Thermoreact® - In-situ Neutralization during Thermal Desorption

JAN HAEMERS

The **speaker**

Jan HAEMERS

Chief Executive Officer

Jan holds M.Sc. degrees in mining engineering (ULB – Brussels), geological engineering (ENSG – Nancy) and hydrological engineering (ULg – Liège). He also holds a business administration degree (Solvay Business School – Brussels) and International Executive Program (INSEAD – Fontainebleau). He has been working in soil remediation since 1991.

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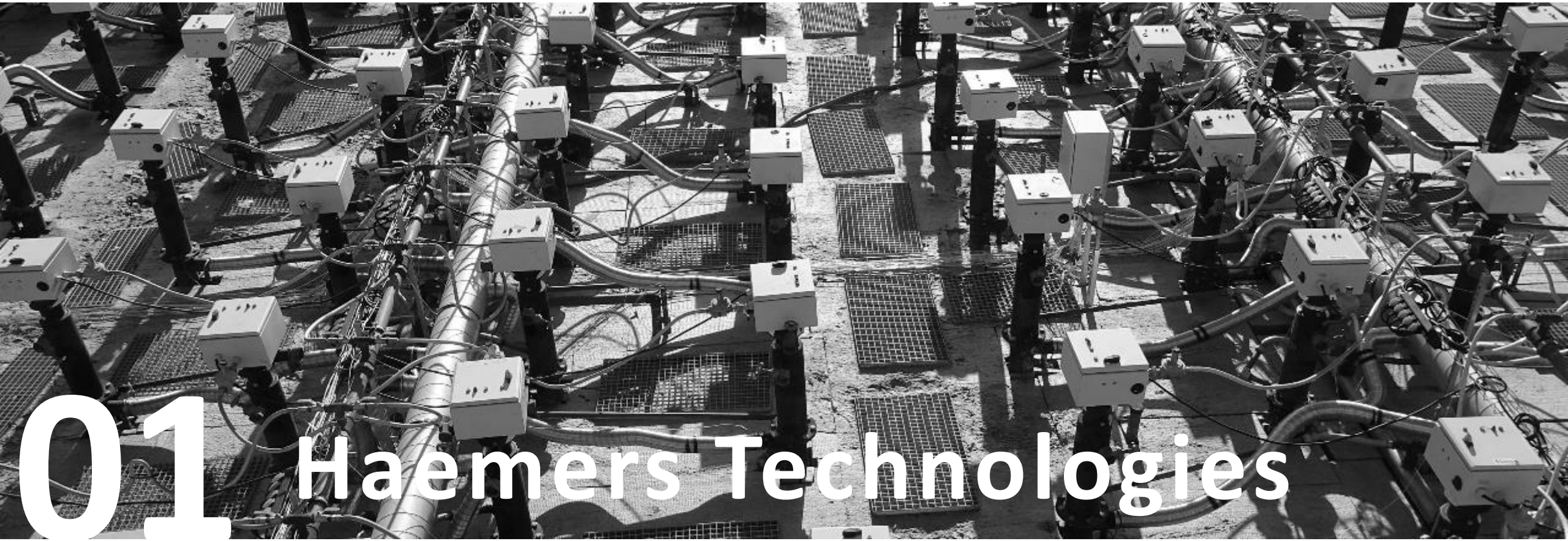


01 Haemers Technologies

Haemers Technologies **TODAY**

Technology provider for thermal treatment

Own Lab and R&D facility

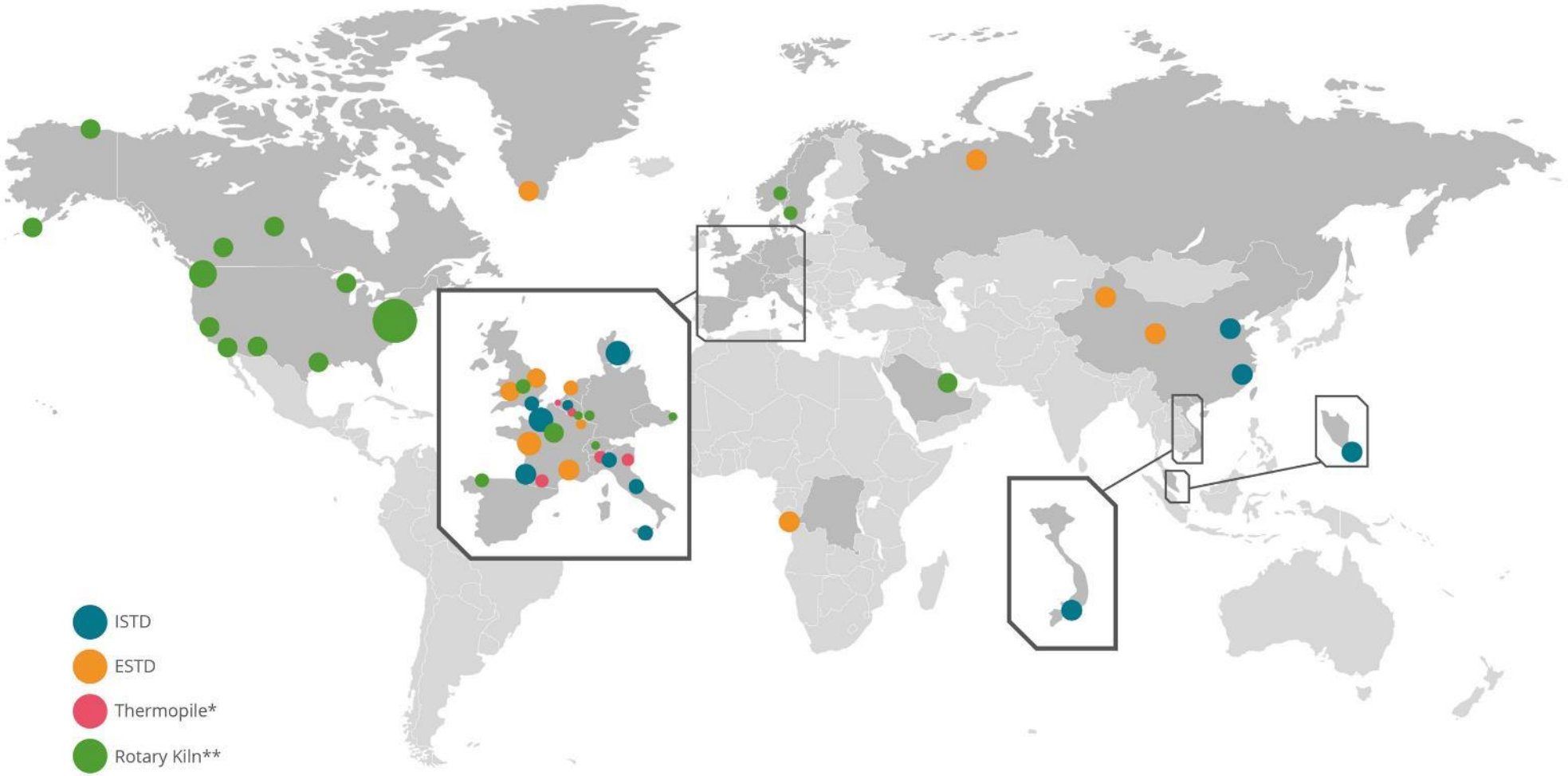
Based in Brussels (Belgium)

