

CASE STUDY #10

Client: Sysco

Category: Plantation Project (Soil Remediation)

Location: Dade County, Florida USA

Problem: An underground leaking motor oil storage tank went unnoticed and unidentified for 15 years. Two areas of soil were contaminated with motor oil.

Batch #1	208 cubic yards	18,000 ppm
Batch #2	178 cubic yards	8,530 ppm

Introduction

In the initial proposal, 208 cubic yards of the more heavily contaminated soil was to excavated and transported for inclusion in the cement manufacturing process. However, our laboratory results demonstrated that the microorganism in PDM-7 H.C quickly degraded all of the fractions of the oil and grease. Of special interest, was the fact that the higher concentrations supported greater growth and faster activity.

Based on these considerations, all of the soil was treated on-site using bioaugmentation remediation techniques.

The initial site assessment report concerning this soil described extremely high quantities of oil and grease that were adhered to soil particles. Grease and oil levels up to 18,000 ppm were found in preliminary samples taken at this site.

The soil was treated in two batches. Each batch was separately removed to a containment area. The soil was treated with the PHase III, Inc. product PDM-7 H.C. and Nutrients.

The oil and grease levels were monitored during the treatment period until a level less than 500 ppm was obtained. The first batch was then removed from the containment area and the second batch was treated in a similar manner.

I. Bacteriological

1. **Pre-Treatment Analysis:** Aerobic an anaerobic plate counts were made on several samples of soil. The flora was also characterized as to general type of microorganisms.

In test designed to determine amount and type of microorganisms naturally present in the untreated soil that could digest oil, a few types

were present. However, these organisms made up only insignificant percentage of the total population.

2. **Product Characterization:** PDM-7 H.C. is a live, synergistic group of bacteria that effectively digest petroleum products and other toxic organic chemicals. It will even digest heavy, tarry types of oil and organic sludge converting all of these compounds to non-toxic, inert compounds such as carbon dioxide and H₂O.
3. **Post-Treatment analysis:** Aerobic and anaerobic plate counts were made on soil samples throughout the duration of the treatment process. The total count of each type remained essentially the same over the periods tested. However, the major types in PDM-7 H.C. soon dominated the population. This was to be expected, as they are all natural soil organisms. The percentage of oil utilizing bacteria present in the soil soon increased to approximately 50%.

The nitrogen, phosphate and moisture levels in the soil were also monitored and maintained in the proper range.

II. Treatment

After the soil was placed in the containment area, it was mechanically treated to produce very small pieces and the product was applied. This process was designed to greatly increase the surface area exposed to the bacteria. The soil was mechanically treated to improve distribution of the organisms two to three times a week unless the schedule was interrupted by rain. The soil in the containment area was covered at night and at all times when personnel were not at the site.

Samples were usually taken from three different sites in the interior of the pile after mechanical agitation. The three samples were combined in the laboratory and then analyzed for oil with a Techator SoxTec Extraction apparatus using Freon. The samples were run in quadruplicate and analyzed for petroleum hydrocarbon by E.P.A. Method 418.1

III. Control Studies

The contaminated soil was evaluated for endemic bacterial activity prior to the on-site remediation. Soil was placed in the containment area and mechanically treated to produce very small pieces. This process was designed to greatly increase the surface area exposed to the natural bacteria. The soil was mechanically treated to improve distribution of the organisms two to three times a week unless the schedule was interrupted by rain. The soil in the containment area was covered at night and at all times when personnel were not at the site. Additionally, nutrients were added to the soil in an effort to stimulate the growth of the endemic bacteria, thereby prompting contamination reduction.

Samples were taken from three sites in the interior of the piles after mechanical agitation. The samples were analyzed in duplicate for hydrocarbon via E.P.A. Method 418.1

Results

The results of the controlled studies performed on the on-site treatment are shown in Table 1. The contaminated soil showed insignificant reduction in the contamination levels when the soil was not treated or nutrient fed only. Even when aeration was utilized with nutrients, the reductions were extremely slow. This shows the rate of reduction is not economically feasible.

Tables II and III show selected results obtained during the course of treatment. These results show that, based on Batch I, approximately 2,880 pounds of oil were degraded in 61 days, or approximately 43 pounds a day. When several rain days are considered, the rate would even be faster. Aerobic and anaerobic plate counts show the normal flora once again would begin to dominate bacterial population in the Batch I soil.

Summary

The soil, which was very heavily contaminated with oil, was bioremediated to acceptable levels by using a strictly biological process within 60 days using PDM-7 H.C. Outside experts had predicted an endemic remediation time of 12 to 18 months, if it occurred at all.

Table 1

CONTROL BIOREMEDIATION STUDIES

Special Conditions: None		Special Conditions: Aeration	
<u>Time (Days)</u>	<u>Oil (ppm)</u>	<u>Time (Days)</u>	<u>Oil (ppm)</u>
0	18,000	0	18,000
7	17,960	7	18,210
14	18,000	14	17,880
21	17,882	21	18,090
28	17,910	28	17,640
35	18,111	35	17,760
45	17,980	45	17,680
60	17,951	60	17,225

Special Conditions: Aeration & Nutrients

Special conditions: Nutrients

<u>Time (Days)</u>	<u>Oil (ppm)</u>	<u>Time (Days)</u>	<u>Oil (ppm)</u>
0	18,000	0	18,000
7	17,750	7	18,120
14	17,810	14	18,010
21	16,770	21	17,990
28	16,900	28	17,880
35	16,550	35	18,000
45	16,175	45	17,550
60	15,990	60	17,640

TABLE II

BIOREMEDIATION OF BATCH 1 SOIL

<u>Time (Days)</u>	<u>Oil (ppm)</u>
0	18,000
10	3,400
21	2,425
24	1,409
40	1,009
43	803
61	147

TABLE III

BIOREMEDIATION OF BATCH 2 SOIL

<u>Time (Days)</u>	<u>Oil (ppm)</u>
0	8,530
7	3,400
14	2,390
21	1,635
28	1,240
35	804
42	197