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Here's How It Works

Cover design by Keith Kavanaugh

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[Images of SoilSafe locations: Shopping Center / Vienna, Virginia, Warehouse / Rockville, Maryland, Service Station / Alexandria, Va]
Getting your hands on equipment

Buy? Lease? Rent? Finding unit costs can help make the decision

Workers conduct soil analyses using equipment rented from Hertz Equipment Rental Corp.

Equipment expenditures can be a significant source of cash outflow for tank owners, as well as consultants and contractors who service tanks and require a wide range of equipment—some to use for an hour, some to use every day. There is no easy answer to the question of whether to buy, lease or rent equipment.

Equipment can be regarded as either mainstream, perhaps a backhoe or loader—or project-specific, such as a drill rig for an environmental site investigation. Accurate predictions must be made for how long the equipment will be needed and what is the useful life of the equipment. Equipment is acquired for the future use of the company, not based on yesterday’s activities. And, no matter how attractive the financing, the wrong equipment always costs too much.

One technique to help the decision-maker determine whether to buy, lease or rent is to determine a unit cost for the equipment. This is the grand total of actual cost, finance charges, insurance, taxes, storage, transportation, licensing and maintenance fees expected to be paid out over the entire time the equipment would be owned. Then, divide that total by a standard of usage—hours, days or weeks you anticipate the equipment would be in actual use. The result is the unit cost, which levels the field somewhat to begin to compare the actual cost of owning to the cost of leasing or renting.

Buying equipment commits capital that could be invested in a number of ways—perhaps to hire additional employees or expand facilities. Therefore, it is important to calculate whether the equipment purchase represents the best return for that capital investment. Purchasing equipment means constant control over that equipment. You control where and how often that equipment is used, how it is transported, maintained and stored. Your financial picture will reflect the depreciation and obsolescence of the equipment. You retain any income from eventually selling the equipment.

If you are buying, you need to estimate the amount of manufacturer follow-up support you need. If you only need the vendor to deliver the item, then go for lowest price. But, if you feel you need follow up service and support, find the vendor with the best reputation for customer service.

It makes sense to choose the least expensive method to pay for equipment you purchase. The three traditional choices are: the installment plan, bank loan, or cash. The cost of paying cash is the lost opportunities or income resulting from not using that cash for other investments. The cost of installments and bank loans is the interest rate charged.

A good rule of thumb for deciding whether to lease equipment is if you need it longer than one month, but less than a lifetime, consider leasing. Leasing can conserve cash that might be used for growth capital or to conserve in hard times. Often, in a lease situation, you can pay for the equipment with the money it makes for you. Leasing is also a good way to get access to late model equipment.

Every lease is either an operating (tax or true) lease or a capital (financial) lease.

Financial Accounting Standards Board (FASB) statement 13 sets four standards for leases. If any one of the standards is met, the lease is a capital lease. If none of the standards applies, the lease is an operating lease. The standards are:

- ownership passes to lessee by the end of the lease term,
- term of the lease is for at least 75 percent of the useful life of the equipment,
- present value of the minimum lease payments is 90 percent or more of the fair market value of the equipment at the beginning of the lease,
- contains a bargain purchase option.

A capital lease is much like financing a purchase. It is carried as a debt and the equipment as an asset. The lease payments are considered to be a reduction of the debt. In an operating lease, the equipment is not shown as an asset and the payments are not debt, but are handled as expenses as they are paid.
Generally, leases are negotiable. Naturally, your negotiating clout depends on the size of your current contract and the perception of your future potential. Any lease should cover:

- price and length of term,
- disposition of the equipment at the end of the term,
- rights and responsibilities for maintenance,
- designation of rights and responsibilities for insurance,
- default and time to correct any default,
- invoicing and payment,
- warranty protection,
- provision to test the equipment before the lease begins.

In analyzing price and term of the lease, it is important to understand total price and total length of the lease. In some leases, it is difficult to determine these figures in total amounts. Misunderstandings often arise about the fate of the equipment at the end of the term. Common options range from simply returning the equipment to the owner—to being required to sell the equipment for a minimum amount. Some leases try to require you only to use a designated maintenance company.

Be on the lookout for insurance provisions in the lease that might conflict with your normal policies, particularly in dealing with contaminated sites. And, watch for insurance requirements that would leave you with the liability in the event of a total loss of the equipment.

Default arrangements can be very important. In most leases, in the event of a default, the lessor has a strong position—in some cases, repossession without notice, all future payments immediately due, even the right to break into your premises without penalty. It is possible to negotiate a provision for reasonable notice and time to prevent such nightmares.

In fact, it is possible to get into a lease where the lessor is not required to invoice you, payment is due on time anyway—whether an invoice is received or not, they don’t have to notify you that you are late or allow you time to correct the default. This could be a recipe for disaster. Be sure to negotiate some protection for yourself on this point.

On new equipment, be sure the warranty coverage extends to you. This is not an important point to the lessor, but could be critically important to you, so see that the warranty relationship flows seamlessly between you and the manufacturer.

Renting equipment can facilitate pinpoint control of expenses. The rental rate and term of the project are specific with no hidden costs for depreciation, repairs and maintenance. Changes in the tax laws in the 1980s, particularly the loss of the Investment Tax Credit, make renting competitive with owning in terms of tax status. Renting can conserve cash flow and hedge against equipment obsolescence.

Unquestionably, the process of acquiring equipment entails a great deal of estimating, guesswork and prediction. But by considering as many statistical factors as you can, it is possible to minimize expensive mistakes.

Write in 544 for more information.

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May 1992 Soils 7
Hammer out the details

Which investigative device is best for a particular site investigation?

By Richard Anderson, Laurel Lefebvre and Eric Nelson

Use of field instrumentation can accelerate the investigation of underground storage tank (UST) sites and thereby reduce the overall cost. Not all instruments are applicable to all sites, and a while a UST owner should rely on a qualified consultant to choose the best type, it is important to know performance characteristics and limitations of all the options. Electromagnetic, resistivity, seismic and ground


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penetrating radar are some of the tools used in subsurface investigations at UST sites. These instruments are portable, require very little power to operate and the data does not require a supercomputer to analyze. Each is capable of giving a picture of the subsurface in a relatively short time. Most importantly, these geophysical tools can help guide the consultant in making decisions based on how much to excavate, where to drill or where a contaminant plume may be headed. Also, several types of analytical chemistry field instrumentation can be used to assist in the investigation and remediation of leaking UST sites.

