

Erfaringer med volumenpumpning i poreluft

Per Loll, Udviklingsleder, Ph.D.

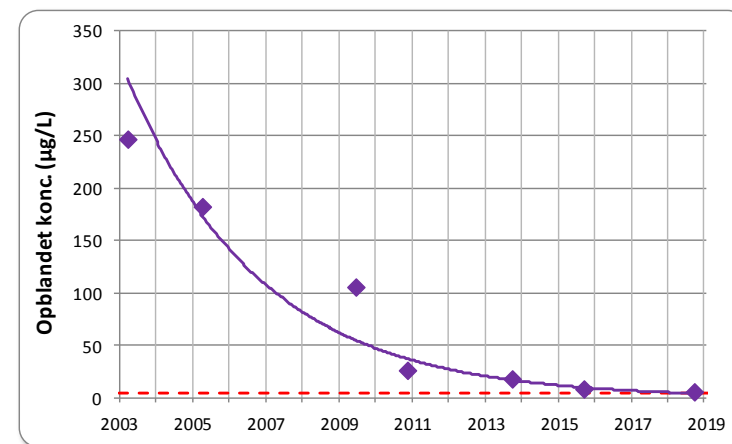
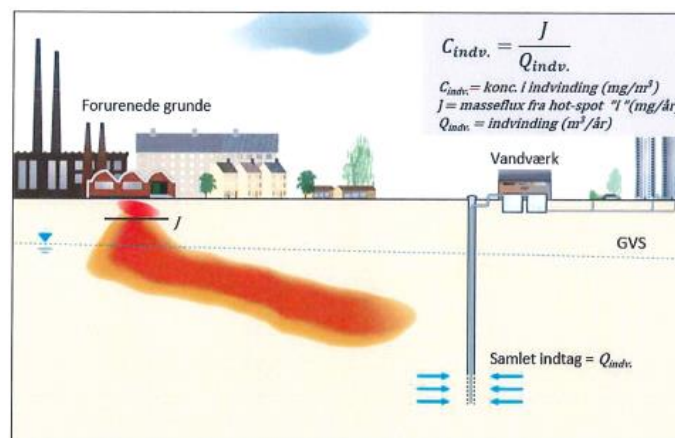
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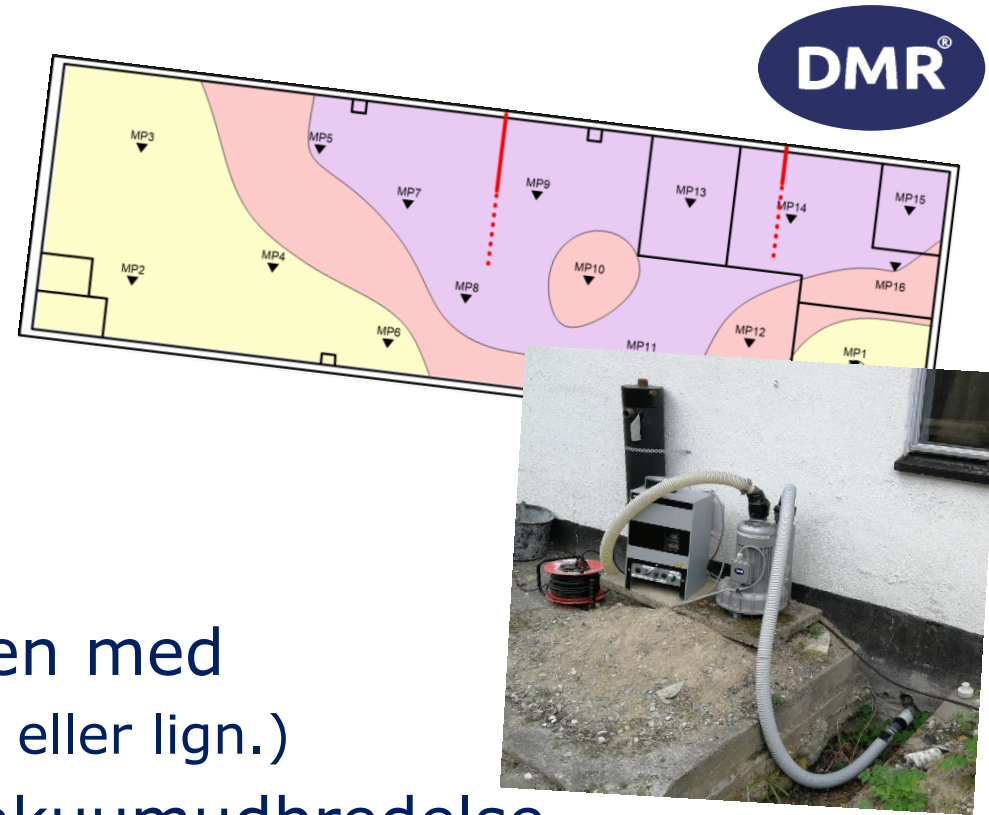
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- The diagram illustrates a contaminant source in a saturated clay aquifer. A rectangular contaminant source is shown within the aquifer, with dimensions L_x and L_y . The contaminant flux is given by $C_s I L_x L_y$. The source is located at a depth z from the terrain level. The piezometric head of the aquifer is indicated by a dashed line. A monitoring well is shown to the right of the source, with the top of the aquifer indicated by a horizontal line. The groundwater flow direction is indicated by an arrow pointing to the right. The diagram also shows the terrain level, a tree, and the saturated clay layer.

