

Case Study #1

Crude Oil Contaminated Soil

Anadarko Petroleum Corporation - Midwest, WY

Anadarko Petroleum Corporation operates a crude oil production field near Midwest, WY. LBI provided DualZorb product to demonstrate and evaluate its remediation capabilities on land farmed crude oil contaminated soil. DualZorb hydration, mixing, sampling, and laboratory results were performed by Anadarko staff with guidance from LBI.

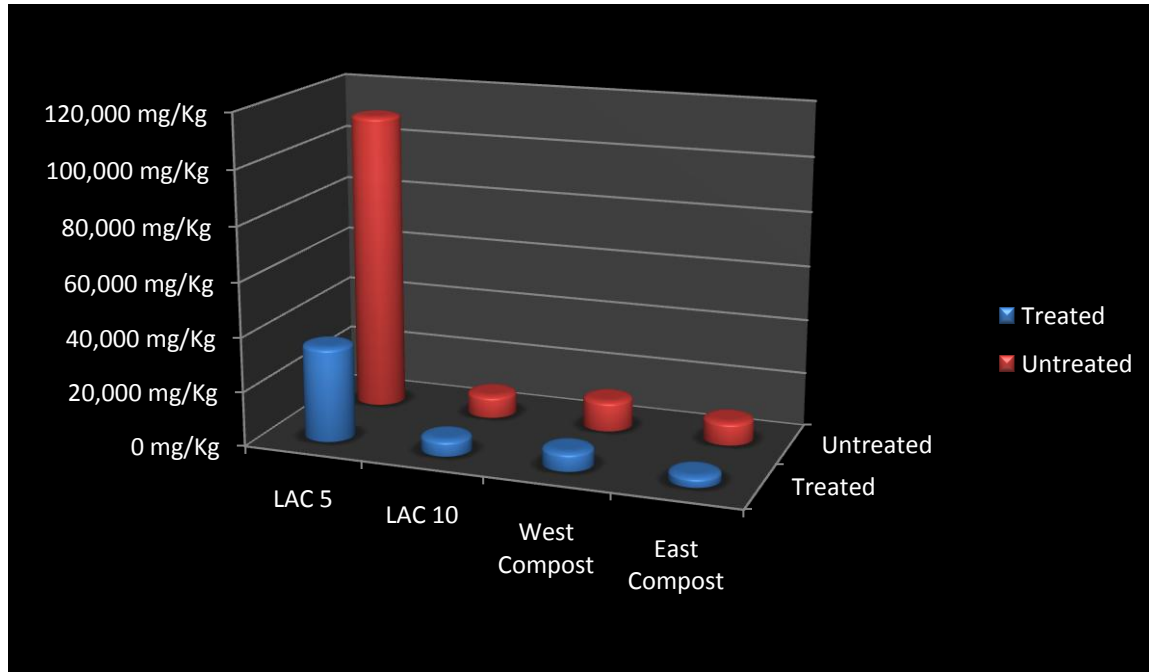
Bench Test #1

Random contaminated soil grab samples were collected from four land farm locations, identified as LAC 5, LAC 10, West Compost, and East Compost. Each land farm location has varying levels of oil contamination and age of contamination. In the first series of tests, equal masses of contaminated soil were placed in mixing trays. DualZorb was then hydrated with tap water in a separate container. The DualZorb was allowed to hydrate for approximately two minutes before being thoroughly hand mixed with the contaminated soil. Contaminated soil was mixed with hydrated DualZorb at ratios of one to one and two parts DualZorb to one part contaminated soil. The test samples were kept hydrated with tap water for two days. The samples were then allowed to dry for one day. Representative grab samples were collected and submitted to Energy Laboratories (Gillette, WY) for analysis of diesel range organics (DRO) and total extractable hydrocarbons (EPA Method 8015B). The results are summarized below:

Location	1:1 Mix Ratio			2:1 Mix Ratio	
	Untreated DRO	Treated DRO	% Reduction	Treated DRO	%Reduction
LAC 5	110,000 mg/Kg	34,900 mg/Kg	68.3%	14,800 mg/Kg	86.5%
LAC 10	8,360 mg/Kg	5,980 mg/Kg	28.5%	4,560 mg/Kg	45.5%
West Compost	11,300 mg/Kg	6,890 mg/Kg	39.0%	2,940 mg/Kg	74.0%
East Compost	8,550 mg/Kg	3,820 mg/Kg	55.3%	4,000 mg/Kg	53.2%

When evaluating the report data, it must be understood that EPA 8015B test methodology uses a solvent to extract hydrocarbons from the soil for analysis. Solvents will dissolve hydrocarbons upon contact. Therefore, the results provide an indication to the ability of DualZorb to retain absorbed petroleum hydrocarbons that would otherwise remain absorbed by DualZorb in the environment.

Results also indicate that product interaction with contaminated soil is critical. Visually, the product did not appear to have reached oil saturation during the tests. It may be inferred that some of the hydrocarbons extracted were from soil that did not receive complete mixing.



Bench Test #2

In the second series of tests, a new set of soil grab samples collected from the four land farm locations. The contact time between DualZorb and the contaminated soil was reduced to just two hours. The mix ratio was one pound DualZorb to one pound contaminated soil. Samples were collected and submitted to Energy Laboratories for analysis. The results are summarized below:

1:1 Mix Ratio			
Location	Untreated DRO	Treated DRO	% Reduction
LAC 5	206,000 mg/Kg	63,800 mg/Kg	69.0%
LAC 10	25,100 mg/Kg	3,810 mg/Kg	84.8%
West Compost	11,800 mg/Kg	4,430 mg/Kg	62.4%
East Compost	8,490 mg/Kg	4,530 mg/Kg	46.6%

Comparing the percentage of DRO reduction between the two series of tests, see below, LAC 5 and East Compost showed consistent contaminate removal percentages. These results indicate that the absorption process occurs quickly and that additional contact time does not increase the amount of contamination removed from the soil. DRO removal percentages for LAC 10 and West Compost

locations showed a considerable increase in the amount of DRO absorbed from the soil by DualZorb. The increased removal percentages may be due to changes in the chemical composition of the soil contamination. But as proper mixing is critical, the second series of test most likely had complete product mixing with the contaminated soil.

Location	3-Days Treated DRO Reduction	2-Hours Treated DRO Reduction
LAC 5	68.3%	69.0%
LAC 10	28.5%	84.8%
West Compost	39.0%	62.4%
East Compost	55.3%	46.6%