**Geophysical instrumentation**

Geophysical instrumentation is useful to determine the location of buried metallic objects. For instance, the precise location of an abandoned UST may not be known. Rather than to excavate numerous test pits to look for it, it is far more cost effective to use a geophysical instrument to locate the tank.

Since geophysical surveys can cover large areas in a short period of time, these instruments usually require operation by two people. However, all portable units, like the ones used for UST work, operate on their own battery power, so access to remote sites is not a problem.

Electromagnetic instruments are commonly used before initiating any invasive exploratory work or removal of a UST. Electromagnetic devices operate on the principle of magnetic inductance where a magnetic signal is produced by the instrument's transmitter. If a metal object, like a UST or a barrel, is below the surface, an electrical current will be induced in the object. This current develops its own magnetic field, which is picked up by the instrument's receiver. Any object within range of the signal that conducts electricity can be detected by the electromagnetic device. Not only is this useful for detecting USTs and associated piping, but electromagnetic instruments can help locate utilities as well. Areas such as construction sites, junkyards and some urban gas stations, may contain numerous metallic objects that create too much background "noise" for electromagnetic devices to be able to detect individual objects.

Once a UST is located, resistivity instruments can be useful to determine small and large scale soil horizons. Also, if the UST was used to store acids, bases or salts, resistivity devices can detect these plumes either in the soil or groundwater. The principle of resistivity is similar to EM in that it uses electromagnetism. However, resistivity involves sending an electric current into the subsurface via metal probes in a linear array. The current is sent back and a resistivity is recorded.

If resistivity is low, there may be a high conductivity, dissolved material in the soil or groundwater, such as chlorine ions from salts. A low signal may also be the result of soil type, such as a clay or wet sand. A high resistance reading might indicate a dry sand layer or a void in the subsurface, such as a large sewer structure. One of the results of the resistivity survey is that borings cannot be more effectively placed to locate groundwater and contaminant plumes.

Again, resistivity devices are

*Continues on page 10*
Hammer out the details, from page 9

susceptible to the same problems as electromagnetic instruments, but where the electromagnetic technique can only reach vertically to the tens of feet, resistivity is capable of penetrating to hundreds of feet of depth.

Both seismic and ground penetrating radar are useful in the same way as resistivity. These instruments can be used to detect soil and rock horizons, groundwater tables and subsurface structures. However, unlike resistivity instrumentation, these devices cannot detect contaminants. Both instruments operate on the principle of sending a vibrational wave into the earth and having the wave reflect back to the instrument. The time it takes for the waves to travel back to the instrument is related to the distance to the soil or rock horizons. One advantage of the seismic instrument is that it is not affected by subsurface metallic objects. Also, once the data is analyzed from either instrument, a two-dimensional picture is provided that shows depths to soil and rock interfaces and structural features. In addition, the seismic waves can travel to great depths if enough energy is “pounded” into the earth.

Analytical chemistry field instrumentation

Several types of field instruments are commonly used to assist in the investigation or remediation of a leaking underground storage tank site: 1) photoionization detectors (PID), 2) flame ionization detectors (FID) and 3) gas chromatographs (GC). The volatile organic compounds associated with hydrocarbon contamination can be quantified with these instruments while determining the approximate lateral and vertical extent of contamination. The instruments are portable, rugged, easy to operate, and offer two types of data resolution. The greatest advantage of the field instrumentation is the provision of real-time data, enabling rapid decisions. The data can be used to 1) guide the drilling of soil borings, 2) provide direction for excavation activities, 3) monitor the effectiveness of remediation and 4) provide air monitoring for health and safety, if required.

Soil and groundwater samples are collected during a UST investigation or remediation to characterize the overall soil and groundwater conditions at a site. The samples may be collected from sidewalls and floor of a UST excavation or in the vicinity of the UST area during drilling of soil borings. Rudimentary screening of the samples can be performed using a PID or FID. The devices respond to virtually all organic compounds, that is, compounds containing carbon-hydrogen or carbon-carbon bonds. The PID or FID measures the concentration of ionizable gases in parts per million (ppm) within the headspace of a sample, however, the instrument does not distinguish among individual compounds. The measurement reported represents the total concentration of all ionizable chemicals present in a sample.

The limitations of the PID are: 1) the reading reflects the total value of all organic compounds present, 2) a compound is not detected if the probe used has a lower energy level than the compound’s ionization potential, 3) the response is affected by high humidity and may change when gases are mixed, 4) readings can only be reported relative to the
calibration standard used, 5) the instrument should not be used at temperatures lower than four degrees Centigrade (40°F).

The limitations of the FID are similar to the PID, except that unlike the PID, the FID can detect methane which could result in false positive readings.

Most regulatory policies require cleanup of soil and groundwater at concentrations in the parts per billion (ppb) range. Field gas chromatographs can quantify and quality contaminants at this ppb level. Soil and groundwater samples are prepared in septa-capped vials. A measured quantity of headspace within the vial is withdrawn by a syringe and injected into the GC. The mixture of volatile components enters a moving stream of carrier gas within an elongated tube, or column. The proportion of each individual compound which is in the mobile phase at any given time is a function of the vapor pressure of each compound. The molecules of the components that exhibit higher vapor pressures are the first to exit the column and the compounds with lower vapor pressures are the last to exit the column. The separation of the individual compounds in a sample and their respective signals, or concentrations, are recorded using an ultraviolet lamp.

Unlike the PID and FID, the GC can identify individual compounds and their respective concentrations in the ppb range. Field screening using a GC can reduce the likelihood of resampling or re-excavating and provides a more detailed characterization of the contaminant plume during site investigation or remediation. Limitations are 1) the results cannot be used for confirmatory testing unless a certified mobile laboratory is used, 2) different sample preparation methods or chemical analysis may account for differences between field and laboratory data, 3) the loss of volatiles which occurs from the time of sampling and the time of laboratory analysis may result in lower reportable concentrations of laboratory data and, 4) personnel must have extensive training in gas chromatography.

Field devices provide rapid detection and delineation of the areal extent of soil and groundwater contamination. The limitations are equipment specific. The most significant advantage of direct-reading field instruments is the acquisition of information at the time of sampling, enabling rapid decision-making. For example, excavation activities could be altered or the location and depth of soil borings could be immediately adjusted according to information obtained from the field instruments. This fast method of evaluating soil and groundwater containing volatile organic compounds at UST sites is generally cost effective.