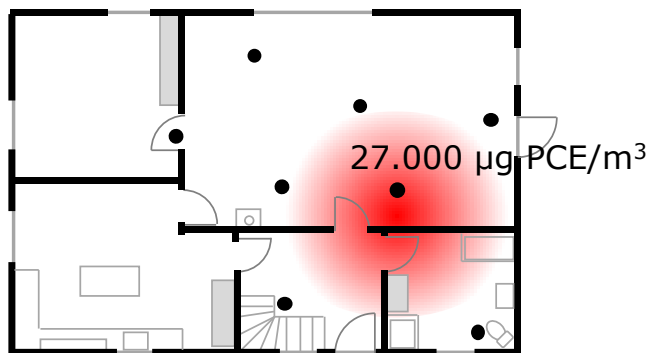
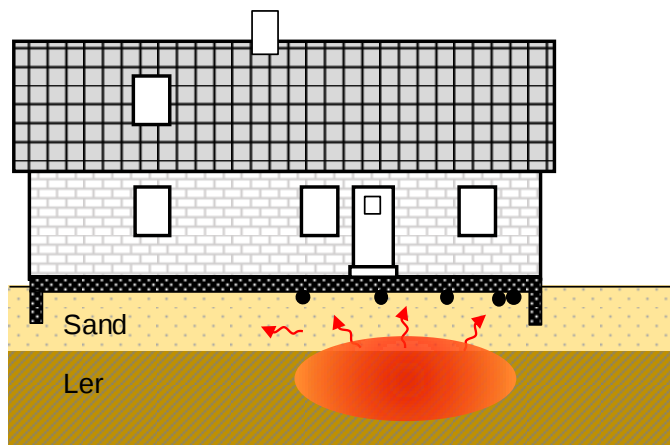


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Vi skal bruge ...

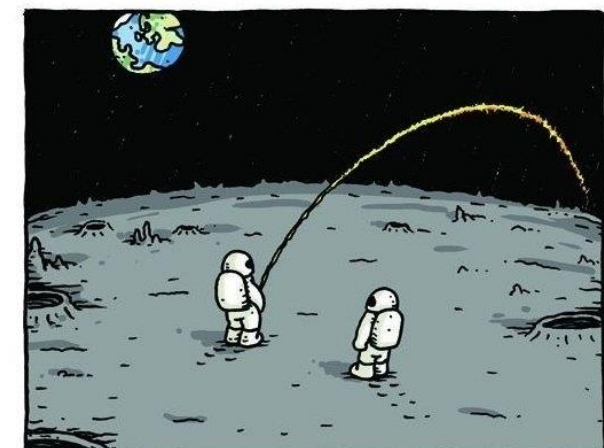
- En poreluftforurening
- Et filter at suge på
- En ventilator
- Et kulfilter til rensning af afkastluften
- En flowmåler
- Poreluftudstyr til at måle koncentrationen med
 - Evt. feltmåler (ppbRAE, PID-måler, felt-GC eller lign.)
- Differenstrykloggere til at kontrollere vakuumudbredelse
- Ved at suge med forskelligt flow kan vi bruge data til at forbedre vores konceptuelle forståelse af forureningen.



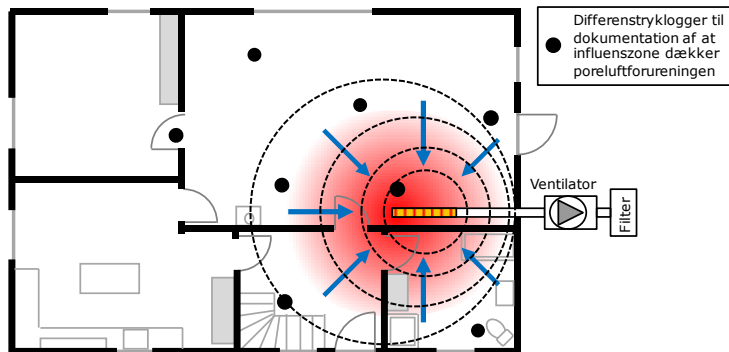
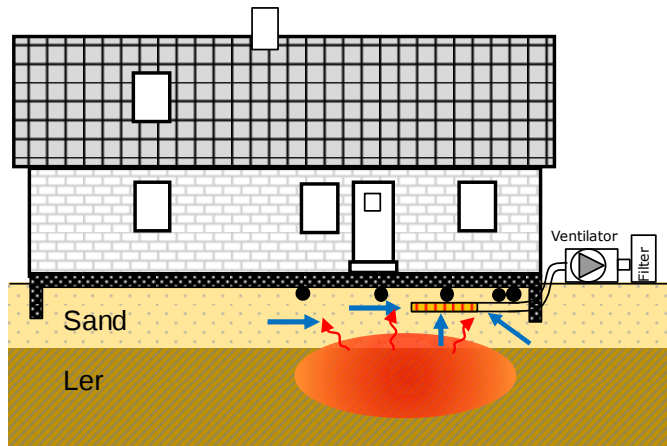


- Hvis opgaven nu var at udføre en risikovurdering for indeklimaet, så ville vi:
 - Regne os fra poreluft til indeklima (f.eks. JAGG)
 - Forholde os til direkte spredningsveje
 - Evt. måle direkte i indeklimaet (flere gange)
- Alternativt kunne vi:
 - Udføre en masseflowtest (maksimum $\mu\text{g}/\text{t}$)
 - Lave en opblandingsbetragtning ud fra boligens volumen og luftskifte ($\rightarrow \mu\text{g}/\text{m}^3$)

- Og vi ville samtidig få at vide om det var et "piss-ant site" eller en "big whopper".