Worldwide Operations

Own Smart Burners™ manufacturing facility

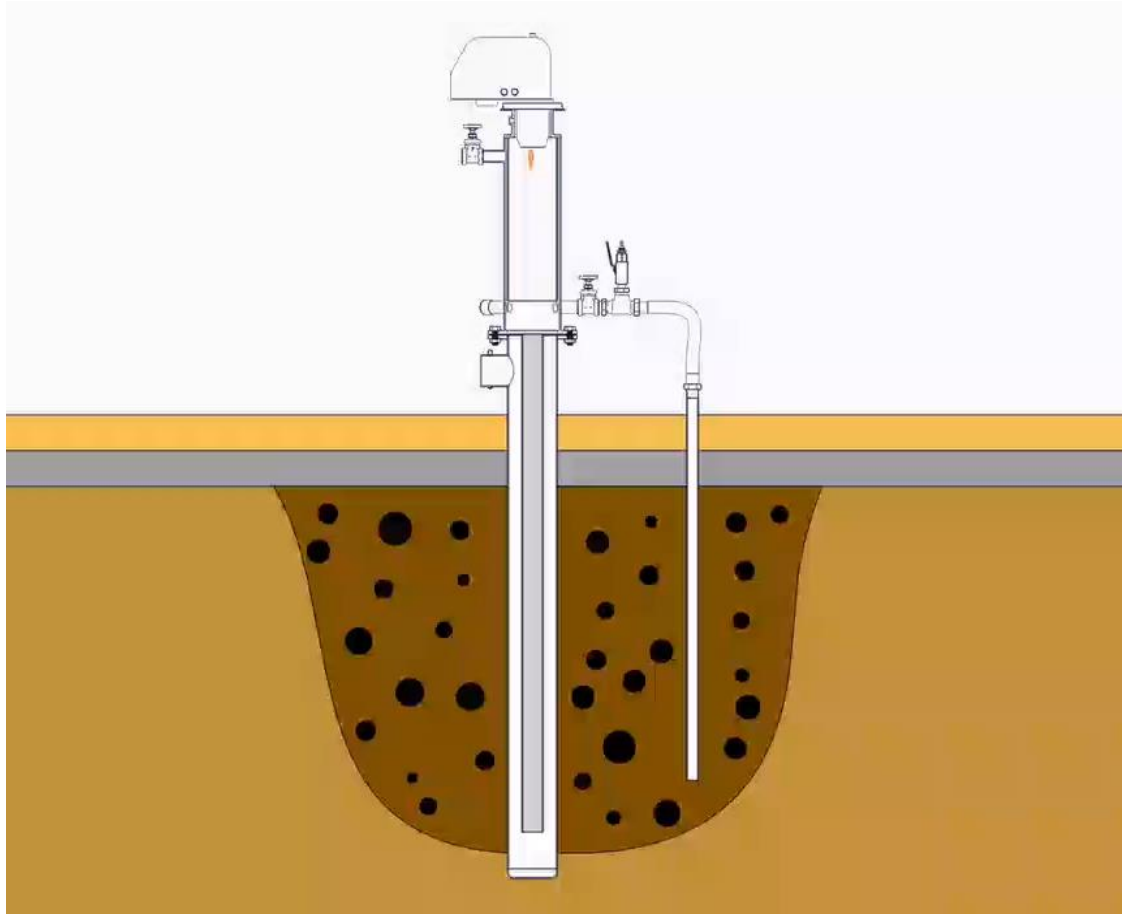
25+ Years in Business

Operations **worldwide**



*operated by L&C S.A. until 2010
**operated by TPS Technologies Inc. until 2006

How does **thermal desorption** work ?



