Turn dirty dirt into brick

Bioremediation: do it yourself

Here’s How It Works

Sparging can cut costs

EPA eyes soil washing

THE ASSOCIATION FOR THE ENVIRONMENTAL HEALTH OF SOILS
150 FEARING STREET
AMHERST, MA 01002
METCO'S portable facilities provide efficient soil remediation at levels of production unattainable by any other plant or equipment operating today. More noteworthy is the fact that METCO accomplishes this production standard with radiant heat, rather than the direct fire systems used by most others in the industry. Operating with production capability of up to 150 tons per hour, the process can handle much higher levels of petroleum contamination based on segregation of the soil from the combustion chamber. This process allows gases from the contaminated material to be processed independently and without direct contact to the heat source.

METCO'S process for radiant thermal soil remediation is the only reasonable alternative for many larger sites tainted with petroleum contaminated soil. Our price can compete with other less desirable methods of disposal. The METCO Group can provide twenty years of experience and the finest technology available to deal with many of your environmental problems. For information and pricing of our services contact us at (301) 729-6922 or FAX 729-0118.
A PROBLEM SOIL?
GRR! HAS
THE SOLUTION.

Recycle Your Soil!
as a raw material in the manufacture of
GIANT CEMENT

Through our patented Tigr1 process, GIANT Resource Recovery has removed the
contaminates from and recycled over 60,000 tons of soil. All of the solid siliceous
residue from the process was then used as part of the raw material for GIANT's
cement production in a facility that meets RCRA standards.

- Improved waste management with NO LIABILITY
- Positive public perception of recycling
- No more dependence on landfills
- Protection of the environment

We turn a liability — waste — into an asset that replaces sand in our
manufacturing process. Call us today at 1-800-786-0477 for an
information packet.

Grr!

GIANT Resource Recovery Company
Highway 453 / Post Office Box 352
Harleyville, South Carolina 29448
(803) 496-7676 / (800) 786-0477

Giant Cement Company
Highway 453 / Post Office Box 218
Harleyville, South Carolina 29448
(803) 496-7880 / (800) 845-1174

GIANT GROUP, LTD.
Post Office Box 218
Harleyville, South Carolina 29448
(803) 496-7880

Keystone Cement Company
7311 Airport Road / Drawer A
Bath, Pennsylvania 18014-0058
(215) 637-1881 / (800) 255-5736

Write in 130
Features

6  EPA eyes washing
   New surfactant washing technique cleans heavy fuel oils

7  Washing German style
   EPA eyes process
   Safe process is cost efficient; firm imports new process

14 Bioremediation: do it yourself
    With help you can manage your project

20 Looking through the glass
    Vitrification safety alert: embed organics in glass

22 Looking into immunoassay
    Efficient analytical tool for compounds

26 Turn dirty dirt into brick
    Firm recycles oily soils into valuable building material

32 Tank tightness testing terms untangled
    Guide helps to clear confusion in terminology

34 Sparging can cut costs in half
    Can also work twice as fast as venting

42 Risk assessments can save remediation dollars
    Not just another step, they can save money

44 Farmers want your biosolids
    New approaches to agricultural uses

Cover: Heidenheim washing site. See page 7

Departments

35 What's new

54 Advertiser Index and Hotline

50 BioVac BioPipe™

52 CHAMA™ Enclosed Auger System

Note:
Abbreviations and acronyms used throughout articles include:
EPA Environmental Protection Agency
UST Underground Storage Tank
ppm parts per million
ppb parts per billion

Soils magazine is published nine times per year by Group III Communications, Inc., 10229 E. Independence Ave., Independence, Missouri, 64055. Phone: 816-254-8735; FAX: 816-254-2128. Entire contents copyright 1992 by Group III Communications, Inc. All rights reserved. Opinions expressed by writers in Soils magazine are not necessarily those held by the publisher. SUBSCRIPTIONS: Soils magazine is mailed to companies with hydrocarbon storage liabilities and to regulatory people. U.S. subscriptions: $36 per year. Outside U.S.: $60 per year, U.S. funds only.
“Whole sector’s contaminated. Need backhoes! Can we get ’em fast?”

Definitely — when you call Hertz Equipment Rental! You’ll get what you need, in any quantity, when you need it. Earth movers, air, electrical, aerial, material handling equipment and — you name it — all available at your call from the huge inventory on hand at every one of our branches, coast to coast. Late models. Brands you trust. All kept in top condition by our factory-trained service professionals who work to standards exceeding manufacturer specifications.

What’s more, Hertz knows the needs of the people who handle hazardous wastes. We’re fully experienced with the demands of Emergency Response Contracts, and we’re prepared to respond well within specified time frames. Moreover, our HazMat customers are assured continuous access to their Hertz representatives, because we supply every number needed for contact 24-hours a day, seven days a week: beepers, car phones, office phones, even home phones.

So, whether your contamination problem is severe or minor, consider your nearest Hertz Branch your equipment yard, ready to fill your needs fast! Want the location of your nearest Hertz Equipment Rental branch? Check your Yellow Pages, or call 1-800-223-0983.*

Ask for your copy of our informative HazMat brochure, too.

*Within New Jersey, call 201-307-2722
As new methods emerge for cleaning petroleum contaminated soils, it is important to learn the performance potential and cost data of innovative approaches. The EPA’s Superfund Innovative Technology Evaluation (SITE) program recently tapped one such system—a soil washing approach—for demonstration at a site in Santa Maria, Calif.

The soil washing process implements design concepts of Mohsen Amiran, Ph.D., president of BioGenesis Enterprises, Inc., of Milwaukee, Wis. The process is surfactant-based and uses aeration as the mixing mechanism. Following initial piloting in Europe, BioGenesis selected IMPREX, Inc. of Milwaukee, to build the first U.S. equipment.

The surfactant blend itself was developed and tested over a five year period. Testing shows that, in addition to separating the pollutant from the soil, the surfactant blends accelerate the natural biodegradation rates of residual organics remaining in the soil after washing. Both the physical washing and the biodegradation of residuals are being evaluated under the SITE program.

Current soil washing technology is derived from the mining industry. Conventional techniques use high pressure washing to separate contaminants from large particles. This results in concentration of the pollutant in the small particles which remain contaminated. EPA studies show this type of washing technique achieves volume reductions on the order of 70 percent for contaminated soil. The remaining 30 percent must then be conventionally landfilled or incinerated.

BioGenesis approaches this problem from two directions—matching the surfactant to the contaminant—and use of versatile equipment. The equipment design mixes the surfactant and soil, facilitates scrubbing the pollutant from soil particles, removes the wash water without recontaminating the soil—and prevents the formation of tight oil-water emulsions in the water. The latter is particularly important to enable hydrophobic pollutants to be recovered, wash water to be reused, and to minimize the difficulty of ultimately cleaning and disposing of the wash water.

At the Santa Maria site, No. 5 fuel oil leaked from an underground storage tank at a healthcare center. The owner, Santa Maria County, had to clean up the site before they could sell the valuable land near the city center. No emissions control was deemed necessary because of the extremely low volatility of the weathered fuel oil. However, the mobile equipment has the capability to control volatile emissions through a hood over the wash unit and activated carbon filtration. Equipment provisions have also been made for future use of condensation processing for volatile contaminants and rapid air stripping of dry soil to remove volatiles prior to washing.

Mohsen Amiran, Ph.D. is president and Charles Wilde is executive vice president of BioGenesis Enterprises, Inc., Milwaukee, Wis.

BioGenesis soil washing technology combines physical washing with biodegradation of residuals.

EPA eyes washing process

New surfactant washing technique cleans heavy fuel oils

By Mohsen Amiran and Charles Wilde

Continues on page 8→
Washing German style

Safe process reconciles environmental objectives with cost efficiency

By Marvin Baker, Sc.D.


A soil washing process is being imported from Germany, where soil washing technology has been established for several years. The devastating contamination of World War II battle sites combined with a relatively high water table in many

Continues on page 9→

Introducing the latest advancement in double wall tank protection.

First with double wall tanks. First with factory-filled brine monitoring. And now Xerxes is first with TRU-CHEK™—a continuous leak detection system with a precise and economical testing procedure that exceeds all EPA criteria.

You get true double wall protection, the non-corrosive durability of fiberglass, and compatibility with all fuels—including alcohol blends. TRU-CHEK™ is just another way Xerxes gives you more built-in value.

For more information on TRU-CHEK™ and the entire line of Xerxes single wall, double wall and multi-compartment fiberglass tanks, call 612-887-1890. Or see your nearby Xerxes representative, today.

XERXES®
CORPORATION
7901 Xerxes Avenue South, Minneapolis, MN 55431-1288

Write in 174

August-September 1992 Soils 7
EPA eyes washing, from page 6

prepared the demonstration project under the supervision of EPA's Risk Reduction Engineering Laboratory in Cincinnati, Ohio. RADIUS Corp. of Austin, Texas, performed quality assurance and sampling in cooperation with PRC. This included independent audit of the testing procedures.

Over 900 samples were drawn from all points in the process during the nine test runs. Key parameters varied during the runs were amount of surfactant blend used and duration of cleaning time. The nine runs provided statistically valid data for estimation of contaminant removal effectiveness. Samples are also being drawn from the cleaned soil batches 14, 30, 45 and 60 days after the cleaning to track biodegradation of residual contamination levels. Results are scheduled to be published by the EPA in November.

The proprietary BioGenesis cleaners are mixtures of ionic and nonionic surfactants plus an additive package to accelerate biodegradation rates of organic pollutants. The cleaning solution is mixed for each site for specific contaminant variables.

At Santa Maria, pre-excavation soil borings and bench testing showed contamination with a cutting oil and fuel oil product mix. Unexpectedly high concentrations up to 10,000 parts per million (ppm) of highly weathered, heavy polycyclic aromatic hydrocarbons (PAHs) were encountered. As a result, BioGenesis managers decided to wash with water heated to 140°F.

Currently, the equipment can clean volatile and non-volatile hydrocarbons in soils with silty fines levels below 30 percent. Equipment is being designed to clean silty fines up to 80 to 90 percent and process on a continuous basis. The technology is also being expanded to remediate other contamination types, including pesticides, PCBs and heavy metals. Extraction efficiencies for the new equipment for acid and base-neutral extractables are 70 to 99 percent per wash cycle based on the soil matrix.
parts of the country stimulated
German government and industry to
develop effective remediation
techniques.

ContraCon GmbH of Cuxhaven,
Germany, is one company that has
developed a biological-physical
washing process that has successfully
remediated over 30 sites. A recent
project, remediation of a power
generating site in southern Germany,
was visited by officials of the U.S.
EPA—and illustrates how the process
works.

The power company, Stadtwerke
Heidenheim, had been a gas works
dating from 1863. The company
wanted to construct new facilities on
the site in the late 1980s, but the
severely contaminated soil stopped
that plan.

A site assessment was conducted by
the Institut Dr. Jungbauer and Partner
of Stuttgart, which found polynuclear
aromatic hydrocarbons of up to 3,200
mg/kg, phenol over 20 mg/kg,
cyanides greater than 200 mg/kg,
benzene, toluene and xylene aromatics
and heavy metals. The quantity of soil
to be treated was estimated at 35,000
tons.

The basic principle of the ContraCon
process is to attain mechanical
separation of the contaminants
adhering to the fines by adding water
and biodegradable detergents,
transferring the contaminants from the
soil particles into the water. The fines
and adhering contaminants are held in
suspension by the detergents and
floculated by a treatment with
polyelectrolytes. Depending on

Continues on page 10→
concentrations and types of contaminants, the resulting sludge can then be treated on site in a bioreactor or dewatered by settling or hydrocloning. The process water, at this stage, largely contaminant-free, is filtered and either recycled to the process or disposed to the municipal sewer.

First, a 10 day bench-scale feasibility study was carried out to provide base data for material balances. This was followed by a full scale demonstration on about one-eighth of the total affected volume. After this was successfully done, the remainder of the soil was treated.

Large chunks (greater than six inches) were separated on a rod screener. Coarse material that was conveyed on a two inch mesh sieve into a coarse material washing drum. This material was washed with a jet, but without the addition of detergents. Fines in the wash water greater than .07 inch were separated and moved by screw conveyor onto a horizontal belt conveyor.

Material less than two inches was reblended with the washwater fines and also fed onto the horizontal belt conveyor, which distributed the material into two parallel free fall mixers, similar to concrete mixers. In these mixers, water and a proprietary detergent, Konsan, were added and mixed.