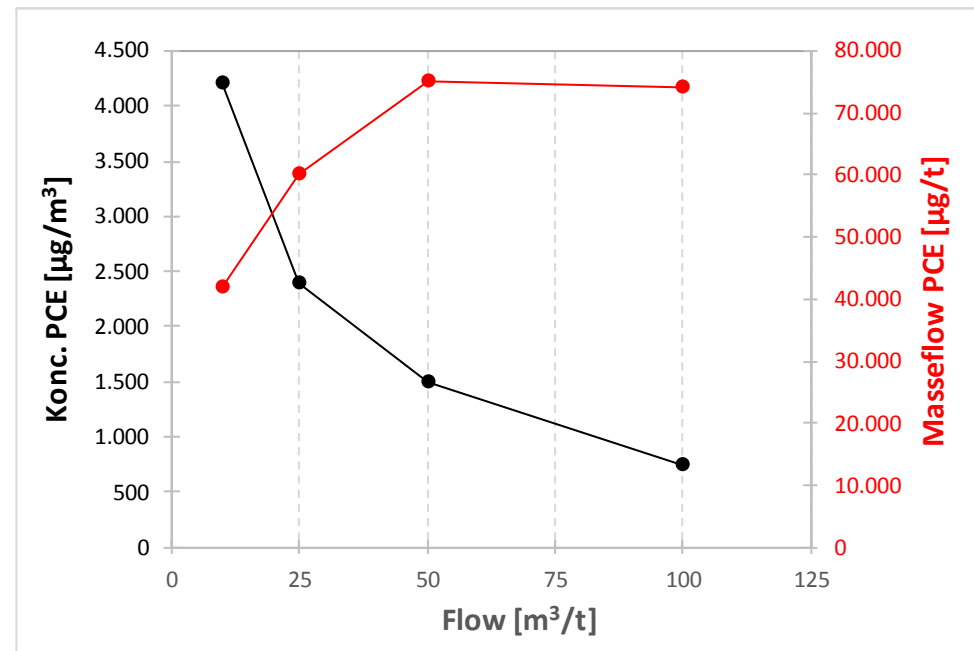
Konceptuelle betragtninger



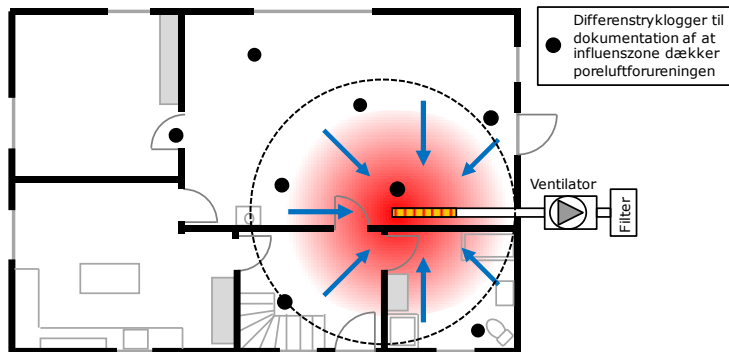
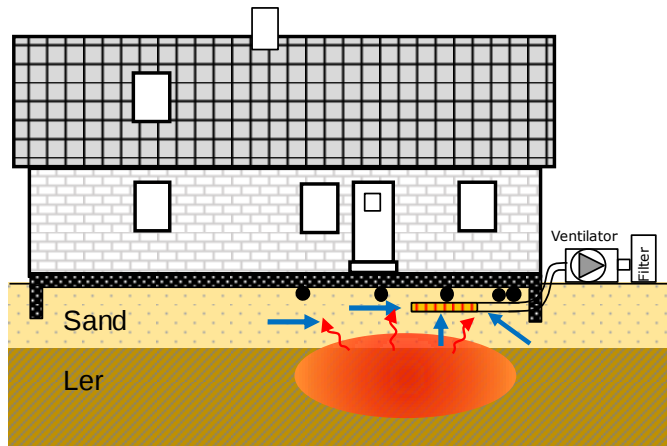
- Vi skyder et filter ind i poreluftforureningen.
- Vi etablerer monitoringspunkter til differensstryk i området for poreluftforureningen.
- Så sætter vi sug på, og vi måler:
 - Flow, differensstryk og koncentration.
 - Nu måler vi konc. ved 4 forskellige flows.

Flow (m ³ /t)	PCE (µg/m ³)	MF(PCE) (µg/t)
10	4.200	42.000
25	2.400	60.000
50	1.500	75.000
100	740	74.000

Maks. MF ca. 75.000 µg/t



Konceptuelle betragtninger



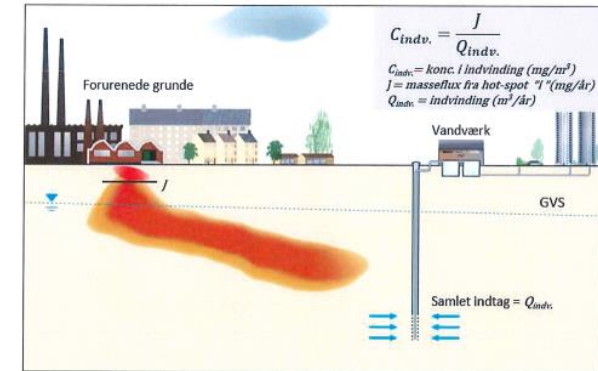
Areal = 128 m²

L_h = 2,3 m

L_s = 0,3 t⁻¹

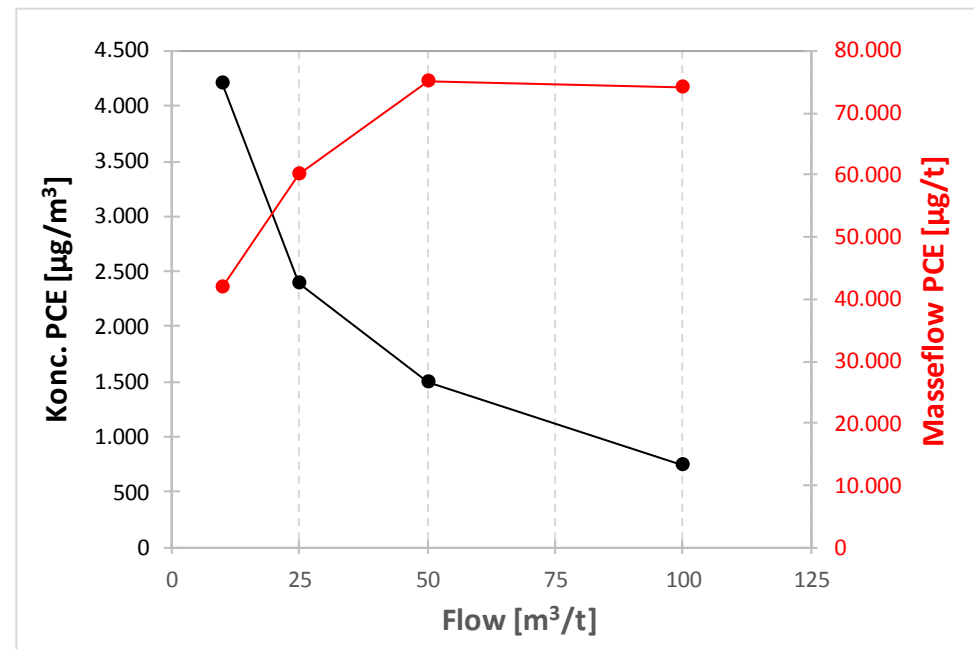
PCE

- Hvis vi blander masseflowet op i indeklimaet får vi et indeklimabidrag på ca. 840 µg/m³, svarende til ca. 140 x ADK.