1. **HEATING** THE SOIL

Objective : Vaporize contaminants

2. **RECOVER** CONTAMINANTS

Extract from soil all vaporized contaminants

3. **TREAT** THE CONTAMINANTS

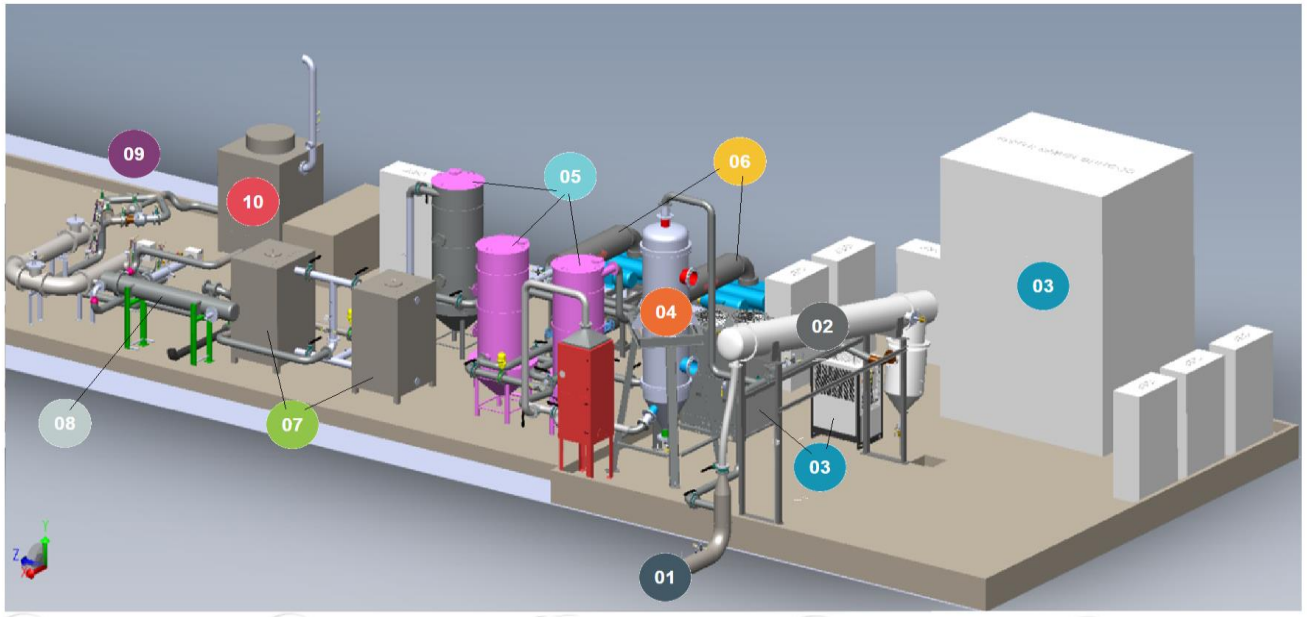
<u>Reburn</u> as fuel in the burners (combustible compounds)

<u>Sent</u> to a vapor treatment unit

02 Vapor Treatment Unit

General description of a **Vapor Treatment Unit**

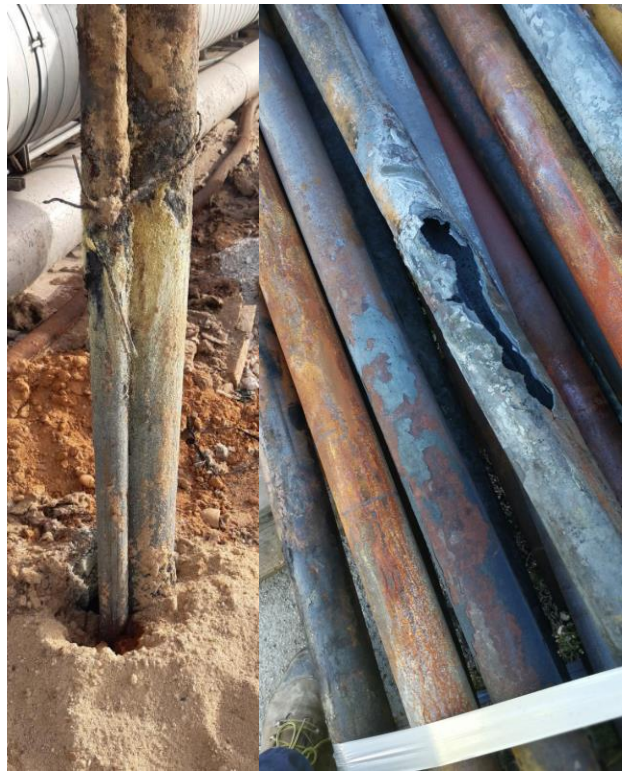
Vaporized during thermal desorption → Extracted from the soil → Sent to a vapor treatment unit → Neutralize **Ex situ**

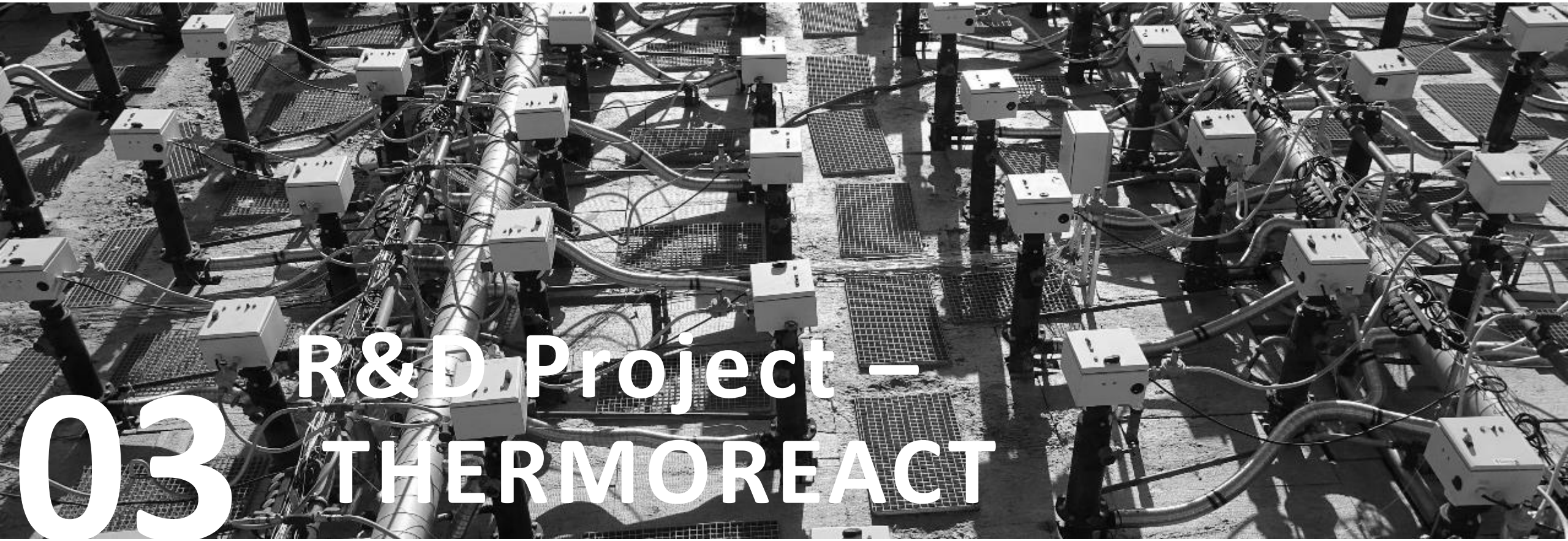


- Excessive cost
- Demand for space
- High energy cost
- Human resource costs -> Monitoring of vapor treatment

