

# VB997<sup>®</sup> soil

## The Ideal Technology for Soil Restoration

VB997<sup>®</sup> is an ideal nutrient formulation that accelerates the production and activity of microbes employed to remediate hydrocarbon contamination. VB997<sup>®</sup> has been designed specifically for hydrocarbon applications in soil.

### Microbial Health

Microbes are living, one-celled organisms that have survived for billions of years. They thrive as the planet's most abundant, most varied and most versatile organisms. They are everywhere. Soil contains thousands of species of microbes, all living off one another's excretions.

Some 20 percent of soil microbes are hydrocarbon-degrading microbes. When a spill occurs, microbes already present begin to emit enzymes to break down the contaminant. They have a feast, and are able to quickly increase in number.

However, because of the sudden increase of microbes, critical nutrients like nitrogen and phosphorus quickly become depleted. These elements along with carbon, hydrogen and oxygen are the main elements required for reproduction, and without them regeneration is hindered. They become unhealthy and begin to die off, leaving the contaminant virtually untouched.

### VB997<sup>®</sup> treatment:

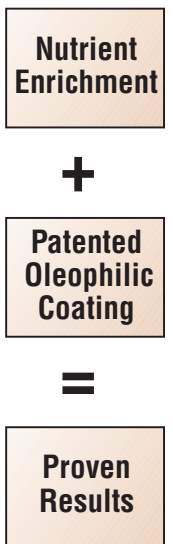
- Supports the growth of all non-fastidious natural microbial populations.
- Ensures no toxic chemicals, surfactants or hazardous substances.
- Remains stable, since it is not affected by pH, salinity, normal temperature fluctuations, alkalinity or type of soil.
- Eliminates pre-mixing or special handling precautions.
- Easy application.
- Offers extended shelf life (at least three years if kept dry).

### Two Keys to VB997<sup>®</sup>'s Effectiveness

VB997<sup>®</sup> provides the right nutrients in the right quantities to encourage the right bugs to be healthy. It also provides key life-source nutrients to the necessary microbes in a form that ensures their accelerated reproduction and activity.

**1. Carbon, phosphorus and nitrogen help microbes speed non-toxic mineralization** — Rapid mineralization of the contaminant is a result of having large, active populations of native microbes, which produce essential enzymes needed to break down the contaminants to carbon dioxide and water. VB997<sup>®</sup> provides the vital nutrients for the growth and health of native microbes present at the contamination site. Accelerating their growth is the key to accelerating biodegradation with no threat to the extant ecological balance.

**2. Patented technology creates effectiveness** — BioNutraTech's unique patented oleophilic coating clings tenaciously to contaminants naturally and without harmful residuals, assuring useful concentrations for the microbes as they work their way through the contaminant. The effect is time-release feeding – making VB997<sup>®</sup> more effective than other remediation approaches.



BIONUTRATECH<sup>®</sup>

Clean and simple.

Covered by one or more of the following:  
US Patents 5,443,845, 5,725,885, 5,945,868;  
European Patent Publication 0 809 612

### Lyondell-Citgo Refinery

In June 1999, about 20,000 gallons of lube oil was spilled onto the ground surrounding several storage tanks at a Lyondell-Citgo refinery in Houston, Texas.

As the spill occurred at Tank 99, oil flowed downhill past a pump pit and between Tank 98 and Tank 112.

Samples of the clay soil were taken from each of the three locations on June 30 and evaluated at the Core Environmental Laboratory and Sam Houston State University's TRIES Laboratory.

At the Tank 99, TPH levels were a whopping 130,000 ppm. At the pump pit, TPH was 26,800 ppm. The EPA required TPH to be brought below 10,000 ppm.

Conventional wisdom suggested that the only way to successfully remediate this site would have been to scrape away the contaminated soil and haul it to a land farm or incinerator.

But a week later, on July 6, VB997® was applied to the site. After white rock had been moved away from

the contaminated area, VB997® was tilled into the contaminated soil at the rate of 1 pound per cubic yard. For the duration of the project, soil moisture was maintained at 15 percent.

Follow-up samples taken on August 6 showed the remarkable changes that took place. TPH at Tank 99 was reduced nearly 95 percent to 6,650 ppm.

All three locations were successfully brought below 10,000 ppm in just 30 days, low enough to be acceptable under TNRCC guidelines.

Location	TPH Level		Plate Count	
	June 30, 1999	August 6, 1999	June 30, 1999	August 6, 1999
Tank99	130,000 ppm	6,650 ppm	1.7x10 <sup>6</sup> cfu	5.7x10 <sup>5</sup> cfu
Pump Pit	26,800 ppm	8,320 ppm	1.8x10 <sup>5</sup> cfu	1.8x10 <sup>5</sup> cfu
Between Tanks 98 and 112	1,370 ppm	1,870 ppm	8.6x10 <sup>5</sup> cfu	5.7x10 <sup>6</sup> cfu

### Lovell, Wyoming Refinery

The Lovell, Wyoming refinery is a 40-acre site that had been heavily contaminated by waste petroleum sludges and products. This U.S. Environmental Protection Agency Superfund cleanup site had high levels of hydrocarbon contamination (30,000 ppm average) and was hazardous because of its close proximity to waterways.

For the site, only four potential products were selected as candidates from the EPA's National Contingency Plan (NCP) Product Schedule.

These candidates were pitted against each other in a carefully controlled lab test. Contaminated soil from the site was mixed for uniformity and each product was applied following the manufacturer's instructions.

The test evaluated the products' ability to break down alkanes as well as aro-

matics which are more difficult. After 60 days it was clear that VB997® was the most effective product (see graph).

A continual monitoring of all treatments for cumulative oxygen consumption and carbon dioxide production was performed. A direct correlation

can be seen between oxygen consumption and carbon dioxide production for all treatments through day 60. Additionally, VB997®, which showed the highest analyte degradation, also showed the most positive response in the respirometric study.

Percent reduction of hydrocarbons after 60 days