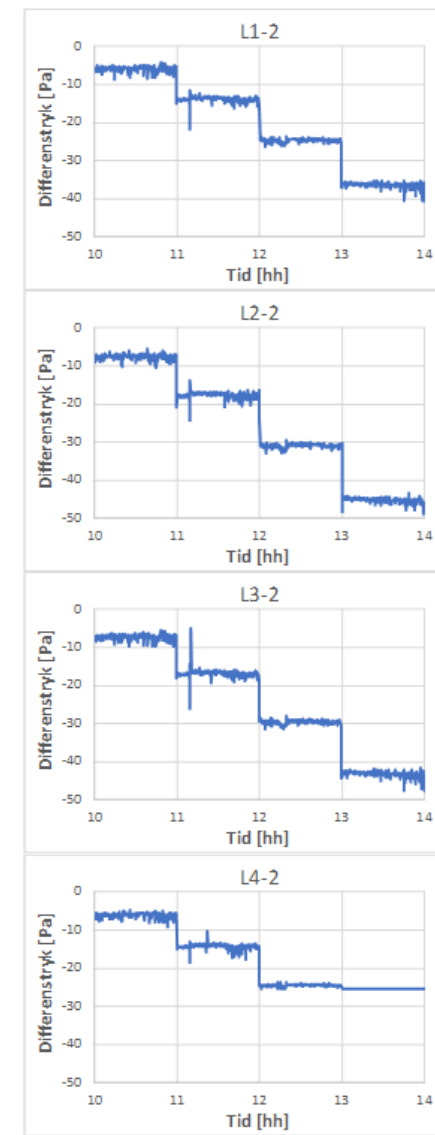
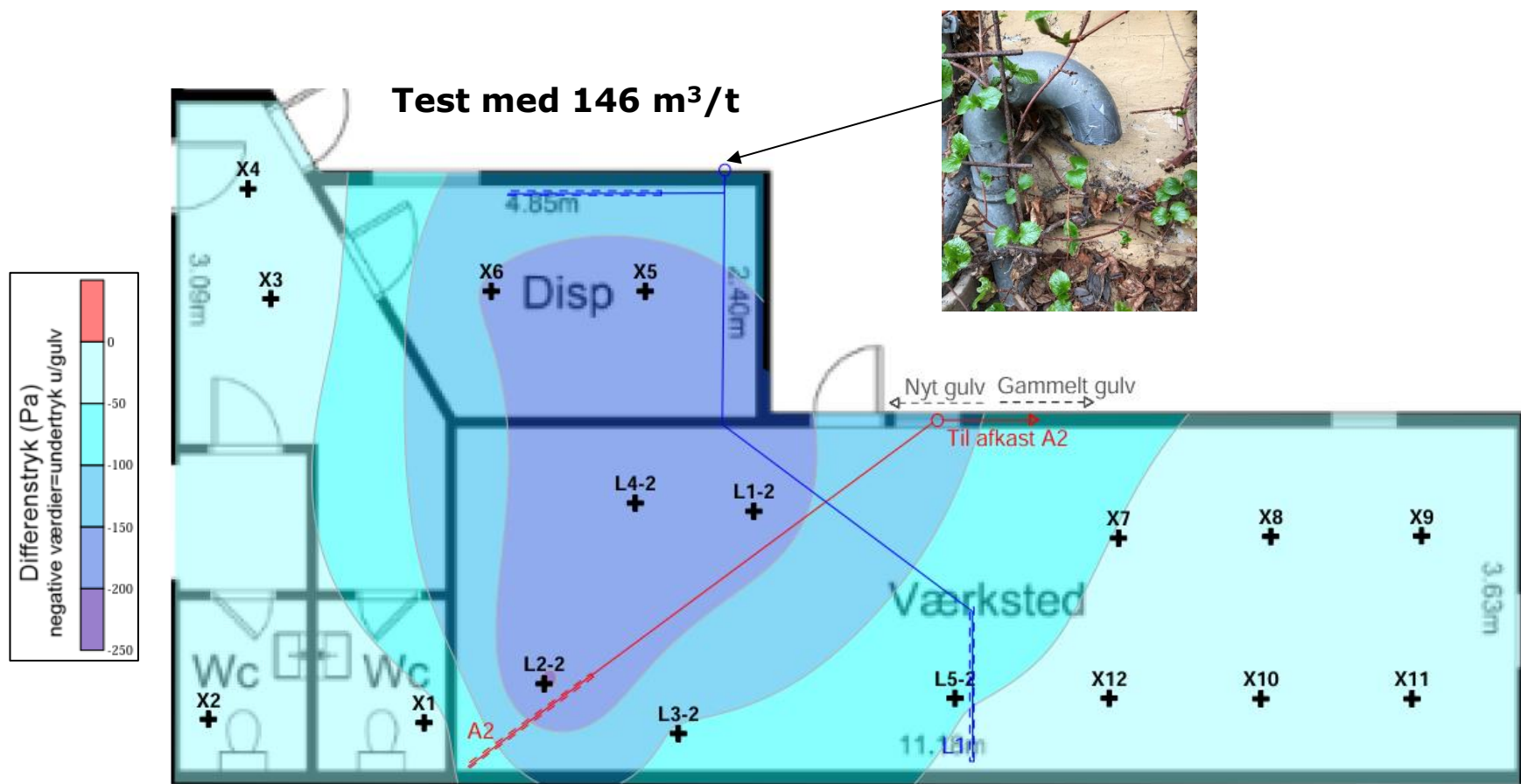
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Eksempel 1 – Obduktionsprojektet (RSD)