Exemples of **problems** with a Vapor Unit Treatment

- **Size** of the installation -> treatment of the vapor ex situ
- Material degradation by **corrosion**





03 R&D Project – THERMOREACT

R&D Project

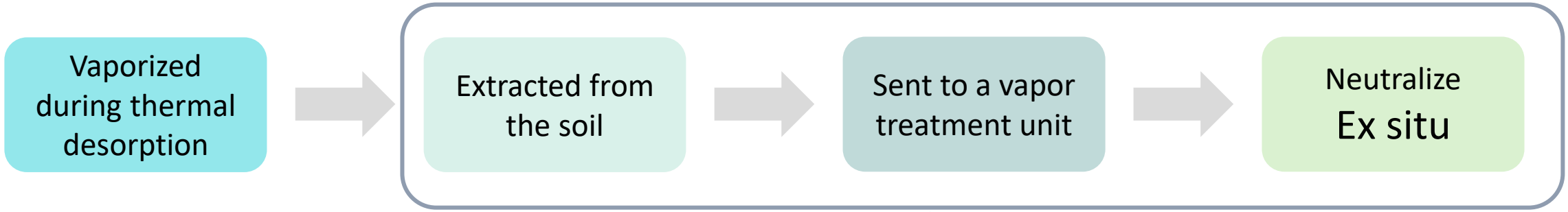
- Improve the competitiveness of our technologies
  - Maximising energy efficiency
  - Minimising treatment time
  - Minimising cost of treatment

Invention of Thermoreact®

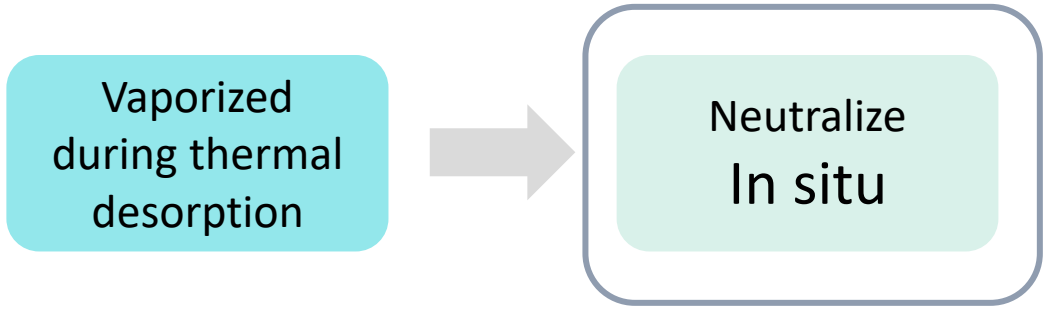
Patents - PCT/EP2022/053514 & PA202270058

Avantages of Thermoreact®

- In the past…
  - Halogens, sulfur, phosphorus and mercury are

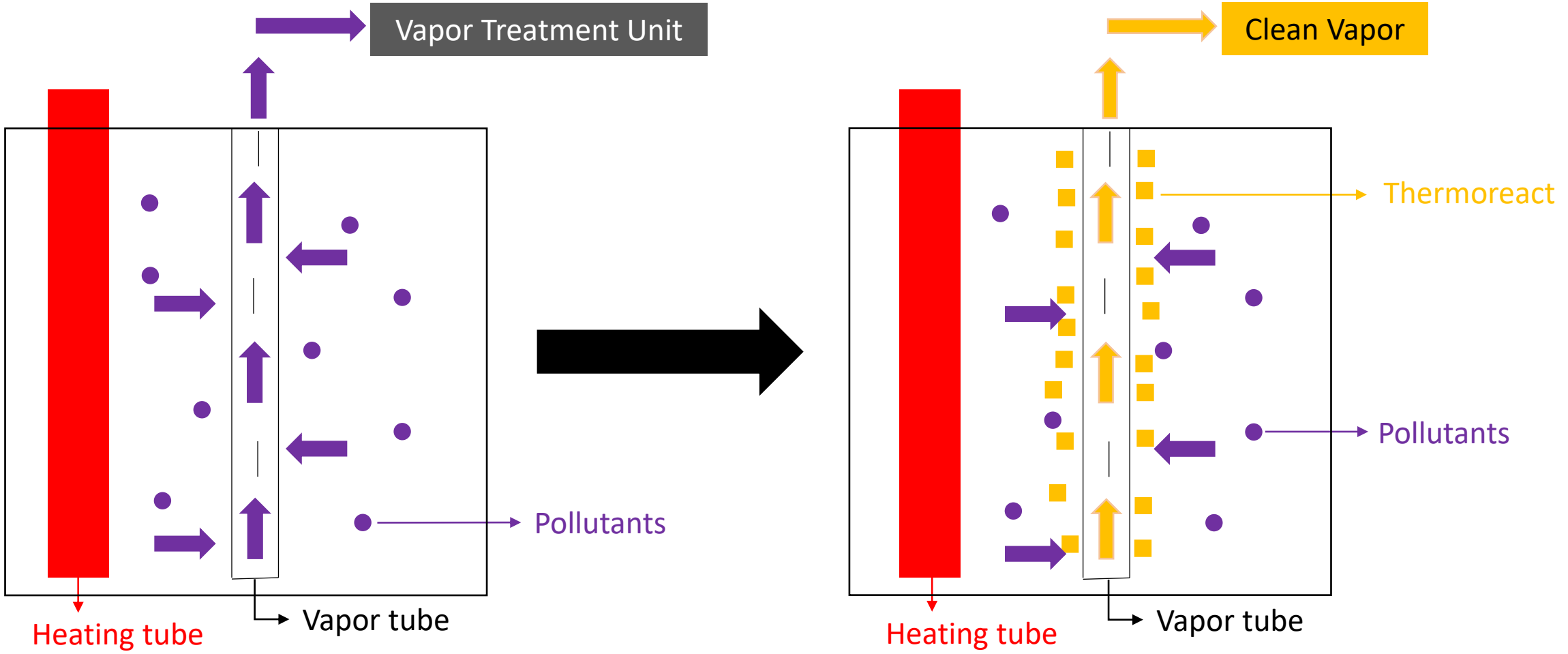


- Now, with Thermoreact
  - Halogens, sulfur, phosphorus and mercury are



- ✓ Reduce the size of the installation and thus the cost
- ✓ Facilitate monitoring of treatment (no degradation of materials)

