



ENVIRONMENTAL

Solutions on Site

SALT AND HYDROCARBON REMEDIATION



SOS Environmental, Inc

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sosenvironmental.com



"Effective Environmental Solutions":

S O S Environmental, Inc uses a system of remediation products and services strictly tailored for today's environmental needs. *DeSalt Plus*TM, *SoilBond*TM, *JumpStart*TM, *MicroBoost*TM, and *BioWash*TM are formulated to help resolve soil remediation problems wherever they exist. These products are easy to apply, fast acting, and economical to use.

- *DeSalt Plus*TM is a soluble liquid amendment product that remediates severe salt (sodium chloride) contaminated soils caused from salt water spills and leaks. This specially designed solution quickly displaces harmful sodium with a concentrated source of calcium and vital soil nutrients helping to restore salt contaminated soils and vegetation to their natural growing conditions. *DeSalt Plus*TM improves soil structure for increased water infiltration and permeability. *DeSalt Plus*TM contains no nitrates.
- *SoilBond 1000*TM is a soil conditioner and catalyst for use with *SoilBond*TM2000 soil stabilizer and erosion control products. *SoilBond*TM2000 is a polymeric soil conditioner and stabilizer. When used in conjunction with *SoilBond*TM1000, it works to prevent erosion and improve soil tilth. Both *SoilBond*TM products are non-hazardous products that can be used in conjunction with soil remediation products and to prevent soil erosion.

- *JumpStart™* is a specially designed pre-emergent growth stimulator and nutrient supplement for accelerated germination of crops and vegetation in areas previously affected by salt and hydrocarbon contamination. *JumpStart™* stimulates growth while supplying a stabilized balance of vital nutrients for depleted and stressed soils. Soils affected by salts and hydrocarbons are usually deprived of the soil structure and critical nutrients necessary for seed emergence and re-growth. These soils are generally composed of dense layers that are usually impenetrable to plant roots. *JumpStart™* also strengthens cell wall structure for improved development during plant emergence. *JumpStart™* is a non-hazardous product that can be used in conjunction with soil remediation products such as *MicroBoos™* and *DeSalt Plus™* for the remediation of hydrocarbon and salt contaminated soils. Please consult your **SOS** representative for product application recommendations and guidelines.
- *MicroBoost™* helps to remediate soils contaminated by the hydrocarbons from oil muds, oil spills or leaks. This proprietary product contains a concentrated and stabilized nutrient package that promotes and accelerates reproduction and growth of microorganisms present in the soil. *MicroBoost™* assists these microorganisms in rapidly breaking down hydrocarbon contaminants for a more efficient and economical bioremediation process.

- *BioWash™* is a highly concentrated aqueous based cleaner and breaker for the removal of petroleum and organic based hydrocarbon accumulation on soils and surfaces. *BioWash™* is superior for routine cleaning operations in commercial and industrial establishments. *BioWash™* can be used on soil, asphalt, concrete, pilings, plant floors, offshore platforms, well heads, tank bottoms, metal parts, rocks and other surfaces. With regular use, *BioWash™* removes oil and grease build-up and stains on surfaces. After initial applications, less *BioWash™* is needed for maintenance treatment. *BioWash™* is a biodegradable product that can be used in conjunction with soil remediation products such as, *MicroBoost™* and *DeSalt Plus™* for the bioremediation of hydrocarbon contaminated soils.

DeSalt Plus™

TREATMENT FOR SALT CONTAMINATED SOILS

DeSalt Plus™ is a water soluble liquid calcium rich solution that remediates soils contaminated with sodium chloride (NaCl). Salt waters and brine disrupt the uptake and utilization of nutrients that plants and crops require for normal growth. Sodium from produced waters and brine deteriorate soil structure resulting in reduced plant water availability, excess water runoff, and ultimately, erosion. A high sodium concentration in the soil causes plant “yellowing” and dehydration resulting in wilting or stunting of the plant.

Chemically, *DeSalt Plus™* affects the ion exchange in the soil. Remediating sodium affected soils necessitates lowering excess exchangeable sodium with a soluble calcium source. The more favorable calcium ions replace the sodium ions present in the soil. The displaced sodium is then free to be flushed out of the root zone by water, allowing plant functions to return to normal.

The remediation affects of *DeSalt Plus™* begin immediately, and normal growing conditions are soon regained. Substantial decreases in sodium concentrations can be measured within weeks. Additional soil conditioning may be required depending upon degree and period of contamination.

Treatment of contaminated soils with *DeSalt Plus™* is quick, *easy, and economical* way to remediate sodium affected soils.

