BIOREMEDIATION: COST-EFFECTIVE METHODS TO RECLAIM AND PROTECT OUR ENVIRONMENT IN THE OILFIELD

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ABSTRACT

Bioremediation is a new technology for which the time has arrived.

This paper presents an overview of various products and processes to reclaim sodium-damaged and hydrocarbon-contaminated soils, to manage tank bottoms, and to biologically clean up sludge pits. The processes include the pre-evaluation analysis, the treatment and the follow-up procedures. Bioremediation is a cost-effective way to handle the aforementioned problems in an environmentally sound manner.

INTRODUCTION

After years and years of producing oil from this great earth, spills and pits from day-to-day operations have damaged countless acres of land. The influx of sodium-tainted waters or of hydrocarbons onto soils will stop the biological activities in that soil, leaving it unproductive. If these damaged areas are left untouched, most of this acreage would remain non-productive for decades.

Previously, the only way to handle these situations would be to dig out and haul off the contaminated soil and replace it with undamaged soil; or in some cases, to just cover the damaged area with top soil. These scenarios do not remedy the problem; they just move the problem to another location or temporarily cover it up.

Now we have Bioremediation: the process of naturally reclaiming or remediating contaminated areas at their present locations.

SODIUM-DAMAGED SOILS

We have found the use of two products to be effective in reclaiming sodium-damaged acreage: LCA-II (Liquid Calcium Amendment) and Medina Soil Activator. The LCA-II product is used if soil analyses reflect an extremely high sodium content. The Medina Soil Activator product is used when soil analyses reflect lower concentrations of sodium.

On older sites, our pre-evaluation analysis consists of retrieving soil samples and running ECe (electrical conductivity) and SAR (sodium adsorption ratio) tests on these samples. From these tests, the rate of application and which product to use can be determined.

The products are diluted with fresh water at a 25:1 ratio and spray-applied.

If the LCA-II is used, it will immediately go to work on relieving the swelling in the clays, opening drainage and reaggregating the soil. LCA-II allows the soil particles to take up calcium on the cation exchange complex by making the calcium readily available. The sodium particles which are kicked off by the soil on the exchange complex are reattached to the clays in the soil

structure down to about 12 to 15 feet at non-toxic levels. If the Medina Soil Activator is used, it will "manage" the sodium in the soil and will usually have to be treated year after year, whereas the LCA-II is usually a one-year treatment. Of course, economics play a role in the selection of which product to use, as the LCA-II is more expensive than the Medina Soil Activator.

After a period of 60 to 90 days, soil analyses will again be checked to see if the site is ready to seed or if the site needs to be treated with a follow-up treatment with one of the two previously mentioned products.

HYDROCARBON-CONTAMINATED SOILS

Hydrocarbon-contaminated areas should be addressed with the following products: Medina Soil Activator, Humate Humic Acid, Hydrabac Bacteria, and if high sodium concentrations are present, LCA-II.

For monitoring purposes or if the customer so desires, TPH(total petroleum hydrocarbons) analyses are run on the contaminated site.

If the contamination is low, the Medina Soil Activator and Humate Humic Acid would be used. The Medina Soil Activator allows the existing microorganisms in the soil to reproduce a thousand times their normal rate, giving the contaminated site a boost. The Humate Humic Acid forms a humus in the soil. This is the same as applying cow manure, cotton burs, etc. to the soil.

If there are high concentrations of hydrocarbons, the Hydrabac Bacteria would be used in conjunction with the other products. Hydrabac is a hydrocarbon-degrading bacteria that actually eats the oil.

The site should be prepared by discing to provide aeration and an aerobic atmosphere for the products which are then spray-applied. The site needs to maintain a moisture rate of 30 - 70 percent saturation. The site will need to be watered and retilled as necessary. The products will need to be reapplied at determined intervals over a one or sometimes two-year period.

If the contamination is 18 inches deep or less, the site can be cleaned up in place. If contamination has leached below 18 inches, the soil must be removed and placed on a hardpan surface and land farmed.

After the aforementioned procedures have been followed and the contamination levels have been lowered enough to support plant life, the acreage will be reseeded or will be put back into production.

MANAGING TANK BOTTOMS

Tank bottoms are a problem for most oil producers. The products we use to liquify tank bottoms present an alternative to exposing a crew to H_2S and other dangers when manually cleaning out tank bottoms.

The first stage in our process is qualifying the tank. In this stage, we conduct an analysis of the components in the tank. We want to find out the percentages of iron sulfide, paraffin, etc. to see if the procedure is feasible on this particular tank.

If the tank qualifies, the following products will be used: DP-5 Bacteria and D-Part. The DP-5 is a bacteria that consumes the paraffins and organic substances. The D-Part is a bacteria enhancer.

The DP-5 is introduced into the tank over the thief hatch. The D-Part is then sucked into a hot oil unit and heated to approximately 100 degrees and

then introduced into the tank. The tank is then rolled with the hot oil unit or by other means. The DP-5 bacteria will start to emit enzymes onto solid organic material. These enzymes will liquify the solids. The bacteria will then absorb the liquified organics, giving off harmless by-products H_2O and CO_2. The D-Part enhances these procedures and supplies other nutrients to keep the DP-5 bacteria active. The tank will be left alone for three days. After the three-day period, more D-Part will be added to boost the activity of the DP-5. At this time, the tank will be rolled again.

The tank will be ready for a final check on the seventh or eighth day after starting this process. At this time, the liquified product in the tank will be ready to circulate and push down the sale line or will be able to commingle with incoming production fluids.

The bacteria will die out if the enhancement products are not supplied periodically or if the bacteria is heated to above 140 degrees.

SLUDGE PITS

Bioremediation of sludge pits represents an alternative to digging out and hauling off the pit contents.

The products used to remediate pits are: DP-5 Bacteria, Hydrabac Bacteria and D-Part Enhancer. Quantities of these products will be adjusted to the size and depth of the site.

The process is started by spraying the products over the pit. The temperature needs to be at least 45 degrees for the bacteria to work. Temperatures of less than 45 degrees won't kill the bacteria, but will cause them to go into a dormant state. The remediation process is speeded up by inducing air into the pit via an air compressor. The pit will be checked every ten to fourteen days and more products will be added as needed.

At the conclusion of this process, there will be some water in the pit that will need to be removed. This H_2O, along with CO_2, are by-products of this process. After the water is removed, the pit can be back-filled.

SUMMARY

This paper certainly does not cover all aspects of bioremediation; but it does give an overview. The processes described in this paper provide environmentally sound, cost-effective methods of dealing with several problems with which the oil industry is faced.

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