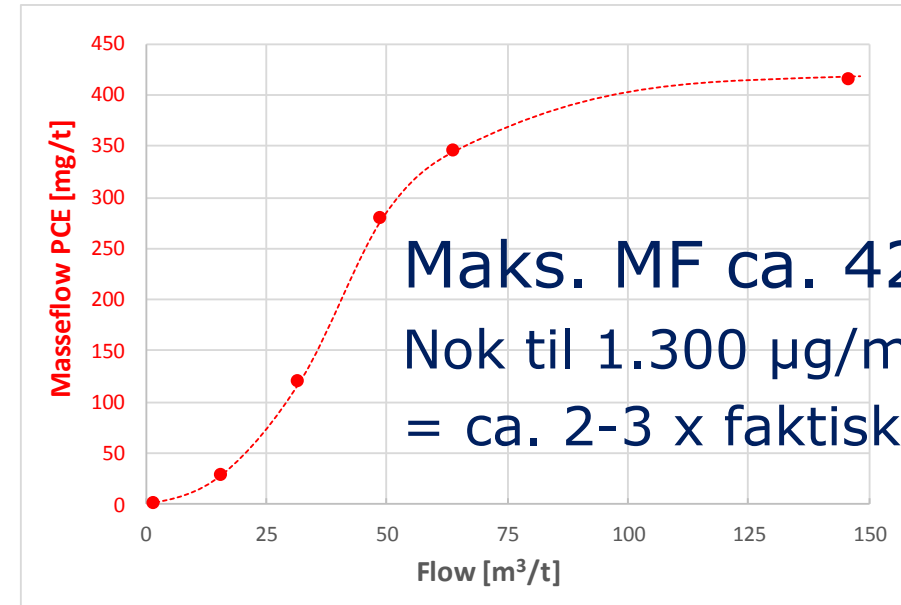
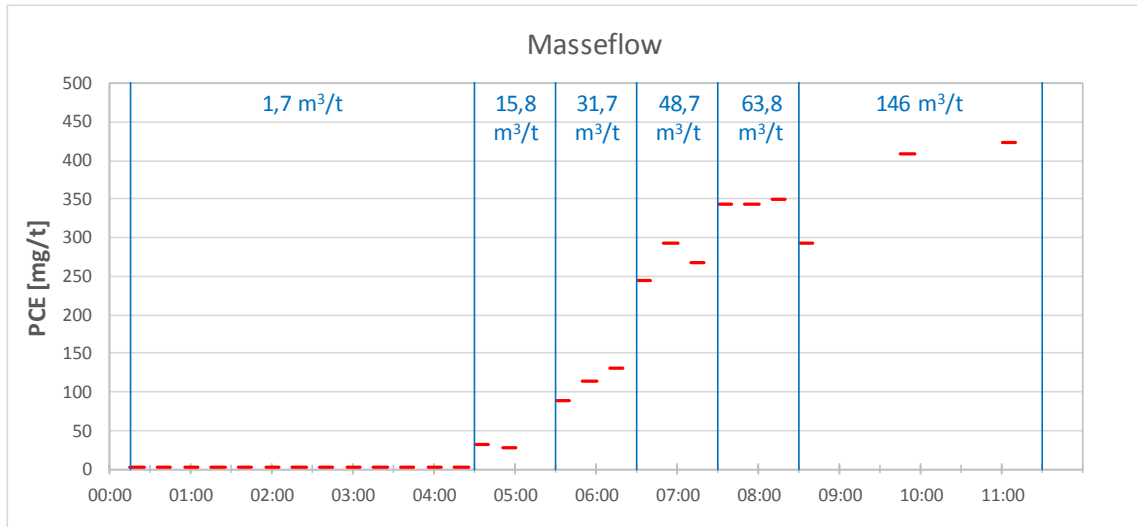
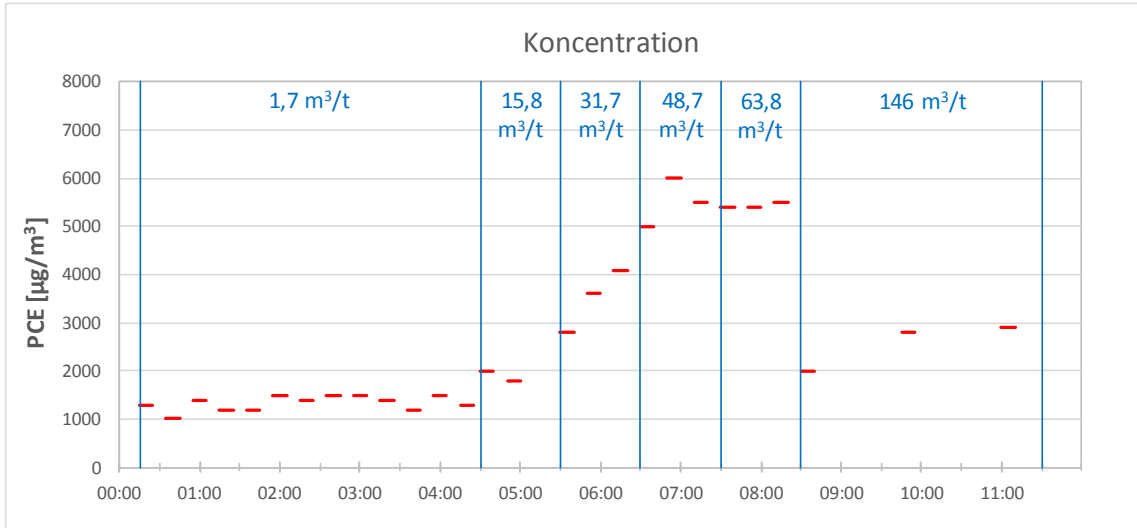
- Flowtrin: 1,7 og 16 – 32 – 49 – 64 – 146 m³/t



Eksempel 1 – Obduktionsprojektet (RSD)