Write in 545 for more information
EPA compiles list of leak detection methods

Region 10 tracks leak detection methods that appear to have met accuracy requirements from federal UST regulations

The U.S. Environmental Protection Agency (EPA), Region 10, Underground Storage Tank (UST) program, acting at the request of EPA Headquarters and the other regions, has compiled the following list of leak detection methods that appear to have met or exceeded the accuracy requirements stated in the federal UST regulations (40 CFR 280).

“Manufacturers listed have provided this office with certifications that their product(s) meet performance standards described in the Standard Test Procedures for Evaluating Leak Detection Methods (EPA/530/UST-90/xxx),” says Joan Cabrera, Region 10 UST/LUST program manager.

The list is divided into seven sections based on method:

- Volumetric Tank Tightness Testing
- Nonvolumetric Tank Tightness Testing
- Automatic Tank Gauging Systems
- Statistical Inventory Reconciliation
- Vapor-phase-out-of-tank Product Detectors
- Liquid-phase-out-of-tank Product Detectors
- Pipeline Leak Detection Systems

Each section shown here includes manufacturer’s name, product name and model, city, state and phone. (The list of Pipeline Systems is not included here.) The full list includes specifications such as probability of false alarm and probability of detection—and is available from EPA Region 10, 1200 Sixth Ave., Seattle, Wash. 98101.

“EPA has not evaluated these certifications and inclusion on this list in no way states or implies that EPA approves or certifies any of these products,” adds Cabrera.

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12 May 1992 Soils
Volumetric Tank Tightness Testing Method
(EPA/530/UST-90/004)

Acutest Corp. Icon Env.
Leak Computer TS 2000
Houston, TX Saco, ME
713-228-8378 800-872-3455

Advanced Tank Cert., Inc. Keekor Env. Prod.
MOD II B FBO-800/801
Knoxville, TN Scottsdale, AZ
800-365-8378 602 443-0001

Alert Tech. Leak Detection Systems, Inc.
Alert 1000 Tank Auditor
Arlington, Hts. IL Cohasset, MA
708-392-0060 617-383-2305

Assoc. Env. Systems NDE Environmental Corp.
AES System II VPLT Tank Leak System A
Bakersfield, CA Torrance, CA 213-212-5244

EBW, Inc. O/C Tanks Corp.
Autostick Hydrostatic Tank Test*
Muskegon, MI Toledo, OH
800-475-5151 419-248-5475

EMCO Wheaton OTEC, Inc.
EECOsystem Q2001 United Detection Systems
Cary, NC De Pere, WI
800-342-6125 800-448-1228

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Greensboro, NC Tampa, FL
919-547-5000 800-981-9421

Hashtech, Inc. Purpora Engineering, Inc.
Leak Computer Purpora 706 Process
San Diego, CA Glendale, WI
619-457-5880 414-228-7631

Heath Consultants, Inc. Red Jacket Electronics
Quick Check 2000 RLM 5000, 5001, 9000
Petro Tite II, Petro Comp Mission, KS
Stoughton, MA 913-831-5700
617-344-1400

Horner Creative Prod. Remote Operating Systems
Horner Ezy Chek I & II ATMS RTM-I
Bay City, MI San Antonio, TX
800-443-0711 212-496-0661

Ibex Ind. Schuster Instruments, Inc.
Ibex Precision Test Tel-a-Leak I
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Leak detection, from page 13

| Soil Test | William M. Wilson’s Sons, Inc. |
| Ainline Tank Tegrity | Gasbey ATGS-Leak Detection |
| Tester S-3 | Model TMS 500 |
| Lake Bluff, IL | Lansdale, PA |
| 800-323-1242 | 215-855-4631 |

| USTest | Xerxes Corp. |
| UST 2000/P | Truchek/DWT II* |
| Lafayette, LA | Minneapolis, MN |
| 318-981-9421 | 612-887-1890 |

| Veeder-Root | Digital Sensing Probe |
| TLS-250, 250i, 350, 8472 | *These test the annual section of the manufacturer’s double-wall tanks. |
| Simsbury, CT | 203-651-2700 |

**Nonvolumetric Tank Tightness Testing**

(CTA/550/UST-90/0005)

| Alert Tech., Inc. | Tankology Corp. Int. |
| Alert 1050 Ullage | VacuTect |
| Arlington Hts., IL | Houston, TX |
| 708-392-0060 | 713-690-8265 |

| Gilbarco | Tracer Research Corp. |
| Gilbarco Ullage Test | Tracer Tight |
| Greensboro, NC | Tucson, AZ |
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(EPA/550/UST-90/006)

| Alert Tech. Inc. | L&J Env. Systems |
| Alert Model 2000 | MCG 1100, 8100 |
| Arlington Hts., IL | Crestwood, IL |
| 708-392-0060 | 708-396-1878 |

| EBW, Inc. | Keekor Env. Prod. |
| Auto Stik | FBO 800/801 Monitor |
| Muskegon, MI | Scottsdale, AZ |
| 800-475-5151 | 602-443-0001 |

| Egemin N.V. | Magnetek |
| E’SPI III | 7021 Digital Gauge |
| Bredabaan, Belgium | Clawson, MI |
| 32/3/645-2790 | 313-435-0700 |

| Emco Wheaton | PetroVend, Inc. |
| EECOsystem-TLM | Petrosonic III |
| Cary, NC | Hodgkins, IL |
| 919-460-6000 | 708-485-4200 |

| Tank Minder ATGS | RLM 9000, 5000, 5001 |
| Tempe, AZ | Mission, KS |
| 602-438-1362 | 913-831-5700 |

| Env. and Safety, Inc. | Remote Operating Systems, Inc. |
| EASI Level-Tru | ATMS RTM-I |
| San Jose, CA | San Antonio, TX |
| 408-954-9081 | 512-496-0661 |

| Gilbarco | Veeder-Root |
| TM-2/TM-3 | TLS-250/TLS-250i, TLS-350 |
| Greensboro, NC | Simsbury, CT |
| 919-547-5000 | 201-651-2700 |

| Incon Env. | William M. Wilson’s Sons, Inc. |
| TS 2000 | Gasbey TMS 500 |
| Saco, ME | Lansdale, PA |
| 800-872-3455 | 215-855-4631 |

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**Statistical Inventory Reconciliation Method**

(EPA/550/UST-90/007)

| Entropy Ltd. | Warren Rogers Assoc. |
| PTIC Rev. 90 | WRA 5.1 |
| Lincoln, MA | Middletown, RI |
| 617-259-8901 | 401-846-4747 |

| USTMAN Ind. | Lakewood, CO |
| USTMAN SIR, YEISSIR | 303-986-8011 |

*Continues on page 16*
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Write in 158
Soil sampling made easier

Hydraulic probes can punch through to save time and money

By George Ten Eyck and Catherine D.C. Hartman

There are ways to save money in environmental audits. One significant expense is in sampling costs. Many parties involved in the transfer of commercial and industrial property have "seen the light" in recognizing the need to evaluate environmental liability associated with property. The days of burying waste in the back forty, covering it over and

selling the problem to an unsuspecting buyer are long gone. Disclosure requirements and due diligence procedures have resulted in the practice of conducting audits prior to many types of property transfers. Audits are conducted in several phases. Phase I includes collection and evaluation of

George Ten Eyck is senior geologist and manager of property audits and Catherine D.C. Hartman is executive vice president of Bruck Hartman Environmental, Inc. of Cincinnati, Ohio.
background information and a visual inspection of the property for problems. Phase II audits include sampling and analyses of various media including soil, groundwater, surface water, wastes or air, as appropriate. Phase III is the remediation of problems uncovered in Phases I and II.

