STARx (Ex Situ) Hottpad™ Pilot Test for the Treatment of Oil Sludge

Sludge Disposal and Brick Manufacturing Facility, Shaanxi, China

Overview

Savron's partner firm in China, JSDDBS (www.JSDDBS.com), worked with Savron staff to conduct STARx Hottpad™ pilot testing at a sludge disposal and brick manufacturing facility in Shaanxi, China. The test was conducted to assess the treatment of three different sources of oil sludge waste, as well as a stockpile of oil-covered bags generated as a waste stream in the facility (IMAGE 1). The system consisted of two pilot scale Hottpad™ units equipped with the 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 (m^3) of soil at a time and both were installed within a shipping container for fast and simple mobilization (IMAGE 2). Ancillary equipment associated with the Hottpad™ system included blowers for air delivery, a vapor collection system, and a control system for heater operation and air flow control.

IMAGE 1: Oil sludge and oil covered bags requiring treatment

IMAGE 2: Dual Hottpad™ pilot system installed within a shipping container for rapid mobilization

Conclusions

The STARx technology is a rapid, safe, and low cost treatment option for oil sludge waste in China. The Hottpad™ system pilot test in Shaanxi, China:

- Demonstrated self-sustaining smoldering combustion (i.e., no energy input into the system following ignition);
- Demonstrated effective use of silty site soils as a porous medium to enable smoldering of oily sludge;
- Reduced sludge concentrations to near non-detect levels demonstrating excellent treatment efficiency;
- Determined that a mixing ratio of 2:1 (soil:sludge) resulted in optimal sludge processing rates for site-specific materials, while minimizing the potential for sludge mobilization within the Hottpad™ during treatment; and,
- Demonstrated effective treatment of other oil waste materials (i.e., shredded oil covered bags), when mixed with soil and sludge.

System Operation

To assess STARx treatment, the oil sludge was mixed with Site soil at varying concentrations to create a mixture that will readily smolder. Each batch of the mixture was then placed on the Hottpad™ system for treatment. The pile was covered with a clean soil cap to act as a heat sink and connected to a vapor collection system prior to initiation of smoldering. A total of eight (8) tests were conducted to assess treatment of mixtures with varying sludge content for each sludge type.

TABLE 1: Test parameters and analytical results

Test No.	Soil Type	Soil:Sludge: Shredded Bag Ratio	Sludge Type	Propagation Rate (m/d)	Total Petroleum Hydrocarbon Concentrations (mg/kg)	
					Pre-STARx	Post-STARx
1	Quartz sand	13:1:0	Pond #1	0.43	3,360*	7*
2	Site soil	13:1:0	Pond #1	0.37	7,830*	7*
3	Site soil	6:1:0	Pond #1	0.15	13,000*	79
4	Site soil	8:1:0	Pond #2	0.22	5,510*	ND
5	Site soil	4:1:0	Centrifuge	0.15	16,800*	ND
6	Site soil	4:3:0	Pond #2	0.13	30,600*	ND
7	Site soil	2:1:0	Centrifuge	0.17	25,300*	167
8	Site soil	1:1:1	Pond #2	0.12	66,300*	ND

Notes:
ND = non detect
* Soil samples analyzed for mineral oil using method CJ/T 221 (as required by local regulatory standards). All other samples analyzed for total petroleum hydrocarbons (C6 to C36) using USEPA 8260D/8015C.

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, emissions composition, and optimization of mixing ratios and operational parameters. Analytical data showed excellent treatment efficiency (TABLE 1). These data were confirmed through visual comparison of the mixture before and after system operation (IMAGE 3).

IMAGE 3: Photographs of treatment materials (soil and sludge mixture) before and after STARx treatment