

STARx (*Ex Situ*) Hottpad™ Pilot Test for the Treatment of Petroleum Hydrocarbon-Impacted Soils

Former Base Oil and Lubricant Blending Plant, Kaohsiung City, Taiwan



Overview

The subject Site is a former base oil and lubricant blending plant in Kaohsiung City, Taiwan. A STARx Hottpad™ pilot test was conducted to treat petroleum hydrocarbon-impacted soil. The system consisted of two pilot scale Hottpad™ units equipped with heating elements for ignition and an air distribution system to support the smoldering combustion reaction. Each unit had the capacity to treat approximately 1.2 cubic meters (m³) of soil at a time and both were installed within a shipping container for fast and simple mobilization (IMAGE 1). Ancillary equipment associated with the Hottpad™ system included blowers for air delivery, a vapor collection system, and a control system for air flow and heater operation.



IMAGE 1: Dual Hottpad™ pilot system each with a capacity to treat approximately 1.2 m³ of soil.

Conclusions

The STARx technology is a rapid, safe, and low cost treatment option for hydrocarbon-impacted soils.

The Hottpad™ system installed in Taiwan:

- Demonstrated self-sustaining smoldering combustion (i.e., no energy input into the system following ignition); and
- Reduced hydrocarbon concentrations to low or near non-detect levels demonstrating excellent treatment efficiency.

System Operation

A total of seven (7) tests were conducted to assess the treatment of hydrocarbon-impacted soils for a range of soil types (i.e., silt, sand, and gravelly sand) and contaminant concentrations (i.e., 4,000 to 32,000 milligrams per kilogram [mg/kg]) (IMAGE 2). Each soil type was placed on the Hottpad™ system for treatment then covered with a clean soil cap to act as a heat sink and a vapor collection system prior to initiation of smoldering. The results of the pilot tests allowed for the collection of Site-specific parameters critical for full-scale design and technology assessment, including treatment efficiency, heating times required to achieve ignition, smoldering front propagation rate, and emissions composition.



IMAGE 2: Petroleum hydrocarbon-impacted silts loaded into Pilot Hottpad™ #1.

Pilot testing successfully demonstrated treatment of Site silt and gravelly sands at initial total petroleum hydrocarbon (TPH) concentrations near to or greater than approximately 4,000 mg/kg. Following STARx treatment, TPH concentrations were often reduced to non-detect levels, with limited areas containing residual TPH (i.e., less than 300 mg/kg) (IMAGE 3). It was also demonstrated that low concentrations of canola oil can be used as an amendment to permit robust treatment of lower concentration Site soils, if desired, to expand the range of soils treatable via STARx.

A unique observation during testing was the hardening of Site sands during the pre-heating (ignition) process. This effect was found only for the sands and was due to limitations with the supplied blower equipment preventing adequate air distribution. Using a blower with a higher pressure capacity and/or blending of silt and sands prior to treatment overcomes this issue.



IMAGE 3: Silts before and after STARx treatment.