Audit costs are generally passed on to the buyer, or to the buyer and seller. Phase I audits generally cost from $1,000 to $5,000. Phases II and III usually cost considerably more, depending on the extent of sampling, analyses and remediation. Phase II sampling and analyses typically involve the use of a drill rig to collect soil samples. The cost of the rig may be several thousand dollars for one day of site work. Thus, most buyers and sellers are eager to avoid the significant expense of using a drill rig. And, use of a drill rig is limited by access to some locations and may be undesirable in some applications due to its highly visible profile—a drill rig on a site draws attention and invites questions.

Use of a hydraulic soil penetration system can quickly and economically sample sites in difficult locations. Such a tool is equipped with a roto-hammer enabling a two-inch diameter hole to be placed in surface pavement up to 24 inches thick. The soil sampling system consists of three-foot lengths of one-inch diameter threaded pipe equipped with a retractable drive point sample sleeve. The probe is driven to the desired sampling depth, the retractable drive point is released with extension rods and the soil sampler is advanced. This process forces undisturbed soil into the sample sleeve for collection similar to the collection of a soil sample with a Shelby tube.

After the probe rods and soil sampler are removed from the boring and disassembled, the soil samples are extruded from the sampling tube and placed in clean sample glass jars. Normal sample volume is approximately 125 milliliters (ml). The hydraulic probe can be used to conduct soil gas surveys and to place piezometers for collection of groundwater information. The samples can be screened using field instruments and then either analyzed with portable equipment or sent to an off site laboratory.

Hydraulic probe systems typically can be mounted in a standard size van and only require a minimum height of just over seven feet or so to operate.

Hydraulic probe systems can easily collect soil samples to depths of 25 to 30 feet in clay soils, deeper in less consolidated materials. They do not produce auger cuttings typical of a standard hollow stem drilling rig.

Two recent Phase II site investigations conducted by Bruck Hartman Environmental, Inc. of Cincinnati, Ohio, using a hydraulic probe, illustrate how the mobility and low profile of the system, when used with an organic vapor analyzer (OVA), allowed the most optimum boring locations to be chosen.

At the first site, a large commercial building built in the early 1900s, (see Figure 1, page 18) a 2.5 inch layer makes standard gravimetric measurements. And the analysis is accurate down to fractional parts per million. Most importantly, the IFF is easy to use.

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Figure 2: Sampling beneath an underground parking garage using a hydraulic probe.

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20 May 1992 Soils
of hydrocarbons was discovered in a dewatering sump. The hydrocarbon layer was detected when the sump pump had broken down, allowing groundwater to collect in the sump. The scope of work for this site investigation included these tasks:

- installation of 15 soil borings using the hydraulic probe to maximum depths of 12 to 15 feet;
- collection of soil samples every three feet, field screening of each sample with an OVA—one sample selected from each boring and analyzed for total petroleum hydrocarbons (TPH) and three samples selected to be analyzed for benzene, toluene, ethylbenzene and xylene (BTEX);
- determination of possible source of the hydrocarbon detected in the sump and the possible pathway from the source to the sump;
- determination of the extent of soil contamination.

The site facility is located in a urbanized warehouse and commercial district which has been developed for over 80 years. There were no underground storage tanks (USTs) used to store hydrocarbons on the site and hydrocarbons were never stored or used at the site during commercial operations.

The focus of the investigation was two recently discovered, off site, abandoned USTs located in the middle of the city street immediately west of the building. The USTs were located approximately 60 feet northwest and 60 feet southwest of the building sump. The tanks had probably been used to store heating oil. They were estimated to be more than 50 years old.

Other possible hydrocarbon sources were from spills along formerly active railroad tracks located immediately north and south of the building.

The ability of the hydraulic probe to easily penetrate surface concrete and street paving enabled soil samples to be collected from many locations with minimal damage to the street. Samples were collected from the apparent upgradient and downgradient locations surrounding the two UST cavities and near the west wall of the site building. Field screening of the soil samples enabled on site identification of highly contaminated areas to optimize locations of soil borings.

Field screening and eventual laboratory analysis showed that the UST southwest of the sump was the most probable source of hydrocarbon contamination. The operation of the sump most likely acted as a groundwater recovery system creating a pathway for hydrocarbons to enter the sump. In addition to minimizing surface damage, use of the hydraulic probe system eliminated the added cost of disposing of soil potentially contaminated with auger cutting that use of a drill rig would have caused.

A second site investigation involved the collection of soil samples to evaluate potential soil contamination.
Add zinc and lead to pavement recipe

Stabilize metal affected soils in asphalt to create useful paving material

By Stephen M. Testa and Dennis L. Patton

Asphaltic metals stabilization (AMS) is a proven alternative to fixate metal contaminated soil in a commercially valuable cold mix asphalt product. AMS methodology uses much the same technology as recycling petroleum contaminated soils in asphalt. Metal affected soils, formerly classified as hazardous waste, are incorporated with asphalt emulsion and specified grades of aggregate to produce a range of cold-mix asphalt products for a variety of end uses—landfill caps and liners, tank farm dikes and containment structures, parking lot, truck terminal and salvage yard pavements, road construction material and port facility container yard surfacing.

A major consideration in formulating remedial action plans is to assure the method is cost effective, time efficient and environmentally sound. AMS can achieve these objectives. One particular site, a former manufacturing plant for rail car brake shoes in California, demonstrates how the process works.

