



Bright ideas.
Sustainable change.

VOC Intrusion: Four years of Pilot Scale Testing

Nordrocs 2026

Tue 15th of September

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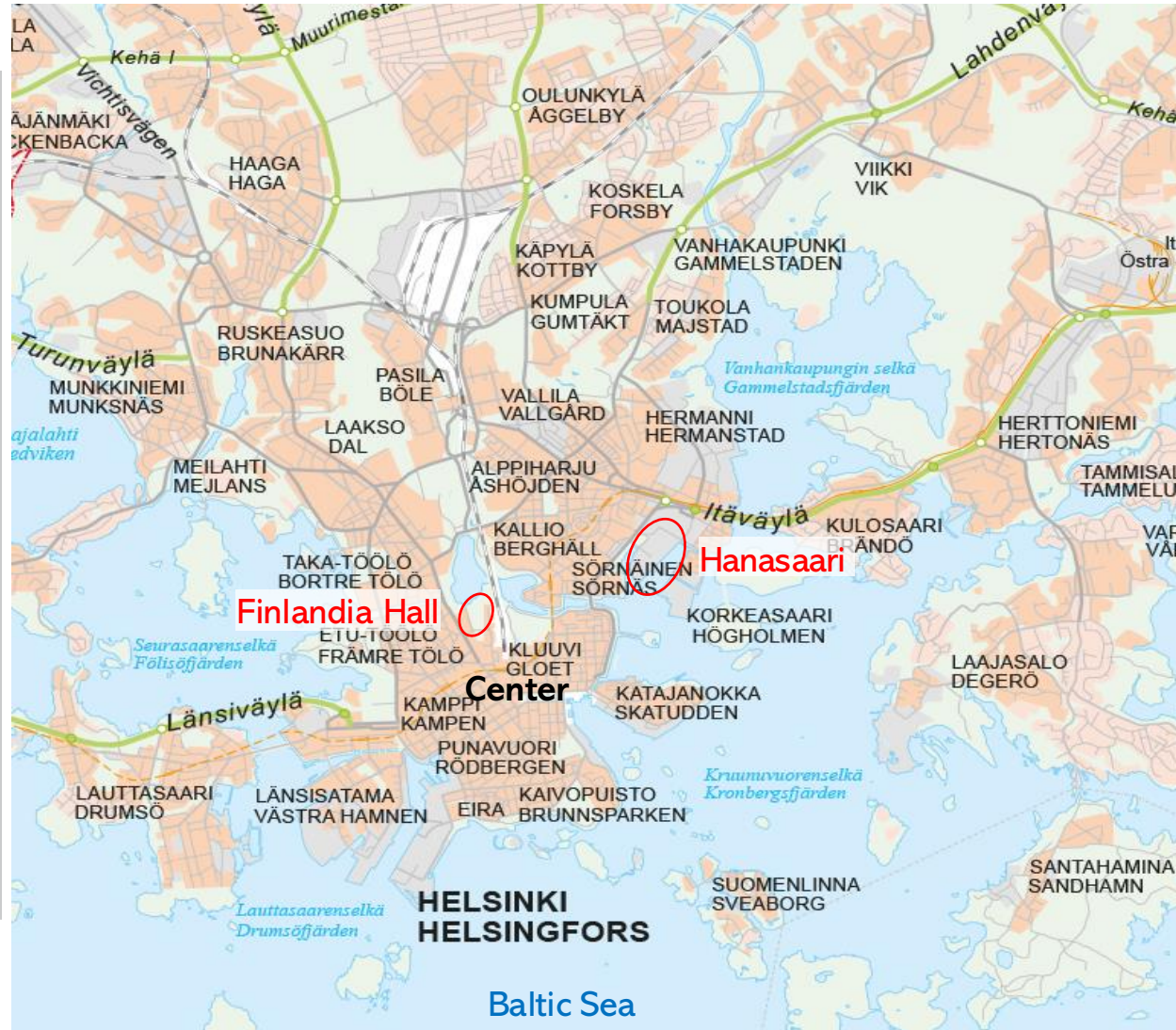
Table of Contents