About

DeSalt Plus™

Reduces sodium levels quickly and effectively.

Helps restore crops and vegetation.

Flocculates soil particles for improved soil structure and water penetration.

Improves nutrient utilization.

Cost-effective treatment.

Easy to apply.

Non-toxic and non-hazardous. Can be applied in and around inhabited areas.

The principal carrier of salt through our environment is water. In the oil and process industries, salt laden waters are stored and transported via cross country piping and storage networks. These systems, through leaks and spills, cause accidental influxes of salt to the soil that can completely devastate all vegetation and stop biological activity in a matter of days.

SODIUM CONTAMINATION

The primary salt associated with oil field wastes or produced waters is sodium chloride (NaCl). Soils, drill cuttings, and other E&P waste solids exposed to high sodium levels naturally become sodium saturated, or sodic. Previous remedies for excess sodium accumulations and influxes to soil have been limited to those problems of minor agriculture salinization. In many such projects, the addition of large quantities of gypsum (2 ½ to 50 tons per acre) and water leaching (1 acre-foot of water per ton of gypsum) have been incorporated. Results are time consuming and costly. These methods show little to no effect at all when sodium influxes are rapid and during a short period of time such as with heavy-laden salt water from pipeline leaks and industrial brine spills.

PROBLEM DEVELOPMENT

Sodium problems can occur suddenly in the case of a spill, or develop gradually in the case of a salt mine or well. As the accumulated sodium reaches higher concentration levels, the plants normal transpiration processes (absorption of water from the soil) are affected. In this process, pure water is removed from the soil and the sodium salts are left behind. As sodium concentrations increase, water that previously flowed easily into the plants root system is reduced.

SOIL RECLAMATION

The parameters often used to estimate sodium damage to the soil include; electrical conductivity (EC), sodium adsorption ratio (SAR), exchangeable sodium percentage (ESP), and cation exchange capacity (CEC).

DeSalt Plus™...Reclamation of sodium contaminated soils

The following values are recommended for farming and residential conditions:

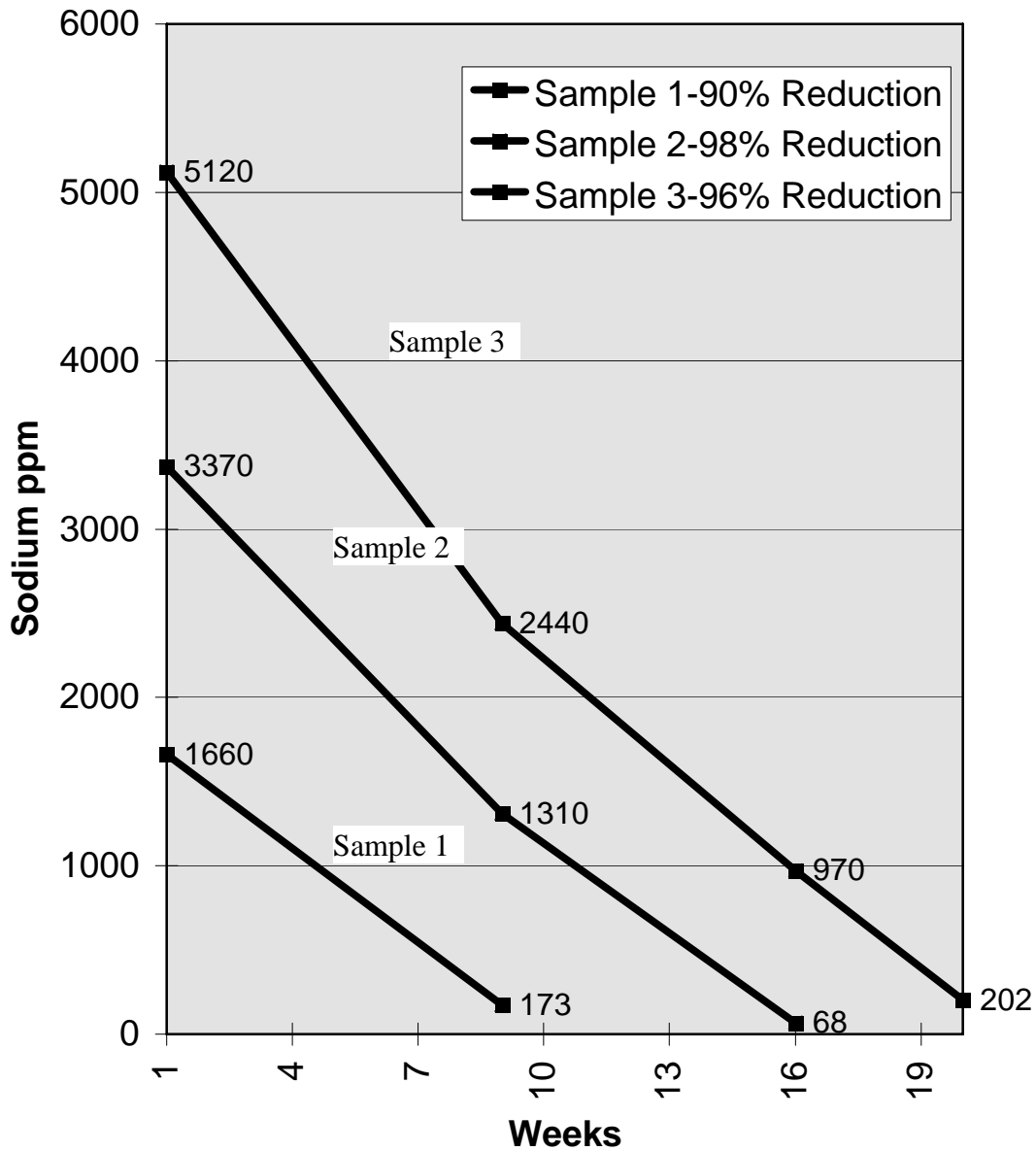
EC	2-4
SAR	<12
ESP	<12
Sodium ppm	<500

Remediating severely sodium damaged soils in a timely manner necessitates lowering excess exchangeable sodium with a *soluble* form of calcium. The calcium cations will replace the sodium ions present in the soil. The displaced sodium is then free to be flushed out of the root zone by water. *DeSalt Plus*™ satisfies the need for a *soluble* calcium source, quickly reducing harmful sodium levels while flocculating soil particles for improved soil structure and water penetration. *DeSalt Plus*™ provides a more concentrated and readily available source of calcium than the traditional lime, gypsum, and other calcium amendments. By using a *soluble* calcium source such as *DeSalt Plus*™, sodium is quickly and efficiently leached from the root zone, resulting in increased water uptake, improved nutrient utilization, and restoration of crops and vegetation.

SOIL FERTILIZATION

Soil fertilization is often overlooked when treating sodium contaminated soils. After sodium has been removed from the root zone, damaged plants and vegetation require proper nutrition for recovery and re-growth. *DeSalt Plus*™ supplies valuable nutrients for plant development and growth. *DeSalt Plus*™ offers optimum nitrogen efficiency. *DeSalt Plus*™ also supplies calcium nutrition for improved plant structure and development. Because *DeSalt Plus*™ improves soil structure and increases soil permeability, sufficient amounts of water can once again reach the plant, allowing vegetation to return to its natural state and growing condition.

