Ivey International Inc.

"Today's Environmental Solutions For A Better Tomorrow"®

Ivey-sol® Surfactant Enhanced Soil Washing Technology Overview and Project Experience

Ivey-sol® surfactant enhanced soil washing is an ex-situ SER® treatment technology which removes hazardous substances from contaminated soil and solids such as clay, silt, sand and gravel, drilling cuttings and drilling mud. The process (Figure 1-1) involves the introduction of the contaminated soil into a treatment chamber, which contains Ivey-sol® and water liquid medium. The soil is then mixed or agitated to ensure effective contact between Ivey-sol® surfactants and the absorbed 'surface bound' contamination. Upon contact, the Ivey-sol® surfactants liberate the contamination to the aqueous water phase (i.e., dissolves them). Following the treatment, the soil and water are easily separated to yield clean soil (Figure 1-2) that can be re-used on-site, and contaminated effluent water which is then separated for further treatment on-site.

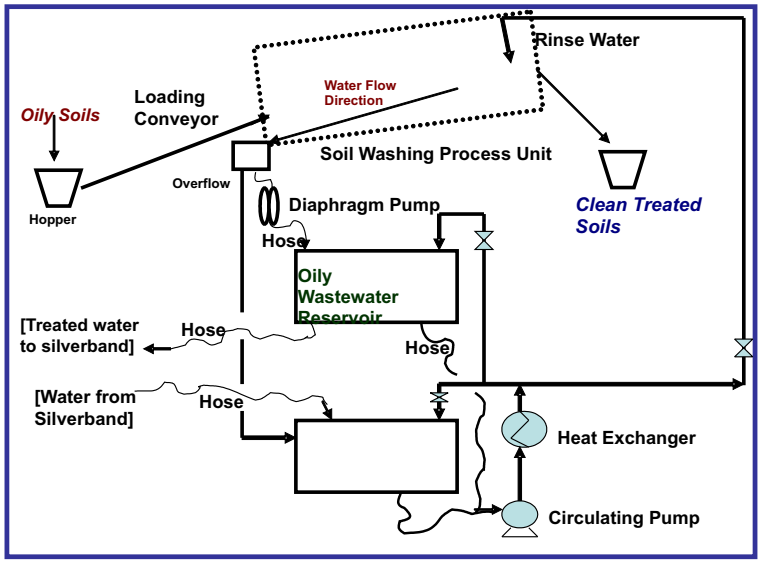

Fig. 1-1: Schematic of a typical soil washing process (actual process will vary from system to system)

Fig. 1-2: Ivey-sol® soil washing: pre and post treated soil from an industrial SER® soil washing process

Project Experience

Refinery Site (>5000 Tons)

Contaminated soil with a baseline concentration of 40,000 ppm (4%). Ex-situ Ivey-sol® Soil Washing SER® Process achieved applicable soil remediation site objectives. Project data set provided below showing pre and post soil washing remediation results with time based sample analysis.

SOIL PARAMETER	BASE LINE	5 MINUTES	7 MINUTES	REDUCTIONS
CCME F1 C6-10	72 ppm	< 1 ppm	< 1 ppm	100%
CCME F1 BTEX	71 ppm	< 1 ppm	< 1 ppm	100%
CCME F2 C10-16	417 ppm	35 ppm	21 ppm	95%
CCME F3 C16-34	13,600 ppm	1,600 ppm	826 ppm	94%
CCME F4 C34-50	5,060 ppm	512 ppm	259 ppm	95%
CCME F4 C34-50+	13,000 ppm	571 ppm	290 ppm	98%

Note: CCME = Canadian Council of Ministers for the Environment. From CCME Soil and Water Clean-up Guideline Parameters.

Waste Oil Contaminated Site (>1000 Tons)

Contaminated soil with a baseline mid-range hydrocarbon concentration of 4,500 ppm. Ex-situ Ivey-sol® Soil Washing SER® Process exceeded applicable soil remediation site objectives for the commercial site. Date shows time based results to show how rapid treatment was.

SOIL PARAMETER	BASE LINE	5 MINUTES	7 MINUTES	REDUCTIONS
VH C6-10	2 ppm	< 2 ppm	< 2 ppm	100%
VH C6-10 (minus)	< 2 ppm	< 2 ppm	< 2 ppm	100%
LEPHs C10-19	191 ppm	191 ppm	46 ppm	76%
HEPHs C19-32	4,430 ppm	1,690 ppm	446 ppm	90%
VPH	< 2 ppm	< 2 ppm	< 2 ppm	100%

Note: VH = Volatile Hydrocarbons
LEPH = Light Extractable Hydrocarbons
HEPH = Heavy Extractable Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
(From BC Environment Soil and Water Clean-up Guidelines)

Oil and Gas Project Site (>500 Tons)

Project involved Ivey-sol® soil washing of approximately 550 tons of F3 and F4 contaminated soils at >20,000 ppm. Reduced the soil contamination by between 78-100%.

SOIL PARAMETER	BASE LINE	POST TREATMENT	REDUCTIONS
CCME F1 C6-10	13 ppm	< 1 ppm	100%
CCME F1 BTEX	13 ppm	< 1 ppm	100%
CCME F2 C10-16	343 ppm	37 ppm	95%
CCME F3 C16-34	9,840 ppm	2,110 ppm	94%
CCME F4 C34-50	3,370 ppm	783 ppm	95%
CCME F4 C34-50+	12,000 ppm	1,630 ppm	98%

Note: CCME = Canadian Council of Ministers for the Environment. From CCME Soil and Water Clean-up Guideline Parameters.