Final eradication of Japanese knotweed by in situ or ex situ thermal treatment

Soilver June 5, 2024

Our company and technology

Haemers Technologies **TODAY**

Own Lab and R&D facility

Based in Brussels (Belgium)

Worldwide Operations

Own Smart Burners™ manufacturing facility

25+ Years in Business

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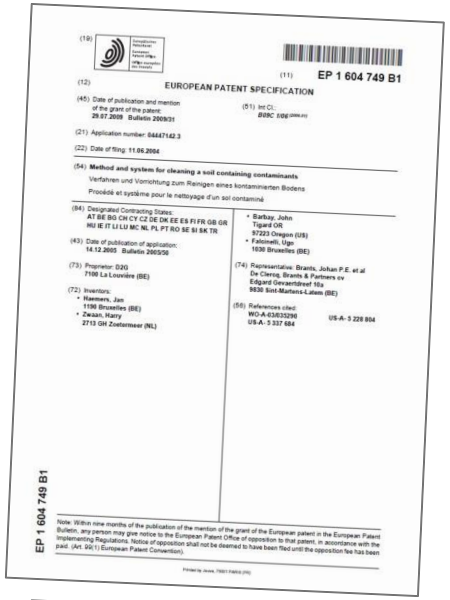
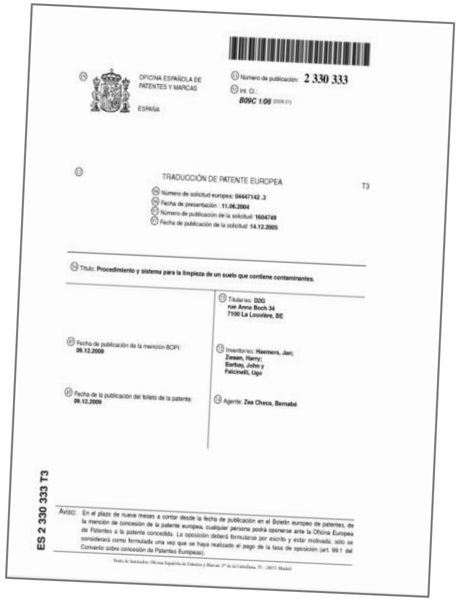
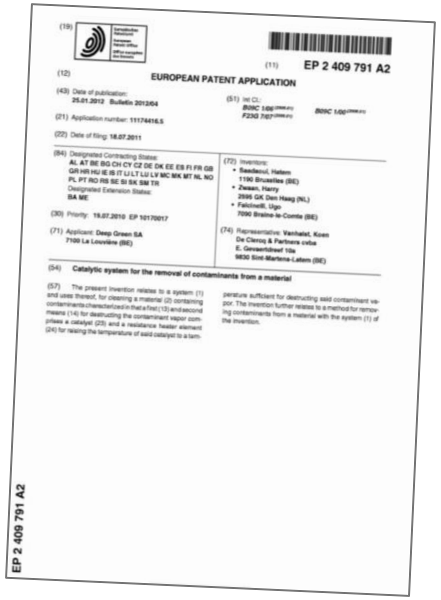
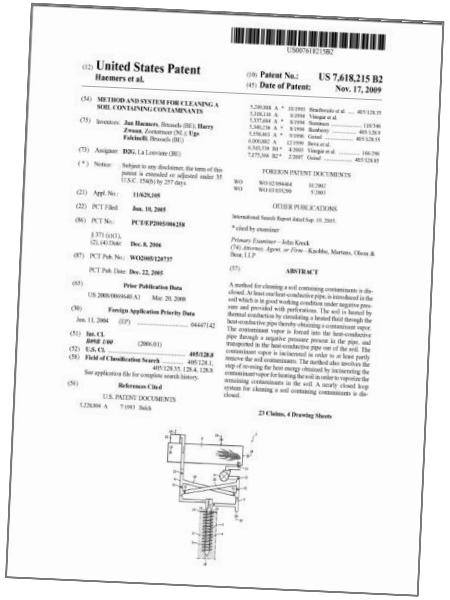
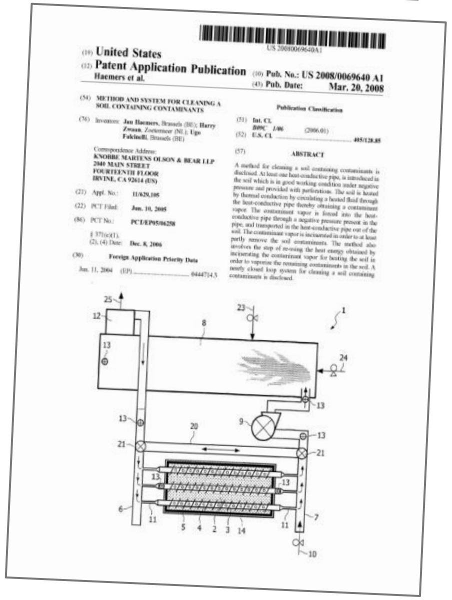
R&D and International Patents