The material was then conveyed on vibrating channels into a second washing drum where it was washed countercurrently. The washed fraction was transported on a vibrating sieve, jet-washed and again fractionated. Fines (particle size less than .07 inch) were separated from the water in a hydrocyclone.

Process water was collected in tanks and pumped to a water treatment unit to be either recycled into the process or delivered to the municipal sewer.

The remaining fines were pumped to a filter press, floculated and dewatered to a product containing 55 to 65 percent solids. The filtrate from the filter press was purified

Continues on page 12→
"Today's Solution to Yesterday's Pollution"

DISPOSAL TECHNOLOGIES, INC.

In today's times, it has become increasingly essential that contaminated soil generators and contractors protect themselves from liability regarding the disposal of their waste materials. At Disposal Technologies, Inc. we pride ourselves in our ability to assure our customers the utmost in protection by eliminating liability through the implementation of our innovative qualification program, waste tracking and security system.

WHY NOT TRY THE BEST!

DISPOSAL TECHNOLOGIES

FEATUREING

- petroleum contaminated soil
- non-hazardous wastes
- hazardous wastes
- municipal solid waste
- demolition debris

CALL 1-800-428-SOIL (7645)

Thermal Treatment • Recycling • Landfilling

Write in 228
BioGenesis

Soil Washing

Demonstrated in the U.S. EPA Superfund Innovative Technology Evaluation Program

MOBILE UNIT CLEANS SOIL CONTAMINATION

- Diesel
- Crude Oil
- Gasoline
- Fuel Oils
- Most Organics

HIGH THRU-PUT AT LOW COST

BioGenesis Enterprises, Inc.
Chicago • Milwaukee • Washington, DC
(703) 250-3442

Write in 254

THERMAL SOIL REMEDIATION

- Full Incineration of Organic Contaminants Including Petroleum Hydrocarbons
- Capable of Treating All Soil Grain Sizes, i.e., Sand, Silt, Clay
- 3 Off-Gas Emission Control Devices
- Post Treatment Analysis and Certification
- High Capacity Production Process
- Cost Effective Results
- Mobile Plant

PET-CON Soil Remediation, Inc.
P.O. Box 205
Spring Green, Wisconsin 53588
Phone (608) 588-7365
FAX (608) 588-2530

Write in 258

Overview of the Heidenheim installation.

German style, from page 10

by passing it over activated carbon filters.

The coarse material was used at the Groebnern landfill and recycling center near Meissen, Saxony, in construction drainage applications. The clean fine material was used as fill in highway construction.

The sludge was added at the 10 to 15 percent level in the production of bricks. The brickyard had conducted experiments over a period of eight years (partially funded by the German Federal Ministry of Research and Technology) to demonstrate that organic substances contained in the sludge can be removed from the brick oven exhaust by means of adsorption media and that remaining traces of heavy metals are rendered inert in the brick. The finished bricks were used by Stadtwerke Heidenheim as a protective layer placed over underground cable installations.

Ronald F. Lewis, Ph.D., research microbiologist for the Emerging Technology Section, SITE Demo and Evaluation Branch of the Superfund Technology Demonstration Division of the U.S. EPA, visited the Heidenheim site as part of a bilateral technology exchange agreement between the U.S. and Germany.

"In Germany, the big firms went to the mining industry to find the large size equipment to handle large volumes of materials quickly," he says. "They have also learned that pilot testing is a must for any new site. Bench-scale and treatability studies with site samples provide for the most efficient configuration of the process and cut costs."

Write in 582 for more information

For additional reading on soil washing:

Surfactant-Enhanced Soil Flushing
S. Kimball, Monographs in Soil Remediation Series,
Lewis Publishers
Chelsea, MI., 1992
New study profiles future of the tank market

Regulations will continue to drive growth

According to a new report by FIND/SVP and the Jennings Group, federal and state requirements should continue to expand the scope and size of the UST market into the next century. “The market for UST-related contracting and consulting services has grown rapidly since the EPA federal regulations governing USTs became effective in 1988,” says Peter Allen, vice president of FIND/SVP in New York, N.Y.

The UST market increased from $6.2 billion in 1990 to $8.8 billion in 1991. Total revenue projected between 1992 and 1996 is $48 billion. The market is expected to peak in 1993, due to testing and compliance deadlines for leaking tanks.

Approximately 250,000 tanks are likely to be permanently closed, reducing the number of regulated USTs by about 14 percent.

While the market for federally regulated tanks is approaching a peak early in this decade, increasing state regulations should rejuvenate the industry.


Write in 584 for more information

TerraStor™
The new low-cost answer for safely containing hazardous soils

Introducing the ideal alternative to berms or other retaining systems—the TerraStor in limitless capacities for temporarily storing hazardous earthen materials. Easily carried galvanized parts for a typical half-acre unit bolt together with ordinary hand tools in under a day. Featuring a full range of flexible membrane liners, the TerraStor is accessed by trucks over field ramps. Modular in design, the heavy-duty, reusable system also assembles into virtually any rectilinear shape for unique sites.

FOR A CATALOG OR ADDITIONAL INFORMATION, WRITE OR CALL:
(800) 245-6964
NY (718) 382-1112

ModuTank Inc.

41-04 35th Ave.
Long Island City, NY 11101

Write in 277

“Providing Innovative Solutions for Today’s Complex Environmental Problems”

Superior

ENVIRONMENTAL CORP

EXPERIENCED REMEDIAL SERVICES
TECHNICAL SUPPORT SERVICES

•Biological Treatment •Environmental Site Assessments
•Thermal Treatment •Technical Drilling
•Soil Venting •Hydrogeologic Investigations
•Soil Flushing •Portable G.C. / Soil Gas Surveys
•Air Stripping •Underground Storage Tank
•Internal Combustion •Closure/Compliance
Engine for Ground Water & Soil Treatment •LUST Fund Assistance

Call today for our Statement of Qualifications, or to discuss your Remedial Needs.
1-800-669-0699

Grand Rapids, Brighton, Kalamazoo, Marshall and Marquette, Michigan.
Bowling Green, Ohio and Atlanta, Georgia.

Write in 203

August-September 1992 Soils 13
Bioremediation: do it yourself

With a little bit of help, you can manage your own project

By Michael Barnhart

Is bioremediation really as easy as it sounds? The notion that microbes that occur naturally in soil will metabolize hydrocarbon molecules sounds like a cakewalk. But what really puts the frosting on the cake is the notion that it is possible for a responsible party to manage the bioremediation of a contaminated site on a “do-it-yourself” basis.

Currently, there are numerous vendors who offer bioremediation products and services to clean up petroleum contaminated sites. Many of these vendors have developed a great deal of experience in performing bioremediation procedures and in the application of various approaches to the process. However, the science of bioremediation is virtually the same for all processes. The variations in approach basically reflect the particular vendor’s beliefs, abilities, and experiences.

There are two schools of thought which relate to the approach one takes to bioremediation: biostimulation and bioaugmentation.

Biostimulation is a process whereby the addition of selected amounts of nutrient materials stimulate or encourage the growth of the indigenous (or native) bacteria in the soil which results in the degradation of the target contaminant compound.

Bioaugmentation is a process where specially selected bacterial cultures which are predisposed to metabolize the target compound are added to the soil along with the nutrient materials to encourage degradation of the contamination.

Michael Barnhart is president and CEO of Waste Stream Technology, Inc., of Buffalo, N.Y.
The basis for these approaches relates to the philosophical belief in "bacterial ubiquity" or "exclusivity" by the technological proponent. These philosophies will no doubt be debated for many years—as both approaches have shown merit and demonstrated success.

The principle of bacterial ubiquity basically assumes that in soils which have been contaminated, there exists a population of organisms which possess the ability to degrade the target contaminant compound.

The principle of bacterial exclusivity assumes that there may be a resident bacteria, but their ability to degrade the target does not exist, or is not nearly as great as the ability of specially developed organisms, and therefore, an inoculation of the "specialized" organism is necessary to promote a more efficient degradation of the waste or target compound.

Although each method has been demonstrated in full scale field applications, most proponents of biostimulation technology do not take into account safety issues which should be a primary consideration for any user of this approach.

Staff at Waste Stream Technology, of Buffalo, N.Y. have examined a great many gasoline and diesel fuel contaminated soils over the last seven years for their ability to support biostimulation and bioaugmentation processes. They have found that although many of these soil systems contained bacteria that could efficiently degrade the target compound to reach cleanup levels, the biostimulation of human, animal and plant pathogens which were also part of the baseline soil bacterial levels, were also stimulated. The proliferation of these "undesirable" bacterial species cannot be controlled through biostimulation processes. Accordingly, the potential may arise for a hazardous situation due to the presence of pathogenic bacteria.

The company has also examined a large number of soil types to determine the makeup of the resident bacterial populations and from these soils have selected a number of organisms for their ability to degrade a wide variety of target compounds in a safe and effective manner. These organisms have been screened for their potential toxicity to plants, animals and humans in accordance with guidelines developed by the U.S. Environmental Protection Agency (EPA) as well as Environment Canada. They have also been found to be non-pathogenic and safe for use or exposure to plants, animals and humans.

Any user of bioremediation products or services must be certain that the procedures chosen are microbiologically safe and that the population and type of organisms in the soils are known continuously throughout the treatment process. Bacterial identification and enumeration by an experienced company employing a staff of Ph.D. microbologists is a "must" for a safe and successful project.

The bioremediation of light fuels (gasoline or diesel) contaminated soils can be performed quite simply and cost effectively if certain operating principles are followed.

Continues on page 16 →

WE SOLVE ENVIRONMENTAL CONCERNS FOR THE MOST COST CONSCIOUS COMPANIES IN THE WORLD.

The list of those who utilize our cost effective environmental solutions reads like a who's who of industrial companies, small and large, including other subsidiaries of The Coastal Corporation.

In fact, Coastal Remediation Company has earned its reputation by satisfying the most cost-conscious clients – other Coastal subsidiary companies who demand cost-effective, fast-track solutions to a wide variety of complex environmental concerns including UST Management, Environmental Site Assessments, soil and groundwater remediation, wastewater treatment and design, and air modelling and permitting.

If you, too, want practical, permanent remediation tailored to your needs, call us at 1-800-776-5733.

Coastal Remediation Company
A SUBSIDIARY OF THE COASTAL CORPORATION
The Energy People

Roanoke, VA  Houston, TX  Philadelphia, PA  Tampa, FL

Write in 234
August-September 1992 Soils 15
Bioremediation operations of heavier fuel oils and other chemical compounds can be much more difficult and involved and should be performed by an experienced company.

Initially, a soil should be screened to determine if it is possible for bioremediation to meet the designated cleanup specifications for the site. This can be accomplished with a treatability study or prescreening for bioremediation potential.

Basically, the treatability study consists of placing a small amount of a representative soil sample into a bowl or container, thereby creating a microcosm of the site and dosing the microcosm with the selected site remedy.

There are a number of products available, and many have slightly differing instructions for use. So, in each application, instructions should be followed carefully to insure the product is used correctly.

**Figure 1**

For example, one kilogram of a contaminated soil system can be placed into a glass, plastic or stainless steel bowl and inoculated with the selected remedy. After a specified period of time, a sample is taken from the microcosm and analyzed for the parameters of concern. This continues until the soil has reached the desired cleanup criteria or until the soil no longer exhibits a change in condition, indicating the endpoint of the lower limit of cleanup attainable.

Typical attainable limits for bioremediation of gasoline and diesel are shown in Figure one, above. After the treatability study has demonstrated that the soil system will in fact support it, a full scale program can be implemented.

To illustrate a full scale process, assume a typical case of a contaminated soil pile originating from a leaking underground storage tank (UST) removal site. The site is a former gas station, and approximately 300 cubic yards of contaminated soil is stockpiled at the site. After a successful treatability study, the operator must decide whether to perform a landfarming style operation, or a heap or pile method of bioremediation.