1. Background
2. Monitoring and Experimental Setup
3. Results
4. Conclusion and Ideas

1. Background

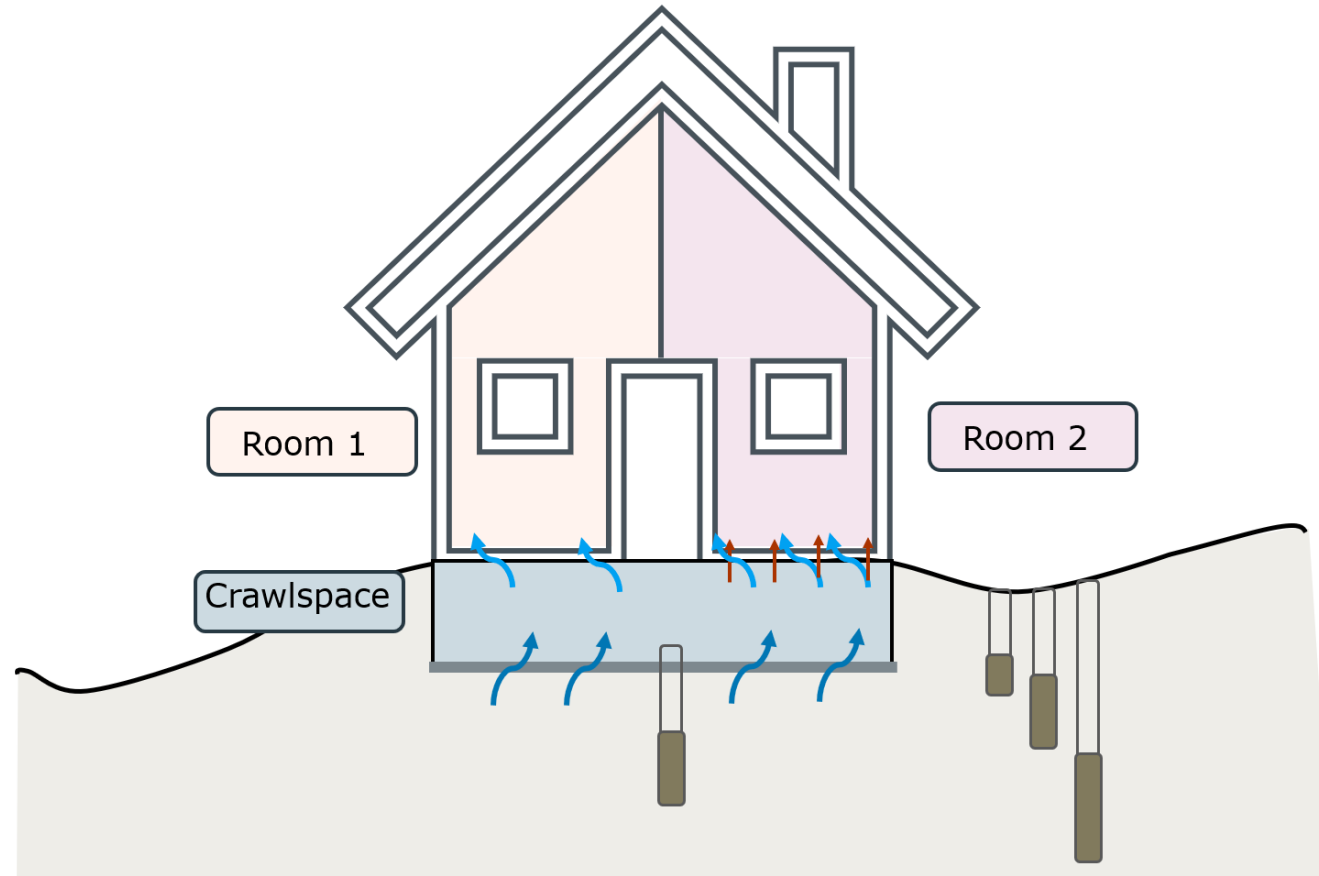
Background

- Hanasaari is an old industrial area located in Helsinki, Finland
- Several industry sectors have operated in the area, including a gas plant, two power plants and a benzene factory
- The latest power plant operating on the site since 1970s ceased operations in 2023
- Housing and office development is planned for the area, with an international design competition launching this autumn