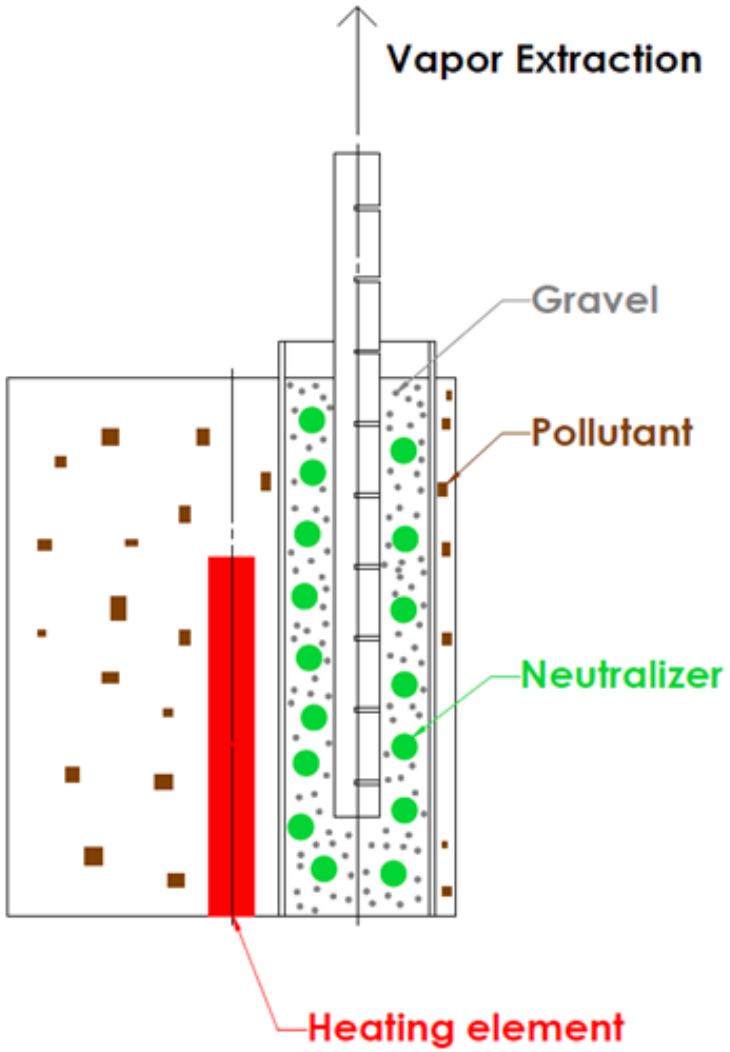
Thermoreact - **Principle**



Without Thermoreact

With Thermoreact

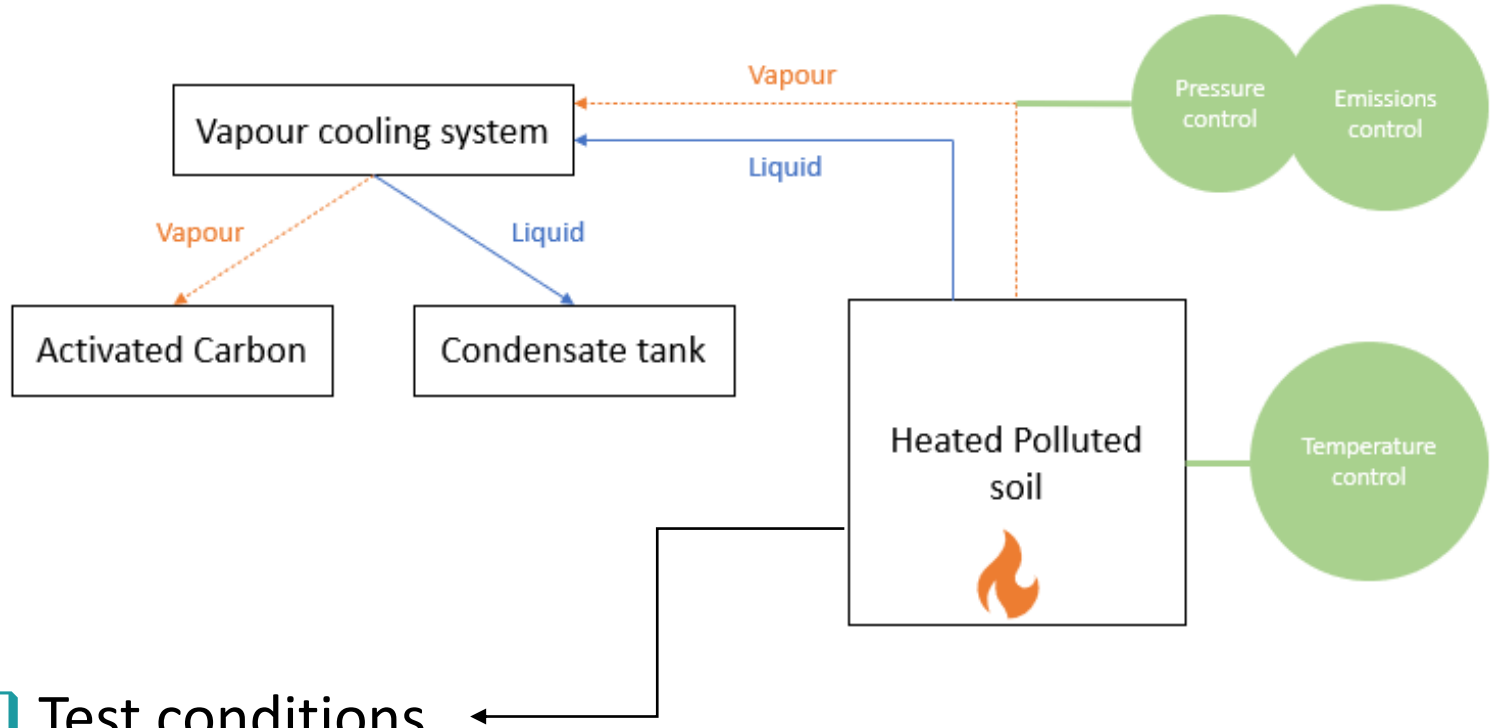
Thermoreact - **Composition**



- Our conventionnal gravel around our vapor tube are mixed with an **active solid and granular alkaline mineral:**
  - hydroxide, hydrated calcium carbonate or sodium bicarbonate, zeolites, etc.
  - its composition varies in function of the pollutants in order to obtain the best neutralization
  - with dimensions comprising between 2 and 70 mm