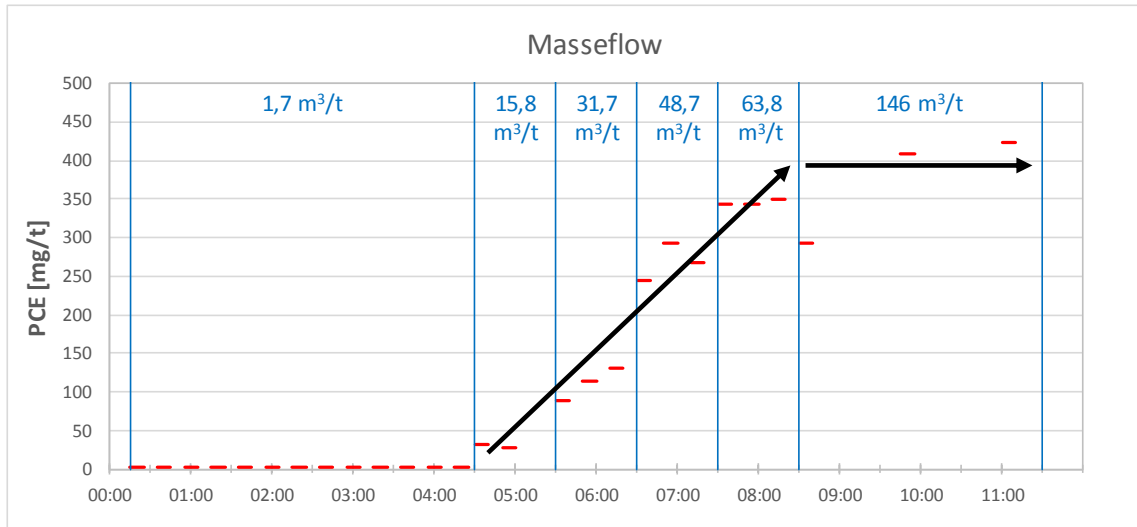
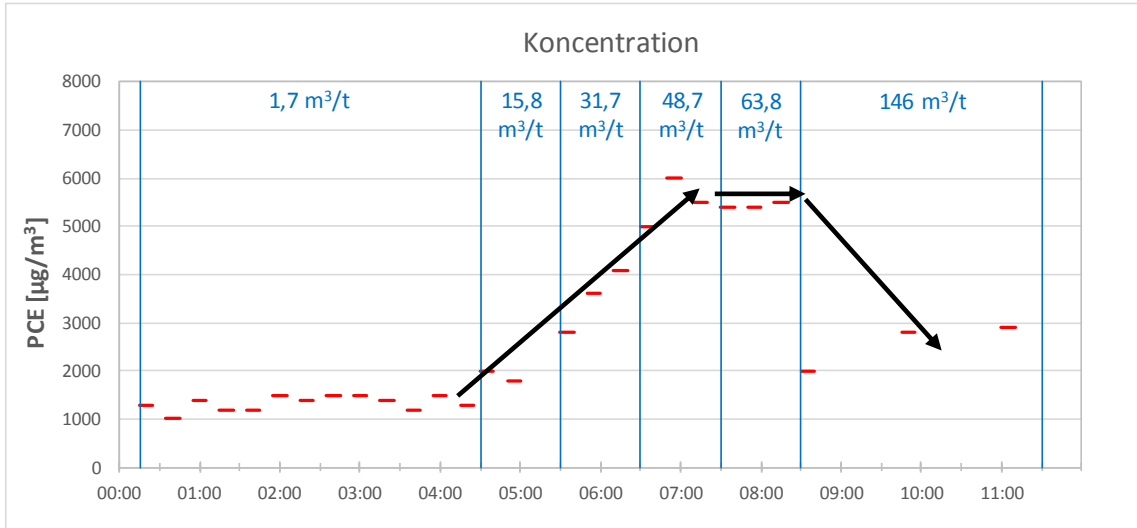
- Resultater:



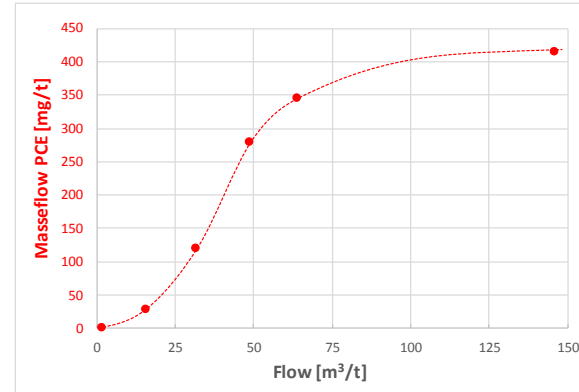
- Estimat på maks. massefjernelse via passiv ventilation ca. 18 mg/t (ca. 4 %).
- Passiv afværgelse var utilstrækkelig, og det er ikke så underligt!

Eksempel 1 – Obduktionsprojektet (RSD)

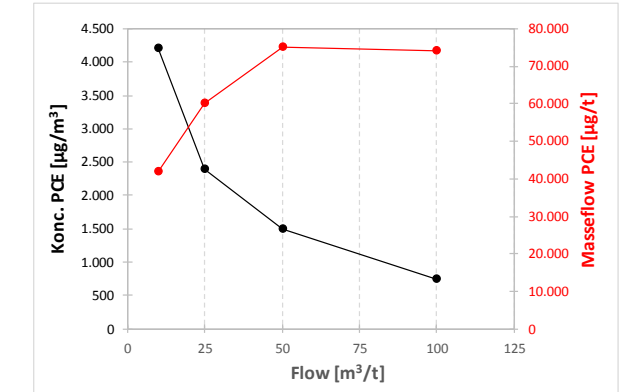
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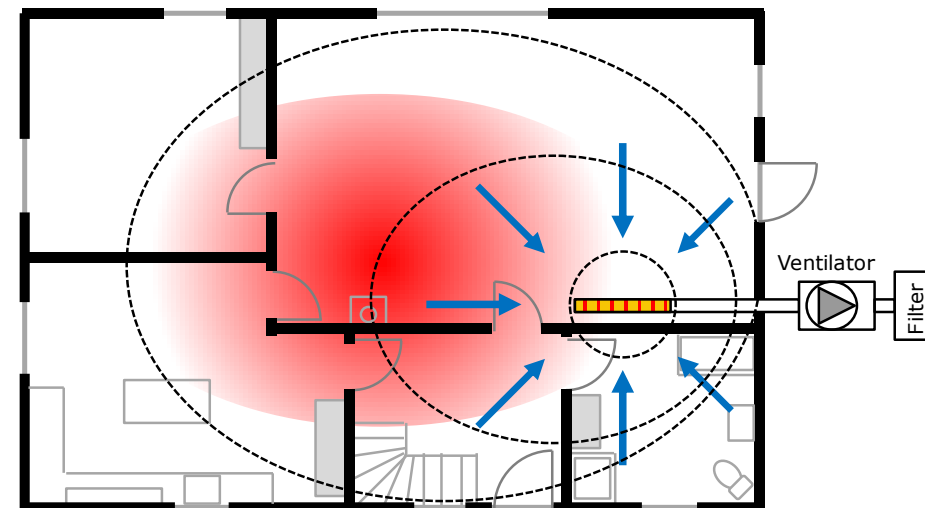
Masseflowet stiger som forventet.