Background

- Due to the heavy industrial background, soil, groundwater and soil gas is contaminated in the area
- High concentrations of TCE have been detected in soil and soil gas
- To support safe and sustainable remediation of the area, contaminant migration from soil gas into indoor air has been studied using a test container
- The test container started operating in late 2021 and it was presented in Nordrocs 2024
- Technical excursion on Thursday (19.9.) will visit the test container



2. Monitoring and Experimental Setup

Monitoring

Active sampling

- Indoor rooms, crawl space, soil gas sampling wells and outdoor air
- Soil gas sampling is also conducted adjacent to the test container
- Samples collected into sorbent tubes (Tenax, Carbopak and charcoal tubes)



Online monitoring

- Indoor air sensors (Decentlab DL-IAM) in crawl space and both rooms
- Outdoor sensor (Decentlab DL-LP8P) on top of the test container
- On-line data on temperature, relative humidity, air pressure, CO₂, and TVOC (only indoor)
- Indoor air pressure differential measurement



Experimental setup: Implemented and Proposed

1. Baseline (0)

- Purpose: monitor concentrations building up in the crawl space
 - Crawl space closed, no ventilation
 - Normal ventilation in the rooms
-
- Duration 2 years (12/2021-01/2024)

2. Effect of subfloor leaks

- Purpose: determine how subfloor leaks affect indoor concentrations
 - Penetrations to the crawl space opened from one room
 - Crawl space closed, no ventilation
 - Normal ventilation in the rooms
-
- Duration 8 months (02/2024-10/2024)

3. Indoor negative pressure

- Purpose: pilot whether indoor concentrations increase when rooms are depressurised
 - Room ventilation adjusted so the rooms are approximately 10–20 Pa negative relative to the crawl space
 - Penetrations in one room remain open
 - Crawl space closed, no ventilation
-
- Duration: on-going (10/2024-)

UPCOMING

4. Crawl-space ventilation

- Purpose: pilot how ventilation affects crawl-space concentrations
 - This scenario is the default assumption in many contaminated-land risk assessments for apartment buildings in Helsinki
 - It is also possible to impose negative pressure in the crawl space, which may draw more contaminants from the soil (but possibly also from the indoor spaces)
-
- Schedule: Autumn 2026