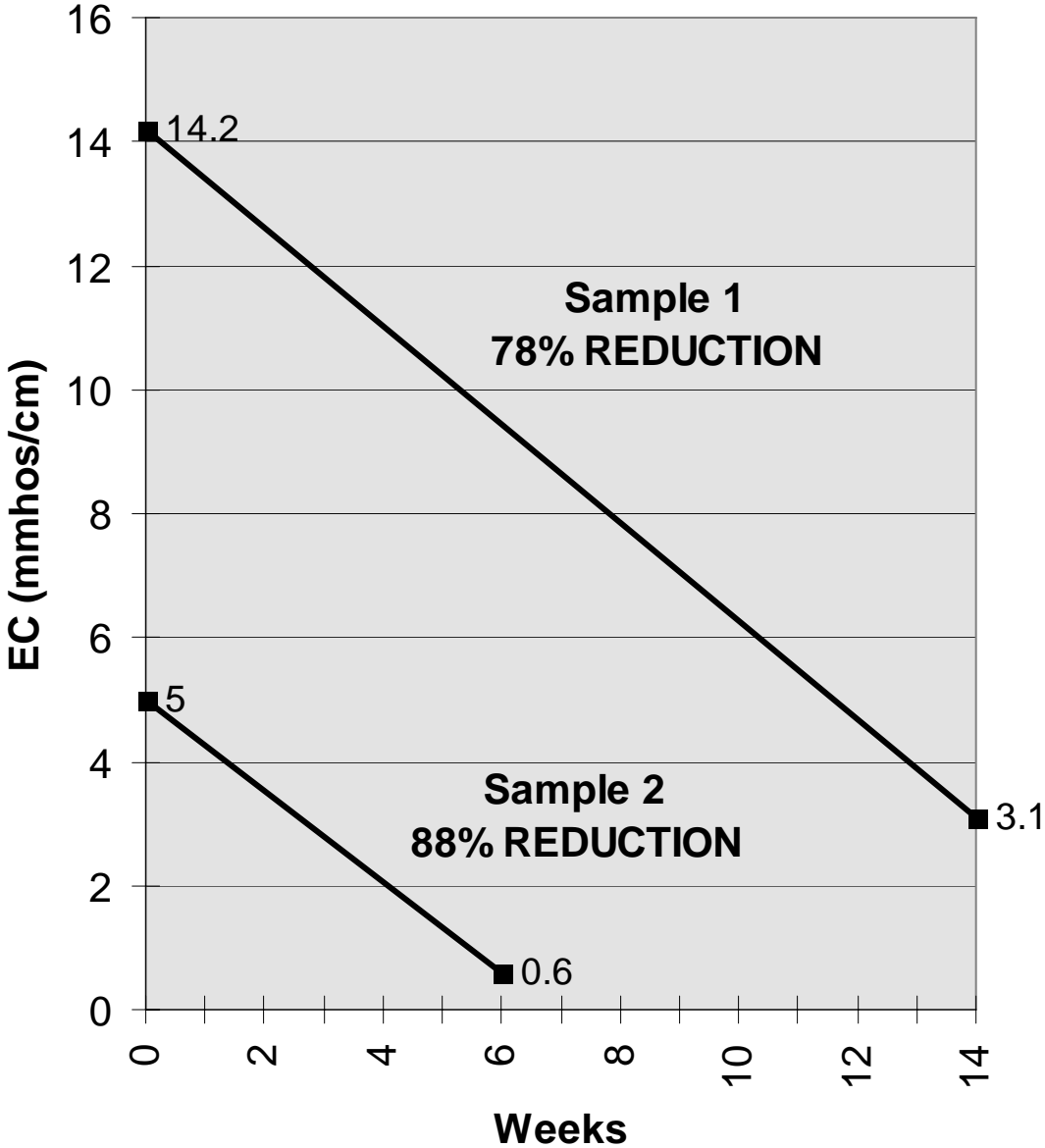
SALT (NaCl) STUDY SODIUM REDUCTION with *DeSalt Plus*TM



SALT (NaCl) STUDY

ELECTRICAL CONDUCTIVITY

REDUCTION with *DeSalt Plus*TM



PRODUCED WATER PIPELINE LEAK

DeSalt Plus™ ...Reclamation of sodium contaminated soils
BEFORE APPLICATION



AFTER *DeSalt Plus*™ APPLICATION



DeSalt Plus™, , JumpStart™

TREATMENT FOR SALT CONTAMINATED SOILS

APPLICATION GUIDELINES -SITE SPECIFIC-

1. Sample soil to establish existing sodium levels.
2. Determine extent of sodium damage in soil to be treated i.e., depth and surface area.
3. Prepare soil to improve percolation by plowing, tilling and bulking.
4. Apply *DeSalt Plus™* and *Jumptart™* solution into soil.
5. Irrigate the site heavily with fresh water.
6. Apply *SoilBond 2000™* to site to improve tilth and control erosion.
7. Sites adversely affected for longer periods of time may require additional treatments.

To verify the volume of soil to be treated is important!

Introduce DeSalt Plus™ to the soil by spraying, tilling, or injection.

Level soils, efficient irrigation and good drainage are recommended.

Application rates may vary due to varying conditions. Depending upon the severity of the sodium soil damage, the depth of contamination and the soil type, a wide range of effective product usage rates can be applied. Consult your local **SOS** Sales Representative for recommendations.

**Site remediation using
*DeSalt Plus™ & JumpStart™***
*Old damaged soil from multiple
saltwater leaks*



Before



After

DeSalt Plus™

TREATMENT FOR SALT CONTAMINATED SOILS

PRODUCT DATA SHEET

PHYSICAL PROPERTIES

Light green/odorless liquid

11.4 lbs./liquid gallon

PACKAGING

55 gallon drums

330 gallon totes

Bulk

AREAS FOR USE

Soil contaminated with salt (sodium chloride)

SAFETY AND HANDLING

DeSalt Plus™ is a non-toxic solution and is not subject to DOT regulations.

Protective clothing, rubber gloves, and either a face shield or safety goggles are recommended. For further details, follow the Material Safety Data Sheet.

