

Ex-Situ Soil Washing – Achieving
Effective Mass Reduction for
Organic Contaminant in Soil via the
use of a Co solvent/Surfactant
Process



CHEMCO Inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR

Presentation summary



- About our Expertise, Products and Services
- Project Inception and Description
- Bench scale Treatability Study Results
- Geological & Contaminant Consideration
- Scale up and Equipment Validation
- Case Study Presentation and Economical Evaluation

About our Expertise, Products and Services



- **Training and Education:** technical transfer session, health and safety training;
- **Consulting and Technology Site Assessment:** technology support and selection (chemical oxidation, co solvent-surfactant soil washing and enhanced bioremediation);
- **Products supply, logistic and storage:** nutrients, bacterial preparations strains, oxidants, catalysts, oxygen and hydrogen release compounds, co solvent-surfactant blends
- **Laboratory Services and Analysis:** Groundwater Parameter Analysis, Tracer Study, Soil and Groundwater Oxidant Demand Evaluation (SOD), Bench Scale Treatability testing.

Project Inception and Description



- Organic Contaminants (Petroleum hydrocarbon, PCB, Dioxin, Furans, etc.) are entrapped as pure product (free phase) or at high concentration in various soil matrix.
- Highly contaminated soils are bringing challenges for an effective low cost remediation.
- Soil Washing using co-solvent and/or surfactant offers the benefit to treat effectively and economically these high contaminant concentration that allow for soil to be re-used or dispose at a lower cost.

Bench scale Treatability Study Protocol



- Laboratory Protocol
 - Fully mixed system of the impacted soil with the co-solvent-surfactant mix at a soil:liquid volume ratio of 1:2
 - Typical system mixing time 30 minutes
 - Liquid:solid separation step followed by liquid:contaminant separation and co-solvent-surfactant blend re-use.

- Notes:
 - 1- Recuperation and re-use of 99.5 % of the co-solvent-surfactant mix after separation of the contaminant.
 - 2- Wash cycle can be repeated if contaminant removal is insufficient.



Bench scale Results

Contaminant	Soil type	Initial Soil contaminant concentration (mg/kg)	Treated Soil contaminant concentration (mg/kg)	Number of wash cycle
PH C10-C50	Silty-Sand	F2 – 32000 F3 – 24000 F4 – 6300	F2 - 840 F3 – 840 F4 - 1400	2 wash
PCB	Clay	640	46	2 wash
Invert Oil Based Drilling Fluid	Shale	120 000 mg/kg (12 %)	6400 mg/kg	1 wash

Geological & Contaminant Consideration



- The washing process is NOT influenced by the geology where the contaminant is entrapped.
- The choice of co-solvent-surfactant mix that are available make for applicability to a large array of organic contaminants
- Addition of wash cycles allow to reach low contaminant concentration
- Contaminant can be re-used or destroyed once separated from the soil
- Additional treatment (chemical oxidation, bioremediation, etc.) can be applied to the treated soil to polish contaminant removal if desired

Scale up and Equipment Validation



- A 4 step full scale portable process was designed and build:
 1. Feed hopper where soils are mechanically added.
 2. The wash tank/auger where the co-solvent-surfactant mix interacts with the soil
 3. The co-solvent-surfactant mix recovery system
 4. The soil dryer

Scale up and Equipment Validation



CHEMCO Inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR



Scale up and Equipment Validation



CHEMCO Inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR




Scale up and Equipment Validation



CHEMCO Inc.

SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR






Case Study Presentation and Economical Evaluation

- Work Description:


Full scale testing done on the treatability of invert based drill cuttings resulting from drilling operations that utilize 'invert' or oil-based drilling fluids.



Case Study Presentation and Economical Evaluation

- Cutting Description:

Drill cuttings originate from drilling operations that use invert as a base fluid to lubricate the drill bit and move cuttings up the well bore to surface. This type of operation is carried out by many oil and gas operators around Western Canada. The wells in this area typically produce 100m³ to 300m³ or 160 to 480 tonnes of hazardous wastes (cuttings), which are sent to a local, Secure oilfield landfill. The hydrocarbon content of the drilled cuttings is usually between 15-50% prior to any fluid recovery or stabilization processes on site.



Case Study Presentation and Economical Evaluation

- Treatment Goal and Benefit

Removing the hydrocarbons from the cuttings to a state where the total hydrocarbon (BTEX, HEPH, LEPH, PAH) will be less than 1%.



