Study Summary

Evaluation of Soil Rx For Crude Oil Impacted Soil

Study Completed In Cooperation With
OES Industries
Vinland Energy
3 Tier Technologies LLC

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William M. Mitchell, PG, OES Industries
Jeff Stainfield, OES Industries
Daniel J Burdette, 3 Tier Technologies LLC

Study Objectives:

The objective of the study is to evaluate Soil Rx, a new approach to solving soil and water hydrocarbon contamination issues, at an active wellhead site. Specially formulated for safety, effectiveness and environmentally friendliness, **Soil Rx** utilizes a blend of activated humic acid, a ultra high concentration of live synergistic bacteria, and a readily biodegradable natural enzyme product consisting of a nutrient-rich extract with a broad-spectrum package of identifiable enzymes, coenzymes, amino acids and other proteins. This triple action product is able to degrade hydrocarbons with minimal use of equipment, labor and cost. The study is designed to create a method of treating active well sites with a simple, cost effective solution to eliminate occasional spills and ensure these areas do not create an environmental hazard requiring expensive cleanup or remediation efforts.

Site Description:

The site is a producing oil well and associated tank battery located on highway 2014 near Four Mile, in Bell County, Ky. There is a small surface area of gravel and soil, approximately three (3) square feet near the wellhead that has been impacted by a minor crude oil release during normal well/tank operations and oil transfer/pickup. This is a working well location that receives periodic contamination during normal use and operation.

Lewis Heirs Lease
Hwy 2014, Four Mile, Bell Co., Kentucky

Sampling Methodology:

Representatives of OES Industries visited the site on four occasions, May 10, 18th, 31th and June 11, 2010. Composite surface samples (soil/gravel) were collected utilizing EPA recommended protocols on the site visits of May 10, 18th and June 11. The initial sample event on May 10th revealed crude oil constituent levels in the surface media subsequent to the release event and prior to treatment of the impacted area with Soil Rx. Confirmatory samples were also collected on May 18th and June 11. The samples collected at each sample event were immediately packed in an ice filled container and shipped overnight to MicroBac Laboratory in Maryville, Tennessee for analysis of volatile organic compounds (BTEX) and Polynuclear Aromatic Hydrocarbons (PAH).

Site Treatments:

The crude oil impacted area was treated using a drench method treatment procedure. Soil Rx was diluted with water at a ratio of 20:1 (32 ounces of Soil Rx concentrate to 4 ¾ gallons of clean water). Each application consisted of five gallons of diluted Soil Rx. The Soil Rx treatment was applied by evenly drenching the solution onto the impacted surface area. The impacted area was treated on May 10, May 31, and June 11, 2010.

Analytical Sampling Data is summarized in Table 1. The initial sampling event prior to treatment of the impacted area with Soil Rx reveals minimal levels of volatile organic compounds (BTEX) with none of the constituents exceeding allowable concentrations established as primary remediation Goals (PRG) by Region 9 of the United States Environmental Protection Agency for hydrocarbon impacted soils at industrial sites. None of the sampling events revealed polynuclear aromatic compounds above the detection limits.

The May 18th sampling event (after remedial treatment) revealed a dramatic increase in volatile organic compounds (BTEX, see Table 2). It was concluded that the surface impacted area may have received additional contamination during one of the normal transfer activities conducted after the initial sampling and treatment. The impacted area was retreated with the Soil Rx dilution on May 31 and the area was sampled again on June 11, 2010.

Investigative Note: Upon further investigation to determine the reason for the increase in volatile organic compound after the initial sampling, it was discovered that between the first sampling on May 10th and the second sampling on May 18th, Regal Petroleum had a scheduled pickup of crude oil from the tank battery. It was further discovered the normal routine for transferring crude oil from the tank battery requires the truck driver to complete pumping out the crude tanks that are located near the wellhead, then the transfer hose is pulled across the impacted area to the truck parked along side of the wellhead, and small amounts of crude runs out of the hose as it is picked up and placed on the truck. This procedure further supports how this area was originally contaminated and is a common practice.

Conclusions and Recommendations

The data presented herein supports the conclusion that OES Industries' hydrocarbon remediation product, Soil Rx, is a cost effective means for normal maintenance and management of wellhead locations that experience minimal spills through normal transfer activities. This study showed that left untreated, this location could and did increase the volatile organic compounds above EPA Section 9 allowable standards which left untreated may have continued to rise resulting in fines, penalties, or costly remediation of the location. The study further validated that the treatment of Soil RX can be used to lower or in some instances eliminate crude oil concentrations to levels below regulatory thresholds that require cleanup or removal of such impacted soils.