04 Experiments with one application of thermoreact

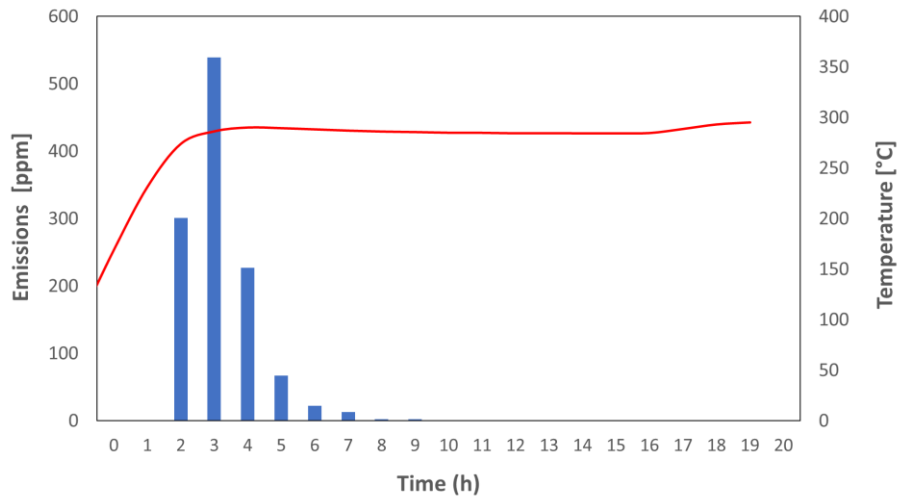
Laboratory **tests**



- Test conditions
  - Soil polluted with sulfur
  - Composition of Thermoreact :
    - 0/100 - gravel
    - 15/85 - granular quicklime/ gravel
    - 100/0 - granular quicklime/ gravel