*Continues on page 18 →*

---

**We KNOW Tanks!**

- 25 Years Experience
- OSHA Trained Crews
- State Certified for work in NJ & PA
- Specialist in UST Removal & Installation
- Site Restoration & Remediation
- Joint Ventures with Consultants & Engineers

*Get Your Project ON TRACK!*

Contact:

**LATTIMORE CONSTRUCTION**
Box 1325 Milford, PA 18337
717 296-5369

Write in 240
16 August-September 1992 Soils
Griffolyn®
Control and Containment
for Your
Contaminated Soil
Problems

Professionals in the critical area of environmental protection understand the need for control and containment while projects are in progress. Griffolyn, a unique nylon reinforced polyethylene, is the ideal choice for covering almost all environmental applications, including:

- Waste disposal site covers
- Contaminated soil stockpile covers
- Erosion control protection
- Daily landfill covers

Griffolyn covers are designed and manufactured for the dependability and versatility demanded by today's environmental challenges. Griffolyn is available in any size up to 200' x 200', reducing field fabrication costs. Stock sizes are ready for immediate shipment. Different grades of Griffolyn have been developed to last the lifetime of projects, from six months to four years.

For more information on Griffolyn and a FREE TX 1200 sample,
Call Toll Free 1-800-231-6074

Lightweight and easy to install, Griffolyn provides the temporary cover for your permanent solutions.

Griffolyn® Division
Reef Industries, Inc.
P.O. Box 750250
Houston, Texas 77275-0250
In Texas or outside
the continental U.S. call collect
713-943-0070
Fax: 713-947-2053

Write in 218
Landfarming involves the construction of a treatment cell and the installation of a plastic liner in the cell for containment purposes. The treatment cell should be placed on a level surface with 24 inch high earthen berms constructed at the periphery of the area. See Figure two, page 16.

The plastic liner is placed over the level surface and the peripheral berms act as a barrier for separation of the contaminated soils from the clean soils under the treatment cell. The total area required for the landfarming treatment cell is the area required to place the soils at a depth of 12 to 18 inches and allow for the building of the containment berms. For example, the computation for a 300 cubic yard site would be: 300 cubic yards equals 8,100 cubic feet, 8,100 cubic feet is equivalent to soil spread 12 inches deep over 8,100 square feet. Therefore, a site which is approximately 80 by 100 feet would be sufficient for placement of the soil at a depth of 12 inches. If the site has space constraints and must be treated at an 18 inch depth, 5,400 square feet of space would be needed. So a site approximately 54 by 100 feet would be sufficient to landfarm 300 cubic yards of soil at a depth of 18 inches.

After the site has been prepared with a plastic liner and the edges bermed to prevent rainfall runoff, the soil is placed in the cell and spread to a level depth, ready for inoculation. The actual inoculation approach varies by product vendor, but in all cases, the soil should be tilled with either a rototiller or farm equipment suitable for use within the site. Tilling should be performed at least once a week throughout the process for optimum effect and economy.

The site should be tested at least once a month for analytes of concern to the regulatory agencies. Nutrient testing and bacterial identification and enumeration should also be conducted once a month by qualified personnel.

The drawbacks to landfarming are basically the space constraints and the potential for ponding of rainfall water within the treatment cell in areas of high rainfall. If the site lacks sufficient space to perform landfarm treatment, a "heap" or "compost pile" method can be installed with similar results.

The heap method involves placement of the soils into a pile over a prepared bed of aeration piping on a plastic liner. The plastic liner bed or cell for the heap is prepared in the same place.
manner as the landfarming cell, but the overall space required is considerably less.

For example, the 300 cubic yard pile of soil would be placed as follows: 300 cubic yards shaped into a pile with a cross section of a 40 foot width piled five feet high with a 45° slope on the sides has a volume of 175 cubic feet per linear foot as shown in Figure three, page 18. Therefore, each linear foot has a capacity of 175 cubic feet divided by 27 cubic feet per square yard—6.5 cubic yards per linear foot. The site would require 46 linear feet (300 cubic yards divided by 6.5 yards per linear foot). Overall, the heap method site would require an area of approximately 40 by 50 feet or 2,000 square feet—approximately one-fourth the area required for the landfarming method.

Once the area required for the treatment cell has been defined, the layout of the piping network and quantity of piping required can be calculated. Standard four inch polyvinyl chloride (PVC) sewer and drain tile is appropriate for aeration. This piping can be purchased almost anywhere for about $4 per 10 foot section.

The piping network is constructed with pipes laid out on five foot centers with a header pipe at either or both ends of the tile, depending on overall pile length. A typical piping network layout is shown in Figure 4, above. The lengths of pipe which are connected to the header pipe should be no longer than 50 feet to prevent dead zones where oxygen transfer has not occurred due to the pressure drop over lengths greater than 50 feet.

The header pipe is connected to a blower system to supply oxygen to the pile on a continuous basis. Generally, a one horsepower or equivalent blower for every 300 cubic yards of contaminated soil is optimal. Each 300 cubic yard pile should be prepared separately with separate blowers to avoid problems with dead zones and power service requirements at the site.

In the event that a smaller area is all that is available, the piles can be constructed higher with steeper sides, but this requires that an additional set of aeration pipes be installed. A series of blower pipes is required for each five feet in height of a pile in order to maintain oxygen levels sufficient to maintain an active and vigorous growth of the microorganism population.

Testing of the soil pile should also be sampled monthly for analytical and biological parameters.

It is quite possible for anyone to perform a small scale bioremediation project using these principles, a reliable vendor and properly trained testing personnel. The decision to use a particular biological product should be based on product safety as well as efficacy and support services.

Write in 572 for more information

---

**How To Get To The Core Of A Toxic Waste Question.**

AMS Augers, Probes And Core Samplers Make Hazardous Waste Soil Sampling Simple.

For the past 40 years, AMS has produced the highest quality soil sampling and soil testing equipment: quick, easy to use, affordable. Our standards dictate superior workmanship and durability. We invite special orders to meet your specifications on all our tools.

For more information call: 1-800-635-7330

AMS
105 Harrison and Oregon Trail
American Falls, Idaho 83211

Write in 002

August-September 1992 Soils 19
In the June-July issue of Soils magazine, we ran a “Here’s How it Works” feature on page 66 describing the remediation process of in situ vitrification. In fact, the process as described in that feature has been withdrawn from the commercial market.

According to tests conducted by Larry Penberthy (No. 8223-4) of Penberthy Electromelt International, Inc., Seattle, Wash. and Battelle, vapors in the process as described in the feature retreat from the approaching melt interface and migrate into the surrounding cooler soil. In addition, a full scale test of the process resulted in fire damage to the equipment with loss of offgas containment and control.

Speaking of glass, in an unrelated development, scientists at the Hebrew University of Jerusalem have succeeded in embedding virtually any chemical compound in glass. This technology makes possible a number of applications—such as the ability to create analyzing sensors to identify chemicals, contaminants and pollutants. The process to embed organics in glass is made possible by a one-step polymerization method that functions at 70°F, compared to standard glassmaking temperatures which exceed 1,000°F (which would melt organics).

“Our glassmaking research has derived a method we call the “Sol-Gel” process, which makes the material at room temperature. The result is a high-surface-area, porous glass that permits embeddings during molding and, later, pass-through of materials being analyzed,” says David Avnir, professor of Hebrew University’s department of chemistry.

“The encapsulating process prolongs the life and usability of normally unstable and heat-sensitive enzymes used as catalysts in various biochemical processes. Chemical compounds immobilized in glass create excellent sensors for the detection of specific components in matter,” says Avnir.

In analysis work, the target compound penetrates the glass and interacts with the entrapped reagents to form chromophoric groups which can be detected by conventional heat or optical techniques.
We design and build soil remediation plants to meet your specifications

- Portable Soil Remediation Plant Designs .......... 10-100 Tons/Hr.
- Stationary Soil Remediation Plant Designs .......... 33-300 Tons/Hr.

Plants should be chosen on your business plan... not just on what suppliers happen to sell!

- Low-temperature, gasoline-contaminated soil remediation.
- High-temperature, heavy oil-contaminated soil remediation.

For more information,
FAX this ad to: 816-228-0888
Name ____________________________ Company ____________________________
Phone ____________________________ FAX ____________________________

Tarmac Equipment Co., Inc. Soils Division
219 N. 7 Highway • Blue Springs, MO 64014
800-833-4383

Original Equipment Manufacturer
Looking into immunoassay

Efficient analytical tool

Immunosassay-based field analysis is simple, inexpensive, compatible with ambient site conditions and can be used to process large numbers of samples quickly. While conventional laboratory-based testing is necessary to establish the identity of contaminants and meet regulatory requirements, test results can take weeks to turn around and can cost hundreds, even thousands of dollars per sample to obtain.
Immunoassay testing can cut down the time it takes to define the extent of site contamination, identify hot spots and clean areas, estimate the volume of contaminated soil, aid in remedial design and cost projections, monitor the progress of remediation and verify cleanup prior to closure.

An immunoassay method combines the specific binding properties of an antibody molecule with a readout system to detect and quantify compounds. Immunoassay methods have existed in the medical field for over 20 years in both laboratory and on site formats. The home pregnancy test is an example of an on site immunoassay format.

Immunoassay technology was developed at the turn of the century as a means for typing blood. In the past five years, a variety of environmental applications have been developed for immunoassays.

Immunoassay formats incorporate detection systems that use chromogenic reactions, radioactivity, chemiluminescence, fluorescence and fluorescence polarization. Chromogenic enzyme-linked immunosorbent assay (ELISA) chemistry has many characteristics that make it especially well-suited to environmental applications. ELISA chemistry uses two key reagents: an antibody molecule that is able to specifically bind the target analyte and an enzyme-conjugate reagent that possesses both the catalytic activity of an enzyme and the molecular identity of the target chemical.

Antibodies or immunoglobulins are binding proteins that can be produced to specifically bind to small molecules like many environmental contaminants. Antibodies have been produced to a diverse range of environmental contaminants: pesticides, such as aldicarb and DDT, herbicides, such as atrazine and 2,4-D and industrial chemicals, such as PCBs and pentachlorophenol.

The enzyme-conjugate reagent used in the assay is synthesized by chemically coupling target molecules to the surface of an enzyme molecule. The conjugate must be able to bind to the antibody via its attached target analyte, and convert a substrate into a colored product. One of the more common enzymes used is horseradish peroxidase (HRP). HRP catalyzes the conversion of a colorless substrate, tetramethylbenzidine, to a colored derivative in the presence of hydrogen peroxide, allowing it to be seen and measured.

For example, to develop a test that will detect pentachlorophenol, both an anti-pentachlorophenol antibody and an enzyme-pentachlorophenol conjugate reagent must be produced. The antibody is immobilized to a solid phase (polystyrene tubes, microtiter plates or plastic beads of assorted sizes) at a level consistent with the desired detection range of the test. The affinity of the antibody for the analyte present in the sample and the enzyme conjugate influence the assay’s overall sensitivity. High binding affinities and minimal non-specific color generation result in assays having superior sensitivity.

The following illustrates how an ELISA test is performed. A water sample containing no pentachlorophenol and a

Kevin Carter is vice-president of marketing and technical services and Stephen Friedman is vice-president of research and development for EnSys, Inc. of Research Triangle Park, N.C.
Immunoassay technology can also measure pesticides in soil. In crop production practices, an immunoassay could determine whether there is significant pesticide residue remaining in soil to injure sensitive follow crops.

Assuming the grower knows which pesticides were applied to the previous crop, the pesticide of interest could be detected by immunoassay without the need for multiresidue analysis. The cost effectiveness of using immunoassay also allows for increased testing of soil from different locations within an area—thereby avoiding pesticide dilution normally associated with analyzing a single composite soil sample representing the same area.

Immunoassays can be interfaced with a soil extraction procedure and used as screening tools to eliminate “negative” samples from further analysis by conventional methods.