Regulatory framework

The brake shoe project fell under California regulation, and while to many clients, consultants and agency personnel, it may appear otherwise, the regulatory framework of federal and particularly California environmental laws does not deem everything as “hazardous” and mandate its disposal in a Class I landfill or by incineration. A review of current regulations proves the contrary. The letter, spirit and intent of current Hazardous Materials legislation is to promote and develop alternate technology that encourages the use, reuse and recycling of materials—rather than the archaic haul and dump remediation techniques that have only moved environmental problems from one place to another.

Specifically, the brake shoe plant project was carried out under the following enabling legislation:

- California Code of Regulations (CCR) Title 22, Section 66262.11 “Hazardous Waste Determination;”
- CCR Title 22, Section 66261.2, “Definition of Waste;”
- CCR Title 22, Section 66261.3, “Definition of Hazardous Waste;”
- CCR Title 22, Section 66261.4, “Exclusions;”
- California Health and Safety Code (CHSC) Chapter 6.5, article 4, section 251-3.2(b), “Recyclable Material;”
- 40 CFR 261.2(e), “Materials that are not solid waste when recycled.”

These are the main sections of the regulations that deal with the use, reuse and recycling of materials. There are numerous subsections and cross references to other sections contained within these main regulations. Briefly stated, to paraphrase CHSC 251-3.2(b), recyclable material which is or will be recycled by any of the following methods is excluded from classification as a waste is:

1) used or reused as an ingredient in an industrial process to make a product, or
2) used or reused as a safe and effective substitute for commercial products.

So, if the regulations do not classify recyclable materials as “waste” and are
not regulated as “hazardous waste,” the use, reuse and recycling of these materials are within the letter, spirit and intent of environmental legislation.

Field test objectives at the site
The objectives of the AMS field test were:
• to effectively reuse metal affected foundry sand residue as an ingredient in a stable, non-hazardous cold-mix asphalt to use as paving on the site;
• to reduce generator liability to a minimum by complying with California regulations;
• to reduce remediation costs by reusing metal affected soil as an ingredient in cold-mix asphalt, eliminating many hazardous waste taxes, pretreatment and landfill disposal costs;
• to demonstrate that AMS stabilizes hazardous constituents of metals-affected soil;
• to demonstrate that AMS is cost-effective, time efficient and environmentally sound as an alternative to landfill disposal.

Site history
At the project site, the manufacturing process of cast iron brake shoes originated with imported raw iron ore and other ores which were processed through an on-site foundry. This foundry produced molten metals which were poured into sand molds. The rough brake shoe castings were removed from the molds, quenched and mechanically trimmed to approximate shape. Final dimensions were accomplished by machining and sand blasting. The sandblast grit resulting from this final dimensioning process was recycled on-site through a magnetic air and water separation system.
Large sumps, located within the complex, served as clarifiers that held the water and fines from the sandblast grit recycling system. So, the first step was to pump that clarifier water into

Continues on page 26

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Method</th>
<th>STLC Regulatory Levels (mg/l)(a)</th>
<th>Actual Concentration (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>EPA 200.7</td>
<td>15</td>
<td>ND(b)</td>
</tr>
<tr>
<td>Arsenic</td>
<td>EPA 206.2</td>
<td>5.0</td>
<td>ND</td>
</tr>
<tr>
<td>Barium</td>
<td>EPA 200.7</td>
<td>100</td>
<td>4.25</td>
</tr>
<tr>
<td>Beryllium</td>
<td>EPA 200.7</td>
<td>.75</td>
<td>ND</td>
</tr>
<tr>
<td>Cadmium</td>
<td>EPA 200.7</td>
<td>1.0</td>
<td>1.42(c)</td>
</tr>
<tr>
<td>Chromium Total</td>
<td>EPA 200.7</td>
<td>5</td>
<td>1.06</td>
</tr>
<tr>
<td>Cobalt</td>
<td>EPA 200.7</td>
<td>80</td>
<td>ND</td>
</tr>
<tr>
<td>Copper</td>
<td>EPA 200.7</td>
<td>25</td>
<td>2.21</td>
</tr>
<tr>
<td>Lead</td>
<td>EPA 200.7</td>
<td>5.0</td>
<td>438(c)</td>
</tr>
<tr>
<td>Mercury</td>
<td>EPA 245.1</td>
<td>0.2</td>
<td>ND</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>EPA 200.7</td>
<td>350</td>
<td>ND</td>
</tr>
<tr>
<td>Nickel</td>
<td>EPA 200.7</td>
<td>20</td>
<td>0.88</td>
</tr>
<tr>
<td>Selenium</td>
<td>EPA 270.2</td>
<td>1.0</td>
<td>ND</td>
</tr>
<tr>
<td>Silver</td>
<td>EPA 200.7</td>
<td>5</td>
<td>ND</td>
</tr>
<tr>
<td>Thallium</td>
<td>EPA 200.7</td>
<td>7.0</td>
<td>ND</td>
</tr>
<tr>
<td>Vanadium</td>
<td>EPA 200.7</td>
<td>24</td>
<td>0.40</td>
</tr>
<tr>
<td>Zinc</td>
<td>EPA 200.7</td>
<td>250</td>
<td>336(c)</td>
</tr>
</tbody>
</table>

(a) Regulatory Levels per CCR Title 22 Section 66261.24
(b) ND = Not Detectable
(c) Metals detected in concentrations above the regulatory STLC levels were Cadmium at 1.42 ppm, Lead at 438 ppm and Zinc at 336 ppm. Expressed as the ratio exceeding STLC levels: Cadmium was .42 times, Lead was 87.6 times and Zinc was 1.34 times their allowable concentrations.
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Write in 195
Zinc and lead, from page 23

vacuum trucks, manifest and transport it to a permitted toxic substances disposal facility. Proper disposal was documented in this way as no waste discharge permit or National Pollutant Discharge Elimination System (NPDES) permit had been obtained for this site. The material remaining in the bottom of the clarifiers was fine-grained sandy residue consisting of 90 percent sieve size #50, #100 and #200 minus particles and 10 percent extraneous materials—wood, nuts and bolts, etc. The water content of the metals affected residue, while not measured, was estimated to be approximately 20 percent by volume at the time of AMS treatment.

The remaining metal affected soil in the clarifiers was removed with a backhoe, the water removed, then sampled and analyzed. After workers hand-cleaned the clarifiers with shovels and coarse bristle brooms and brushes, the clarifiers were steam cleaned. The rinse water from the clarifiers was loaded directly onto semi-trailer end dump transport trucks. No materials were stockpiled on the site. Transport trailers were lined with seamless sheeting to prevent leakage.