Neutralization of sulfur vapors with lime – **Vapor analysis**

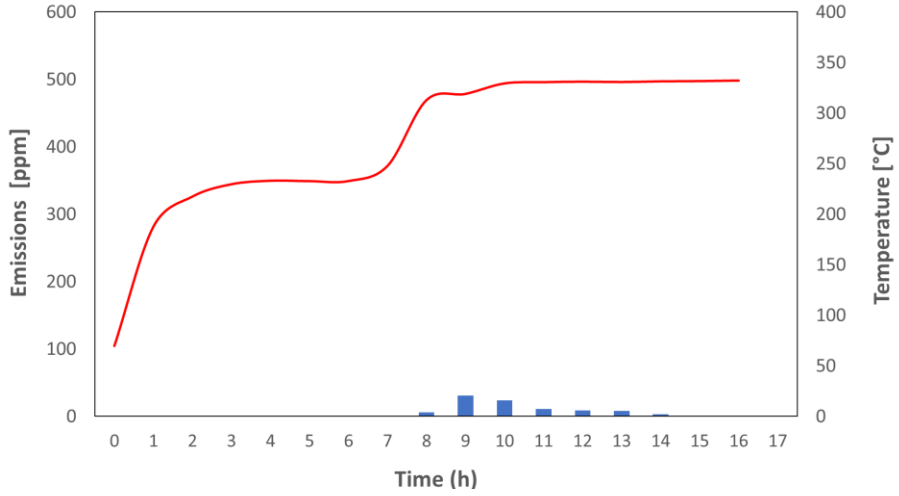
Without Thermoreact



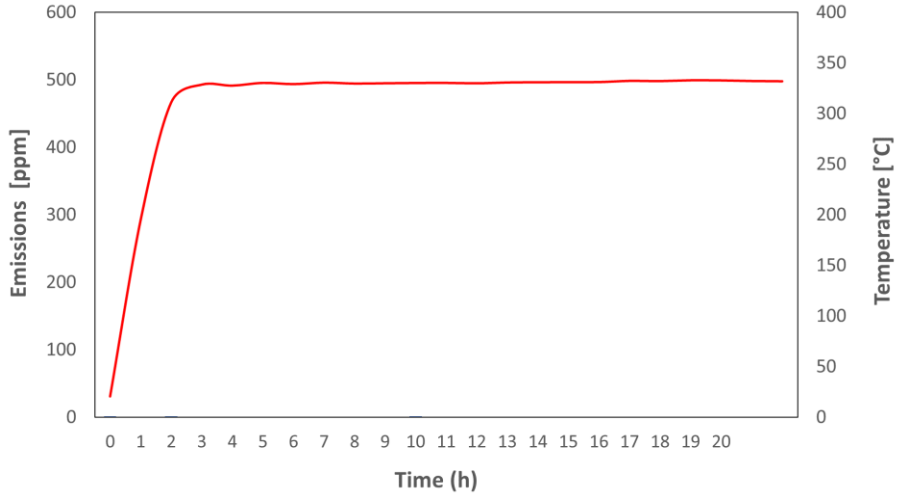
SO2 emissions

Temperature of the soil

With Thermoreact



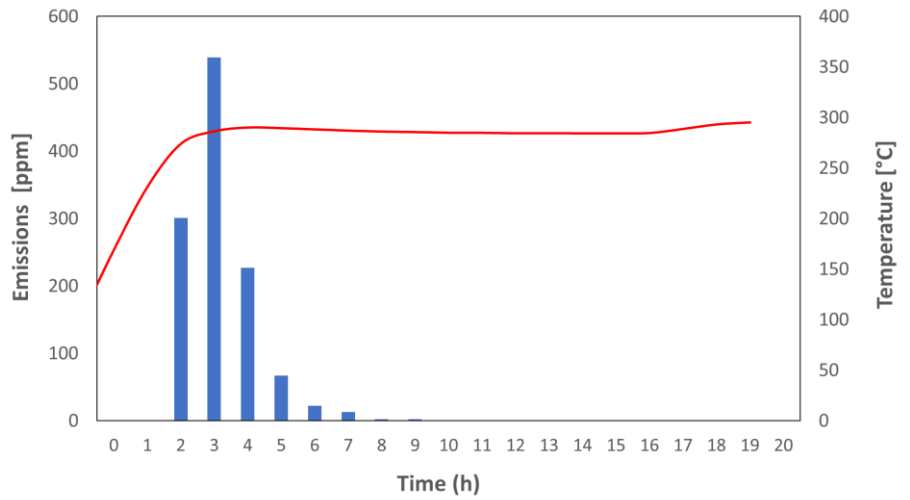
15/85 of granular quicklime/ gravel mass filter



100/0 of granular quicklime/ gravel mass filter

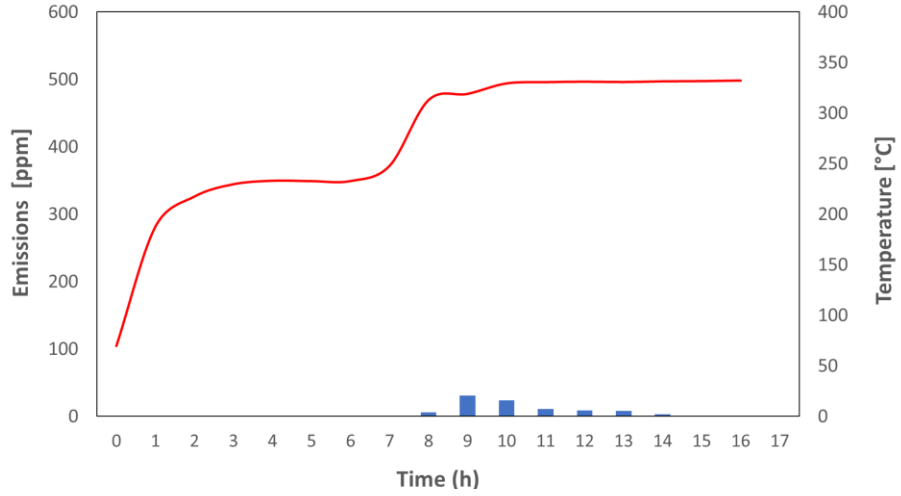
Neutralization of sulfur vapors with lime – **Vapor analysis**