In the procedure, a 100 to 200 μL sample is added to a disposable test tube, along with 250 μL of enzyme labeled pesticide and 500 μL of rabbit anti-pesticide magnetic particles. Both pesticide in the sample and enzyme labeled pesticide compete for antibody sites on the magnetic particles. After 15 to 30 minutes incubation, a magnetic field is applied to hold the magnetic particles in the tube while sample contaminants and excess reagents are washed away. Pesticide and enzyme labeled pesticide remain bound to the magnetic particles in

Continues on page 41 →
### Immunoassay soil test correlation

<table>
<thead>
<tr>
<th>Fuel type</th>
<th>Spike level (ppm)</th>
<th>PETRORIS™ test results (ppm)</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>gasoline</td>
<td>600</td>
<td>≥100 &lt;1000</td>
<td>yes</td>
</tr>
<tr>
<td>gasoline</td>
<td>120</td>
<td>≥100 &lt;1000</td>
<td>yes</td>
</tr>
<tr>
<td>gasoline</td>
<td>60</td>
<td>&lt;100</td>
<td>yes</td>
</tr>
<tr>
<td>gasoline</td>
<td>30</td>
<td>&lt;100</td>
<td>yes</td>
</tr>
<tr>
<td>diesel</td>
<td>600</td>
<td>≥75 &lt;750</td>
<td>yes</td>
</tr>
<tr>
<td>diesel</td>
<td>300</td>
<td>≥75 &lt;750</td>
<td>yes</td>
</tr>
<tr>
<td>diesel</td>
<td>120</td>
<td>≥75 &lt;750</td>
<td>yes</td>
</tr>
<tr>
<td>diesel</td>
<td>30</td>
<td>&lt;75</td>
<td>yes</td>
</tr>
<tr>
<td>none</td>
<td>7.5</td>
<td>&lt;75</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Figure 3**

Presence/absence indication relative to a known concentration. With competitive ELISA methods, the color intensity produced is an inverse logarithmic function of the concentration of analyte in the test sample. Quantitative ELISA methods suitable for laboratory use employ a series of standard solutions that are analyzed in tandem with the test samples. A standard calibration curve is constructed and the sample concentration is calculated by interpolation of sample results to concentration.

One of the situations where immunoassay-based field tests works to best advantage is when a single analyte is driving the cleanup process, and numerous samples need to be collected to characterize its presence on a site. Immunoassay field testing can efficiently be conducted at several concentration levels on samples collected on a systematic grid to construct a map of contamination. Such a map can be invaluable to determine actual site boundaries, to define clean areas and hot spots, to suggest further sample collection and estimate the volume of contaminated soil. All this can help establish a remediation approach and aid in predicting its cost and timeframe. Immunoassay-based field tests are specific, highly sensitive and give fast answers for this type of decision-making.

Testing costs using immunoassay methods can save from 10 to 50 percent over costs associated with chromatographic and spectrometric instruments. The high specificity of immunoassay-based tests leads to relatively few false negative results.

Results obtained on hazardous waste sites with immunoassays have been shown to correlate well with those obtained with existing laboratory methods. This combination of accurate analytic results with the ability to use these results for on site decision-making provides the user with a powerful, cost effective tool for assessment and remediation of soil contamination.

Write in 574 for more information

---

**Q.** Who developed the most effective process for IN SITU treatment of hydrocarbon contaminated soils?

**A.** MOTHER NATURE with BIOREMEDIATION.

**Q.** Who has taken advanced technologies and developed procedures to enhance, accelerate, and stimulate this most effective process for IN SITU treatments without adding microbes?

**A.** EARTH RESTORATION COMPANY takes MOTHER NATURE’S BIOREMEDIATION into the 21st century.

**BIOREMEDIATION** can be accomplished IN SITU or EX SITU in unparalleled time frames, at reasonable costs, and avoids the faults and liabilities associated with alternative methods.

**IMPRESSIVE, EFFECTIVE, AFFORDABLE, SIMPLE**

Terms used to describe the results achieved by EARTH RESTORATION COMPANY’s mastery of MOTHER NATURE’s BIOREMEDIATION PROCESS.

Call or write for information

713/476-5995

K. Sue Nelson
Dir. of U.S. Marketing
EARTH RESTORATION COMPANY
4222 Pasadena Boulevard, Pasadena, TX 77503

---

Write in 283 August-September 1992 Soils 25
Turn dirty dirt into brick

Firm recycles oily soils into valuable building material

By Blaine Miller

What soil recycling process can use petroleum contaminated soil to produce a contaminant free product which can be sold for $75 per ton? Cherokee Sanford Group Inc., of Sanford, N.C. mixes petroleum contaminated soils with locally obtained clay and shale.

Blaine Miller is director of Cherokee Environmental Group, a division of Cherokee Sanford Group, Inc., Sanford, N.C.

CONTROL WORK SITE ENVIRONMENT
with protective fabric solutions from Hanson

FROM ASBESTOS ABATEMENT TO SOIL REMEDIATION - CONFIDENT CONTAINMENT BEGINS WITH HANSON

- SUPER SIZE CONTAMINATED SOIL STOCKPILE COVERS
- CONTAINMENT PIT LINERS AND LEACH PADS
- WOVEN AND NON WOVEN SOIL STABILIZATION GEOTEXTILES
- LANDFILL RUN OFF DIVERSION TARPS AND DAILY TRASH COVERS
- ENCLOSURES AND FIRE RETARDANT PARTITIONS
- CUSTOM FITTED COVERS AND STORAGE TARPAULINS
- CONTAINER LINERS AND TRUCK COVERS

Hanson High Strength, Ultra Violet and Chemical Resistant Protective Covers and Liners for Cost Effective, Versatile and Dependable Contamination Control during all phases of Hazardous Waste Site Restoration.

For immediate assistance call toll free 1-800-827-3398 or fax 1-800-827-5834

C.H. Hanson Company
Protective Fabric Division
3630 North Wolf Road
Franklin Park, IL 60131

Our 126th Year
We stand behind the products we sell

Made in U.S.A.
Petroleum contaminated soil is blended with clay and ground to achieve a uniform size to feed into the brick-making process.

The process blends clay and shale with the contaminated soils into a plasticized mixture which is then extruded and molded into brick. Once the green brick is dried and preheated, the kiln fires it at 1,700 to 2,000°F for approximately 12 hours. The temperature and residence time in the kiln destroys any organics and incorporates any inorganics into the vitrified brick product.

The contaminated soil is screened for debris and extensively blended with mined clay and shale into production stockpiles. The blending process is monitored and controlled to insure production of a feedstock which yields quality brick products. Grinders reduce this raw material to particles of acceptable size for brick formation. The raw material is mixed with water in a pug mill to increase plasticity.

The pugmill extrudes a continuous column of clay which is cut into green brick. These brick are stacked on rail cars that travel through tunnel kilns. Kiln travel time is approximately 2-1/2 days. In the kiln, brick are first preheated to 600 to 1,600°F to remove moisture. At the peak temperature of 1,700 to 2,000°F, the kiln fires them for 12 hours. After cooling, the brick are ready for packaging and shipment.

The company started using soil contaminated with petroleum products after dealing with an oil spill at one of its plants in the mid-1980s. After verifying that groundwater had not been affected, state environmental officials recommended the soil be

Continue on page 28→

There is one soil remediation company that won't take you for a ride.

When you have petroleum contaminated soil, there is no need to drive it all over creation. At Mobile Reclain, we come to your site and can be ready to operate in just two hours. Our process remediates soils contaminated with diesel, aviation fuel, kerosene or gasoline. Your job will be finished on time by a team of engineers and technicians that keeps our equipment operating at peak performance 24 hours a day.

No need to worry about transportation liability or the time and expense of backfilling your site. You and your client are back in business quickly — our mobile units process 25 tons per hour — and with peace of mind, knowing your job is done according to all government regulations. Find out how Mobile Reclain can cost-effectively handle both large and small jobs. Call today: (904) 373-4614.

MOBILE RECLAIM, INC.
4131 NW 13th Street
Gainesville, Florida 32609

Write in 085

August-September 1992 Soils 27
excavated and transported to an unlined landfill. Since the soil where the spill occurred was a basic raw material in brick manufacturing, the company asked if the material could be used to make brick. Regulatory officials in North Carolina were enthusiastic about what they saw as a logical and innovative solution.

The brick manufacturing process can recycle various petroleum contaminated soil types including silts, sands, loams and clays. This process is particularly suited for reuse of highly plastic clays that are difficult to treat with other remediation methods. Sandy soils also work well for their properties which reduce firing shrinkage and improve moisture absorption from mortar—an important characteristic during brick laying. Shales and sedimentary rock are also appropriate raw materials. Soils that contain large quantities of debris, concrete, stone or asphalt may require prescreening.

Charges for accepting contaminated soil can range from $25 to $45 per ton (exclusive of transportation), because the company assumes liability for it and encounters processing and handling expenses. The cost depends on type of soil, contamination level and its ability to blend with local, natural materials.

One advantage for a responsible party to send contaminated soil off site is the quick recovery of the property or to make the property more immediately available for sale. The company can accept material by truck or rail to accommodate a large
The three day trip through the kiln reaches temperatures of 2,000°F.

regional area.
The company is looking at incorporation of other waste materials into brick-making. Mineral-based materials, coloring agents or other industrial by-products may make suitable ingredients in the brick recipe. So-called “auto fluff,” the non-metallic parts of an automobile and filter cake are other candidates under consideration. The company also uses sawdust as a fuel resource.

In an interesting twist, some customers want their product back—in the form of brick. Several oil companies want to build their gas stations out of recycled brick.

McDonald’s has selected Cherokee products to help its McRecycle program reach its goal of 25 percent recycled materials in new construction. Maryland Clay Products, a subsidiary of Cherokee, provided brick to the Washington D.C. Suburban Sanitary Commission to build its $25 million headquarters.

The brick were made with bio-sludge generated at various Washington D.C. sewage treatment facilities.

The ability to economically recycle petroleum contaminated soil into brick products is a strong incentive for generators to consider brickmaking as a disposal method.

For further reading about solidification:

“Concrete solution to solidify soil problems,”

A.S. Ezeldin, D.A. Vaccari, L. Bradford, S. Dilzer, E. Farouz and R.T. Mueller,

Soils magazine, April, 1992, page 14

You get the combined experience of three unique companies. Cedarapids Inc., a leader in asphalt hot mix systems and aggregate processing equipment. Badger, a specialist in the petro-chemical industry. And the entire Raytheon Corporation, with over 25 years of experience solving pollution control problems of all kinds.

No one else can offer this combination of specialties in soil remediation development. That’s why a Cedarapids environmental restoration system is the best choice for meeting EPA and RCRA guidelines. To find out more call (319) 363-3511.
Credibility gap

Who do they trust? Survey shows consumers wary of environmental claims

Research shows consumers are least likely to believe environmental information that corporations supply them in advertisements, on product labels or printed on packaging. The most believable information comes from universities. These findings come from a survey of 1,006 men and women 18 years or older, living in the continental U.S. The random telephone survey by the Hartman Group, a Newport Beach environmental consulting firm was completed in October 1991 and published in the Los Angeles Times.

| Percent who rated the following as trustworthy sources of environmental information |
|---------------------------------|---------------------------------|
| Universities 51%                | TV/Radio news 47%               |
| Newspapers/magazines 46%       | Environmental groups 46%       |
| Government 23%                  | Companies 13%                   |

In addition to a 1-year "regardless-of-cause" warranty, Gast offers:
- lower price than competitive blowers.
- fast delivery from 6 models in stock.
- 34 distributors throughout the U.S. and Canada.
- motor-mounted models with Class 1 Group D explosion-proof motors.
- performance up to 410 ft.³ per min. (12 m³ per min.) and 7 in. Hg (224 mbar).

Gast has been supplying air moving products since 1921. Circle the reader service number below or call 1-800-952-GAST for a free pollution engineering application guide, product literature and the name of your local distributor. Gast Manufacturing, Box 97, Benton Harbor, MI 49023-0097.
Compliance gap

Random spot check reveals 11 of 12 UST sites not in compliance with leak detection regs

In spite of the federal regulations mandating leak detection and monitoring to be installed on all underground storage tanks and piping, owners and operators do not seem to be rushing into compliance. This is according to a report in Tank Talk, the newsletter of the Steel Tank Institute, Lake Zurich, Ill. According to Alex Ralston, president of Petcon Co., Richland, Miss., 12 sites in EPA Region 8 were randomly visited to inspect for leak detection compliance. Of the 12 sites, 11 were not in compliance.

The number one problem inhibiting compliance is communication, Ralston says. Some sites had no leak detection because they said they did not know about the regulations. Other problems were equipment-related. In some cases, sites had proper equipment but it was not being used properly. Often, the required monthly monitoring program was not in place. When one operator was asked why he wasn't checking monitoring wells on a monthly basis, his response was, "I thought the state was supposed to do that."

In other cases, equipment was not hooked up or functioning properly. At one site, half the sensors on a continuous electronic system were not working. Ralston recommends that all continuous monitoring systems be tested at least once a year.

At another site, the owner thought that double wall tanks and piping did not have to be checked every 30 days. It seems there is still a lot of education and installation left to be done out there.

V.O.C. Monitor

The Byron 302 delivers
new flexibility and convenience.

It's ideally suited to a variety of VOC control tasks, including:
- assessing the real problem— it differentiates between naturally occurring methane and non-methane VOCs.
- reading VOC levels in real-time to expedite engineering design or permitting.
- fence-line monitoring
- periodically demonstrating emission control system efficiency.

