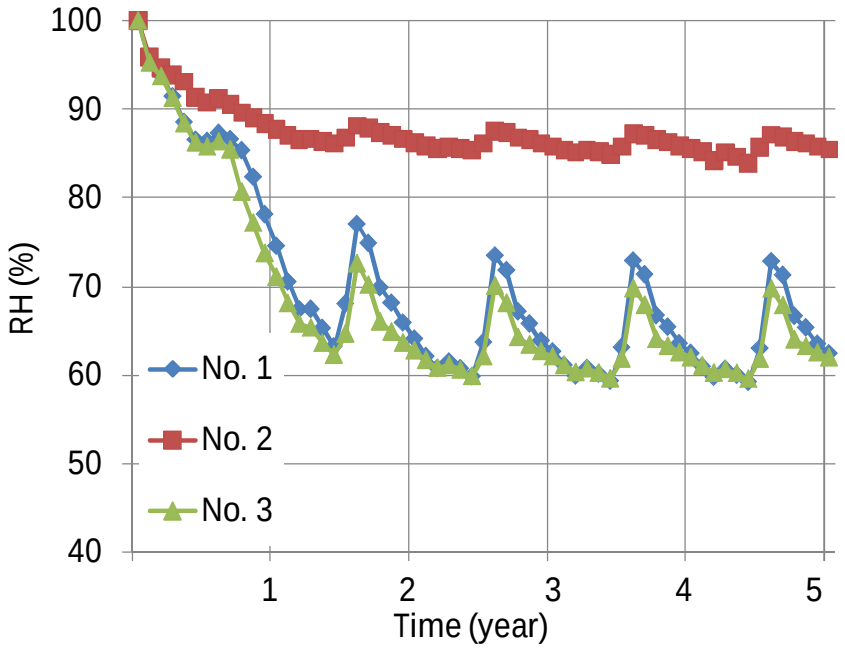


H = 1000 mm

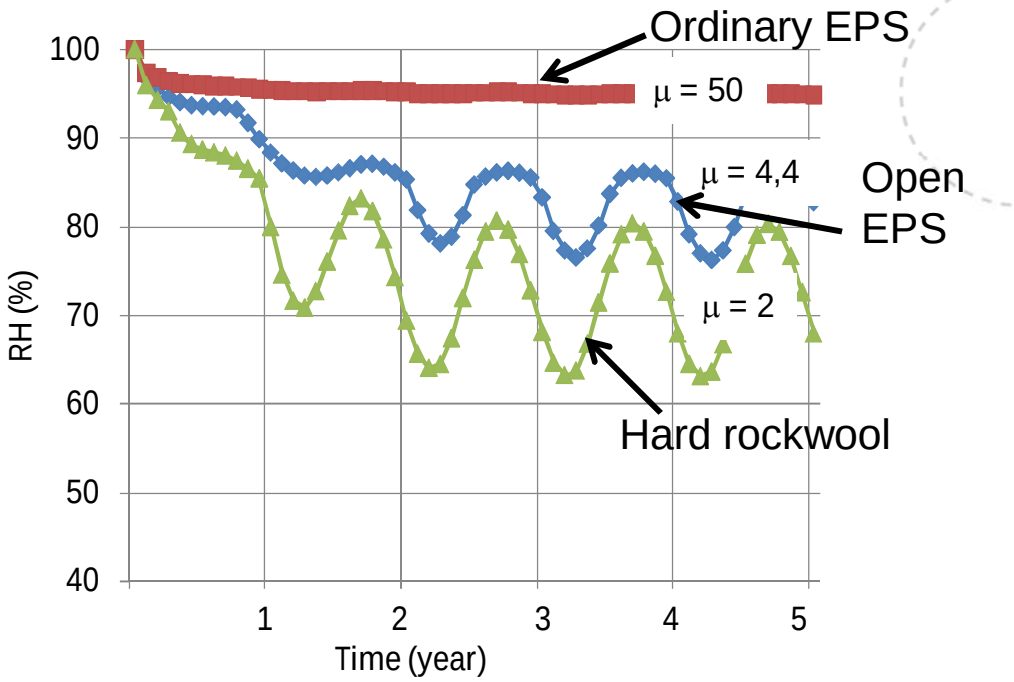
Effect of various vapour permeability of insulation



RH for H = 100 mm and two different depths.



d = 25 mm



d = 175 mm

Some influencing factors

- Indoor temperature:
  - Unheated: very little effect
  - Extra warm: increased effect
  - Note: Method is based on temperature difference over the insulation !!!
- Thicker insulation
  - 200 mm gives slower drying
  - Increased temperature difference, BUT doubled vapour resistance
- Interior insulation + board material:
  - Very reduced drying
  - Total drying less than with vapour tight EPS and nothing on interior side
- Ordinary EPS give practically no drying to the exterior (same as with membrane between insulation and concrete)

Conclusions

- Vapour open insulation:
  - Gives higher drying speed
  - Lower moisture level after stability

- Basement should be heated to see some effect
- Internal boards or extra internal insulation should not be added before the wall is sufficiently dry