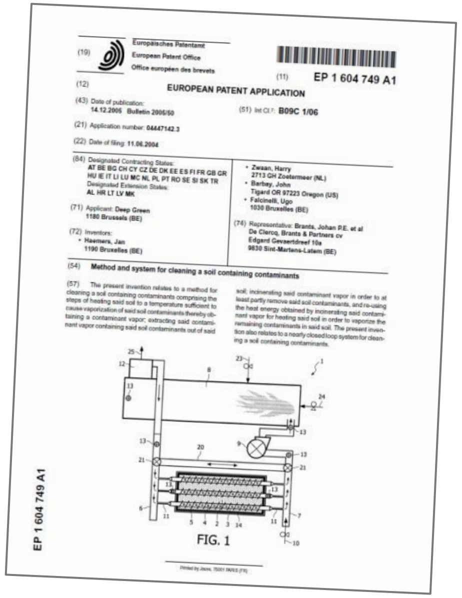


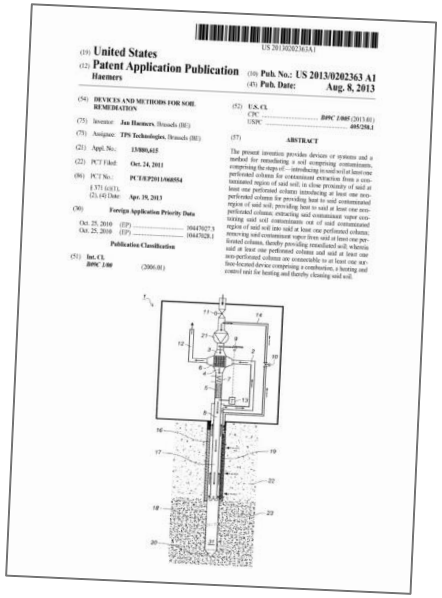


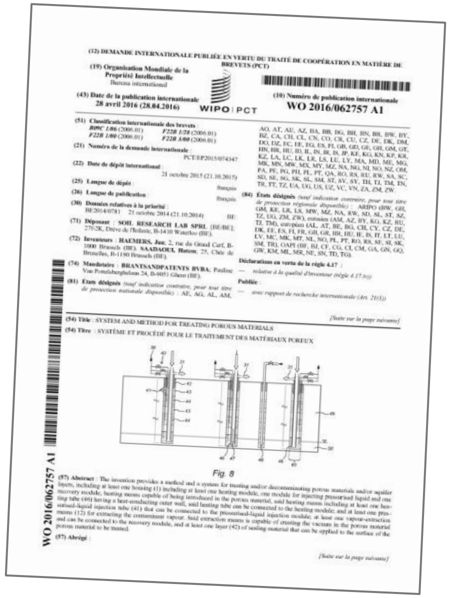












OPERATIONS **WORLDWIDE**

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

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HOW DOES **THERMAL DESORPTION** WORK ?