- continuous monitoring to document compliance or detect breakthroughs.

Features include self-diagnostics and auto-zeroing for up to 3-months of unattended operation, ±1% accuracy from 20 ppb up to 10,000 ppm, ease of use, good transportability and a 1-year warranty.

For more information call Charles Womack at (714) 581-4464.

BYRON INSTRUMENTS
A GENERAL MONITORS COMPANY
26776 Simpatica Circle, El Toro, CA 92630-9914
Telephone: (714) 581-4464 Telex: 678-372 Fax: (714) 581-1151

Write in 244
August-September 1992 Soils 31
There are about a dozen tank testing terms in use today, which are often used interchangeably, even though they may mean different things. These definitions are listed in approximate chronological order to show the evolution of methodologies to determine if an underground storage tank (UST) is leaking.

**Tank test**—This is probably the most commonly used term, and also the most all-inclusive. A tank test is an intensive monitoring procedure conducted over a period of a few hours when the storage system is not operational. Although it can be used as part of a leak detection monitoring method, it is distinct from most other leak detection methods in that it is generally performed by specialized personnel using equipment brought to the site to conduct the test. With a few exceptions, this is probably a good working definition for a term that encompasses so many different methodologies. By itself, this term implies nothing about a specific test procedure.

**Pressure test**—Probably the earliest form of tank tightness test, a pressure test involves plugging all the storage system openings and pumping air into the tank to a pressure of five pounds per square inch. A pressure gauge is attached and monitored for a period of an hour or so. If the pressure remains reasonably constant, the tank passes the test. There is no standard procedure for how much product is to be left in the tank.

This test is only able to detect very large leaks, because the compressibility of air makes it necessary for a very large amount of air to be lost before the pressure in the tank is measurably affected.

In addition, the procedure is dangerous when used with highly volatile products such as gasoline, because the addition of air into the tank can produce an explosive ratio of gasoline vapor to oxygen. The rapid introduction of air through an ungrounded rubber hose can produce a spark that could ignite this mixture. It was a fatal accident involving an air pressure test that prompted the development of today’s volumetric tank tests.

**Standpipe test**—This test involves filling the storage system into the fill pipe and monitoring the level of liquid in the pipe for an hour or so. Sometimes a length of pipe is added to the fill pipe to bring the liquid level above grade to facilitate measurement and include all the piping in the measurement. A one inch drop of level in the standpipe is a commonly accepted standard for failure.

Although the test is safer than the pressure test, its accuracy leaves much to be desired. There is no compensation for temperature and no time allowed after filling the tank for deformation to occur. Many tanks probably failed this test simply because of tank deformation effects. The .05 gallon per hour standard for leak detection probably originated with this test. A one inch drop in a four inch diameter standpipe translates to a volume change of .05 gallons.

**Final test**—The National Fire Protection Association (NFPA) has for many years published the document Underground Leakage of Flammable and Combustible Liquids, commonly known as, “NFPA 329.” This document is intended for use by fire officials or other regulatory authorities who may need to determine the origin of explosive vapors in buildings or
sewers. As part of the investigation, the document describes some preliminary procedures for investigating USTs, such as checking inventory records and inspecting the visible portions of the facility. In earlier versions of NFPA 329, if these methods did not reveal any evidence of leakage, then a “final test” was to be performed.

The final test is basically a standpipe test, with the additional requirement that the test compensate for variables such as temperature changes in the product and the deflection of the ends of the tank when the tank was overfilled with liquid. The liquid level is to be above grade so all the below grade components of the system can be tested. Although labelled “final test,” the requirements actually paralleled a recently developed test known as the Kent-Moore test.

**Kent-Moore test**—Although the safety of the standpipe test was recognized, it was also known to be very unreliable. Working with the American Petroleum Institute (API), Fred McClean, a retired Mobil Oil Co. engineer, investigated the reasons for this unreliability and identified two factors. One was that the changing temperature of the product dramatically affected its volume, so temperature effects had to be taken into consideration to improve accuracy and reliability of the standpipe test. This was accomplished by measuring the temperature of the liquid with a sensitive thermistor and circulating the product in the tank to obtain a uniform temperature distribution.

The second factor was tank end deflection, which resulted in an apparent loss of volume in the tank because of the increase in hydrostatic pressure from overfilling the tank. This was compensated for by first raising then lowering the level of the liquid in the standpipe. It was thought that the tank deformation would stabilize after the pressure was reduced.

The test got its name from the Kent-Moore Co., a tool-making firm which developed the equipment and held the patent rights. The test equipment became commercially available in 1965.

**Petro-Tite test**—In 1980, the patent rights to the Kent-Moore test were purchased by Heath Co., who renamed the test method, “Petro-Tite.” The term is sometimes used generically to refer to any tank test, in the same way that Xerox has come to mean photocopy.

**Precision test**—In the 1984 version of NFPA 329, the “final test” was renamed “precision test” to identify it as the most precise method of UST leak detection then known.

**Hydrostatic tank test**—This term is sometimes used as a generic term for a volumetric tank test. It refers to the fact that the test is conducted using liquid pressure rather than air pressure.

**Volumetric tank test**—This test monitors the volume of the liquid in the system while compensating for any variables that may affect the volume. The results of the test are usually given in terms of a measured loss or gain of liquid per hour.

*Continues on page 46 →*

---

**The Brick Solution To Your Company's Environmental Recycling Needs**

---

**Cherokee Recycles:**
- Petroleum contaminated soils and water from underground storage tank cleanups and spills
- Qualified solid industrial waste streams (i.e. filter cake, sludges, etc.)

*Cherokee Sanford is the largest North Carolina owned and operated brick manufacturer. We beneficially reuse these recycled materials in our brick making process to produce high quality brick products.*

**Cherokee Sanford Group, Inc.**
Call Cherokee Environmental Group at 919-774-5330 or 1-800-277-2700
1600 Colon Road • Sanford, North Carolina 27330
Air sparging, used in conjunction with soil vapor extraction, is emerging as an effective treatment technology for soils and groundwater contaminated with volatile organic compounds.

Air sparging is the highly controlled injection of air into the contaminant plume in the saturated zone. Air bubbles traverse horizontally and vertically through the soil column, creating a transient air-filled porosity in which volatilization can occur.

"Sparging extends the effective volatilization principles applied in soil vapor extraction, venting to high zones of contaminant concentration—adsorbed chemicals in the saturated zone or below the water table," says Richard Brown, director of remediation technology for Groundwater Technology, Inc., of Norwood, Mass. "These were inaccessible to venting. This technology often makes it possible to reduce by as much as 50 percent the typical cost of treatment, as well as the treatment period for sites contaminated with volatile organic compounds (VOCs)."

Groundwater Technology has declared air sparging with soil vapor extraction (SVE) is now its primary treatment of choice.

Air sparging effectively creates a crude air stripper in the subsurface, with the soil acting as the packing. Air is injected and allowed to flow through the water column over the "pucking." Air bubbles that contact dissolved or adsorbed-phase contaminants in the aquifer cause the VOCs to volatilize.

The volatilized organics are carried by the air bubbles into the vadose zone where they can be captured by a vapor extraction system. Moreover, the sparged air maintains a high dissolved oxygen content, which enhances natural biodegradation.

Air sparging also creates turbulence and increased mixing in the saturated zones, which increases the contact between groundwater and soil. This results in higher concentrations of the VOCs in the groundwater, which can be recovered by pumping or stripped by sparging.

Brown says that one of the first commercial air sparging/venting systems to be implemented by Groundwater Technology was used to treat dry cleaning solvent contamination along with some residual heating oil. Contamination on site ranged from 40,000 parts per billion (ppb) VOC contamination near the former tank pit, to less than 1,000 ppb elsewhere. After 125 days of operation, the sparging/venting system reduced contamination by 98 percent.

Brown acknowledges there are still reservations in the industry over the use of air sparging. One is that the accelerated vapor travel created by sparging introduces the potential for vapors to be drawn into nearby receptors such as basements. This is resolved by using venting systems in areas with potential vapor receptors.

A second concern is that, under specific conditions, a misapplied sparge system could actually push the contamination away from the site. For example, a clay barrier above the zone of injection could cause this to happen. Uncontrolled flow could also be caused by pressurization of the system beyond the soil's capacity to accept a smooth flow of injected air. Therefore, restrictive geological conditions and optimal system operating pressures must be determined by meticulous testing prior to implementation. In the event that barriers and low permeable formations are found, groundwater recovery may be necessary to prevent the spread of dissolved contamination.

Sparging can result in mounding of the water table. Under normal hydrogeological conditions, mounding can accelerate the flow of groundwater and hence, the spread of dissolved contamination. However, with sparging, the mounding is typically caused by the displacement of water with air, resulting in a less dense fluid column. While this phenomenon is now being studied, Brown believes it is very likely that this type of mounding will prove to have little, if any, effect on groundwater flow.

Sparging systems do require very sophisticated analysis of site hydrogeology and careful engineering before implementation.

"Air-based treatment is exceptionally cost-effective, and its dramatic reduction of treatment periods significantly reduces potentially responsible parties' window of maximum exposure to liabilities typically to less than a year," concludes Brown.

Write in 577 for more information
PDI's new model works on site

PDI, Inc., Hartland, Wisc., introduces the Soil/TEK™ ST-400 model for on-site thermal remediation of petroleum hydrocarbon contaminated soil.

The model's patented design uses a quench chamber and Powerclone™ centrifugal separator in place of a baghouse for particle removal from the exhaust. One-trailer design results in easy mobilization with limited downtime and allows interstate shipment without oversize load permits.

Write in 595 for more information.

Rotron blowers provide soil solutions.

EG&G Rotron regenerative blowers have proven themselves in years of environmental service to be quiet, compact, and reliable. These direct-drive low-maintenance blowers require no lubrication.

They have explosion-proof motors, spark-resistant construction, and adaptable vacuum performance curves. Environmental applications include: ■ Soil remediation.
■ Landfill degassing. ■ Aeration.
■ Rotron also has accessories such as moisture separators available. Call or fax a request for a copy of A Consultant's Guide to Environmental Applications.

Enviropac® gives secondary containment some color

Environmental Container Corp., Delafield, Wisc., offers solutions to leaking drums, dripping faucets and overflowing buckets: Enviropac® dikes (for indoor use) and covered, lockable and weatherproof vaults (for outdoor use).

The dikes and vaults, available in either polyethylene or steel construction, provide secondary containment for up to four 55 gallon drums.

A special rack allows horizontal gravity dispensing from one or two drums per Enviropac®, with ample room in the unit for receiving pallets, the manufacturer says.

Write in 596 for more information.
SOIL REMEDIATION, INC.
1721 Pine Street • Warren, Ohio 44483 • (216) 394-5557 • FAX (216) 743-0014
Site Location: phone (216) 536-6825 • FAX (216) 536-6838

DON'T DESTROY YOUR CONTAMINATED SOIL REMEDIATE, RECLAIM, RECYCLE

Soil Remediation Plant

Site Assessments
Analysis
Testing
Excavation
Transportation

Stone Processing
Screening
Crushing
Aggregate Plants

Asphalt Plants
Asphalt Recycling
Material Production

YOUR FULL SERVICE COMPANIES
All companies owned and operated by GENNARO GROUP OF corporations

CALL NOW FOR IMMEDIATE INFORMATION AND QUOTATIONS
Phone (216) 536-6825 • FAX (216) 536-6838

Write in 259
AMS sampler offers new way to look at soil
Art’s Manufacturing & Supply (AMS), American Falls, Idaho, introduces the patent-pending Split Core Sampler with a core or auger tip that gives the user a basically undisturbed view of the sample.

The Split Core is compatible with AMS extensions and cross handles, up and down hammer attachment and the truck-bumper mounted Hydraulic Core Pusher. Liners are available in plastic, Teflon, aluminum, bronze or stainless steel. Write in 585 for more information.

Timco offers screen for SVE
Timco Manufacturing, Inc., Prairie du Sac, Wisc., introduces a high-flow screen for soil vapor extraction (SVE). The slot spacing of the high-flow screen helps maximize the flow of vaporized VOCs during extraction. Write in 586 for more information.

Xerxes introduces fiberglass underground water tanks
Xerxes Corp., Minneapolis, Minn., offers a line of non-corrosive, fiberglass underground water storage tanks that can be used in potable and non-potable applications.