Analytical Results for Pb–Zn Sludge Prior and After Fixation via Cold-Mix Asphalt Incorporation

![Analytical Results Chart]

Figure 2

steam cleaning was collected, sampled, analyzed and transported to a permitted treatment, storage and disposal facility for disposal. All material removed from the

---

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26 May 1992 Soils
covered with tarps and the material was taken to the cold-mix asphalt plant site under CHSC 25143.9 as "exempt recyclable material."

All personnel at the project site and the cold-mix asphalt plant were Occupational Safety and Health Administration (OSHA) 40-hour trained and certified hazardous materials technicians working under the direct supervision of a certified hazardous materials manager. The contracting company was a California Class A general engineering contractor with hazardous substance removal and remedial actions certification.

At the asphalt plant site, the material was unloaded adjacent to the screening unit. The plant site is completely covered with 18 inches of cold-mix asphalt and bermed to prevent run on and run off of water. As the material had a high moisture content, dusting was not a problem. The material was screened to remove wood and other materials, and conveyed into the soil hopper of the asphalt batch plant.

There are two hoppers on the batch plant, one for soil and the other for aggregate. Both hoppers were calibrated to feed predetermined mix design quantities into the mixing chamber.

Rotary vanes inside the mixing chamber blends the affected soil and aggregate, while an internal spray bar coats the mixture with a predetermined percentage of proprietary asphalt emulsion. Retention time in the mixing chamber is set to ensure that the resulting blend of soil and aggregate is uniformly coated and mixed. The asphalt product was conveyed directly onto transport trucks and delivered back to the brake shoe plant site for placement on the heavy equipment storage yard.

The mix design was 44 percent metal affected soil, 50 percent 3/4-inch minus Class II aggregate and six percent asphalt emulsion.

No bench scale testing was performed prior to the processing of this material as the test was intended to be conducted under actual field conditions.

Twenty-two tons of metal affected soils were processed to produce fifty tons of finished asphalt product.

**Sampling and analysis**

The pre-treatment analytical results of the metal affected soil is shown in Figure 1, page 23. These analyses were conducted in accordance with CCR Title 22, Section 66261.24, “Characteristics of

Continues on page 34→

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**Toxicity Characteristic Leaching Potential**

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<table>
<thead>
<tr>
<th>Analyte</th>
<th>TCLP Regulatory Level (mg/L)</th>
<th>Concentration of TCLP Metals (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadmium</td>
<td>1.0</td>
<td>ND</td>
</tr>
<tr>
<td>Lead</td>
<td>5.0</td>
<td>3.97</td>
</tr>
<tr>
<td>Zinc</td>
<td>Not Listed</td>
<td>7.62</td>
</tr>
</tbody>
</table>

(a): Per Title 22 sec. 66261.24

---

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Write in 101

May 1992 Soils 27
Out of the rough... on to the green

Now that the lenders appear to be off the hook, who do suppose will pick up the liability slack?

By James M. Savige

PAR 5: Evidence of prior use of the property for industrial or manufacturing purposes was on site.
- not found
- managed
- neglected
- unknown

PAR 5: Pits, ponds or lagoons for waste treatment storage or disposal are on site.
- not found
- managed
- neglected
- unknown

PAR 4: Underground storage tanks were or are on site.
- not found
- managed
- neglected
- unknown

PAR 4: The storage of chemicals, solvents or other regulated substances is on site.
- not required
- managed
- neglected
- unknown

PAR 4: Any asbestos containing materials are on site
- not found
- managed
- neglected
- unknown

PAR 3: NESHAPS, TSCA, RCRA, SARA are acronyms in my vocabulary.
- not found
- found
- unknown

PAR 3: PCB's in equipment are on site.
- not found
- managed
- neglected
- unknown

PAR 4: Evidence indicates that regulated wastes have or currently are on site.
- not found
- managed
- neglected
- unknown

What is your environmental awareness handicap?

Scoring: The par shooter has some environmental awareness and needs to develop a program to further reduce risk. The bogie player needs to devote some immediate attention to environmental awareness. The under par shooters understand and play the game well—may only need to fine tune their programs a bit. Try to increase your environmental awareness over the next several months and then play another round. You might be surprised.

James M. Savige is vice president of Professional Service Industries, Inc., of Clearwater, Fla.
It looks like the liability pendulum is swinging to a more centered position for lenders. It is common knowledge that environmental issues and liability have tightened the purse strings of the lending community for the last several years. But as things improve for lenders, will that focus still more liability burden on owners? In 1990, a case that has become known as “Fleet Factors,” (United States vs. Fleet Factors Corp., 901 F.2d, 1550, 11th Cir. 1990), created tremendous concern for lenders. It had been thought that lenders, acting as lenders, were exempt from liability. But the Fleet Factors decision essentially eliminated most of the protection thought to be afforded in the Secured Credit Exemption provision of Superfund. The decision went so far as to say that merely having the ability, through contract documents, to affect decisions concerning hazardous waste disposal, could make lenders liable. Based on Fleet Factors, the routine activities that lenders historically performed to manage secured loans could subject them to Superfund liability.

The good news is, in response to the lending community’s criticism of the Fleet Factors decision, the Environmental Protection Agency

*Continues on page 30*
Out of the rough, from page 29

(EPA) announced it would develop a rule to set forth the dos and don'ts for lenders to avoid Superfund liability. There have been two drafts of the rule (October 1990 and February 1991) and implementation of the final rule is imminent. This rule essentially reverses Fleet Factors and encourages secured creditors to protect their collateral through:

- performance of environmental investigation;
- required cleanup of a facility prior to or during the life of the loan;
- requiring the borrower (facility owner, operator) to provide assurance of compliance to applicable environmental rules, laws and regulations;
- performance of periodic monitoring and inspection of the site.

In addition, lenders will be given the leeway to undertake workout activities and even foreclose, without incurring Superfund liability, so long as they don’t overstep the guidelines set forth in the rule for participation in the management of the property.

Therefore, things seem poised to change for the better for the borrowing community. The EPA’s Secured Creditor Exemption Rule— together with lender liability exemption laws in several states will diminish the liability issue with lenders and probably open the purses again. However, like few things in life, looser purse strings will not come without a price. But why a price if the lenders’ exposure to liability has been so dramatically reduced?

First, consider these questions: How many lenders have actually been named as a “Potentially Responsible Party” under Superfund and had to pay for remediation? An article in the Wall Street Journal of April 11, 1991, reported only 35 lenders were known to have picked up the tab. And, what percentage of lenders have had the collateral securing their loans devalued due to environmental problems or contamination? At present this has not been documented, but the ABA Weekly of December 17, 1991, says a survey indicated 88 percent of lenders had changed their lending procedures to protect themselves from environmental problems.

