

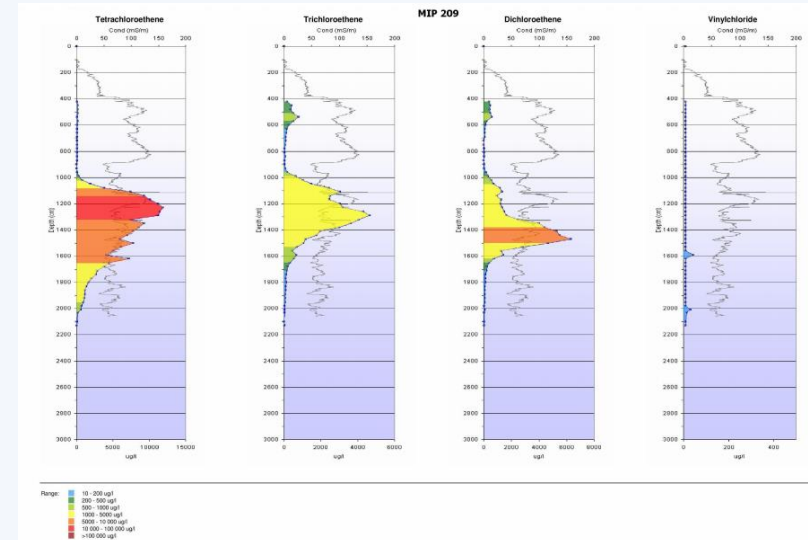
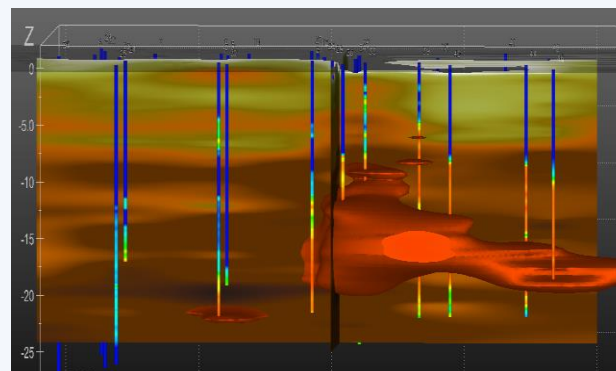
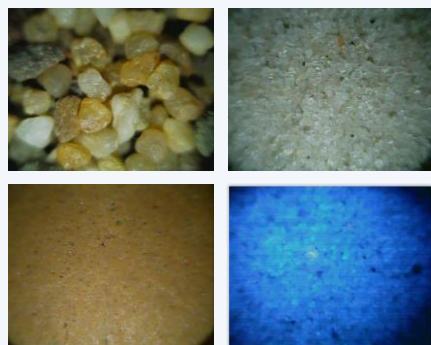
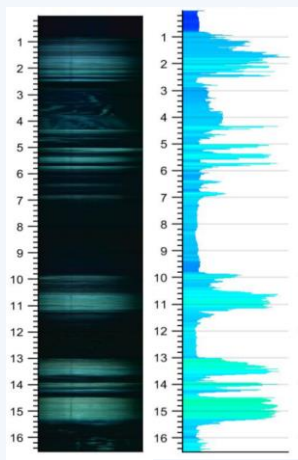
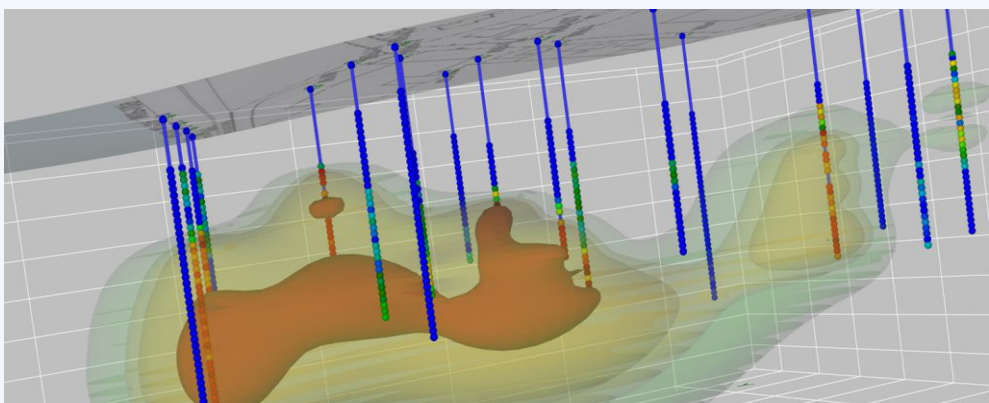
Smelling out cVOC's. The application of fast, on-site GCMS evaluation of indoor air quality in a vapour intrusion impacted building

