

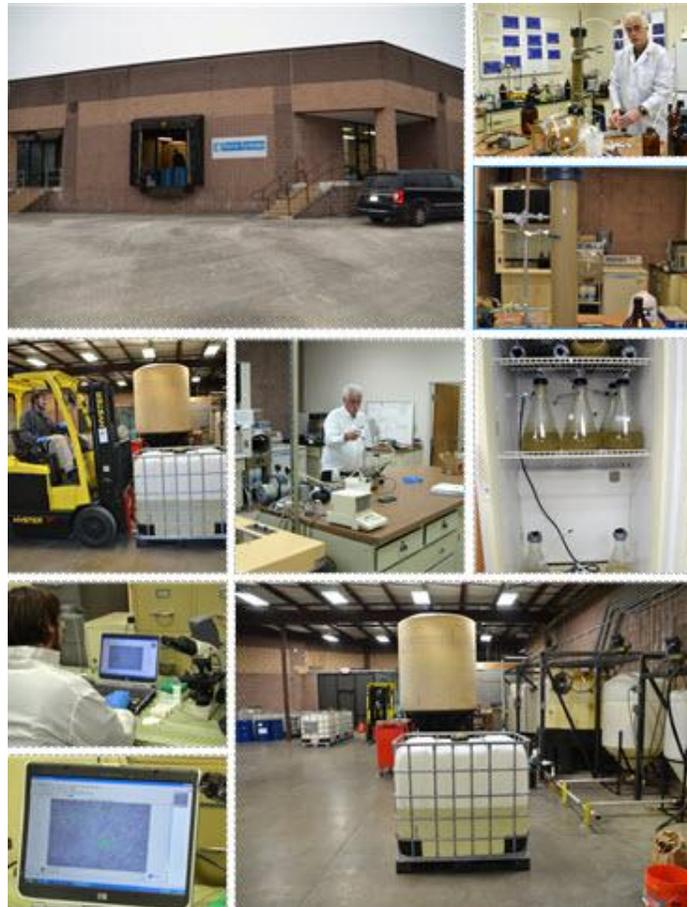


Terra Systems Capabilities Document

Research – Product Development – Manufacturing – Distribution

Core Competencies

1. Operates its own U.S. manufacturing plant with a full time U.S. production staff
2. Flexible manufacturing process that enables the company to produce five unique formulations of SRS[®] emulsified vegetable oil substrate packages and customer designed formulations
3. Quality control lab on the manufacturing floor
4. On-site R&D and Treatability Study Laboratory
5. Sustainable Partnership program for minimizing carbon footprint of remediation projects
6. Data management and process visualization
7. Distribution system with Just-In-Time Delivery



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Summary of In-Situ Bioremediation Products

Offering Anaerobic and Aerobic In-Situ Bioremediation Solutions

Terra Systems, Inc.'s scientists have been developing in-situ bioremediation technology since the 1980's. Our roots go back to Richard Raymond, Sr. who received the first patent for in-situ bioremediation of petroleum hydrocarbons in the 1970's. Today, Terra Systems, Inc. offers proven bioremediation products backed by a strong Research & Development program unmatched by any of our competitors, focused on the advancement of bioremediation technology and implementation cost reduction. Our emulsified products have assisted site remediation companies with green remediation alternatives for over 12 years and include a family of patented SRS[®] products.

Terra Systems operates its own manufacturing facilities so we can easily setup "**Just-In-Time**" manufacturing and delivery of SRS[®] to your site. We work closely with the on-site project managers to produce and deliver SRS[®] based on real-time site conditions. The benefit of this is that if you run into any injection delays, you don't have to worry about on-site storage of large amounts of material especially in hot weather. As a product supplier, we view environmental consulting companies as our customers, not our competitors and our goal is to make you successful with your clients.

Product	Description	Benefit
SRS [®] -SD	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B ₁₂ , which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. 0.6 μm droplet size and a nonionic (does not have a charge) surfactant mixture .	Proprietary surfactant mixture doesn't have a charge and will not adhere readily to the positively charged soil particles. This combined with a small droplet size will result in greater distribution in the aquifer. Ideal for groundwater flow rates (gwfr's) of less than 0.5 ft/day . Nutrient package for optimal bacteria growth.
SRS [®] -FR	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B ₁₂ , which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. 5 μm droplet size and an anionic (has a negative charge) surfactant mixture .	Proprietary natural emulsifier has a negative charge and will adhere more readily to the positively charged soil particles than a nonionic surfactant. This increased " stickiness " combined with a larger droplet size (5 μm) will result in more adsorption of SRS [®] -FR in fractured bedrock system or other highly permeable aquifers. Ideal for gwfr's of 0.5 ft/day or more . Nutrient package for optimal bacteria growth.
SRS [®] -C	SRS [®] -C is a defined by the client and can be a specific client recipe or special packaging requirements.	Packaging in 5 gallon buckets, 50/50 mix of SRS [®] -SD and SRS [®] -FR, or can increase lactate from 4% to 7%.