Case Study Presentation

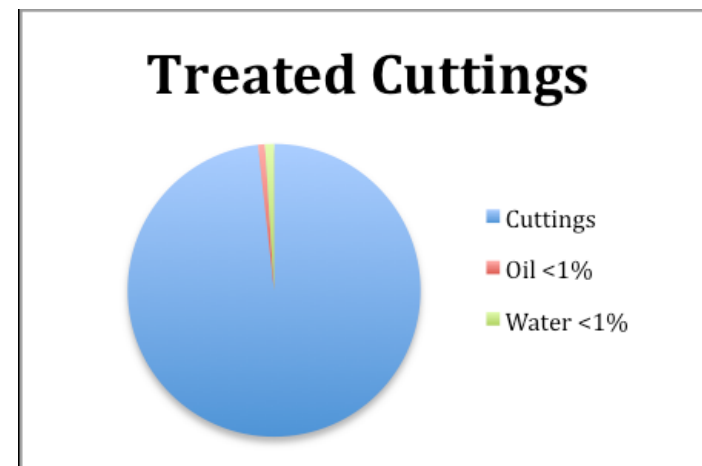
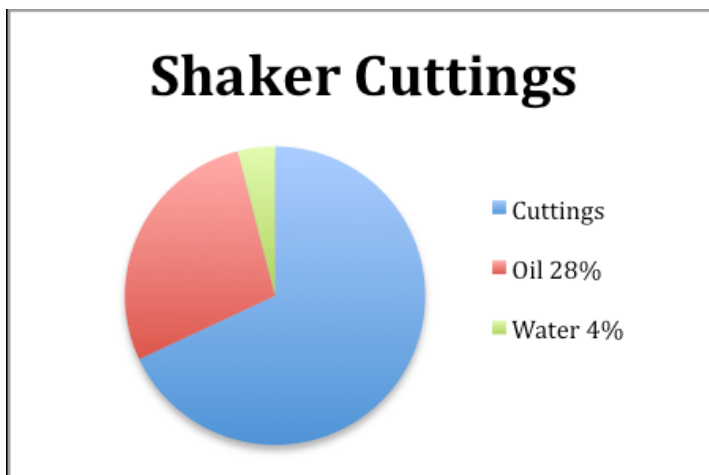
Environmental, health and safety benefits:

- **Significant reduction in greenhouse gas emissions due to a 30-40% volume reduction of wastes entering a landfill.**
- **Safer roads with less trucks on roads and highways**
- **Minimize the frequency or potential for spills**
- **No need for wood waste to be transported to wellsites for stabilization of material during transport**
- **Recovery of all base fluid from waste streams previously lost to landfill.**
- **Landfill cells can be open longer and will require less expansion**
- **Less drilling fluids needed to be transferred to site from recovery and reuse**
- **Near elimination of liquids (water or hydrocarbons) entering the landfill**
- **Reduction or limitation of liability associated with hazardous wastes in landfills**

Case Study Presentation and Economical Evaluation

■ Treatment Results

- Cutting waste treated had an original average 20% wet weight of hydrocarbons (using a retort analysis) after undergoing a high-gravity shaker. Treatment was able to reduce these hydrocarbon levels to the below levels:



Economical Evaluation

Standard Operating Practice (Stabilized using Track-hoe & Sawdust)	“Normal” Cuttings Volume is 200m³ (538 tons) 350 tons cuttings (with an SG of 2.0) 50 tons OBM (with an SG of .99) {Plus} 138 tons of sawdust (6 walking floors)	Treatment & Recovery (Treated by Cutting Edge Systems)
538	Total tonnage hauled to land fill	109
\$55,000	OBM lost to cuttings & fines	\$11,000
\$14,148	Sawdust consumed (@ \$2,358 per load)	\$4,716
\$57,600	Rental cost of Stabilization method @ \$1,200 (hoe)	\$0
\$0	Rental cost of Treatment System @ \$1,800 (CES)	\$86,400
\$0	Rental cost of Generator & Shale Sloops (CES)	\$28,800
\$1,440	Fuel Cost @ \$.74/litre	\$20,000
\$4,800	Transport of equipment to/from site	\$4,800
\$31,602	Transport of “Contaminated Cuttings” from site to a secure landfill @ \$58.74/ton	\$6,320
\$0	Recovered OBM sent back to tank farm	-\$44,000
	Others?	
\$164,590	END COST COMPARISON	\$118,036



SOLUTIONS AND ENVIRONMENTAL PRODUCTS
WATER - SOIL - AIR

Acknowledgement

- Cutting Edge System

Thank you for your attention !

Contact information:

E-mail: jean.pare@chemco-inc.com stanross@gmail.com

Tel: 418-953-3480

403-390-7797

Web site: www.chemco-inc.com