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EnISSA – Enhanced In Situ Soil Analysis



Vapour intrusion and Indoor air quality

- Migration of vapor forming chemicals into overlying buildings
- Main risk of soil and groundwater contamination
- Soil and groundwater projects
 - Characterise contamination and design a remediation
 - Risk assesment!
 - Exposure

<https://www.epa.gov/vaporintrusion>

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What is Vapor Intrusion?

Vapor intrusion occurs when there is a migration of vapor-forming chemicals from any subsurface source into an overlying building. Recognition of soil vapor intrusion to buildings and other enclosed spaces occurred in the 1980s with concerns over radon intrusion. Subsequently, there was an increasing awareness that anthropogenic chemicals (e.g., petroleum hydrocarbons and chlorinated solvents) in soil, groundwater, and sewers and drainlines could also pose threats to indoor air quality via the vapor intrusion pathway.

Vapor-forming chemicals may include:

- volatile organic compounds (VOCs), such as trichloroethylene and benzene.
- select semivolatile organic compounds, such as naphthalene.
- elemental mercury.
- some polychlorinated biphenyls and pesticides.

Figure 1: Migration of Soil Vapors to Indoor Air
This figure depicts the migration of vapors in soil gas from contaminated soil and groundwater into buildings. Vapors in soil gas are shown to enter buildings through cracks in the foundation and openings for utility lines. Atmospheric conditions and building ventilation are shown to influence soil gas intrusion.

Vapour intrusion and Indoor air quality

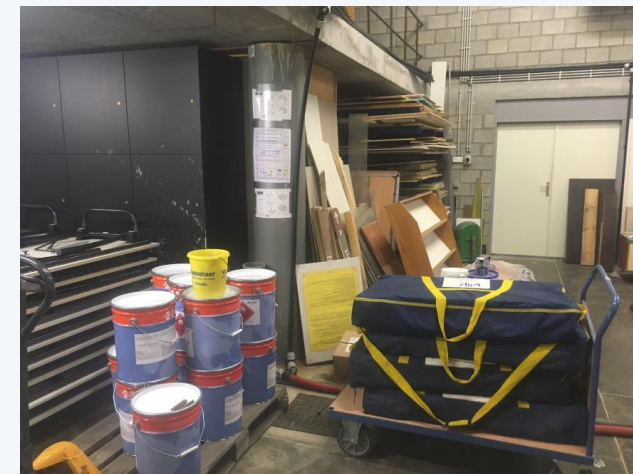


- Exposure
 - Limited (modeled) data
- Measurements of indoor air concentrations are often underexposed in Site characterisation
 - Knowledge about Indoor air quality or management
 - available sampling and analysis methods

Indoor air monitoring

On site measurements (PID)

sensitivity vs standards/norm values



Sampling (passive or active)

sensitive!

slow!

variability

Vinyl Chloride?



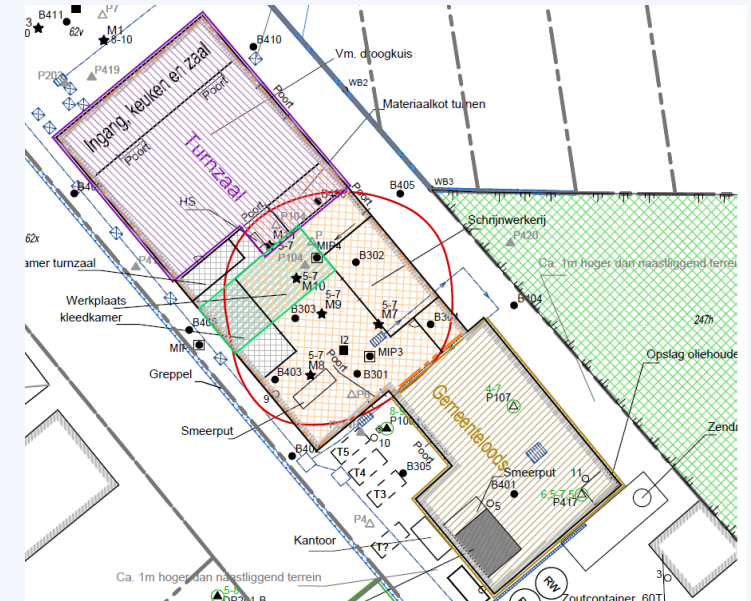
Site Description

OVAM : Public Waste Agency of Flanders

Former Dry cleaning site.