Product	Description	Benefit
SRS [®] -Z _{VI} (new)	Terra Systems SRS [®] -Z _{VI} uses our state of the art manufacturing facility to produce a unique oil/iron product that combines patented emulsified vegetable oil substrate technology (SRS [®]) with zero valent iron (ZVI).	SRS [®] -Z _{VI} provides better flow characteristics and higher carbon and hydrogen yield than other commercially available products. SRS [®] - Z _{VI} is shipped in 275-gallon IBC totes and is shipped ready-to-inject.
SRS [®] -M	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B ₁₂ , which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity. A proprietary food grade reductant is included which will reduce hexavalent chromium (Cr ⁶⁺) and other metals. The concentration of the abiotic reductant can be adjusted depending on the metal concentrations.	The microbial population removes the oxygen, nitrate, sulfate and other competing electron acceptors. The redox potential is depressed, which results in the reduction and precipitation of the Cr ⁶⁺ . The slow release characteristics of SRS [®] -M maintain reducing conditions for up to 24 months with a single application. The proprietary food grade reductant reduces Cr ⁶⁺ to Cr ³⁺ Ideal for sites with both chlorinated solvents (PCE, TCE) and Cr ⁶⁺ contamination.
SRS [®] -B	60% soybean oil, at least 4% potassium or sodium lactate, which are both soluble substrates that rapidly generates anaerobic conditions. Proprietary organic and inorganic nutrients such as yeast extract, nitrogen and phosphorus, which have been shown to support growth of the anaerobic microbial population. A neutral pH for optimum aquifer conditions. >250 ppb Vitamin B ₁₂ , which He et al. 2007 demonstrated is an important micronutrient to enhance dechlorination activity.	SRS [®] -B _{buffered} is offered in four standard “ <i>off the shelf</i> ” concentrations (1%, 5%, 10% and 15%) based on the buffering capacity of the aquifer (groundwater and soil) or it can be custom blended depending upon the site’s pH. It provides immediate and long-term pH optimization at your site and sustains optimal pH conditions for dechlorination to occur. Ideal for sites where the pH is <4 .
QRS [®] -SL and QRS [®] -PL	60% sodium lactate or 60% potassium lactate substrate.	Soluble quick release sodium lactate substrate provides an immediate carbon source and arrives “ <i>injection ready</i> ”, which provides short-term sustainable, in-situ anaerobic remediation.
QRS [®] -SL Plus and QRS [®] -PL Plus	60% sodium lactate or 60% potassium lactate substrate fortified with a proprietary nutrient package (QRS [®] -Plus).	Soluble quick release sodium lactate substrate with a proprietary nutrient package and Vitamin B ₁₂ (standard), provides an immediate carbon source and arrives “ <i>injection ready</i> ”, which provides short-term sustainable, in-situ anaerobic remediation.



Product	Description	Benefit
EZVI-Mixed Micro/Nano or EZV -Nano	10% - 17% Mixed Micro/Nano Scale or 10 - 17% Nano Scale Emulsified Zero Valent Iron	A combination of zero valent iron (ZVI), biodegradable soybean oil, surfactants, and water that form a stable emulsion particle (or micelles) that contain ZVI particles in water surrounded by an oil-liquid layer. The exterior oil layer has similar hydrophobic properties as chlorinated compounds. The emulsion attracts the contaminants and pulls them into the interior reactive zone for degradation.
NutriPlus™	NutriPlus™ can be added to other carbon substrates like lactate, molasses and emulsified vegetable oil substrates to enhance in-situ bioremediation.	Addition to carbon substrates for aquifer remediation of chlorinated solvents.
TSI DC® <i>Dehalococcoides ethenogenes</i> Bioaugmentation Culture	An enriched natural bacteria culture that contains <i>Dehalococcoides</i> species for bioaugmentation.	At sites where <i>Dehalococcoides</i> microorganisms are not present or are found at low numbers, the process will often "stall" at cis-1,2-dichloroethene. The TSI-DC® Bioaugmentation Culture will promote the complete dechlorination of PCE or TCE. The TSI-DC® Bioaugmentation Culture contains greater than 1×10^{11} <i>Dehalococcoides</i> /L.
Microbubbler	Oxygen Generator and Oxygen Spargers	An oxygen generator concentrates oxygen from air to greater than 90%. The standard unit can produce 27 pounds of oxygen daily using 120 volt power. The Microbubbler Oxygen Spargers generate fine (<5 μm) bubbles for maximal oxygen distribution.



Summary of In-Situ Treatability Laboratory Services

Offering Anaerobic and Aerobic In-Situ Lab Treatability Studies

Introduction

Terra Systems, Incorporated's Treatability Laboratory is located at 130 Hickman Road, Suite 1, Claymont, DE. 19703. Terra Systems is one of the most experienced companies in conducting treatability studies. Our laboratory has conducted over 200 studies to evaluate enhanced anaerobic bioremediation of chlorinated solvents, in situ chemical oxidation, monitored natural attenuation of chlorinated solvents and petroleum and enhanced aerobic bioremediation of petroleum. TSI can evaluate the benefits of inorganic nutrient additions, pH control, or various oxygen sources from sparged oxygen, slow release oxygen compounds, or hydrogen peroxide. TSI has an EPA permit DER000002360 to accept and dispose of hazardous wastes from treatability studies.