COVERAGE

Site specific, consult your *SOS* Sales Representative

TOOLS FOR APPLICATION

Spray tank, vacuum truck, agriculture sprinkler systems, and any common method of water application

APPLICATION TEST REQUIREMENTS

EC, SAR, Sodium ppm, ESP, CEC

- *DeSalt Plus™* is an effective source for immediate sodium ion exchange. *DeSalt Plus™* offers immediate sodium displacement and improved soil structure for increased water infiltration and soil permeability.
- *DeSalt Plus™* will improve soils of naturally inadequate drainage as well as the drainage losses caused by excess sodium concentrations.
- *DeSalt Plus™* causes aggregation of dispersed soil particles, generally associated with older sites and heavily sodium contaminated soil.
- *DeSalt Plus™* serves as a valuable source of nutrition for plants and crops through enhanced nitrogen uptake and efficiency.
- *DeSalt Plus™* is a safe to handle liquid that is easily applied to sodium damaged soil. Any common method of water application will be suitable for *DeSalt Plus™* application. Spray tanks, vacuum trucks, and agriculture sprinkler systems as well as water flood methods have all been proven effective.
- *DeSalt Plus™* is a concentrated liquid requiring fresh water dilution and irrigation following application. *DeSalt Plus™* is available in, 55 gallon drums, 330 gallon totes, and bulk.

JumpStart™

TREATMENT FOR SALT CONTAMINATED SOILS

PRODUCT DATA SHEET

PHYSICAL PROPERTIES

Colorless/odorless liquid
10.9 lbs./gal

PACKAGING

55 gallon drums

AREAS FOR USE

Soil deeply contaminated with salt (sodium chloride)

SAFETY AND HANDLING

JumpStart™ is a non-toxic solution and is not subject to DOT regulations. Protective clothing, rubber gloves, and either a face shield or safety goggles are recommended. For further details, follow the Material Safety Data Sheet.

COVERAGE

Site specific, consult your *SOS* Sales Representative

TOOLS FOR APPLICATION

Spray tank, vacuum truck, agriculture sprinkler systems, or any common method of water application

APPLICATION TEST REQUIREMENTS

NPK, soil nutrients

- *JumpStart*™ is specially designed for accelerated restoration of crops and vegetation in areas previously affected by salt and hydrocarbon contamination. *JumpStart*™ stimulates growth while supplying a stabilized balance of vital nutrients for depleted and stressed soils. Soils affected by salts and hydrocarbons are usually deprived of the soil structure and critical nutrients necessary for seeding emergence and re-growth. These soils are generally composed of dense layers that are usually impenetrable to plant roots. *JumpStart*™ amends the soil by flocculating soil particles and destroying these dense layers, allowing water and nutrients to reach the root zone. *JumpStart*™ also strengthens cell wall structure for improved development during plant emergence. *JumpStart*™ is a non-hazardous product that can be used in conjunction with soil remediation products such as *MicroBoost*™, and *DeSalt Plus*™ for the remediation of hydrocarbon and salt contaminated soils. Please consult your *SOS* representative for product application recommendations and guidelines.

If used according to recommended procedures and guidelines, *JumpStart*™ accelerates the restoration of vegetation in areas previously affected by salt and hydrocarbon contamination.

MicroBoost™

NUTRIENT ADDITIVE FOR TREATMENT OF PETROLEUM HYDROCARBON WASTES

MicroBoost™ is a concentrated water soluble nutrient for microorganisms. It promotes the reproduction and growth of naturally occurring microorganisms in the soil, which have adapted over time to feed on hydrocarbon pollutants. Use of *MicroBoost™* accelerates the consumption of hydrocarbons naturally by serving as the energy source for this process. The resulting biodegradation is also a natural process that reduces the hydrocarbons to biomass and subsequently to carbon dioxide. When the hydrocarbon food supply is exhausted, the microorganism population diminishes back to normal levels.

Bioremediation is the most natural and cost effective technology in the environmental field. With *MicroBoost™*, remediation can be accomplished quickly and easily, avoiding more costly options.

Application of *MicroBoost™* is easy. The product is applied to the affected soil in-situ. It can be sprayed directly onto the affected area, or injected into the soil. Tilling is recommended for faster results. Soil conditions will determine the application concentrations.

Treatment with *MicroBoost™* liquid nutrient is a ***quick, easy, and economical*** way to remediate petroleum hydrocarbon wastes.

About

MicroBoost™:

Promotes the growth and activity of microorganisms present in the soil.

Provides concentrated nutrition to microorganisms.

Non-toxic and non-hazardous.

Cost-effective way to remediate petroleum hydrocarbon wastes.

Environmentally safe, poses no health threat to humans or animals.

Easy to apply.