Currently Gym, warehouse, workplace,
canteen,

Impacted with Chlorinated Solvents



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SVE Installation

High VOC readings (PID) During installation of SVE well's in the building

Soil analysis indicated an additional source zone

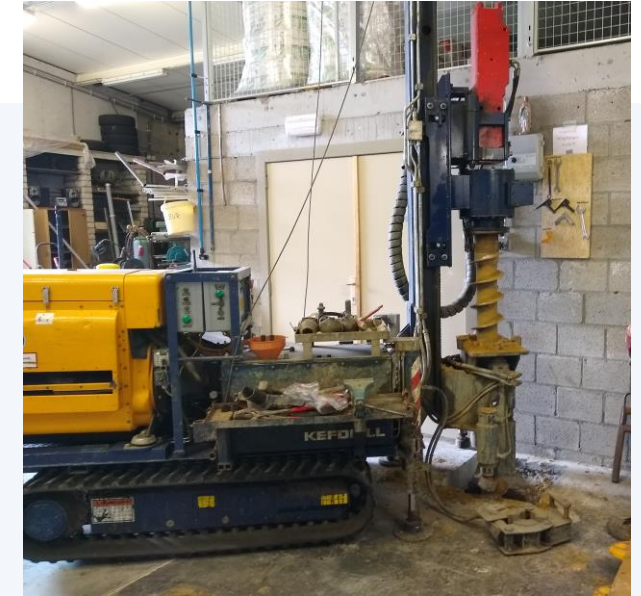
Indoor air assesment with passive diffusive sampler (Radiello™) after completion of SVE system

PCE 2,200 $\mu\text{g}/\text{m}^3$

TCE 54 $\mu\text{g}/\text{m}^3$

Additional locations

	TRI ($\mu\text{g}/\text{m}^3$)	PER ($\mu\text{g}/\text{m}^3$)
	13	140
	13	330
	11	290
	54	2.200
Additional locations	13	920
	9,3	370
	13	490
	14	500



Detailed investigation with on site fast GC-MS measurements



Detailed investigation

1. Spatial variability

Changing room 1800 $\mu\text{g}/\text{m}^3$

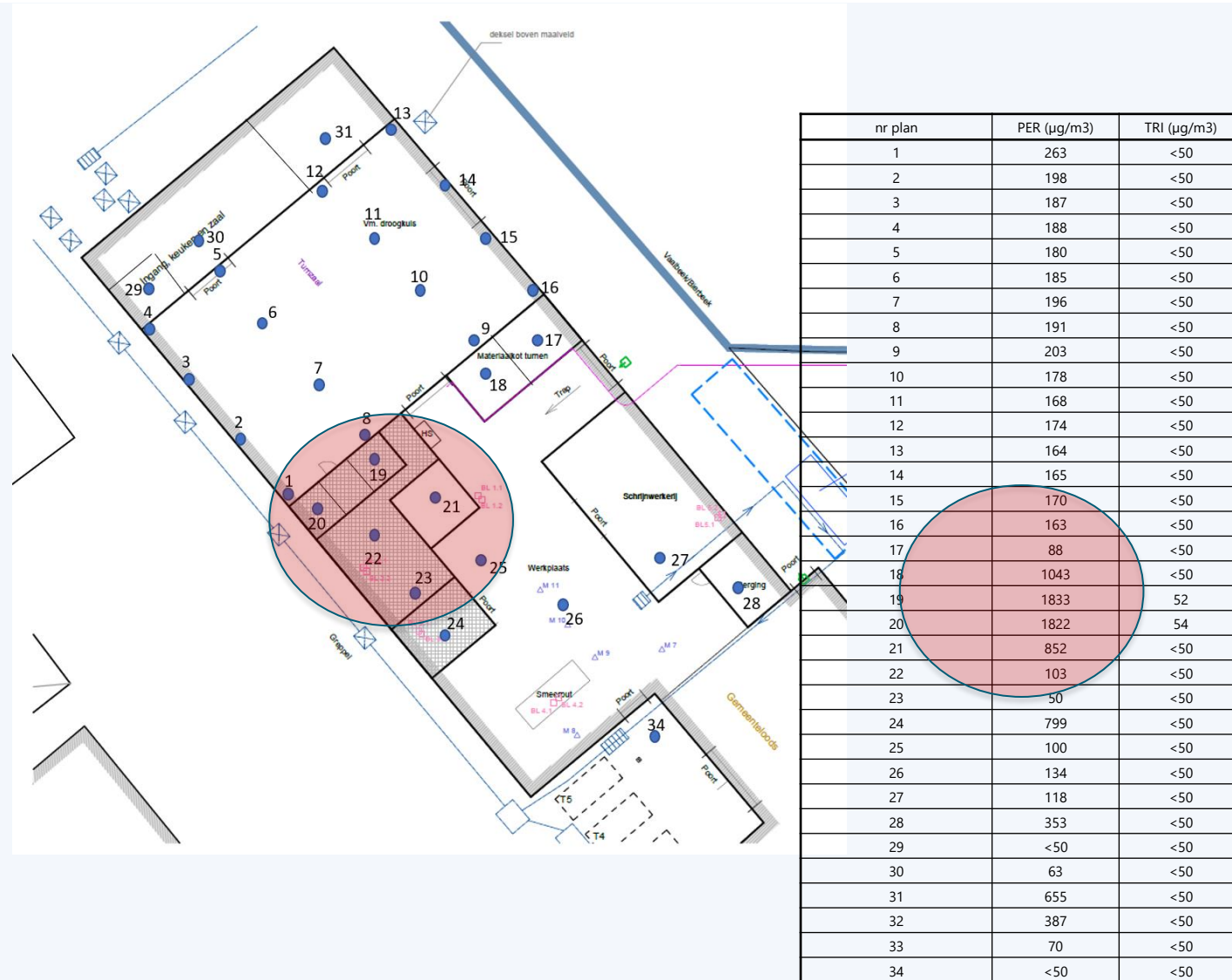
Workplace 50-850 $\mu\text{g}/\text{m}^3$