The analytical results reveal that the level of Volatile Organic Compounds were reduced by an average of 59% in the twelve day interval between the last treatment (May 31) and the last sampling (June 11). Benzene, which exceeded the EPA Standard, was reduced 68% during this 12-day period, reducing the contamination well below the EPA standard. Table 1 depicts the amount of reduction of BTEX constituents during that period.

Table 1. BTEX Reductions

constituent	5/18 sample	6/11 sample	Amount ppm reduced	% reduction
benzene	3.02 ppm	0.961 ppm	2.059 ppm	**68%**
toluene	15.0 ppm	5.25 ppm	9.75 ppm	**65%**
ethylbenzene	5.88 ppm	2.50 ppm	3.38 ppm	**57%**
xylenes	55.8 ppm	28.10 ppm	27.70 ppm	**47%**

It should be noted that during the period, mid-May through early June, the site experienced numerous rain events that provided both a benefit and a potential challenge for the study. A key for optimal bio-remediation is that the site maintains a reasonable level of moisture for aggressive microbial activity. At the same time, excess moisture or abnormal rain events may create is over-saturated or flushing events that could remove the treatment from the affected area thereby reducing the effectiveness of the bio-remediation treatment. This study shows that even with above average moisture, the performance of Soil Rx was unaffected and provided the desired results.

No constituents are indicated to be present at the site that exceed US EPA Region 9 PRGs, thus no additional remedial work is required at this time other than a preventative program establishment consisting either once or twice a month treatments as a management tool for accidental spills that may occur through normal operating procedures. It is recommended that best management practices be reviewed, revised as required and implemented by the crude purchasing company during the pump-out of the crude oil tanks.

It is concluded that the use of Soil Rx as a preventative maintenance tool and/or as a remediation tool for crude oil impacted areas in the oil field is a viable, cost-effective method to maintain regulatory compliance. The ability to remediate hydrocarbons in-situ represents a highly desirable and cost saving measure over the normal practice of excavating hydrocarbon impacted soils and disposing of the impacted media in a landfill.

Study implementation and oversight conducted by William M. Mitchell, PG, (Ky registration # 1426).

For additional information or specific site analysis, contact OES Industries @ 317-590-2699 (www.oesgreen.com) or 3Tier Technologies LLC @ 877-710-6953 (www.3tiertech.com).

MicroBac Certified Analysis results available upon request

Table 2: Vinland Energy Lewis Heirs Site

Crude Oil Impacted Soil	**Contamination after "release"**	**Analysis after treatment with Soil Rx**	**Analysis after treatment with Soil Rx**	**EPA Standard (Region 9)**
date	***5/10/10***	***5/18/10***	***6/11/10***	
Volatile Organic Compounds(BTEX)				
B- benzene	0.733 ppm	**3.02 ppm**	0.961 ppm	**1.3 ppm**
T-toluene	3.68 ppm	15.0 ppm	5.25 ppm	**520 ppm**
E-Ethylbenzene	1.56 ppm	5.88 ppm	2.50 ppm	**20 ppm**
X-Xylene	13.6 ppm	55.8 ppm	28.10 ppm	**420 ppm**
Polynuclear aromatic Hydrocarbons (PAH)				
Benzo(a)anthracene	BDL	BDL		**2.1 ppm**
Benzo(a)pyrene	BDL	BDL		**0.21 ppm**
Benzo(b)fluoranthene	BDL	BDL		**22,000 ppm**
Benzo(k)fluoranthene	BDL	BDL		**2.1ppm**
Dibenz(a,h) anthracene	BDL	BDL		**0.21 ppm**
Indeno(1,2,3-cd)pyrene	BDL	BDL		**2.1 ppm**
Acenapthene	BDL	BDL		**NA**
Acenapthelene	BDL	BDL		**NA**
Anthracene	BDL	BDL		**100,000 ppm**
Benzo(g,h,i)perylene	BDL	BDL		**NA**
fluoranthene	BDL	BDL		**22,000ppm**
fluorene	BDL	BDL		**26,000 ppm**
phenanthrene	BDL	BDL		**NA**
pyrene	BDL	BDL		**29,000 ppm**
chrysene	BDL	BDL		**210 ppm**
naphthalene	BDL	BDL		**190 ppm**

BDL= below detection limits
Values in bold exceed EPA Standard PRGs