3. Results

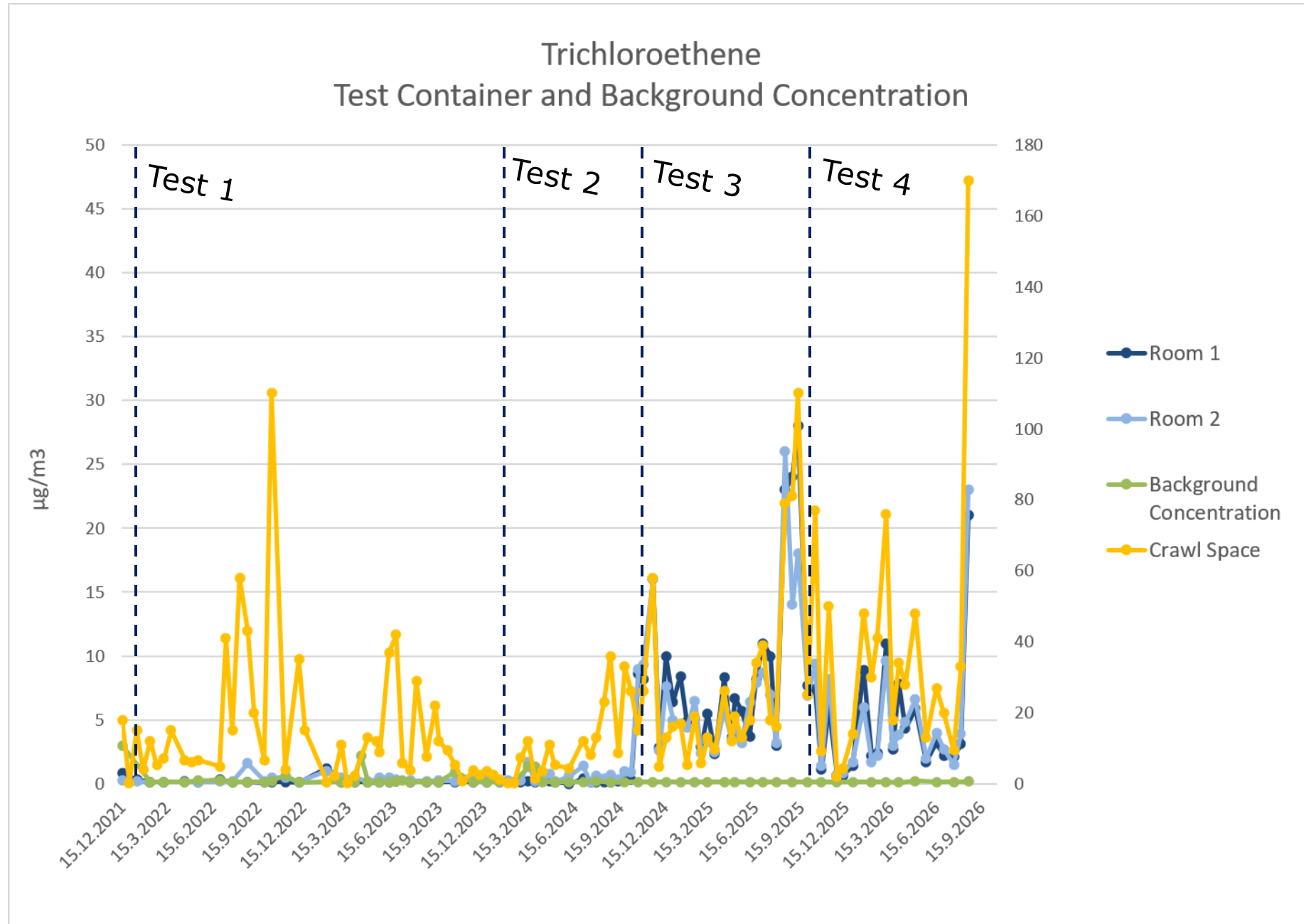
Results

Test 1: All pipe sleeves closed (12/2021)