"In March of 1989, the supertanker Exxon Valdez ran aground on Bligh Reef in Prince William Sound, Alaska, flooding one of the nation's most pristine and sensitive environments with approximately 11 million gallons of crude oil in about 5 hours. In the aftermath of the accident a massive cleanup was organized. Many conventional techniques were used in an effort to remove the oil from the contaminated shorelines and beaches. Methods like booms, skimming, spraying and actual scrubbing of the rocks were unable to clean up all of the oil in the soils."

"To enhance cleanup efforts the EPA suggested bioremediation be tried. On the basis of favorable results of field tests where remediation occurred two to four times faster than if unaided, a large scale application of nutrients began on August 1, 1989. Findings from follow up field and laboratory tests conducted then and now, indicate that using nutrients to enhance biodegradation is effective and environmentally safe."

Bioremediation uses naturally occurring microorganisms, such as bacteria, fungi, or yeast to degrade harmful chemicals into less toxic or non-toxic compounds. Microorganisms, like all living organisms, require nutrients e.g., nitrogen, phosphorous, and trace metals. Microorganisms also break down a wide variety of organic compounds (hydrocarbons) found in nature and are considered nature's recyclers. Some species of soil bacteria process hydrocarbons as a food source converting the contaminant into carbon dioxide, water and fatty acids. Bioremediation recognizes these phenomena and builds upon them.

HYDROCARBON IMPACTS

Oil contaminated soils and waters typically contain high concentrations of hydrocarbons. Hydrocarbons have detrimental effects on soil, water, and the surrounding environment. In plants and crops, high hydrocarbon concentrations cause reduced plant growth, yield and germination. Hydrocarbons, when released to surface soils, penetrate to varying

MicroBoost TM...Nutrient additive for accelerated hydrocarbon degradation

depths depending upon the soil type. Oil has an affinity for clay. As a result, oil does not penetrate deeply into clay soils. However, oil penetrates deeply into sandy soil. The parameter used to measure hydrocarbon contamination in both soil and water is Total Petroleum Hydrocarbons (TPH, method 418.1 or 413.1). Studies have shown that hydrocarbon loadings of >1 percent TPH (10,000 ppm) have adverse impacts on plants, crops, and the environment. Regulatory authorities usually require that soils contain < 1 percent TPH.

BIOSTIMULATION

A unique characteristic of bacteria is the fact that as certain microorganisms become exposed to hydrocarbon contaminants, they tend to develop an increased tolerance and ability to degrade those substances. New strains of bacteria naturally appear at hazardous waste sites and begin to degrade the wastes. The art of bioremediation consists of identifying and creating a favorable environment for the growth of the 5 to 10 percent of all microbes in-situ that perform the desired remediation function, thus accelerating the time frame in which these cleanup processes unfold. Since they are acclimatized to the environment, the naturally occurring microorganisms are most effective in the field of bioremediation. *MicroBoost* TM is a water soluble concentrated nutrient for the microorganisms. *MicroBoost* TM serves as the energy source for microorganisms, improving the organism's rate of reproduction and in turn, increasing the rate of decomposition of hydrocarbons into carbon dioxide. This product does not conflict with EPA policies or Toxic Substances Control Act (TSCA) regulations concerning the use of microorganisms for the purpose of bioremediation.

OPTIMIZING ENVIRONMENTAL CONDITIONS

Bioremediation ultimately depends on the activities of the microorganisms. Microbial population size may be limited by the existing environmental conditions. By optimizing environmental factors such as; water content, temperature, pH, the presence of toxic

materials such as metals and sodium, the type and amount of organic material present, and the availability of nutrients such as nitrogen and phosphorous, regulatory compliance levels can be achieved in minimal amounts of time.

INCREASED NITROGEN UPTAKE

MicroBoost™ supplies existing microorganisms with a highly concentrated source of nitrogen. Nitrogen is necessary for the synthesis of proteins and nucleic acids.

Exhaustion of available nitrogen inhibits the growth rate of the microbial populations.

