



Terra Systems Capabilities Document

Lab Treatability Studies and Lab Services – Statement of Qualification (SOQ)

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 300 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 DEN201200001 to accept and dispose of hazardous wastes from treatability studies.

In Situ Chemical Oxidation

TSI has conducted treatability studies at over 150 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, Wood Group, TRC, Moraine Environmental, AECOM, 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 100 anaerobic bioremediation studies over the past 25 years investigating the fate of chlorinated solvents such as 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 works closely with several analytical laboratories when certified analyses are required. TSI possesses 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 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.

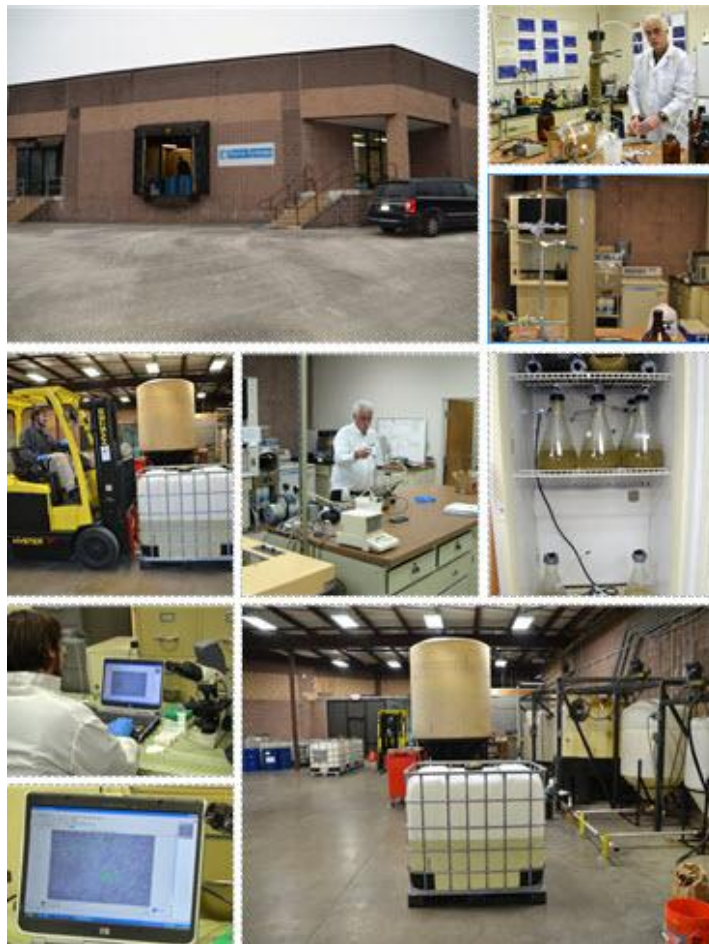


Treatability Sample Disposal

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 30 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 ten years. Each treatability study is custom designed with input from the client and the final price is approved by the client. To discuss a potential treatability study with Dr. Mike Lee or to obtain a ‘*sample*’ treatability report call him at the lab at [302-798-9553](tel:302-798-9553) or email him at mlee@terrasystems.net.





Price Ranges for Treatability Studies and Lab Services Based on the Complexity of the Study

Price Range			
Description	Complexity	Lower	Upper
ISCO Treatability Studies	Simple	\$750	\$5,000
	Moderately Complex	\$5,000	\$15,000
	Highly Complex	\$15,000	\$50,000
Anaerobic Biodegradation Micocosms	Simple	\$3,500	\$5,000
	Moderately Complex	\$5,000	\$15,000
	Highly Complex	\$15,000	\$50,000
Column Studies	Simple	\$5,000	\$10,000
	Moderately Complex	\$10,000	\$25,000
	Highly Complex	\$25,000	\$75,000
pH Buffering Test	Simple	0*	\$750
	Moderately Complex	\$750	\$10,000
	Highly Complex	\$10,000	\$25,000
Oil Retention Capacity Column Test	Simple	0*	\$750
Microbial Plate Counts	Total Bacteria	\$39	\$47
	Hydrocarbon Utilizers	\$48	\$56
Aerobic Biodegradation Micocosms	Simple	\$3,500	\$5,000
	Moderately Complex	\$5,000	\$15,000
	Highly Complex	\$15,000	\$25,000
*If SRS[®] or TSI-DC[®] Culture is purchased for site Each treatability study is custom designed with input from client and the final price is approved by the client.			