



INTEGRATED ENVIRONMENTAL SOLUTIONS

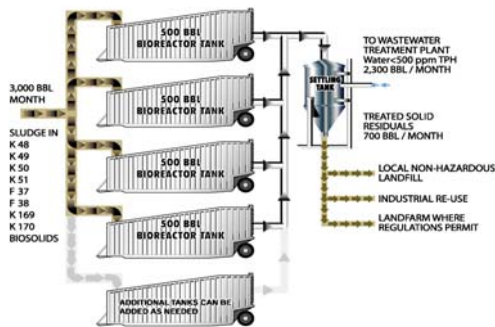


Bioreactors for Oily Wastes and Sludges

- Closed-loop, Controlled Bio-Remediation Solution that converts hydrocarbon waste to “non-hazardous” levels while recovering usable product
- On-Site treatment capability – no storage requirements or special handling
- Suited to high temperature, low water reserve environments
- Uses indigenous bacteria and locally available resources
- Successfully piloted at JO Kharafi, KSA

Parameters	Landfarming	Incineration	Centrifuge /Bioreactor
Harmful byproducts	Yes	Yes	No
Greenhouse gases	Yes, if transported offsite	Yes	No
Liabilities	Spills, emissions	Spills, emissions	No Liability, Onsite, contained
COST (Includes offsite transportation and value of recovered oil)	USD \$60-\$200/m3	USD \$200 - \$480 m3	USD \$20 - \$100/m3

TYPICAL BIOREACTOR LAYOUT



Organics	MAL – EPA (mg/L)	Petrozyme treated sludge (mg/L)		
		Gas Plant	Oil Terminal	Oil Refinery
Benzene	0.135	<0.0022	<0.0022	<0.0022
Toluene	0.08	<0.0022	0.0029	<0.0022
Ethyl benzene	0.057	<0.0022	<0.0022	0.004
Xylenes	0.032	<0.004	<0.004	0.015
BEHP	0.28	<0.0067	<0.004	<0.002
Phenol	6.2	<0.030	<0.039	0.035
Cresols (m,p,o)	54.0	<0.002	<0.002	<0.002
Nitrobenzene	0.0969	<0.002	<0.002	<0.002
Diocetyl phthalate	0.017	<0.002	<0.002	<0.002