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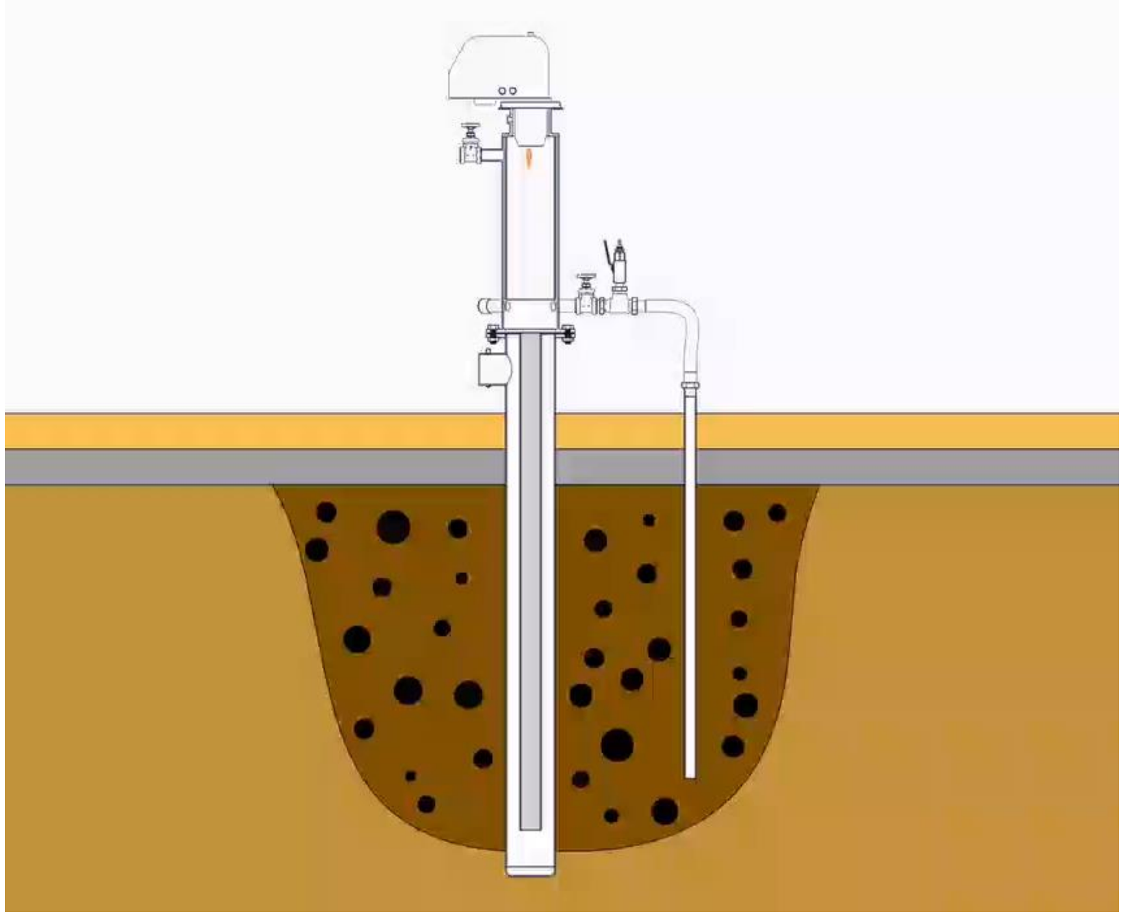

1. **HEATING** THE SOIL BY CONDUCTIVITY

Functioning: Each Smart burner is a unique processing unit applied in a specific pattern and individual and remote controllable
Objective : Vaporize contaminants

2. **RECOVER** CONTAMINANTS

Extract from soil all vaporized contaminants

3. **TREAT** THE CONTAMINANTS

As **fuel** (in the burners) or
as **liquid product** (after condensation)

Large Scale Hydrocarbons Pollution (EU refinery)

Gela, Italy

- In partnership with ICARO Ecology and SIMAM
- 100,000 tons have to be remediated in 46 months and 22 batches.
- 350 burners have been built for this project, as well as a fully custom-designed vapor treatment unit.
- Contaminants are multiple and complex ranging from heavy hydrocarbons to mercury and chlorinated solvents.

ADVANTAGES OF THERMAL DESORPTION ?