It isn’t hard to understand that devaluation of collateral probably presents a much greater everyday problem to lenders than Superfund liability. The “value” of collateral is in part derived from its marketability, the borrower’s repayment ability and the ability to convert it to cash.

Marketability is obviously a function of environmental condition and devaluation occurs when marketability is impacted due to environmental problems. When the owner/borrower is required to clean up contamination, two things have generally occurred:

- The borrower’s ability to repay is impaired to some degree. Most people don’t have thousands of dollars sitting around to pay for remediation. Unfortunately, in most cases, the money comes off the bottom line.
- The value of the property has just dropped substantially. Whatever
equity the owner had is probably gone.
A clue of what the future might hold is given in the EPA’s Secured Creditor Exemption rule which, though not required for the exemption, encourages lenders to perform environmental assessments, conduct periodic monitoring of their collateral and requires that the borrower be in compliance with all applicable environmental rules and regulations. Having been given this encouragement, it would be foolish to think they will not exercise these options—and pass the costs along.

In addition, with a large share of the “deep pockets” eliminated from the liability picture, the EPA and state agencies are probably going to focus more closely on owners, now that the lenders are exempt. It is unlikely the future holds an exemption to be enacted for owners!

So, the price to the opening of the purses is the price of maintaining your “environmental worthiness.” Owners, any potentially liable party, need to go on the offensive to reduce and limit exposure.

Environmental worthiness essentially means, “placing yourself and your properties in an environmentally sound position.” In addition to the Phase I site assessments lenders require, the environmental engineering community has developed and uses a system to check not only the property, but also the borrower. Public records such as Site Enforcement Tracking System (SETs), Compliance Monitoring Enforcement Log (CMEL) and Consolidated Docket of Administrative and Civil Enforcement Action (DOCKET), to mention a few, are reviewed for individual (not site) inclusion.

Increasingly, lenders are becoming as concerned about a borrower’s environmental worthiness as about the collateral itself. Much like a credit report, an individual’s environmental history needs to be good. Remember, lenders would prefer to make their money the old fashioned way, through repayment of the loan, rather than having to deal with contaminated properties (even if lenders are exempt from the liability).

The best way to go on the offensive, to develop and maintain environmental worthiness is to implement an environmental awareness and monitoring program. Remember, the liability is the owner’s problem, and, unlike a used car that is depreciated, environmentally devalued property cannot be traded in on new property.

People who own, operate or manage single or multiple properties need to start thinking environmentally:

- Are the properties and on site activity in compliance with applicable environmental rules and regulations?
- What about tenants? What are they doing with the property?
- Do everyday on site activities or uses tend to contaminate the property?
- When was the last inspection to check what was stored or disposed on the property?

There are at least four broad categories of action to limit exposure

Continues on page 32

---

Low-Temperature Thermal Desorption

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Out of the rough,
from page 31

to liability and property devaluation, to increase environmental worthiness and to be able to answer the above questions.

Training
First, train all office and field staff to be observant and aware of conditions that can lead to environmental problems. Many sites are contaminated unintentionally through everyday activities people just don’t think about. Big problems generally do not start big. They are small things that, over time, eventually become larger. Maintenance and landscaping staff are generally out and about every day. Think what an effective force they could be with a little training in storage and disposal procedures, site observation technique and typical waste stream identification.

Periodic site visits
Establish a schedule for visits and a system to record them. The frequency of such visits depends on the property and its use, but as a rule of thumb, consider:
- Annual visits for multi-family, “clean” office parks and shopping centers.
- Semi-annual visits for light industrial parks and certain manufacturing sites.
- Quarterly or monthly visits for heavy industrial, manufacturing, equipment or automotive service and repair facilities. Many of these, such as underground storage tank owners, are required to monitor their sites at specified times by federal, state or local agencies. What to look for is, again, very site specific and best determined by an experienced environmental consultant. However, some of the following would be included on most checklists:
  - changes in the uses of the property,
  - installation of new or additional underground storage tanks,
  - changes in number, type and condition of drums, barrels or storage containers on site,
  - changes in substances stored on site,
  - new discharges,
  - new types of wastes generated on site,
  - changes in waste disposal,
  - any new processes on site,
  - any liquid or solid waste disposal occurrences,
  - any visible stained areas, sheens on water or distressed vegetation.

And, what questions should be asked? If questions like, “How do you dispose of that waste?” or “Where do you keep your Material Safety Data Sheets?” get responses such as, “I don’t know,” or “Someone does it...” there is potential for a problem.

Monitoring questionnaires
Use a monitoring questionnaire and disclosure form for tenants or operators. It should be designed to detect changes in uses, activities, etc. and should be completed at least once a year. Tenants and operators compliance level with applicable environmental laws and regulations can also be verified on this form. The questionnaire needs to address, at a minimum, the following:
- former and current uses,
- asbestos, lead-based paint and PCBs,
- tanks, drums and storage containers,
- air emissions and discharges,
- waste generation, processes, industrial uses and agricultural chemical uses,
- other site specific concerns.

Contract language
Tenants have lease agreements. Have legal counsel draft such documents with new language enabling you to require their assurance of compliance with applicable environmental rules. Also include the right to perform periodic site visits and inspections relating to environmental issues and require tenants to complete your monitoring questionnaire.

Remember, the lending institution will have such language in its contract with you. By working with legal counsel and an environmental consultant, you will be able to develop a program suited to you.

All these items, observational training, site visits, the questionnaire and contractual provisions, cost very little to implement. To enhance environmental worthiness puts an owner on the offensive, rather than in a position to be surprised by major environmental problems. All things considered, the price tag for the opening of the lender’s purses is not such a bad deal for borrowers.

Write in 549 for more information
Soil sampling made easier, from page 21

associated with three abandoned USTs located beneath the basement floor of a large parking garage. The ceiling height of the parking garage is approximately 7.5 feet, and the tanks were located in the middle of the building (some 50 feet from each exterior wall). Therefore, collection of soil samples on the perimeters of the building would not be likely to characterize the contamination. Two separate sampling events compared the efficiency of the hydraulic probe. See Figure 2, page 20).

desired depths. This task took two staffers a half day to complete. The analytical results of this second sampling showed the extent of the soil contamination was limited to the area immediately surrounding the USTs.