In Situ Chemical Oxidation

TSI has conducted treatability studies at over 100 sites in support of in situ chemical oxidation using potassium and sodium permanganate, activated persulfate, catalyzed hydrogen peroxide, or ozone and in situ chemical reduction of volatile organics, semivolatiles organics, and metals. Targeted compounds range from aromatics like benzene, toluene, ethylbenzene, xylenes; polynuclear aromatic hydrocarbons; chlorinated solvents such as perchloroethene, trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, and others. TSI does not perform in situ chemical oxidation or in situ reduction field projects, but works with a number of environmental engineering consultants including ERM, AMEC, TRC, Moraine Environmental, URS, GZA, and others to evaluate chemical oxidant demand and effectiveness in the laboratory before the consultants go to pilot or full-scale implementation. Analytical samples can be submitted to any laboratory selected by the consultant.

In Situ Aerobic Bioremediation Treatability Studies

TSI has extensive experience in evaluating in situ aerobic biodegradation of petroleum hydrocarbons ranging from gasoline and diesel to heavier products such as No. 6 Fuel oil. TSI can evaluate the benefits of inorganic nutrient additions, pH control, or various oxygen sources from sparged oxygen, slow release oxygen compounds, or hydrogen peroxide.

In Situ Anaerobic Bioremediation

TSI has conducted more than eighty anaerobic bioremediation studies over the past 20 years investigating the fate of chlorinated solvents such perchloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, 1,2-dichloroethane, carbon tetrachloride, chloroform, methylene chloride, Dinoseb, 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, chloroethane, and petroleum. We can evaluate different substrates, amendments to adjust pH, nutrients, or the need for bioaugmentation to promote the complete dechlorination of the solvents. TSI personnel conducted a number of the microcosm studies in support of the Remediation Technology Development Forum (RTDF) project at Dover Air Force Base. TSI also operated the pilot system which was the first field demonstration of bioaugmentation to promote the complete dechlorination of trichloroethene and cis-1,2-dichloroethene to ethene. TSI was a participant in the SABRE (Source Area BioRemediation Evaluation) project in Great Britain, which conducted laboratory and field investigations of bioremediation of trichloroethene dense nonaqueous phase liquids. The treatability study which TSI participated in used over 100 microcosms to evaluate the effects of substrates, nutrient addition, bioaugmentation, and



trichloroethene dosage on the dechlorination of trichloroethene. TSI's emulsified vegetable product, SRS[®], was selected as the optimal electron donor and was used in subsequent column and field studies.

Monitored Natural Attenuation

TSI has done a number of assessments of monitored natural attenuation of chlorinated solvents and petroleum hydrocarbons in soils, groundwater, and sediments both in laboratory evaluations and from field monitoring data.

Other Services

TSI can determine the number of culturable total bacteria and numbers of specific degraders such as gasoline or diesel. TSI offers light hydrocarbon gas analyses to quantify biodegradation products such as methane, acetylene, ethene, and ethane.

Equipment

TSI has a gas chromatograph dedicated to the analyses of chlorinated solvents and light hydrocarbon gases. We also work closely with other analytical laboratories when other analyses are needed or when certified analyses are required. TSI possess a laboratory chemical hood to safely conduct treatability studies with volatile constituents. The TSI laboratory also has an anaerobic chamber used to set up anaerobic microcosm studies. General laboratory equipment include centrifuge, temperature controlled shaker table, ovens, pH meters, redox meters, conductivity meters, dissolved oxygen, spectrophotometer, microscope, and other miscellaneous equipment.

USDA Permit to Receive Foreign Soils

TSI has a permit from the United States Department of Agriculture allowing it to import soils from outside of the continental United States. The permit number is P330-10-00222. The labels that need to be attached to the shipping container with the soil sample, copies of the USDA permit, and shipping instructions can be provided upon request.

EPA Hazardous Waste Small Generator ID

TSI has an EPA Hazardous Waste Small Generator permit. Our EPA Permit number is DEN201200001. We report the number and quantity of treatability study samples to the Delaware Department of Natural Resources and Conservation yearly.

Treatability Sample Disposal

Upon receipt, samples are logged in. When the samples are used in the treatability study, the quantity of soil remaining is recorded. Upon the completion of the studies, the treatability samples can be returned to the client or sent for disposal at licensed disposal facilities with shipment by licensed hazardous waste transporters.

Personnel

The treatability studies will be conducted under the supervision of Michael D. Lee, Ph.D. He has over 25 years of experience in bioremediation and monitored natural attenuation. Erich Hauptmann is a technician who



provides support for the treatability studies; he has worked in the treatability laboratory for more than four years.