

ESTD/ E-22-04 BIEN HOA (VN)

Context & Project Description

During the US-Vietnam War, millions of liters of herbicides were dropped over Vietnam: The Rainbow agents. Agent Orange was proven to cause severe health issues, including birth defects, neurological problems and cancers. More than four decades after the Vietnam War ended (in 1975), the stability and bioaccumulation of dioxins- originating from agent orange- still affect the inhabitants.

The Center for Technology Environmental Treatment/Chemical Force (CTET/CF), the GAET Corporation and HAEMERS Technologies SA agreed to establish a joint operation to proceed testing activities proving the effectiveness of thermal desorption treatment on dioxin-contaminated soils at Biên Hòa Airbase.

The key objective of the trial treatment is to demonstrate the effectiveness of the Smart Burners treatment technology and design in order to meet the site-specific dioxins and furans target levels.

The target temperature of 335°C is reached after 40 days of heat treatment. A destruction rate efficiency of dioxins of 99% is achieved. Particularity of the project lies in the method of treatment of the vapors via a thermal oxidizer, demonstrating compliant emissions and avoiding the generation of any solid or liquid waste. The project demonstrates that ESTD with a Thermal Oxidizer is a very effective technology for treating dioxin-contaminated soils in the most sustainable way



Equipment

Therefore, Haemers Technologies has designed a thermal treatment pilot plant composed of two main units:

The thermal pile of 237m³ composed of 3 types of materials: 187m³ of contaminated soils, 25m³ of contaminated sludges and 25m³ of soil washing cake.

The vapor treatment unit where dioxins are destroyed composed of a Thermal Oxidizer, avoiding the production of any liquid and solid waste.

Treatment target

Material	Unit	Initial Concentration	Treatment Goal	Treated Soil Results	Destruction Rate Efficiency
Soil	ppt WHO-TEQ ₂₀₀₅	11.400	300 (Urban residential)	4,84	99,96%
			1200 (Industrial)	96,29	99,16%
Sludges	ppt WHO-TEQ ₂₀₀₅	5.410	150	ND	>99,99%
Washing cake	ppt WHO-TEQ ₂₀₀₅	17.200	300	6,7	99,96%

Key words

Contaminants
Dioxins

Max. concentration
Soil: 11.400 ppt WHO-TEQ₂₀₀₅
Sludges: 5.410 ppt WHO-TEQ₂₀₀₅
Washing cake: 17.200 ppt WHO-TEQ₂₀₀₅

Volume
237 m³

Tonnage
426 T

Nb of heating tubes
15

Temperature Target
335°C

Project duration
40 days in total

Treatment targets
Soil: 300 ppt WHO-TEQ₂₀₀₅
Sludges: 150 ppt WHO-TEQ₂₀₀₅
Washing cake: 300 ppt WHO-TEQ₂₀₀₅

Location
Biên Hòa Airbase, Vietnam

Future Use
/ (demo pile)

Client
**The Center for Technology
Environmental Treatment/
Chemical Force**

Partner
GAET Corporation

Date
2020-2022



Key words

Contaminants

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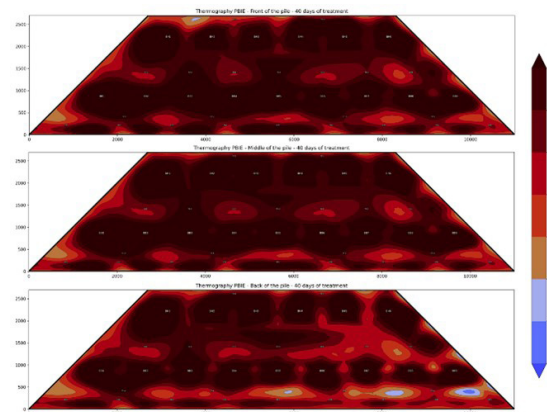
Date

2020-2022

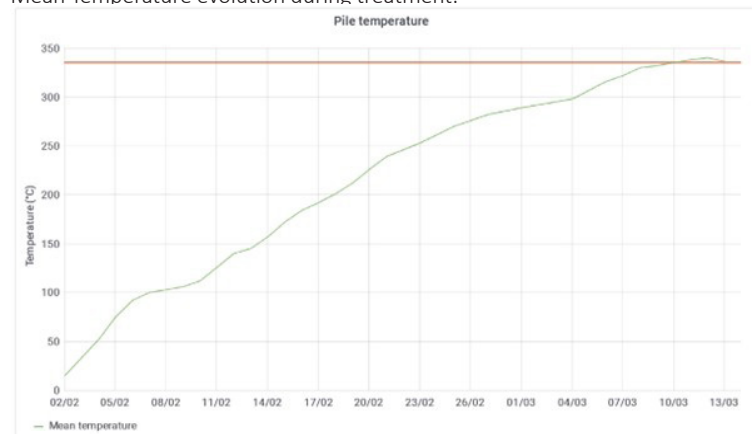
Monitoring

1) Temperature in the pile

335°C has been reached in the thermal pile after 40 heating days.



Mean Temperature evolution during treatment:

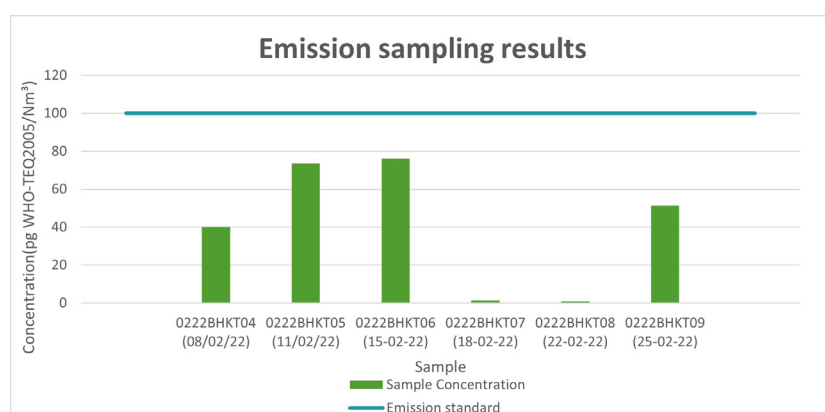


2) Soil pressure and Ambient Air monitoring

Vacuum was maintained in the thermal pile throughout the treatment (pressure < 0 mbar). These results demonstrate that no fugitive emissions occurred. Results of ambient air monitoring (conducted by the CTET) also confirm these findings (< 0,6 pg-TEQ/m³).

3) Emission control

The temperature in the Thermal Oxidizer maintained over 1.100°C during all treatment resulting in compliant emission at the stack (< 0,1 ng-TEQ/Nm³). Air emissions were fully compliant with VN, EU and US standards.





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Planning

Although the project was mobilized and started early 2020, it was interrupted due to the COVID pandemic. At the end of December 2021, Haemers returned on site and resumed its activities to fulfill its commitment on the demonstration project. On February 2nd 2022, the pile was restarted. Treatment stopped on March 14th, 2022, after 40 days of treatment. HT left the site on April 2022.



Conclusion

Haemers Technologies' pilot thermal desorption treatment of very heavily dioxin-contaminated soils has demonstrated that:

- Ex-situ thermal desorption can effectively recycle highly dioxin-contaminated soils to residential levels for subsequent beneficial use.
- Haemers Technologies' design has proven to be effective in destroying dioxin and producing zero waste.
- Haemers Technologies' operations have proven to be fully compliant with air emission and did not affect ambient air quality.



The pilot project demonstrated that Ex-Situ Thermal Desorption with diesel burners is a very effective technology for treating dioxin-contaminated soils in the most sustainable way.