Men koncentrationen stiger også?

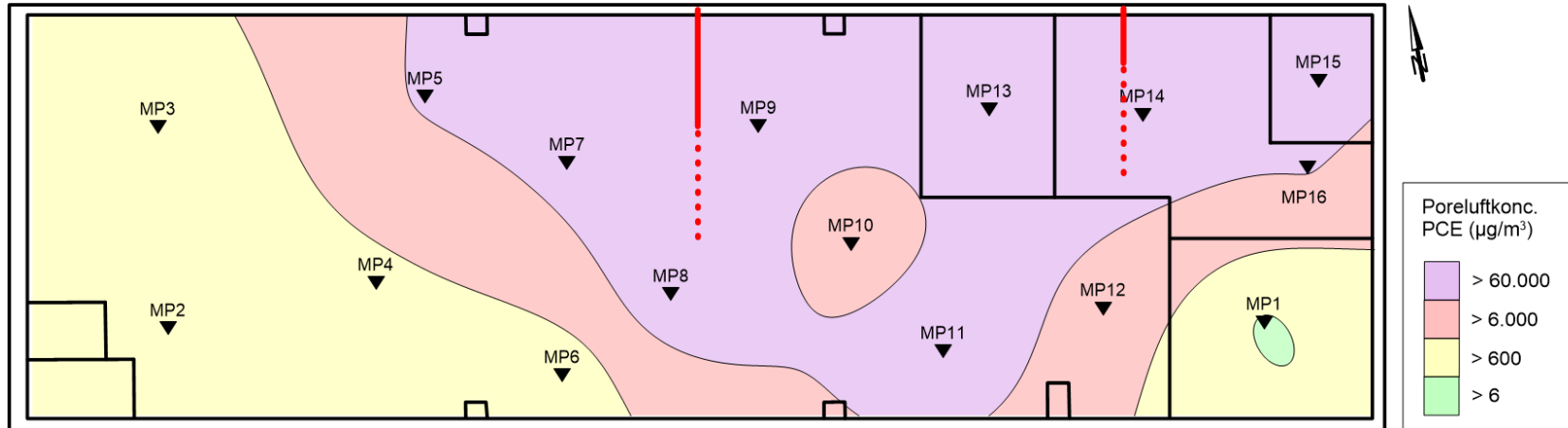


- Konceptuel forståelse:

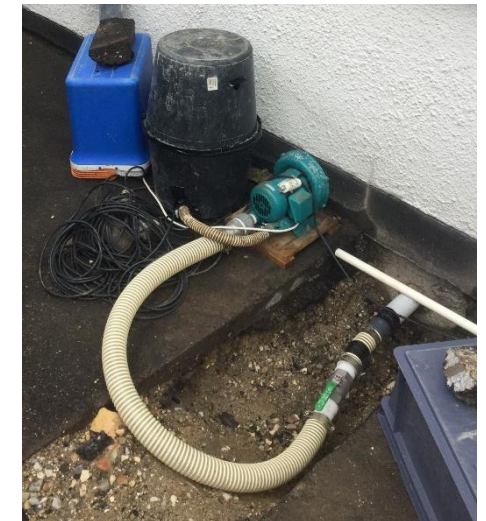
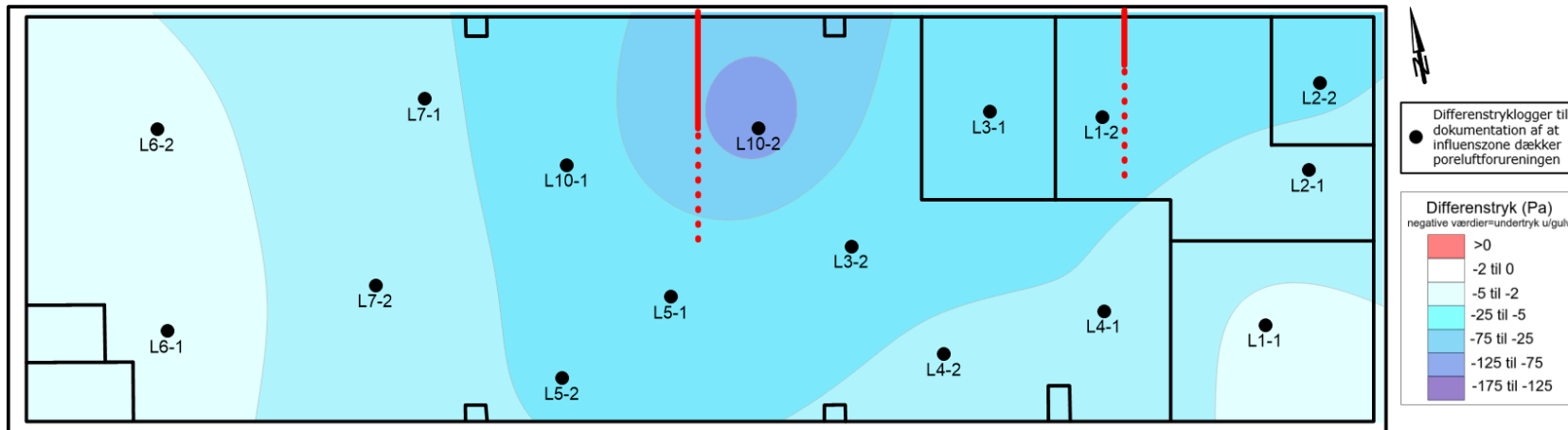


Eksempel 2 – Innovationsgaragen (RH)

- Pilotforsøg med undertryksløsning = Langtidstest over 1 måned:



