

Scaling up of Dioxin Contaminated Soil Thermal Desorption Treatment: Laboratory tests and pilot conception at Bien Hoa Airbase, Vietnam

A. JORDENS, H. SAADAoui, J. HAEMERS. HAEMERS Technologies

During the US-Vietnam War, millions of litres of herbicides were dropped over Vietnam: The Rainbow agents. Bien Hoa Airbase was a joint operating base for the South Vietnam Air Force and the United States Air Force where thousands of barrels of Agent Orange were stored.

Agent Orange was proven to cause severe health issues, including birth defects, neurological problems and cancers. Agent Orange is a mixture of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic. Traces of dioxins were also found in some Agents. Indeed, dioxin 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) can be formed by condensation of 2,4,5-trichlorophenol during 2,4,5-trichlorophenoxyacetic synthesis. Dioxins are generally very insoluble in water, are lipophilic and are very persistent.

More than four decades after the Vietnam War ended (in 1975), the stability and bioaccumulation of dioxins still affect the inhabitants. Measures had to be taken to improve living conditions for residents, starting with the remediation of dioxin contaminated soil.

A pilot of *In Situ* Thermal Desorption (ISTD) and *Ex Situ* Thermal desorption (ESTD) will be conducted by HAEMERS Technologies © at Bien Hoa Airbase in the beginning of 2019, in combination with soil washing.

To prepare this pilot project, laboratory tests have been completed with contaminated soil from the Bien Hoa Airbase. Treating the soil at +/-350°C and maintaining this temperature during at least 5 days reduces the TEQ-TCDD concentrations by 77,5%: a decrease of 2800 ng/ Kg Ms TEQ-TCDD to 630 ng/Kg Ms has been observed. However, the minimum initial TEQ-TCDD concentration required is 1000 ng/Kg Ms to observe a significant reduction. These results report that for the dioxins, Thermal Desorption Treatment can ensure efficient outcomes. Certainly, Thermal Desorption functions according to temperature and time and a couple of more days at 350°C will be enough to discharge most of them.

The design of the pilot project at Bien Hoa Airbase has been based on the result obtained by the laboratory tests. The first step of Thermal Desorption is the heating and vaporizing of dioxins impacted soil. The second step consists of recovering and treating the vapors containing contaminants and associated vaporized products.

Various methods exist to treat those vapors. Thermal oxidation is one of this methods. It has been selected for this project because of it does not generate any liquid or solid waste during treatment. By oxidizing the vapor flow at high temperature, only gaseous emissions will be produced. Proper oxidation guarantees compliant air emissions, with no waste left behind.