TREATMENT
IN SITU OF EX SITU

FLEXIBLE, SCALABLE
AND EASY TO
MANAGE

IN OR NEAR
INFRASTRUCTURE

INNOVATIVE AND
PATENTED
TECHNOLOGY

EASY TO TRANSPORT,
INSTALL AND
DISMANTLE

SUSTAINABLE AND
CIRCULAR

FAST TREATMENT
IN A FEW WEEKS

LIMITED
INCONVENIENCE
DURING
TREATMENT

COMPETITIVE AND
FIXED PRICES

GUARANTEED
RESULT:
CLEANED SOIL

Eradication of Japanese knotweed

Why we started eradicating Japanese knotweed

- Technology not invented for the treatment of Japanese knotweed
- Destruction of Japanese knotweed by destroying the cell wall of the rhizomes matched features of our technology
- An affordable solution?
  - Low temperature -> not vaporizing groundwater
  - No contaminated vapours and so no vapour treatment unit necessary
- 3 experiments
  - Lab
  - Ex-situ
  - In-situ

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Research


KU LEUVEN

DEPARTEMENT AARD- EN OMGEVINGSWETENSCHAPPEN
KU Leuven

Treatment of Japanese knotweed-infested soils by thermal desorption

6. Conclusions

Japanese knotweed is an invasive alien species causing much harm to native biodiversity and human structures such as roads, buildings and dikes. Current management strategies are often not very successful and could even increase the risk of spread. According to the literature, heating the roots could be a potentially interesting avenue to eradicate knotweed populations. Here, we investigated the feasibility and effectiveness of the Smart Burners™ technology, patented by HAEMERS Technologies to treat invaded sites.

We conducted three experiments to test and optimize the treatment. In the first experiment conducted in lab conditions, we tried to identify the optimal temperature and treatment period to kill 100% of the rhizomes. Three days at 50°C or 1 day at 80°C were identified as effective warming treatments. This information was subsequently applied in an ex-situ and situ experiment. In the ex situ experiment, knotweed rhizomes and soil were transferred in a steel container of 3 m^3 and heated for 1 day at 80°C. The results of this experiment confirmed the conclusions of the first experiment: no rhizomes were found to survive the applied treatment. In the last experiment, the technology was tested under field conditions. A full-scale set-up was installed in an invaded site in the Netherlands and the soil was heated up to 4 meters deep to a temperature of 50°C for 3 days and a temperature of 80°C for one day. Although the latter temperature goal was not achieved at all monitored locations at the treated site, no living roots were found after the treatment.

From these experiments, we conclude that the Smart Burners™ technology of HAEMERS technologies could be used to eradicate knotweed species. Importantly, the experiments were performed during spring and summer. Effectivity of the proposed treatment in winter conditions, when all energy of the plant is stored belowground, remains to be tested. Careful screening of the site before treatment is always necessary to accurately map the rhizome network to treat a sufficiently large area. During the treatment, all precautions should be taken to avoid the additional spread of rhizomes or stem fragments, as they could start new populations. Finally, monitoring the treated site for several years is also recommended to check for any regrowth and to take corresponding actions.

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Experiment 1: Lab kinetic testing

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Table 1. Number of rhizome fragments for three size categories (thin (< 1 cm diameter), medium (1 – 1.5 cm) and thick (>1.5 cm)) in each of the warming treatments

	50°C			80°C		
Heating period	Thin	Medium	Thick	Thin	Medium	Thick
1 day	7	7	6	12	9	3
2 days	2	11	2	3	21	2
3 days	5	7	3	15	3	2

Table 4. Survival rates (% of the planted rhizomes) of the rhizomes of experiment 1 for the three size categories (thin (< 1 cm diameter), medium (1 – 1.5 cm) and thick (>1.5 cm)) in each of the warming treatments

	50°C			80°C		
Heating period	Thin	Medium	Thick	Thin	Medium	Thick
1 day	57	43	50	0	0	0
2 days	50	0	0	0	0	0
3 days	0	0	0	0	0	0