The water tanks are constructed of glass fibers and resin and cannot rust and/or corrode, according to Xerxes. Special design elements include ribs, which are built as part of the tank and give exceptional strength. The water tanks are available in capacities from 550 to 50,000 gallons. Write in 587 for more information.

New standard for TPH analysis
The Foxboro Co., East Bridgewater, Mass., announces a unique quality control and calibration standard for performing TPH and Oil/Grease analysis in soil or water with the Miran 1FF and Miran 1ACVF. The new TPH Standard is a sealed quartz cuvette containing the EPA 418.1 mixture of synthetic oil—a concentration of 300 ppm. It is packed in its own protective case and has a shelf life of 1.5 years. Write in 588 for more information.

Kit tests soil, not just soil gas
The Petro Risc™ Soil Test Kit from Ensys, Inc., Research Triangle Park, NC, measures soil gasoline/diesel contamination by analyzing the soil directly, not just the soil gas. The kit analyzes samples at 100 and 1000 ppm. Results can be obtained in 20 minutes by a color change in a test tube. Write in 589 for more information.
Universal Valve offers new manhole

Universal Valve Co., Inc., Elizabeth, N.J., introduces the model 63-9075, nine inch Monitoring Well Manhole, recommended for applications requiring maximum monitoring well security, the manufacturer says.

The 63-9075 manhole, painted white to easily distinguish it from other fills, features a cast iron cover and galvanized steel skirt, with a clearly marked "Monitoring Well" designation cast into the cover, and three stainless steel flush mount bolts give added security.

Write in 590 for more information.

Piping system aids in EPA compliance

Smith Fiberglass Products, Little Rock, Ark., introduces a telescoping secondary containment piping system to assist users in complying with EPA requirements, the manufacturer says.

"This system (that offers a 100 percent inspeetable telescoping system) provides the customer with extra assurance that the pipe system is secure and properly installed," says Richard Hickman, vice president of marketing.

Write in 591 for more information.

Tracer's system tests aboveground tanks

Tracer Research Corp.'s Tracer Tight® assessments is a newly developed method of evaluating aboveground tanks and piping networks for leaks without emptying tanks or interrupting service, the Tucson, Ariz.-based manufacturer says.

The method can also indicate which tanks and piping systems are secure and can give an evaluation of hydrocarbon contamination upon request.

Write in 592 for more information.

SkimRite™ unit has high recovery rate

Enviro Products, Inc., Lansing Mich., introduces the SkimRite™ free product skimmer system with pump, skimmer, and controller in one package suitable for two inch and larger wells.

The pneumatic control unit is factory adjusted, and a fully integrated buoy and skimmer assembly ensures collection of only "free product."

Write in 593 for more information.

Sybron's Bio-Sock™ provides infiltration of bacterial cultures

Sybron Chemicals Inc., Birmingham, N.J., introduces Bio-Sock™, a bacterial culture delivery system that provides continuous infiltration of Sybron's selectively adapted bacterial cultures.

This system of rugged construction has been shown to reduce and/or eliminate oil and grease buildup, hydrogen sulfide (H₂S) odors and related corrosion in sewage and waste treatment collection lines, Sybron says.

Write in 594 for more information.
ContraCon GmbH, Cuxhaven, Germany, which specializes in soil washing, is looking for U.S. companies interested in forming regional joint ventures to practice soil washing. Contact Marvin Baker, High Technology Associates (713) 963-9300.

Enviro Products, Inc., Lansing, Mich., has been named the new Michigan distributor for Mobile Drill, a line of drilling rigs and tooling for the environmental monitoring and water well industry.


Two of Hertz Corp.’s employee publications—Hertz Headlines and On Site—have won superior achievement awards in the North Jersey Press Club’s 45th Annual Memorial Journalism Awards Competition. Both publications are written and edited by Dick Burnon, a 21-year Hertz Corp., Park Ridge, N.J., employee.

Illinois Union Insurance Co., one of the CIGNA Property and Casualty Companies, Philadelphia, Pa., is offering a new insurance policy for contractors that remove, install or maintain underground storage and aboveground petroleum storage tank systems. The policy offers these contractors protection for most sudden or non-sudden releases of petroleum from their “products” or the “work” which causes “environmental damage.”

Resna Industries, San Francisco, Calif., has been named the general service contractor for the clean-up of pesticide contaminated soils at the FMC Superfund site in Yakima, Wash. The remediation project will last about 10 months with close association with the U.S. EPA, FMC Corp. and Bechtel Environmental, Inc. The estimated value of the contract is $500,000.

Roy F. Weston, West Chester, Pa., was recently awarded a subcontract with EG & G Idaho, Inc., Idaho Falls, Idaho, to provide organic and inorganic sample analyses, mixed waste sample analyses and special analytical services to support the U.S. Dept. of Energy

Environmental Restoration Program activities at the Idaho National Engineering Laboratory.

Joseph V. Milo P.E. (above) has been named the 1992 New Jersey Engineer of the Year by the New Jersey Society of Professional Engineers. Milo has been the recipient of over 50 industry citations and awards, most recently the NJIT Lifetime Achievement Award in 1990 and New Jersey Inventor of the Year in 1991. During his career with Universal Valve, Elizabeth, N.J., Milo has participated in over 60 patented products.

USTech (Underground Storage Tank Technical Service Group), Flint, Mich., has entered into a Master Waste Systems Agreement with a national landfill operator. This exclusive agreement secures and protects USTech and its customers from any claim, including environmental contamination, arising from conforming waste disposed of at its lancfill, the company says.
In-Situ covers leak detection

In-Situ, Inc., Laramie, Wyo., introduces a leak detection brochure that describes the flexibility and applications of their UL approved systems, which provide continuous external monitoring for leaks in tank environments.

In-Situ’s monitors use a patented sensing technology. For a copy of the brochure, call 800-446-7488.

Assoc. Design offers catalog of hazardous waste equipment


Featured in the catalog are a full line of products and accessories, including rotary extractors, hazardous waste filtration units and gas-tight syringes. For a copy of the catalog or more information, call (703) 549-5999.

Steel Tank brochure details aboveground tanks

Steel Tank Assn., Lake Zurich, Ill., details two new technologies available in aboveground storage tanks in their full-color brochure, Trade up to Secondary Containment Aboveground. For a copy or more information, call 800-822-3186.

Van Nostrand guide for professionals available

Van Nostrand Reinhold, New York, N.Y., offers the seventh edition of Sax’s Dangerous Properties of Industrial Materials, which details hazardous substances. The 3-volume set is $399.95. For more information, call 800-926-2665.
Pesticide, from page 24

concentrations proportional to their original concentration.

The presence of labeled pesticide is detected by adding the enzyme substrate and chromogen (hydrogen peroxide and tetramethylbenzidine), generating a colored product. Since the enzyme labeled pesticide was in competition with the unlabeled pesticide (sample) for the antibody comparing immunoassay with other analytical methods. Values predicted with the immunoassay may be slightly higher than with other methods since some assays exhibit cross reactivity with compounds closely related to the analyte being tested. Other differences may be due to techniques used by the investigator and analyte concentrations of standards used as calibrators in the analysis. The Environmental Protection Agency (EPA) approved standards can be used to evaluate accuracy of the immunoassay and other analytical methods.

The greatest advantage of using immunoassay as a screening tool for detecting pesticides is the direct analysis of extracts through eliminating numerous time consuming steps in sample clean up and concentration used with other analytical methods. The extract can be analyzed within one hour and soil extracts of negative samples can be eliminated from further analysis.

Write in 583 for more information

<table>
<thead>
<tr>
<th>GC (µg/L)</th>
<th>Immunoassay (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>69</td>
</tr>
<tr>
<td>60</td>
<td>84</td>
</tr>
<tr>
<td>120</td>
<td>76</td>
</tr>
<tr>
<td>30</td>
<td>45</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>50</td>
<td>69</td>
</tr>
<tr>
<td>190</td>
<td>166</td>
</tr>
<tr>
<td>130</td>
<td>96</td>
</tr>
<tr>
<td>130</td>
<td>112</td>
</tr>
<tr>
<td>80</td>
<td>76</td>
</tr>
<tr>
<td>80</td>
<td>59</td>
</tr>
<tr>
<td>80</td>
<td>8</td>
</tr>
<tr>
<td>220</td>
<td>219</td>
</tr>
<tr>
<td>2000</td>
<td>185</td>
</tr>
<tr>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>160</td>
<td>110</td>
</tr>
<tr>
<td>50</td>
<td>63</td>
</tr>
<tr>
<td>40</td>
<td>57</td>
</tr>
<tr>
<td>220</td>
<td>191</td>
</tr>
<tr>
<td>80</td>
<td>77</td>
</tr>
<tr>
<td>80</td>
<td>79</td>
</tr>
<tr>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td>190</td>
<td>114</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>120</td>
<td>98</td>
</tr>
</tbody>
</table>

Regression output:

# Constant: 7.134976
# Std err of Y est: 1.663599
# R squared: 0.898573
# No. of observations: 28
# Degrees of freedom: 24
# t coefficient(s): 0.803595
# Std err of coeff: 0.057635
# T: 0.943066

What is it, and where did it come from?

Someday you may be asked to clean up someone else's spill.

Often, in the mad rush to satisfy state or federal regulators, characterization and identification analyses are overlooked. After the regulators are gone, questions come up like: "Was it all ours?" or "Just how old was it?". It is usually too late to ask these questions because all of the evidence needed (oil sheens, contaminated soils) has been removed.

Friedman & Bruya, Inc. are experts in the identification and fingerprinting of petroleum products. There are simple, inexpensive tests that can be run to provide information that can be used next year or the year after to figure just what was present and where it came from.

Call 1 - (800) 487-8231 for more information.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Petroleum Product Identifications
Expert Witnesses • Soil and Water Testing

Write in 055

August-September 1992 Soils 41
How risk assessments can save remediation dollars

Not just another step, they can end up saving money

By Jenifer Heath and Carol Day

Risk assessment methods are often perceived by many underground storage tank (UST) site decision-makers as too expensive, too inflexible, too detailed or too superficial to have meaningful application to UST sites. In fact, the basic concepts of risk assessment can be scaled down to contribute to closure decisions at UST sites. Regulators in several states are looking to risk assessment as not only a means to protect human health and the environment, but also as a safeguard for limited state reimbursement funds. At the same time, petroleum marketers and oil companies recognize that proper application of risk assessment tools can result in earlier, less costly closure of UST sites.

Historically, most states have applied restrictive criteria to UST sites. Benzene, toluene, ethylbenzene and xylenes (BTEX) and total petroleum hydrocarbons (TPH)—as well as lead and other hydrocarbon components—often are required to be remediated to background concentrations, practical quantitation limits or arbitrary numerical concentrations. This conservative approach results in a backlog of sites with paperwork on the desks of regulators, threatening to overwhelm staff and deplete reimbursement funds. Ultimately, restrictive UST closure criteria result in investment of scarce resources in remediation of sites that do not present a significant risk to human health or the environment.

For many UST sites, a risk-based approach considering protection of human health and the environment, can demonstrate that remediation is unnecessary. Or, it can indicate that active remediation can be discontinued prior to achieving restrictive state criteria. Considerable cost savings can be realized by both the responsible party and the state reimbursement fund.

A phased, risk-based approach that is site-specific and driven by the extent of contaminant release and land uses at and adjacent to the site can identify sites where conditions warrant remediation. This approach combines information gathered during the site investigation with a three-step process to evaluate whether the site presents a significant risk to human health or the environment. Decisions about remediation are then based on the level of risk, if any, presented by the site.

Most states require recovery of free product in groundwater. The phased, risk-based approach can determine whether any further remediation is necessary.

"For many UST sites, a risk-based approach considering protection of human health and the environment, can demonstrate that remediation is unnecessary.”

Jenifer Heath is principal toxicologist and associate and Carol Day is risk assessment project manager for the Risk Evaluation Group of Geraghty & Miller, Inc., Raleigh, N.C.
The first phase of the risk-based approach is a simple comparison of medium-specific state standards or criteria with analytical data describing constituent levels in media at the site. Statistical procedures may be used in this phase to evaluate laboratory data. Groundwater or surface water transport models may also be applied. If site-related concentrations are lower than the standards or criteria at the point of compliance, then remediation should not be necessary. If site-related constituent concentrations exceed state criteria, or if no criteria exist for a specific constituent, the next phase is required.