Without Thermoreact

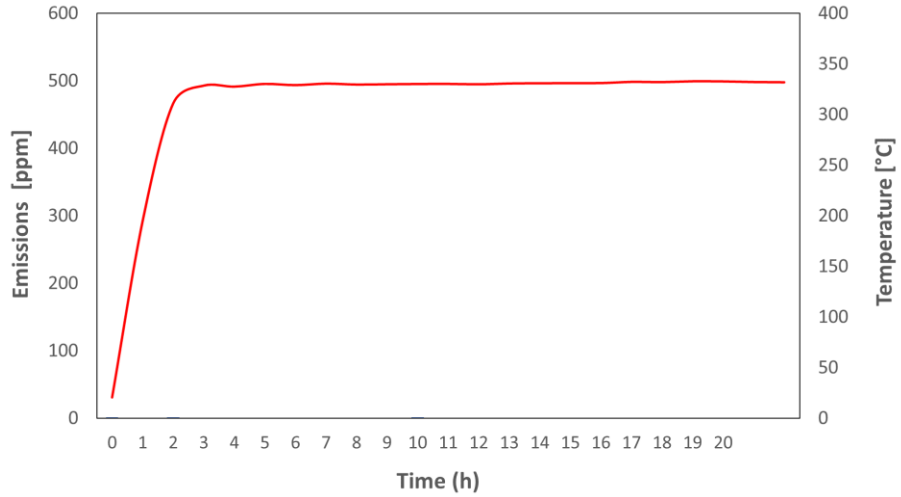


Thermoreact allows the sulfur to be **neutralized** prior to vapor extraction

With Thermoreact

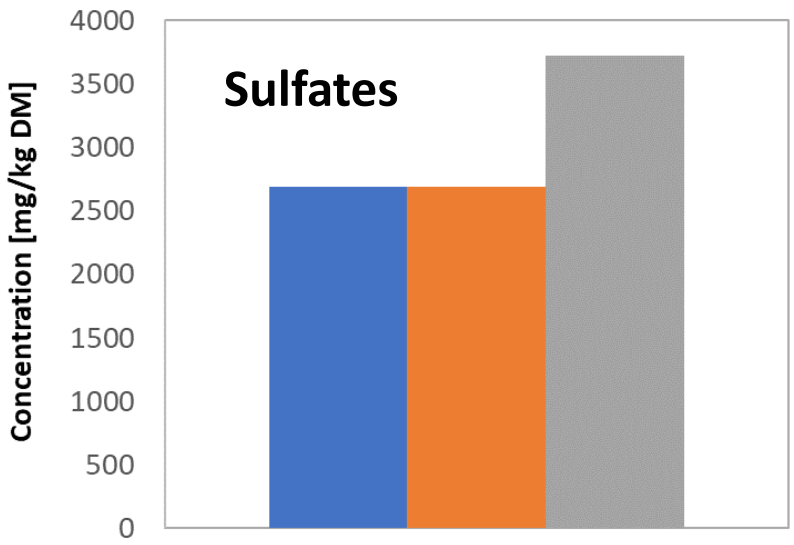


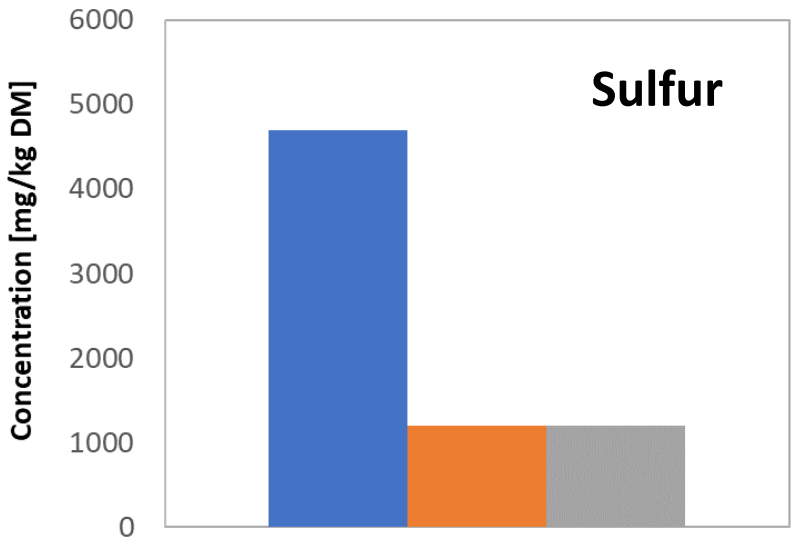
15/85 of granular quicklime/ gravel mass filter



100/0 of granular quicklime/ gravel mass filter

Neutralization of sulfur vapors with lime – **Soil analysis**





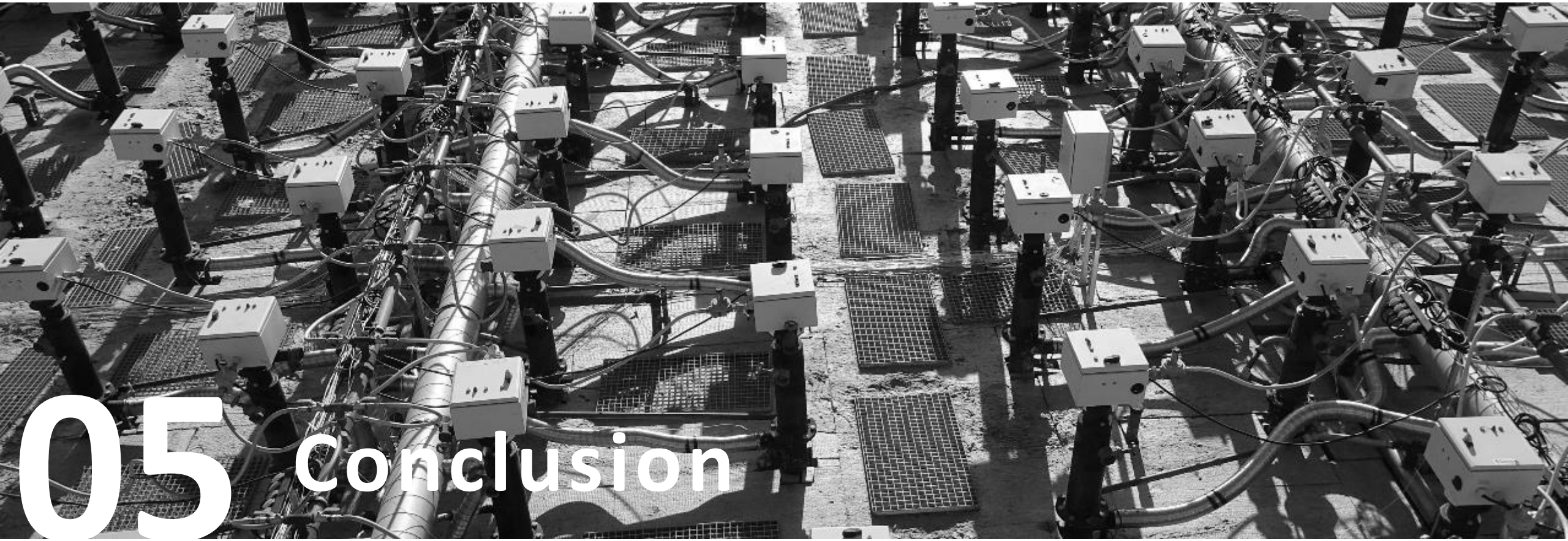
Before any treatment

After thermal treatment **without** Thermoreact

After thermal treatment **with** Thermoreact

The quicklime neutralizes SO2 from the vapor phase by the following acid/base reactions:

- $CaO + H_2SO_4 \rightarrow CaSO_4 + H_2O$
- $CaO + SO_2 \rightarrow CaSO_3$
- $CaO + SO_3 \rightarrow CaSO_4$



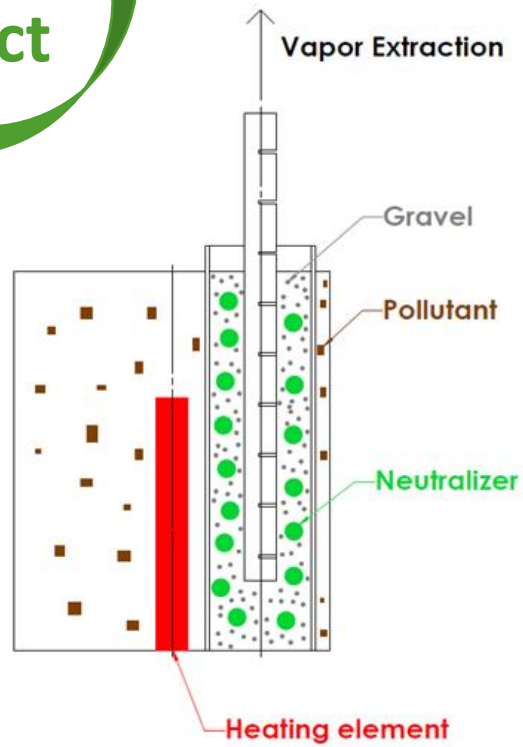
05 Conclusion

Conclusion

Vaporized during thermal desorption → Extracted from the soil → Sent to a vapor treatment unit → Neutralize **Ex situ**

Utilisation of Thermoreact

Vaporized during thermal desorption → Neutralize **In situ**



Exemples of Problems

- ✓ Reduce the size of the installation and thus the cost
- ✓ Facilitate monitoring of treatment - no degradation of materials and less staff


Haemers®
technologies
Thank you for your attention !