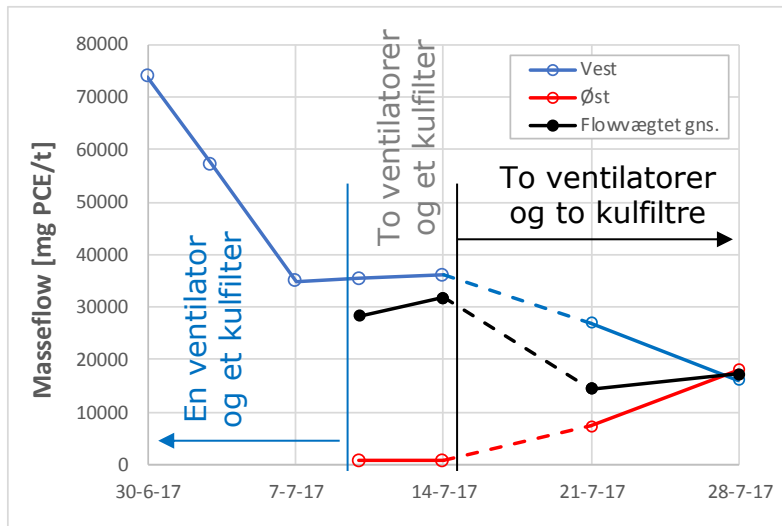
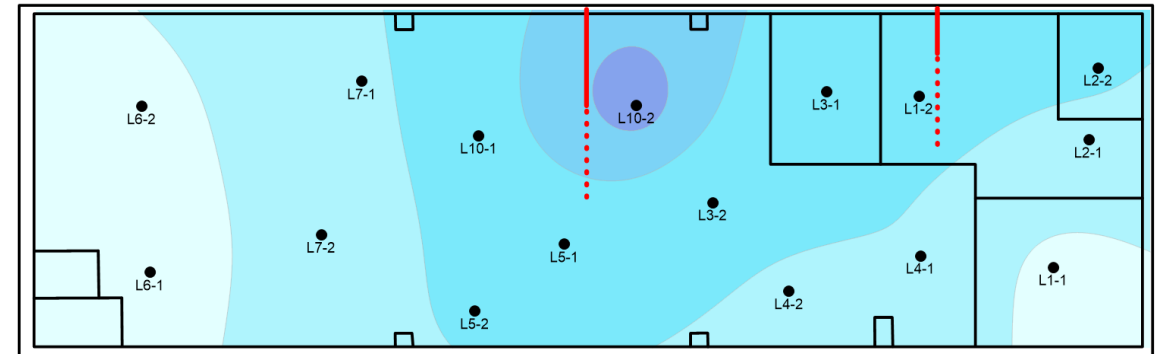
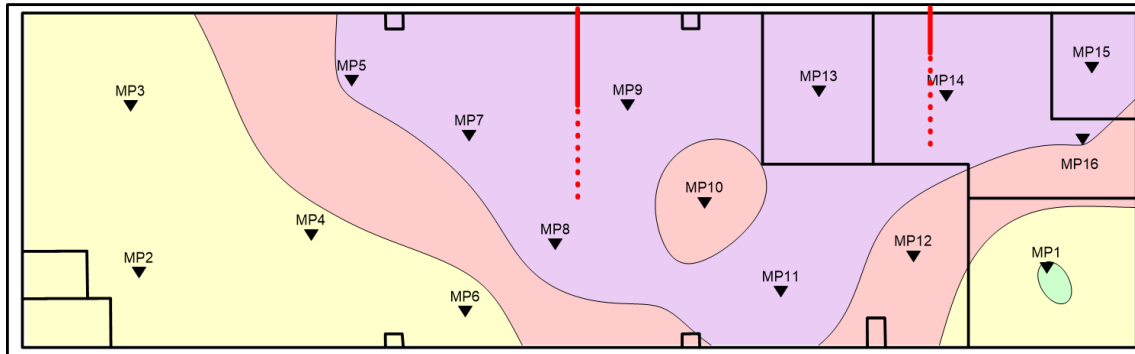
Vest



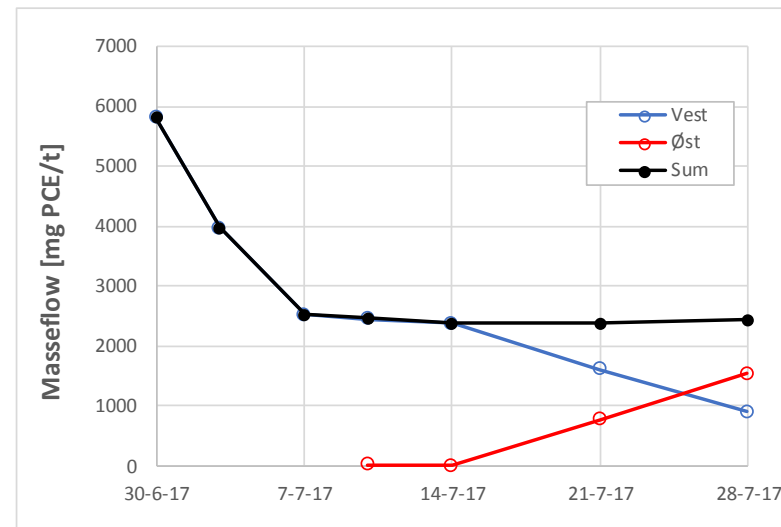
Øst

Eksempel 2 – Innovationsgaragen (RH)

- Pilotforsøg med undertryksløsning = Langtidstest over 1 måned:



- Nogenlunde konst. flow igennem testen.
- Højst konc. i starten = vi har fat i hot-spot.



- Højt masseflow i starten = ophobet masse under gulv.
- => korttidstest kan medføre konservativ MF (her x 2,4).
- Steady-state MF = 2400 mg/t
- Nok til ca. 12.000 $\mu\text{g}/\text{m}^3$
- Ca. 10 x faktisk.

- Korttidstest vs. Langtidstest
 - Anvendelser hver især
 - Fordele og ulemper ved de to tests
- Hvilke anvendelser kunne man have for en masseflowtest?
 - Er passiv ventilation en farbar vej?
 - Periodevist tjek af passive løsninger?
 - Kvantificering af kloakbidrag - Poul Larsens indlæg tidl. i dag.
- Vurdering af pulserende drift for aktive systemer?