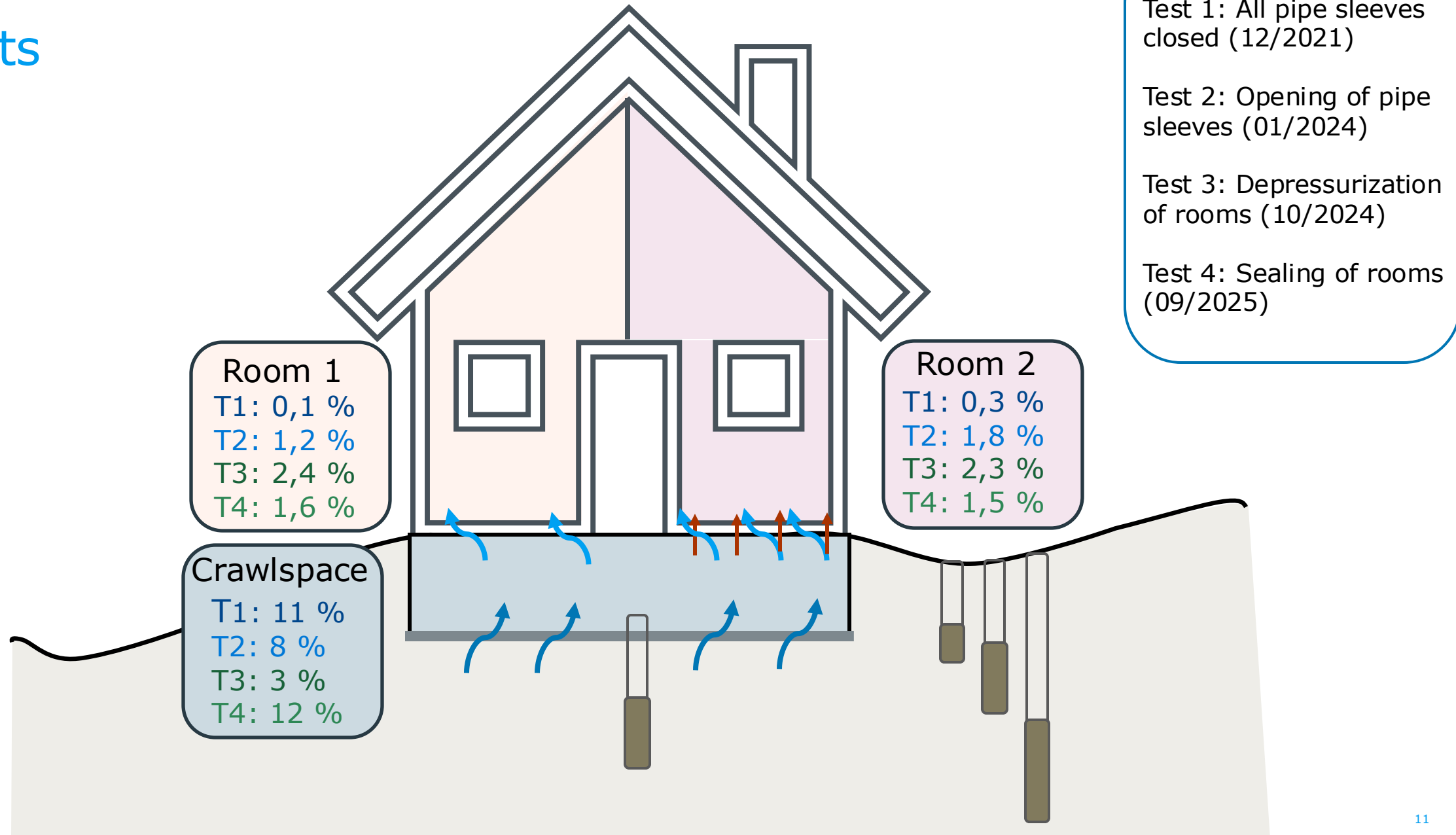
Test 2: Opening of pipe sleeves (01/2024)

Test 3: Depressurization of rooms (10/2024)

