

# GLOBAL CLEAN-UP TREATMENT

## Bio-Remediation - TECHNICAL INFORMATION

### *NATURE AT WORK*

#### **APPLICATIONS**

- Contaminated soil and water
- Oil/water interceptor
- Separation pits
- Industrial waste systems
- Waste lagoons

#### **EFFECTIVE FOR DEGRADING**

Fuels (diesel, petrol)  
Lubricants (oils, grease)  
Detergents  
Phenols  
Aliphatic and aromatic hydrocarbons  
Methacrylates  
Nitriles  
Cyanide  
Alcohols  
Organic amines  
Heterocycles  
Ethoxylated phenols  
Wax

#### **DESCRIPTION**

*(Bacteria and micro-organisms are one of the same. Both words are used and interchanged in this text.)*

Global Clean-Up Treatment is a blend of naturally occurring micro-organisms that have been selected for their ability to biologically remediate hydrocarbon contaminated industrial waste, soil and water. The bacteria have been selectively cultured to produce the most efficient mix of micro-organisms for the task of bio-remediating contaminated soil and water. When added to contaminated soil, sludge or water the enzymatic action of the bacteria accelerates the decomposition of short and long chain organic chemicals and polycyclic hydrocarbons. Enzymatic action breaks down and degrades the contaminating chemicals into water and carbon or similar organic states.

#### **BIO-REMEDIATION PROCESS**

Water and soil can be purified using the enzymatic action of bacteria as a biological process. This process is commonly known as bio-remediation.

The bio-remediation process of cleaning soil and water requires time and the presence of a large number of naturally occurring, but scarce in nature, micro-organisms. The micro-organisms use organic materials as an energy source (the contaminants) and available nutrients for their growth and convert them to carbon dioxide and water. By controlling the number of micro-organisms and their environment, hydrocarbons and other chemicals contaminating soil and water can be removed through acceleration of the biological process.

### ***BIO-REMEDICATION***

Bio-remediation is the controlled use of naturally occurring micro-organisms. The enzymes produced by the bacteria break down contaminating chemicals that are present in the environment. Bio-remediation creates the right environment to accelerate the decomposition of many hazardous organic compounds.

Bio-remediation if left to nature (without the addition of large numbers of bacteria) would take many more years to achieve a satisfactory result than it does with the "Global Clean-Up Treatment"

### ***MICRO-ORGANISMS***

Global Clean-Up Treatment micro-organisms are a diverse population of specially selected and naturally occurring bacteria. The micro-organisms in the case of soil are applied at a concentration of approximately one million per gram of soil. This concentration provides an efficient population that will increase up to one thousand fold as contaminants are digested.

The micro-organisms transform the contaminant by ingestion or by extracellular enzymes. Extracellular enzymes on the exterior of the bacteria transform the contaminant, molecule by molecule, without the contaminant entering into the micro-organism. In other micro-organisms the contaminant must pass through the micro-organism's cell membrane in order for them to transform the contaminant.

### ***OPTIMUM CONDITIONS***

The condition of the soil or water needs to be correctly balanced for maximum bacterial growth and maximum degradation of contaminants.

Oxygen, nutrient concentrations, pH, temperature and moisture affect the reproduction of the micro-organisms. The control of these conditions will provide optimum biological activity and maximum contamination degradation.

Micro-organisms perform within a pH range of 5.5 to 9.5 with the optimum near pH 7.5. Soil or water temperature affects biological activity as does the level of oxygen. Little activity can be expected below 15°C or above 45°C. The level of oxygen available directly affects the rate of biodegradation of contaminants. The greater the volume of oxygen that can be distributed into the soil or water the more rapid the rate of cleanup.

## **SOIL**

Where surface farming is used - up to a depth of 300mm, the soil must be turned (tilled) to provide an even distribution of micro organisms, oxygen, nutrients and moisture. Regular tilling provides aeration and optimum bacteria growth.

Clay and other soils that do not allow easy moisture penetration may need treatment with an emulsifier. However in, these soil types soakage of contaminants is likely to be limited.

Where contamination has penetrated to depths that can not be tilled excavation may be required. If this is not possible bioventing may be considered. Bioventing involves drilling many holes in the substrate and flood irrigating with a bacteria enriched solution.

## **WATER CONTAMINATION**

Water in lagoons and ponds can be treated with Global Clean-Up Treatment. This is achieved by adding activated bacteria to the water body. Contaminated water bodies are generally oxygen deficient due to the contaminant exerting a high oxygen "demand" on the ecosystem. Supplementary oxygenation may be required to achieve ideal conditions.

## **SURFACE FARMING**

*1 litre of concentrate will treat 150 cubic metres of soil at a mix of 1 part concentrate to 50 parts of water, i.e. 50 litres of mixed solution will treat 150 metres of soil.*

**STEP 1** Work the contaminated area to a depth equal to the extent of the contamination with a tiller, fork, plough, grader tines etc.

**STEP 2** Mix Global Clean-Up Treatment with potable water (de-chlorinated is preferable) at 1 part concentrate to between 20 and 100 parts of water. Lightly contaminated soil will require a mix of approximately 1:100 whereas heavily contaminated soil may need a stronger mix. De-chlorinate water by leaving in the sun for 24 hours or add Sodium Thiosulphate (Hypo) (1ml per litre of 10% solution of Sodium Thiosulphate).

**STEP 3** Evenly spray the diluted mixture to the affected area until moist.

**STEP 4** Re-aerate the soil periodically (at least once weekly for heavily contaminated soils) and after each substantial rainfall. Monitor soil moisture, soil pH, and nutrient levels to maintain optimum levels. Till affected area after each application of supplemental chemicals for maintenance of pH or nutrients.

**STEP 5** Repeat steps 2-4 every two weeks depending on the progress of the biodegradation.

## **WATER TREATMENT**

**STEP 1** Mix Global Clean-Up Treatment with potable water at 1 part concentrate to between 20 and 100 parts of water. For heavily contaminated water use 1:20 mix.

**STEP 2** Spray or add mixed Global Clean-Up Treatment solution to the contaminated water. Use 10 litres of solution to treat 10,000 litres of water as an initial dose.

**STEP 3** Repeat weekly until the contamination has been eliminated.

## **OPTIMUM CONDITIONS FOR SURFACE FARMING**

- Soil Depth - 200 to 300mm maximum
- Soil Temperature - 8°C minimum. Limited to warmer climates or warmer months.
- Soil pH\* - 5.5 - 9.5, ideal 7.5. Adjust downwards to ideal with Aluminium Sulfate. Adjust upwards to ideal with Soda Ash.
- Soil Moisture\* - 15-20% achieved by very light irrigation (no flooding or pool water on soil surface).

Nutrients\* - Nitrogen = 15 ppm

Phosphorous = 5ppm

## **SOIL CONTROL**

**SOIL MOISTURE** Dry a pre-weighted amount of soil at 100°C overnight. Subtract the dried weight from the wet weight and divide by the wet weight. The answer has the units % moisture.

**Quick Moisture Test** Take a representative sample of the soil and wrap it in a paper towel. The soil should compress and moisten the towel when squeezed. Water should not drip from the towel when squeezed.

**SOIL pH** Take a representative sample of the soil and add 1 gram to a test tube. Add 10 grams water (neutral pH), mix and allow and the soil to settle. Using pH strips measure the pH of the supernatant.

**SOIL NITROGEN** Place representative 1.0 gram sample of soil in a test tube and add 10.0 grams of clean water. Mix thoroughly, allow the soil to settle and measure nitrate level.

**SOIL PHOSPHATE** Use the same procedure as above with a phosphate test kit.