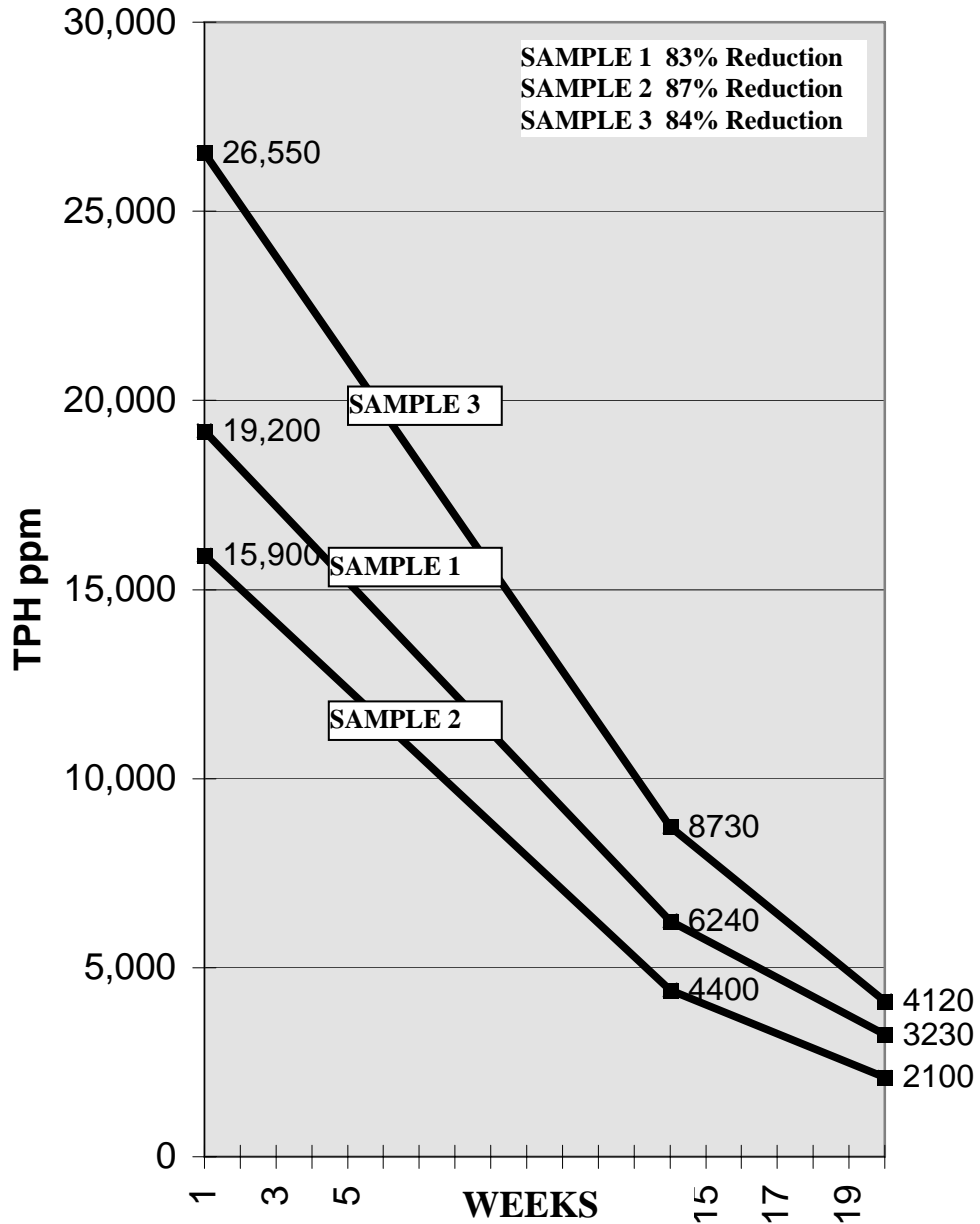
MicroBoost™ offers optimum nitrogen efficiency. When applying *MicroBoost*™, the microorganisms receive a sufficient supply of nitrogen, increasing the growth rate of the population and reducing the amount of time needed to break down petroleum hydrocarbons.

IN SITU TREATMENT

MicroBoost™ is a cost-effective, in situ bioremediation product that can be surface applied or injected into the soil. In the case of surface remediation, necessary oxygen is available directly from the atmosphere, whereas in subsurface remediation, oxygen must be supplied by physically delivering water or air to the contaminated material. The top 6 to 18 inches of the contaminated soil is usually treated by tilling the soil to provide aeration, and adding water and nutrients to stimulate bacterial growth. Bioremediation has taken a prominent place among today's technologies used to clean up and protect the environment. *MicroBoost*™ is an easy-to-apply, non-disruptive, cost-effective, and efficient method of enhancing and accelerating bioremediation.

HYDROCARBON STUDY

TPH REDUCTION (HYDROCARBON REDUCTION) with *MicroBoost*™



MicroBoost™

NUTRIENT ADDITIVE FOR TREATMENT OF PETROLEUM HYDROCARBON WASTES

APPLICATION GUIDELINES -SITE SPECIFIC-

1. Sample soil to establish existing contaminant levels.
2. Remove excess free oil and treat sodium damaged soil before applying.
3. Apply *MicroBoost™* solution into the soil.
4. Irrigate soil to optimize the bacterial process.
5. Note and adjust soil pH if necessary.
6. Till soil frequently for oxygenation.
7. Highly contaminated sites may require additional treatments.