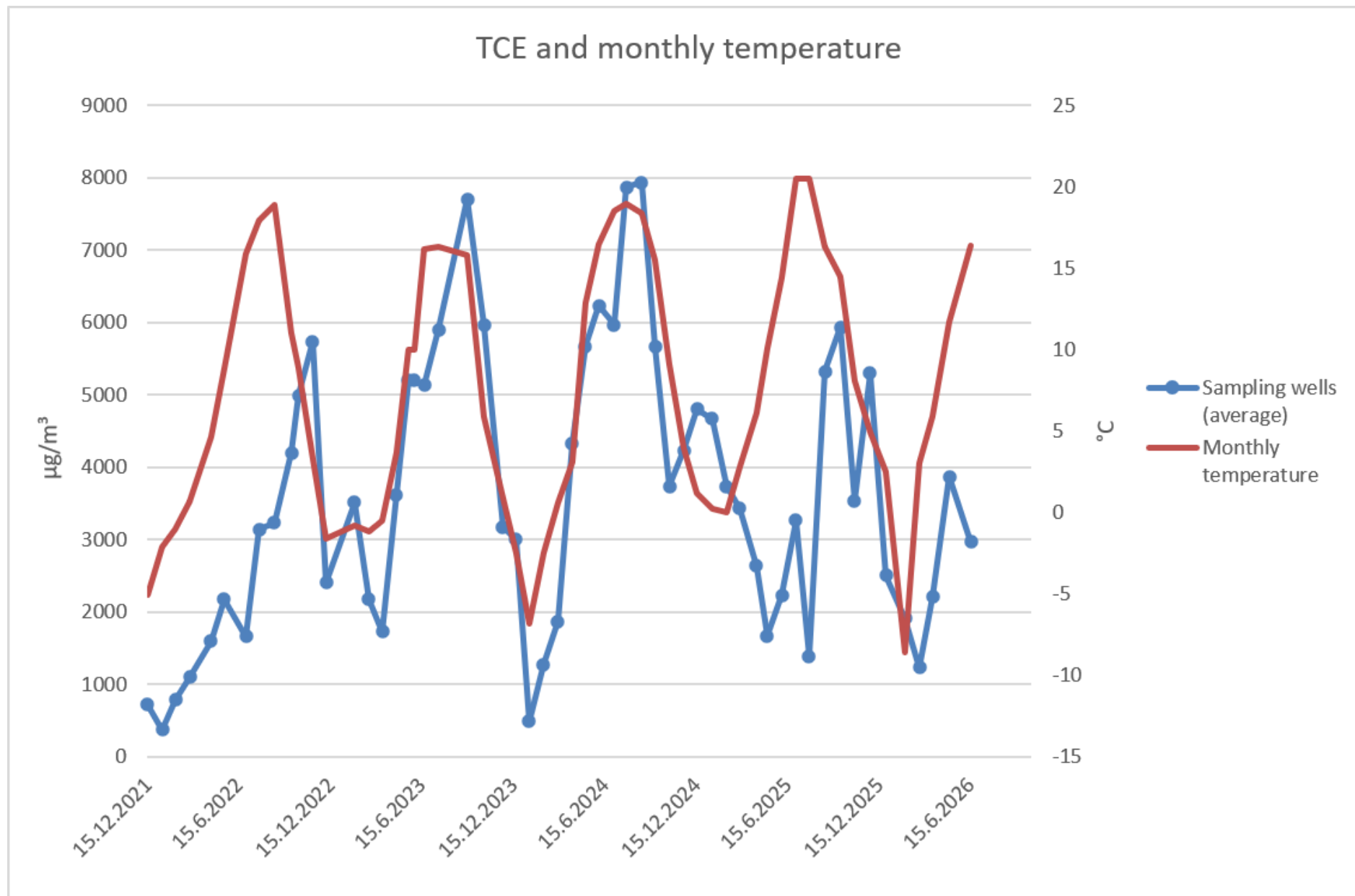
Test 4: Sealing of rooms (09/2025)