Phase two of the risk-based approach is an exposure pathway analysis. Risk is a function of exposure and hazard. Although hydrocarbon related constituents are inherently hazardous (as are all chemicals, including water) if no person or environmental receptor comes into contact with the constituents, there is no chance of adverse effects. In the absence of exposure, there is no risk. Exposure can only occur if constituents from the UST can migrate in the environment to a place where humans or ecological receptors could come into contact with them. This is referred to as the exposure pathway.

Exposure pathway analysis incorporates information about constituent specific chemical and physical properties and site-specific conditions that affect constituent movement in the environment, along with results of groundwater or surface water modeling, and information about the mitigating effects of natural biodegradation that will occur at the site. If there are no current or foreseeable future pathways by which humans or ecological receptors could come into contact with site-related constituents, there will be no exposure—no risk. Further investigation would be unnecessary, and remediation should not be required at such sites. If there are pathways by which exposure to site related constituents could occur, then phase three of the risk-based approach should be implemented.

The third and final phase of the risk-based approach is to develop remediation goals. For sites where humans or environmental receptors may be exposed to site-related constituents at concentrations exceeding state criteria, site-specific, constituent-specific remediation goals can be developed. These goals are designed to protect humans and ecological receptors that have direct contact with affected media and to protect other media.

For instance, soil remediation goals could be designed to protect construction workers who are working in the contaminated soil and to protect groundwater from constituents leaching from the soil. If site-related constituent concentrations do not exceed these risk-based remediation goals, then remediation would not be necessary for the site. For UST sites where constituent concentrations exceed risk-based remediation goals, remedies can be designed to cost-effectively achieve the risk-based or other feasible goals—rather than to achieve unnecessarily restrictive (and often unfeasible) criteria that are more appropriate for screening.

Thus, the risk-based approach can help facilitate closure at hydrocarbon sites by: (1) determining whether constituent concentrations exceed state criteria; (2) determining whether exposure to site-related constituents is likely; or (3) developing defensible medium- and site-specific remediation goals. Remediation goals can then be used to determine the appropriate cleanup strategy, when the remedial system can be shut off or that remediation is not required.

Because both site owners/operators and state reimbursement funds have limited resources, cost-effectiveness joins protectiveness as a pivotal criterion for decision-making about UST closure. This approach focuses resources on those UST sites where remediation is necessary to protect human health or the environment.

**Write in 578 for more information**

---

**advertisements**

**advertise in soils**

**816-254-8735**

**Its easy...and it pays!**

**Call Darcy Case for details**

**Fax: 816-254-2128**

---

**There's only one earth, it's our job to keep it clean.**

At Gibson Environmental, we are committed to recycling. Our fully permitted facilities return oily soil and water to usable products, like fuels and road base. Nothing goes to waste. And because we recycle, our clients are not subject to federal, state or local disposal fees.

We take our job seriously at Gibson Environmental because there's only one earth and we want to help you keep it clean.

For more information please call (800) 582-3935 or (805) 327-0413 outside California.

**Gibson Environmental**
Farmers want your biosolids

New approaches to agricultural use of sludge

By Edward Clerico and Andrew Higgins, Ph.D.

Common sense is still the driving force behind the continuing trend to develop ways to reuse nutrient rich organic biosolids (sludge) to benefit agriculture. There are new alternatives to incineration or landfilling on the horizon. AgLime is an organic based lime product which provides supplemental nutrients and a 55 percent equivalent neutralizing value (ENV). Compost, another biosolids product, will also become more available and affordable as supplies increase in the future. Both products are in demand by farmers. AgLime is used primarily on field crops while compost is used for sod production, fruit and horticultural operations.

The term “biosolids” will begin appearing to differentiate good quality, usable material from “sludge,” which is associated with industrial contaminants.

Over the past 15 years, there have been many successful land applications of sludge. Unfortunately, a few poorly managed operations received a great deal of attention, leaving regulators with an uneasy feeling about the agricultural use of sludge.

AgLime was developed by Dale Crouse, a dairy farmer from Phillipsburg, N.J. It can be used by farmers without special permitting or concerns about contamination at about half the cost of crushed limestone.

Over the past 10 years, Crouse’s farm operated a program using more than 60 million gallons of liquid sludge and 25,000 tons of dewatered sludge. With continuous monitoring and repeated successful crop yields, the operation proved sludge can be a long term resource to agriculture. But, such a program requires extensive input of engineering and scientific expertise and the investment of considerable capital for permits and monitoring devices.

In fact, the permits were so difficult and expensive to obtain and comply with that Crouse sought to find a less regulated means of using biosolids on his unpermitted lands. The solution was a process known as N-Viro, alkaline stabilization with accelerated drying to combine biosolids with cement kiln dust to form a nonputrescible soil-like product. AgLime looks and handles like wet lime, but has the extra advantage of slow release organic nutrients.

The Environmental Protection Agency (EPA) certified that AgLime achieves the highest level of pathogen reduction.

Because the contaminant content is monitored and verified, the farmer need not verify quality. And, disposal and sewerage authorities can eliminate costly incineration by sending sludge to the AgLime producer, AgOrganic, Inc., Phillipsburg, N.J., at a cost only slightly higher than landfilling.

Use of AgLime is not completely unrestricted, as regulations vary from state to state, but the material can be used without special permits. Under existing regulations, it cannot be directly applied to vegetable crops.
NEW BOOK from the Association for the Environmental Health of Soils

CONTAMINATED SOILS REMEDIATION: CURRENT REFERENCES 1990

Paul T. Kostecki, Ph.D.
and
Edward J. Calabrese, Ph.D.

Environmental Health Services
University of Massachusetts
Amherst, Massachusetts

Current References is destined to become an indispensable addition to your resource library and is the most cost effective way to keep abreast of state-of-the-science technical information and developments. Consulting Current References will become an essential part of your report, proposal, and market plan preparations. Current References will also help you identify professionals, companies, and agencies which are active in the field.

CONTENTS

- Cover journal and magazine articles, government documents, books and book chapters, patents, theses and dissertations, gray literature reports, and conference proceedings.
- Provides instructions for inclusion of your company’s reports in future editions.
- Will be produced on an annual basis to cover previous year’s information.

- Includes bioremediation, chemical and aqueous washing, chemical treatment, composting, concretion and cementation, containment, flushing, incineration, land treatment, solidification, stabilization, thermal treatment, vacuum extraction, vitrification and volatilization.
- Over 200 titles
- Comprehensive subject index
- Author index
- Information on availability

Limited Time Offer!

Special Prices:

AEHS Members $20.00

Regulatory Non-Members $40.00

Non-members $60.00

AEHS
150 Fearing Street
Amherst, MA 01002

Name ____________________________

Company or institution ______________

Street ____________________________

City/State/Zip ______________________

Telephone ___________ PO# _______

Signature _________________________

All orders must be signed

Check one

___ Please bill me

___ Check enclosed in the amount of __________________

___ Credit Card __________________

____ Mastercard ___ Visa ___ Diners Club

Account # _______________________

Expiration date _______________

Signature _______________________

________________________________________________________________________
BIOREMEDIATION ORGANISMS

WASTE STREAM'S BIOBLENGS are specialized bacteria pre-blended with all required nutrients for a one step application to meet your soil remediation needs. The Bioblends are the same organisms used by Waste Stream in the successful remediation of over 100 sites in the last 7 years.

-Bioblends cost only $6.00/pound and are conveniently packaged in 50 lb bags and 1/2 to 3 pounds are required per cubic yard of soil.

FULL BIOLOGICAL & ANALYTICAL SUPPORT

CALL OR FAX
TO GET OUR BIOBLEND “BUG LIST” TODAY

WASTE STREAM TECHNOLOGY
302 Grote Street
Buffalo, New York 14207
PHONE: 716-876-5290  FAX: 716-876-2412

Tightness test terminology, from page 33

Overfilled tank test—This is a volumetric test which meets the original NFPA 329 requirement that all below grade piping be filled with liquid during the test.

Underfilled tank test—This is a volumetric test conducted with the liquid level in the system significantly below the tank top. The development of this test grew out of the recognition that overfilling the tank during the test introduces the problem of vapor pockets and exacerbates the problem of tank deformation. This type of test has been encouraged by the Environmental Protection Agency (EPA) definition of tightness test, whereby only those portions of the storage system that routinely contain product need to be tested for leakage.

Piping tightness test—Specifically designed for piping, in UST systems, it is generally applied to the product supply piping which carries product from the tank to the dispenser. Inasmuch as piping can withstand much higher pressures than tanks and the volume within a typical piping network is relatively small, pressure testing of piping is still the standard method.

NFPA 329 specifies that piping must be tested by hydrostatic pressurization at 150 percent of operating pressure, but not less than five pounds per square inch—for at least 10 minutes. Federal regulations have added performance requirements to piping tightness testing of a minimum detectable leak rate of .1 gallon per hour and a probability of detection of 95 percent and false alarm of five percent.

Non-volumetric tank test—The problems associated with volumetric tightness testing have encouraged the development of non-volumetric tests. These use techniques that do not involve measurement by volume of liquid in the tank and are thereby unaffected by many of the problems associated with volumetric tests. These tests typically give results in terms of pass or fail based on the detection of a specific leak criteria, such as the presence of a trace gas or an acoustical signal.

Tightness test—This is a generic term for a UST testing methodology which can meet EPA performance standards. The test must evaluate any portion of the tank that routinely contains product, and must compensate for thermal expansion or contraction of the liquid, vapor pockets, tank deformation, evaporation or condensation and the location of the water table.

The definition includes a performance standard of the detection of a leak of .1 gallon per hour with a detection probability of 95 percent and false alarm probability of five percent. This means, in a population of 100 tanks, each of which has a .1 gallon per hour leak, the method will find the leak in at least 95 of those tanks. Conversely, in a population of 100 tanks, each with a leak rate of zero, less than five of the tanks will fail the test and incorrectly be called leakers.
You're an Environmental Professional. You Need the Professional Environmental Directory

There's an O'Keefe's Guide for Your Environmental Region

O'KEEFE'S GUIDES

COMPLETE • DETAILED

O'KEEFE'S GUIDES are professional directories prepared by professionals in the directory business. Over 350 headings, with listings and advertising of regional services, equipment and products. Complete with names, addresses, phone and fax numbers.

COVERS ALL BUYERS
SUBSCRIPTIONS ARE FREE

Controlled, free-of-charge circulation to compliance officers and environmental managers in industry, consultants, environmental lawyers, contractors, lenders, government and specialized environmental services.

ADVERTISING IS INEXPENSIVE

O'Keefe's Guides are unique, and O'Keefe's ad rates average less than one-half of what other directories charge. Quality and circulation are second to none. Call, fax or write for information.

☐ Please send me a free copy of O'Keefe's Guide for my region, if I qualify.
☐ I would like to be included in one or more O'Keefe's Guides. Please contact me.

Name ___________________________ Title ___________________________
Company ___________________________ Type of Business ___________________________
Phone Number ___________________________ Address ___________________________

The Philip O'Keefe Co., 2200 Sansom St., Philadelphia, PA 19103 • 215-557-6218 • FAX 215-988-0402
Two new videos explore remediation and disposal techniques

Treat hydrocarbon contaminated soil by incorporating it in cold mix and hot mix asphalt...it works.

Proven throughout the U.S., here’s how independent contractors, municipals and utilities are handling this costly problem simply, with great economy. Fifty minute video explores several techniques in depth.

Here’s how an Arizona community composts 15 tons of trash and sludge daily

After months of investigating costly alternatives to disposal of trash and wastewater sludge disposal, this community used available technology and simple economics to develop its own revolutionary method, a sludge and solid waste co-composting facility...the only one of its kind. Fifty minute video.

CALL TOLL FREE
1-800-927-8444
In Canada call 1-816-461-4037
CHARGE TO MASTERCARD, VISA OR AMERICAN EXPRESS

Or mail check to:
Video University Productions, Inc.
10229 E. Independence Ave.
Independence, MO. 64053

$89
plus $3 shpg & hdg

$89
plus $3 shpg & hdg
DON'T MISS THE...

8th Annual Presentation 92

Haz Mat™

FALL

west

Hazardous Materials and Environmental Management Conference & Exhibition West/Fall

November 10-12, 1992
Long Beach Convention Center • Long Beach, California

The West Coast's Largest Event for Hazardous Materials and Environmental Management Professionals

The Exhibition:
See, compare and evaluate the industry's newest products and services for Hazardous Materials and Environmental Management...on display in over 600 exhibit booths.