Petroleum hydrocarbons consist of hundreds of constituents.

High sodium chloride levels and standing oil are toxic to microbes.

Tilling aids penetration, spraying ensures surface coverage.

The remediation process requires:

- *nutrients*
- *water*
- *oxygen*
- *sufficient temperature*
- *proper pH*

Application rates may vary due to varying conditions. Depending upon the levels of TPH damage, the depth of contamination and soil type, a wide range of effective product usage rates can be applied. Consult your local your *SOS* Sales Representative for recommendations.

MicroBoost™

NUTRIENT ADDITIVE FOR TREATMENT OF PETROLEUM HYDROCARBON WASTES

PRODUCT DATA SHEET

PHYSICAL FORM

Liquid
10.9 lbs./liquid gallon

PACKAGING

55 gallon drums
330 gallon totes
Bulk

AREAS FOR USE

Soil contaminated with petroleum hydrocarbons

SAFETY

MicroBoost™ is a non-toxic, non-hazardous solution and is not subject to DOT regulations. However, it contains a strong solution of alkali earth metal electrolytes. Protective clothing, rubber gloves and either a face shield or safety goggles are recommended. For further details, follow the Material Safety Data Sheet.

COVERAGE

Site specific, consult your *SOS* Sales Representative

TOOLS FOR APPLICATION

Spray tank, vacuum truck, agriculture sprinkler systems, or any common method of water application

APPLICATION TEST REQUIREMENTS

EPA 413.1 or 418.1, or as required by governing authority

- *MicroBoost™ accelerates the consumption of petroleum hydrocarbons by serving as a concentrated nutrient source for microorganisms.*
- *MicroBoost™ promotes growth and activity of microorganisms already present in the soil. MicroBoost™ accelerates the organism's rate of reproduction, thus reducing the amount of time needed to break down the hydrocarbons.*
- *MicroBoost™ serves as a valuable source of nutrition for plants and crops. MicroBoost™ offers enhanced nitrogen uptake and efficiency.*
- *MicroBoost™ is a safe to handle liquid that is easily applied to petroleum contaminated soil. Any common method of water application will be suitable for MicroBoost™ application. Spray tanks, vacuum trucks, agriculture sprinkler systems, as well as water flood methods have all been proven effective.*
- *MicroBoost™ is a concentrated liquid requiring fresh water irrigation following application. MicroBoost™ is available in, 55 gallon drums, 330 gallon totes, and bulk*

BioWash™

BIODEGRADABLE ORGANIC SOLVENT, CLEANER, AND BREAKER FOR TREATMENT OF HYDROCARBON WASTE

PRODUCT DATA SHEET

PHYSICAL FORM

Light amber liquid/citrus odor

Specific gravity .99 @ 20°c

pH 6.5 - 7.5

PACKAGING

5 gallon pails

55 gallon drums

AREAS FOR USE

Soil, equipment, or surfaces contaminated with petroleum hydrocarbons

SAFETY

BioWash™ is a non-toxic, non-hazardous solution, and is not subject to DOT regulations. Protective clothing, rubber gloves, and either a face shield or safety goggles are recommended. For further details, follow the Material Safety Data Sheet.

TOOLS FOR APPLICATION

Spray tank, high pressure sprayer, steam cleaner, or any common method of liquid application

- *BioWash*™ is a highly concentrated aqueous based cleaner and degreaser for the removal of petroleum and organic based hydrocarbon accumulation on soils and surfaces.
- *BioWash*™ is superior for routine cleaning operations in commercial and industrial establishments.
- *BioWash*™ can be used on soil, asphalt, concrete, pilings, plant floors, offshore platforms, well heads, tank bottoms, metal parts, rocks and other surfaces.
- *BioWash*™ is a biodegradable product that can be used in conjunction with soil remediation products such as *MicroBoost*™ and *DeSalt Plus*™, for the bioremediation of hydrocarbon contaminated soils.
- *BioWash*™ when used on a routine basis will help prevent oil and grease accumulation from establishing, resulting in a safer and cleaner environment.
- *BioWash*™ applications and coverage amounts are dependent upon the quantity and type of contamination. For initial application and on heavily contaminated surfaces, such as thick or crusted oil and grease accumulation (tank bottoms, drill cuttings, soils, etc.), *BioWash*™ should be diluted with fresh water at a ratio of 10:01 (10 parts water to 1 part *BioWash*™). For moderate accumulations (automotive repair shop floors, etc.) and with routine use, a dilution of 20:1 is recommended. For light contamination (warehouse floors, etc.), a dilution ratio of 30:1 is recommended.



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