Open area closer to gate 100- 135 $\mu\text{g}/\text{m}^3$

1 floor:

office : 70 $\mu\text{g}/\text{m}^3$

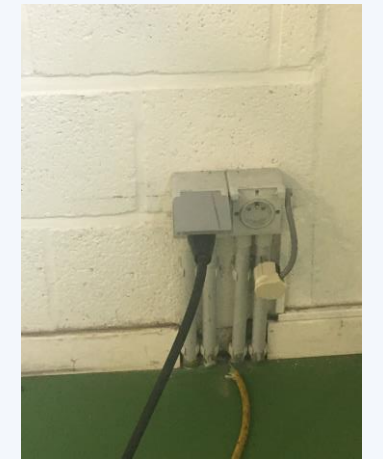
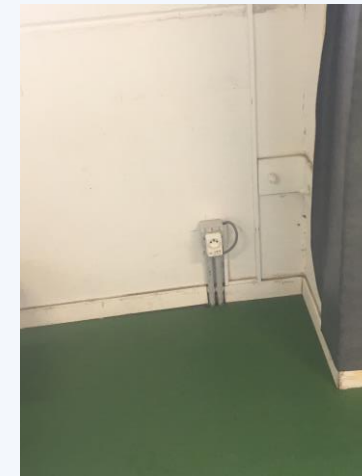
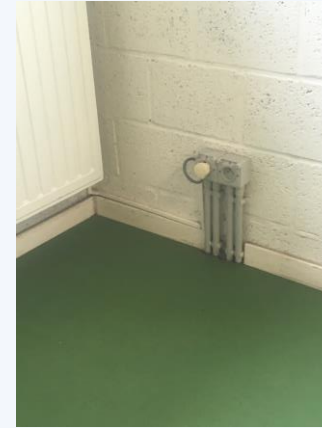
technical room (heating system: 400 $\mu\text{g}/\text{m}^2$)



Detailed investigation

2. Identify vapor intrusion pathways

letter plan	PER ($\mu\text{g}/\text{m}^3$)	TRI ($\mu\text{g}/\text{m}^3$)
A	46921	637
B	68	<50
C	29215	2841
D	8959	1023
E	57	<50
F	205	<50
G	10536	2542
H	636	57
I	319	<50
J	634	<50
K	280	<50
L	155	<50
M	576	<50
N	174	<50
O	1006	<50
P	296	<50