Experiment 2: ex-situ Antwerp/Brussels

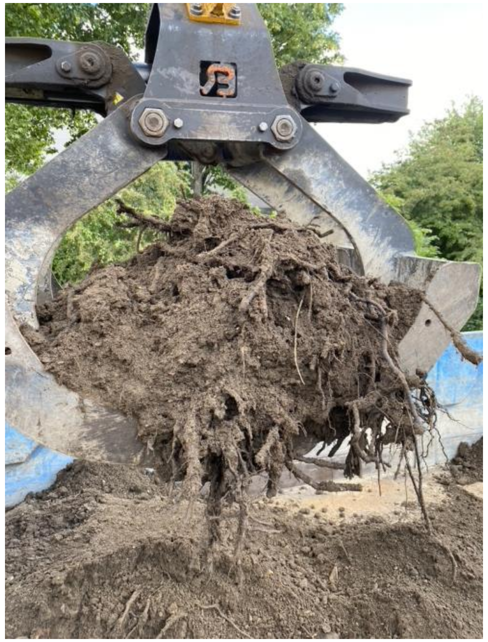

Table 2. In the second experiment, 156 rhizome fragments were planted in the greenhouse. The control fragments (each 20 cm in length) were homogeneously divided across the three thickness classes and three sampled soil depths. Roots from different depths were mixed before the treatment

	Thin (< 1 cm)	Medium (1 – 1.5 cm)	Thick (> 1.5 cm)
Control			
0-30 cm	8	8	8
30-60 cm	8	8	8
60-90 cm	8	8	8
Treatment	46	19	19

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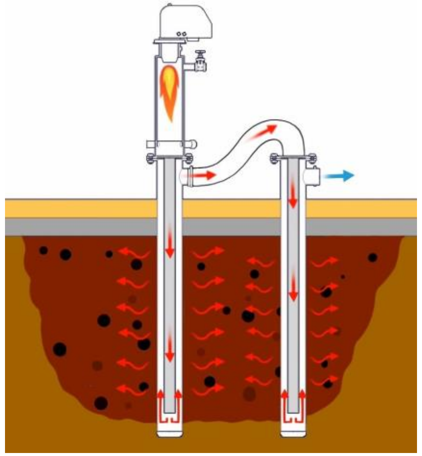
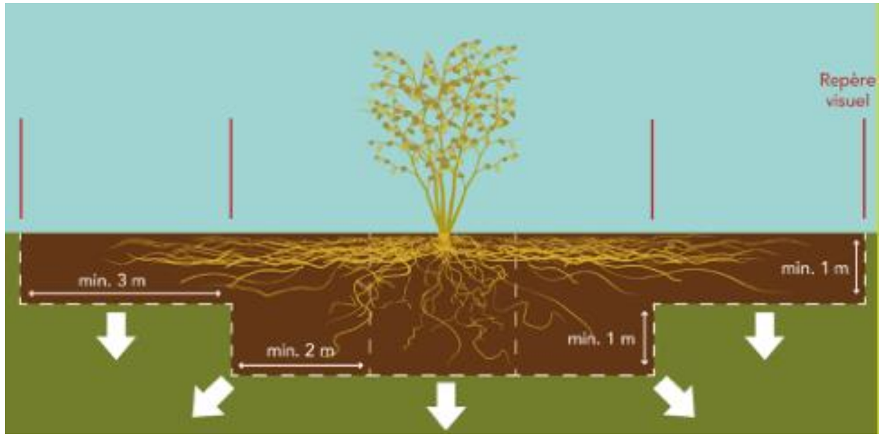
Experiment 3: in-situ Heerlen (NL)





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Experiment 3: in-situ before (06/2022) and after (06/2023)

Before treatment

After treatment

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Conclusions

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- Speciality = controlled heating i.e. guaranteed desired temperature and duration in entire zone
- Environmentally friendly: low temperature, short duration, no residues left behind
- Tailor-made: particularly flexible system scalable to size and depth of plant and context
- Adaptable: tubes can be placed vertical, horizontal and diagonal
- Polyvalent: industrial sites and open spaces, on sloping verges or close to infrastructure
- On-site processing (in more remote locations): so no excavation or transport of soil
- Very limited impact: no noise, odour or traffic during process
- Continuously monitorable and controllable from a distance: predictable result
- Rapid regrowth after treatment
- **Permanent removal with short processing time**

Research questions

- Determining the minimum treatment depth
- Optimising treatment temperature and duration
- Simple determination of treatment zone (without digging)
- Soil life research
- Legal framework for treated soil
- Further adaptation of technology to treat Japanese knotweed

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Thank you for your attention!