The Conference:
Wide-ranging Conference Program covers current industry issues, new technology and the latest regulations. More than 150 individual papers in 31 Technical Sessions PLUS hands-on Workshops, Certification Exams...and more!

Sponsored by: HAZMAT WORLD magazine

Plan NOW to attend! Simply complete and mail the coupon or contact the organizer for full details including pre-registration form for reduced admission to the exhibits

Organized by:
Tower Conference Management Co.
800 Roosevelt Rd., Bldg. E - Suite 408
Glen Ellyn, IL 60137-5835
(708) 469-3373 • FAX: (708) 469-7477

TO: Tower Conference Management Co.
800 Roosevelt Rd., Bldg. E - Suite 408
Glen Ellyn, IL 60137-5835

☐ I am interested in ATTENDING HazMat West/Fall '92. Please send Conference details when available.

☐ My company is interested in EXHIBITING. Please contact me with full details.

Name ________________________________
Title ________________________________
Company ________________________________
Address ________________________________
City ________________________________ State __________________________ Zip+4 __________
Phone ( ) ________________________________
FAX ( ) ________________________________
Biovac's Biopipe™ in situ bioremediation process simultaneously addresses vadose zone, saturated and "smear zone" hydrocarbon contaminated soils and groundwater, says the St. Louis, Mo firm. A subsurface network of Biopipe, a porous, osmotic membrane bio-inoculation conduit, delivers nutrients, oxygen and microorganism solutions to the contaminated zone. The walls of the Biopipe are composed of a labyrinth of microscopic passages for low pressure dispersion of fluidized nutrients. The pipe is elastic so it can be pneumatically pulsed to easily free any pore blockage that may occur. Biopipe is buried directly into the soil matrix to take advantage of the natural capillary forces of the soil structure to horizontally wick outward and disperse oxygenated water, bioreactor effluents, nutrient solutions and commercial microbial cultures. In oxygen or gas sparging applications, the pipe's microscopic passages create a fine bubble aeration to provide optimum oxygen transfer. The very small diameter bubble has high gas to water surface interface ratio. Fine bubbles have less bouyancy than those generated by sparging through perforations drilled in PVC sparge pipes. Smaller bubbles are more readily dispersed horizontally throughout the contaminated soils, resulting in greater oxygen mass transfer per unit of air injected. Oxygen sparged below the water table rises up through the smear zone, created by the rise and fall of floating hydrocarbons with fluctuations in static water table levels. This creates an aerobic environment to stimulate biological degradation of hydrocarbons. The system can be installed under buildings, in high traffic areas, and under aboveground tanks. A bioreactor can serve as an onsite plug farm to culture site specific bacteria, says the company. Write in 580 for more information.
ANNOUNCEMENT
Seventh Annual East Coast Conference

HYDROCARBON CONTAMINATED SOILS CONFERENCE

Analysis, Fate, Environmental & Public Health Effects and Remediation
at the University of Massachusetts at Amherst  •  September 21-24, 1992

PRESENTATIONS IN THE FOLLOWING AREAS:

- chemical analyses
- hydrocarbon identification
- site assessment/field sampling
- regulatory programs and policies
- environmental fate & modeling
- soil chemistry
- hazard, exposure, and risk assessment
- standard remedial technologies/corrective actions
- innovative remedial technologies
- case studies on the above

PAST SPONSORS AND SUPPORTERS:

- AERIS Software Inc./Wastewater Technology Centre
- The Association for the Environmental Health of Soils (AEHS)
- Agency for Toxic Substances & Disease Registry
- American Petroleum Institute
- ARCO
- Association of American Railroads
- Edison Electric Institute
- Electric Power Research Institute
- Health & Welfare Canada
- Massachusetts Department of Environmental Protection
- Shell Oil Company
- Texaco
- 3M
- Union Carbide Corporation/Agri-Diagnostics Associates
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. EPA/Office of Underground Storage Tanks
- Major Environmental Engineering & Consulting Companies

For further information please contact:
Paul T. Kostecki, Ph.D.
Environmental Health & Sciences
N344 Morrill
University of Massachusetts
Amherst, MA 01003
Tel: (413) 545-2934  •  Fax: (413) 545-4692

EXHIBITION SPACE is available and potential exhibitors can receive information by calling Chuck Bell at (413) 545-4269
CHAMA Corp., Roanoke, Ind., says use of their Screen Placement System (SPS), an enclosed auger system, can minimize cross contamination, smearing and compaction in installing boreholes around well casings. The snug fit of the borehole at the outside surface of the screen provides direct contact with existing soil conditions and eliminates need for backfill and grout materials required by traditional drilling methods, says the company. "Displacement integrity" means removing only the amount of soil from the hole which the method can replace, thereby maintaining underground compaction necessary to support the components in the area—such as tanks and piping. Most hollow core augers large enough to install a four inch PVC observation well are 10 inches outside diameter and have exposed sharp edge flighting. The boring tools on the CHAMA system are only slightly larger than the outside of the PVC casing, with a tapered head and an effective sharp cutting point of only two inches. The enclosed system eliminates the free flow of backfill and minimizes cavities created as a result of groundwater, soil layering and/or frozen ground. The enclosed system works in frozen ground, pea gravel, sand, clay and other materials. It installs through asphalt. The components mount on skid steer loaders, backhoes, boom trucks or CHAMA's self-contained truck mount unit. The company says a four- or six-inch diameter screen 13 to 20 feet long can usually be installed in less than 30 minutes, either vertically or angularly in low headroom conditions. Inserting the screen as you dig reduces equipment and manpower needs. The unit is used for soil investigation, observation, monitoring, remediation, dewatering wells and is used to install cathodic protection anodes near underground tanks, says the company.

Write in 581 for more information
A quantum leap for in situ remediation

Here is the answer for high volume production and more effective application of multiple remediation agents – MecTool. A patented tool system of robust design that delivers your remediation solution faster and more effectively, even on the most difficult contaminated sites.

Before you specify a remediation plan for your next project, find out what MecTool could do for you. For information on MecTool, sample specifications, test reports and our MecTool technical applications chart, call Jeff Jacobs today:

313-261-9760
<table>
<thead>
<tr>
<th>Advertiser Index and Fast Response Fax Hotline</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>page #</strong></td>
</tr>
<tr>
<td>AEHS</td>
</tr>
<tr>
<td>Alttech Associates</td>
</tr>
<tr>
<td>Alpha Environmental Services</td>
</tr>
<tr>
<td>AmRec</td>
</tr>
<tr>
<td>Art’s Manufacturing &amp; Supply</td>
</tr>
<tr>
<td>Biovac Environmental Services</td>
</tr>
<tr>
<td>Brown Bear Corp.</td>
</tr>
<tr>
<td>Cambridge Environmental Group</td>
</tr>
<tr>
<td>Canaan Scientific</td>
</tr>
<tr>
<td>Cedarapids</td>
</tr>
<tr>
<td>Central Testing Service</td>
</tr>
<tr>
<td>Cherokee Sanford Group</td>
</tr>
<tr>
<td>The C.H. Hanson Co.</td>
</tr>
<tr>
<td>Coastal Remediation Co.</td>
</tr>
<tr>
<td>D’Appolonia Engineering</td>
</tr>
<tr>
<td>Disposal Technologies, Inc.</td>
</tr>
<tr>
<td>Earth Restoration Co</td>
</tr>
<tr>
<td>EG&amp;G Rotron</td>
</tr>
<tr>
<td>Enviroscan</td>
</tr>
<tr>
<td>FerTech Enviro Systems, Inc.</td>
</tr>
<tr>
<td>Friedman &amp; Bruya, Inc.</td>
</tr>
<tr>
<td>Gast Manufacturing</td>
</tr>
<tr>
<td>General Analysis Corp.</td>
</tr>
<tr>
<td>General Monitors/Byron Instruments</td>
</tr>
<tr>
<td>General Testing Corp.</td>
</tr>
<tr>
<td>GenTec Corp.</td>
</tr>
<tr>
<td>Geraghty &amp; Miller, Inc.</td>
</tr>
<tr>
<td>Giant Resource Recovery Corp.</td>
</tr>
<tr>
<td>Gibson Environmental</td>
</tr>
<tr>
<td>Hertz Equipment Rental Corp.</td>
</tr>
<tr>
<td>Lamson Corp.</td>
</tr>
<tr>
<td>Lattimore Construction</td>
</tr>
<tr>
<td>Mack Laboratories</td>
</tr>
<tr>
<td>Metco Environmental, Inc.</td>
</tr>
<tr>
<td>Millgard Environmental Corp.</td>
</tr>
<tr>
<td>Mobile Reclalm, Inc.</td>
</tr>
<tr>
<td>Modutank</td>
</tr>
<tr>
<td>O’Keefe’s Guide</td>
</tr>
<tr>
<td>Pet-Con Soil Remediation, Inc.</td>
</tr>
<tr>
<td>RE Wright Associates</td>
</tr>
<tr>
<td>Reef Industries</td>
</tr>
<tr>
<td>Soil Remediation, Inc.</td>
</tr>
<tr>
<td>Soil Safe, Inc.</td>
</tr>
<tr>
<td>Superior Environmental</td>
</tr>
<tr>
<td>Tarmac Equipment Co.</td>
</tr>
<tr>
<td>Tower Conference Management</td>
</tr>
<tr>
<td>Unique Products</td>
</tr>
<tr>
<td>United Retek Corp.</td>
</tr>
<tr>
<td>University of Massachusetts</td>
</tr>
<tr>
<td>V.U. Graphics</td>
</tr>
<tr>
<td>Waste Stream Technology</td>
</tr>
<tr>
<td>Xerxes Corp.</td>
</tr>
</tbody>
</table>
This is not what we do. This is what we save.

Through soil recycling, the beauty and value of a virgin forest will not be destroyed by clearing for a new landfill. Soil Safe’s unique stabilization process recycles 100% of incoming material, thereby not contributing to landfill growth.

We offer turnkey services for petroleum contaminated soil removal needs. Professionally managed from start to finish, we perform site audits, collect soil samples, complete required analytical tests, schedule trucking and loading, supervise soil removal, and finally, accept material at our facility where it’s recycled into high quality construction materials and paving products.

Our comprehensive Materials Management Program provides a complete audit trail for every truckload and/or drum of material that enters the facility. All incoming soil and outgoing recycled products are closely managed to monitor our constantly changing inventory of material.

Another advantage we offer our clients is the volume of material we are capable of recycling relative to other disposal alternatives. The plants at our Baltimore facility are capable of producing 650 tons of paving products each hour. Because of these significant production capabilities, we have recycled in excess of 375,000 tons of soil in the two year period we have been in business.

The market for our recycled products is ever expanding. We have completed over 50 construction projects to date, and our Construction Sales Division consistently has an inventory of 50 potential projects under evaluation. Many of our clients who bring soil to our facility enjoy significant savings by utilizing our recycled products in their paving projects.

Having the capability to manage both incoming and outgoing material in a cost effective and efficient manner is the key competitive advantage we offer our valued clients. For more information on our services and how we can help you solve your soil problems, call DAN NIESER, Marketing Director.

This is what we do.

Shopping Center / Vienna, Virginia

Warehouse / Rockville, Maryland

Service Station / Alexandria, Va
The new SPILL KILLER™ is here...

...turning oil-contaminated soil and sand into clean fill ON SITE!

- **SAFE** for the environment and the operators! Uses our InProve Colloidal™ Oil Spill Cleanup Agent — non-toxic, 100% biodegradable, EPA-accepted.
- **EFFECTIVE** on oil, gasoline, jet and distillate fuel, and other hydrocarbon spills — new or old!
- **FAST** — clean 11 tons/hour with model shown. Other SPILL KILLERS offer 40, 100, 200 tons/hour capacity.
- **PORTABLE** and self-contained, from its own power supply to its separation tanks.
- **COST-EFFECTIVE** — with only the separated contaminant to remove from site, and no need to haul in clean fill. Contractors make more money on lower bids — customers save time and money, too. Everybody wins with the SPILL KILLER!
- **FAX** (415) 358-9902 on your letterhead for free SPILL KILLER demonstration video tape!

InProve™
INDUSTRY-PROVEN PRODUCTS

UNIQUE PRODUCTS, INC. 1-800-325-6747

SALES OFFICE: 2228 So. El Camino Real, #175 • San Mateo, CA 94403 USA • Tel: (415) 358-1930 • Fax: (415) 358-9902

Write in 222