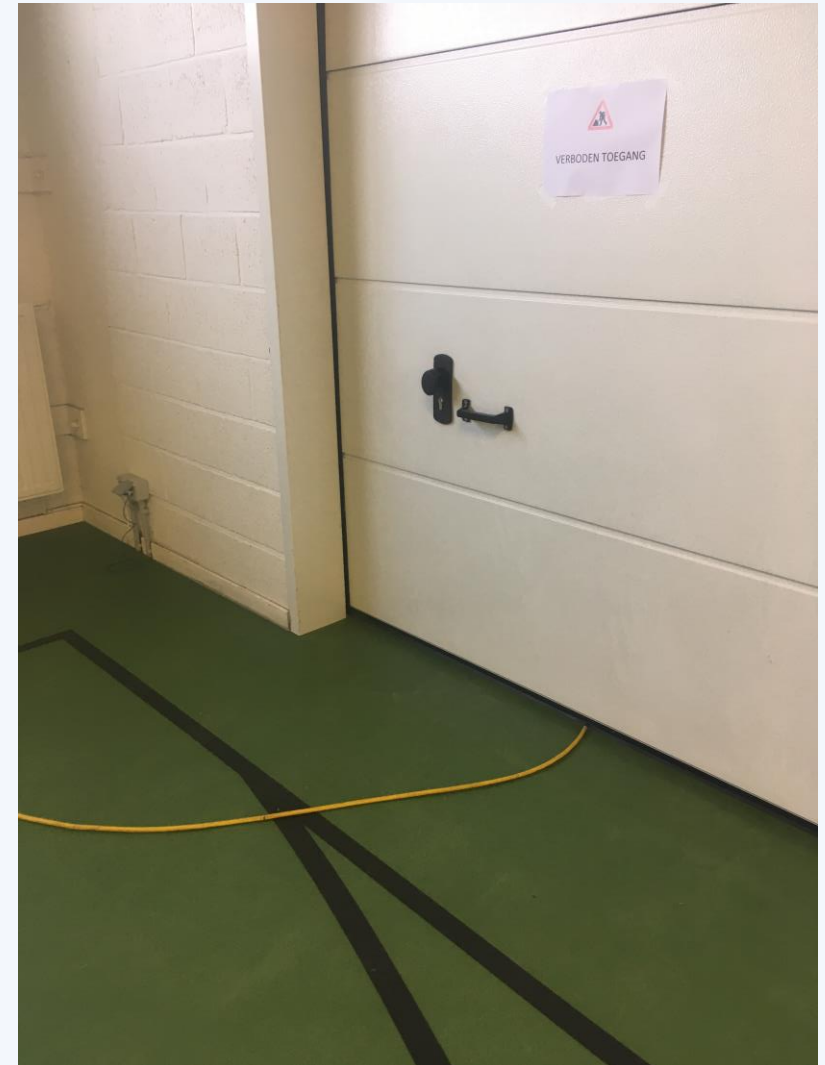


Verification measurements after sealing and activation of SVE

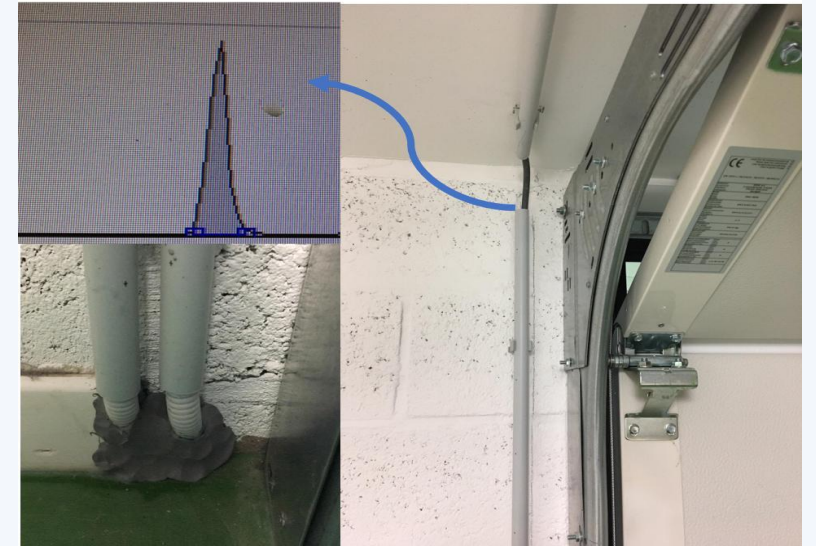
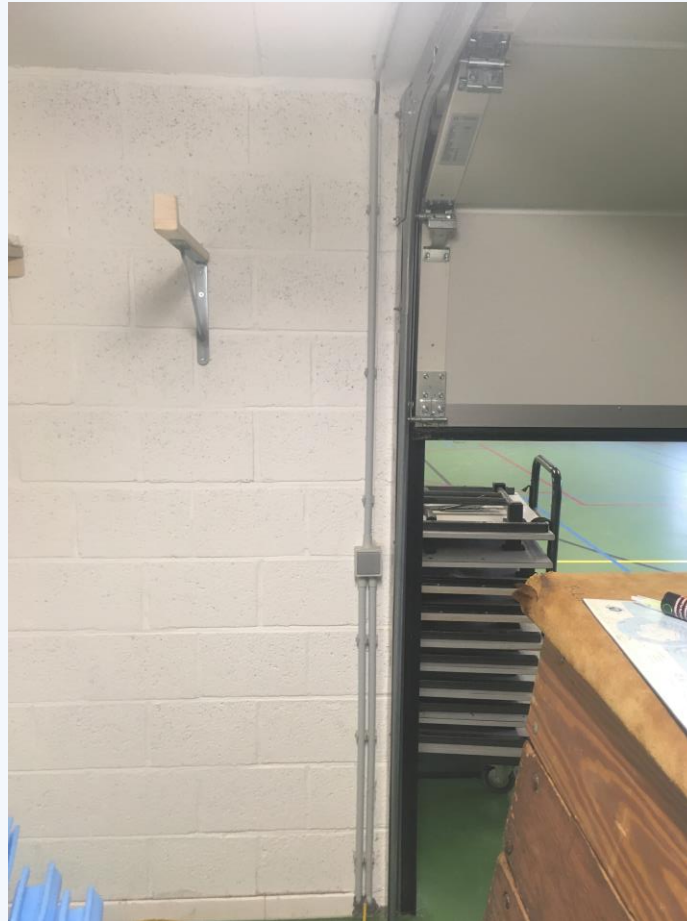
Identified intrusion points have been sealed

Meanwhile SVE system is activated

Indoor air quality is reevaluated with on site measurements



Sniffing for Vapor Intrusion



On site GC-MS measurements

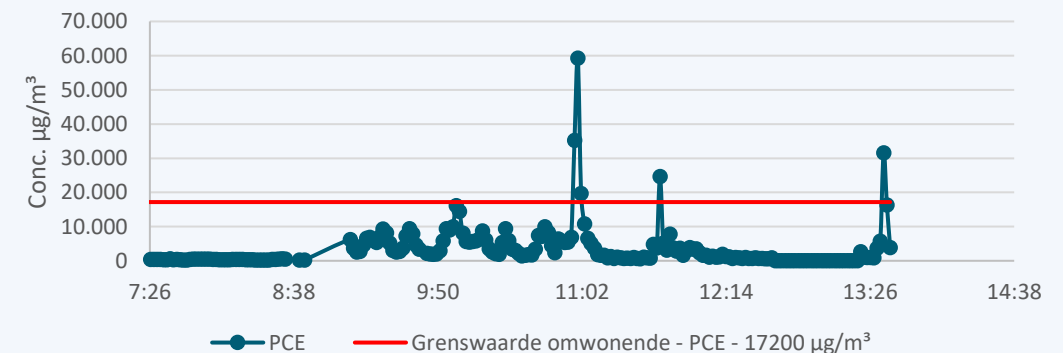
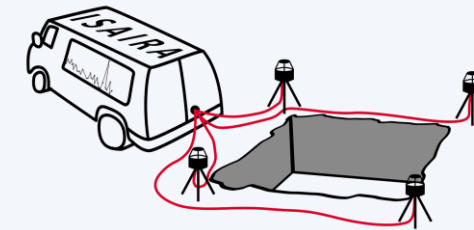
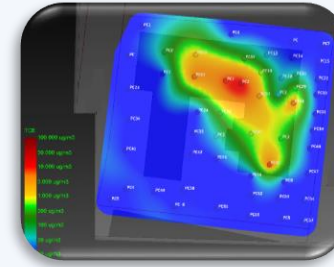
Fast measurements of > 100 data points/day

On site information: dynamic investigation approach

Compound specific results: comparison with compound defined standards and and differentiation from other indoor VOC's

Insight in spatial and temporal variations of indoor (or outdoor) VOC levels

Different automated sampling setups and analytical approaches are possible: monitoring remediation projects, long term evaluations





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