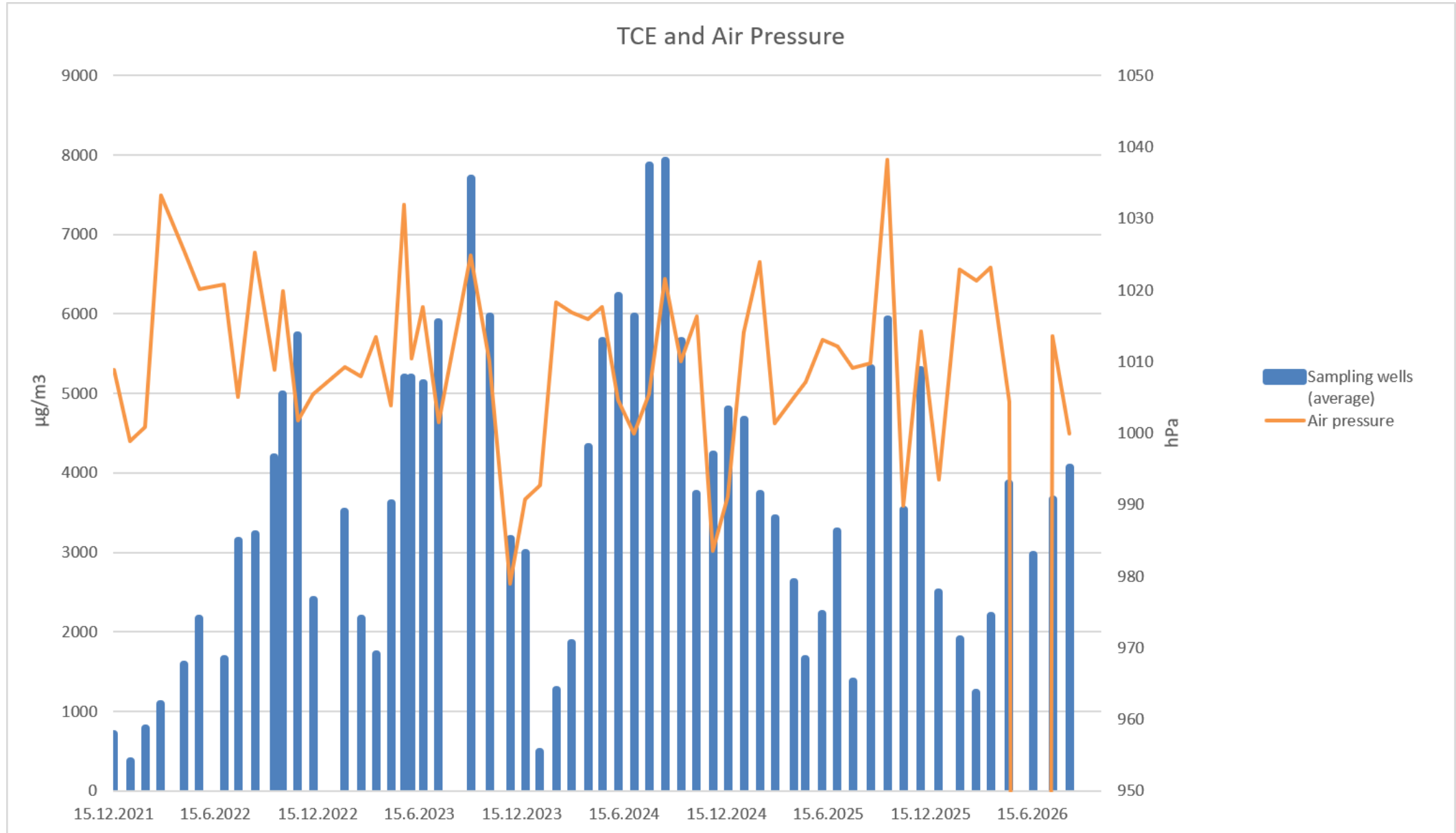
Results



Results



Results



4. Conclusions and Ideas

Conclusions

- A) Despite the large concentrations of TCE in soil gas, only a small amount transfers to indoor air
- B) Season (i.e. temperature) strongly affects soil gas TCE concentrations – likely to apply to other VOCs as well
- C) Building pressure differentials influences TCE migration from crawl space into indoor rooms
- D) Making reliable conclusions requires sufficient soil gas concentration data and sufficiently long test periods
- E) Discussions with the authorities have begun on whether the test container results can be used in the future risk assessment of the area.



Future Ideas

- The test container is easily relocatable → can be used at other sites.
- Any VOCs can be tested.
- A VOC of interest can, if desired, be introduced into the crawl space at a chosen concentration to study its migration into indoor air.
- How does outdoor temperature affect the pipe beneath the test container?
- The test container is small; in large real buildings outdoor air temperature is unlikely to affect the temperature beneath the building as noticeably — should this be taken into account? If so, how?
- Concentrations measured in the pilot test will later be compared with concentrations predicted by models.
- The intention is also to assess the influence of different factors (air leakage, pressure differential, temperature, etc.).
- How can site-specific data be used in the Hanasaari remediation risk assessment and to inform building-engineering solutions?

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