While the practice of conducting audits increases the cost of buying and selling properties, the audits can be a lifesaver if the property has contamination or other environmental liabilities. Because of the added expense, however, buyers and sellers want to minimize costs wherever possible. A hydraulic soil penetration system is a soil sampling device that allows rapid, efficient and less destructive collection of soil and groundwater samples for Phase II investigations and therefore reduces overall costs. It greatly increases the amount of scientific information that can be collected to rapidly evaluate the environmental condition of a property.

Write in 547 for more information
Soil sampling made easier, from page 21

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The scope of work for this site included:

• collection of soil samples from 15 locations to a maximum depth of six to 10.5 feet;
• field screening of soil samples with an OVA and selection of one sample from each boring for analysis for TPH, BTEX and total lead;
• determination of the potential vertical and horizontal extent of contamination.

The initial sampling event was conducted by opening the concrete floor with a jack hammer, augering to a desired depth with a small, mechanical auger (with maximum attainable depth of six feet) and collecting the soil sample with a hand auger. Soil samples were collected from 10 locations and the entire operation, including replacement of the concrete took three BHE staffers two days. This initial sampling was conducted in the immediate area of the three USTs and confirmed that a gasoline release had occurred.

The second sampling event at the parking garage was conducted to determine the possible extent of soil contamination. The low profile of the hydraulic probe system enabled sample collection in the basement of the garage at increased sample depths in a greatly reduced time with fewer personnel. The probe easily penetrated the concrete floor and soil samples were collected from five locations at the desired depths. This task took two staffers a half day to complete. The analytical results of this second sampling showed the extent of the soil contamination was limited to the area immediately surrounding the USTs.

While the practice of conducting audits increases the cost of buying and selling properties, the audits can be a lifesaver if the property has contamination or other environmental liabilities. Because of the added expense, however, buyers and sellers want to minimize costs wherever possible. A hydraulic soil penetration system is a soil sampling device that allows rapid, efficient and less destructive collection of soil and groundwater samples for Phase II investigations and therefore reduces overall costs. It greatly increases the amount of scientific information that can be collected to rapidly evaluate the environmental condition of a property.

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Write in 176

May 1992 Soils 33
Cost Comparison AMS vs Hazardous Waste Landfill Disposal

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Description</th>
<th>AMS</th>
<th>HWLD</th>
<th>Difference (per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Sample and Analyze Affected Material in Place in Clarifiers. * Waste Characterization plus Metals.</td>
<td>$3,200.00 L.S.</td>
<td>$3,200.00 L.S.</td>
<td>0</td>
</tr>
<tr>
<td>2.0</td>
<td>Excavate and Load Affected Material. * Includes standby time on transport truck (4 hrs.), Backhoe (8 hrs) and all labor (2 ea. @ 40.00/hr x 6)</td>
<td>$2,200.00 L.S.</td>
<td>$2,200.00 L.S.</td>
<td>0</td>
</tr>
<tr>
<td>3.0</td>
<td>Transport Material. * Tonnage rates for AMS material transport vary according to mileage and routing. Price shown is site specific.</td>
<td>$3.25 per ton</td>
<td>$37.50 per ton</td>
<td>$34.25</td>
</tr>
<tr>
<td>4.0</td>
<td>AMS Process vs. Disposal of Material * Includes pretreatment per land disposal restriction regulations</td>
<td>$40.00 per ton</td>
<td>$150.00 per ton</td>
<td>$110.00</td>
</tr>
<tr>
<td>5.0</td>
<td>Value of Finished Product Assigned by Client * Net after transportation and application as pavement at site of origin</td>
<td>$&lt;20.00 per ton</td>
<td>0</td>
<td>$20.00</td>
</tr>
<tr>
<td>6.0</td>
<td>State Taxes for Disposal of Hazardous Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Superfund H.W. Landfill (HS)</td>
<td>0</td>
<td>$52.50 per ton</td>
<td>$52.50</td>
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<tr>
<td></td>
<td>Hazardous Waste Disposal Fee (HA/HY)</td>
<td>0</td>
<td>$105.00 per ton</td>
<td>$105.00</td>
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<tr>
<td></td>
<td>Generators Fee and Surcharge</td>
<td>0</td>
<td>$6.00 per ton</td>
<td>$6.00</td>
</tr>
<tr>
<td></td>
<td>County Tax</td>
<td>0</td>
<td>$9.50 per ton</td>
<td>$9.50</td>
</tr>
<tr>
<td></td>
<td>TOTALS PER TON (LUMP SUM TASKS NO. 1 &amp; 2 nic)</td>
<td>$23.25</td>
<td>$360.50 per ton</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>DIFFERENCE PER TON AMS VS HWLD =</td>
<td>0</td>
<td>0</td>
<td>$337.25</td>
</tr>
<tr>
<td></td>
<td>ADDITIONAL ANALYTICAL PERFORMED ON THE AMS FINISHED PRODUCT FOR THE PURPOSE OF THIS TEST WAS $1,100.00 OR $50.00 PER TON.</td>
<td>$1,100.00</td>
<td>0</td>
<td>- $50.00</td>
</tr>
<tr>
<td></td>
<td>NET</td>
<td></td>
<td>$287.25</td>
<td></td>
</tr>
</tbody>
</table>

Even more dramatic is AMS vs. Incineration. The incineration facility fee alone is 78 to 90 cents per pound. At 90 cents per pound that is $1,800.00 per ton. For 22 tons that equals $39,600.00. Then add $900.00 per ton transport and the taxes, the incineration cost is well over $2,000.00 per ton.

Figure 4

24 to 48 Hour Turnaround Times

- BETX/TPH Soil Analysis
- Soil Characterization
- Waste Characterization

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34 May 1992 Soils
Reduction of zinc was 4.46 to one and 4.62 to one, respectively.

These results are vital indicators of the stabilizing effect of the AMS process, as the design mix for the asphalt product uses 44 percent metal affected soil. Had no stabilization been affected by the AMS treatment, a numerical reduction of slightly less than 50 percent would have been shown by the analysis. A reduction to 50.5 parts per million (ppm) from 438 ppm is 8.67 to one—which demonstrates the effective stabilization capabilities of the AMS process.

The ratio of reduction in the level of contamination in pre and post AMS treatment proves the reduction in levels is not proportionate to the mix design. Therefore, the AMS process is not one of dilution or attenuation, but one whereby metal affected soils are stabilized by the asphalt mixture.

Toxicity characteristic leaching potential (TCLP) analysis was performed on the constituents that analyzed over the STLC levels. Results are shown in Figure 3, page 27. Zinc is not listed as a regulated constituent in California, so the concentration of 7.62 ppm is within acceptable limits. The only other regulatory level for zinc that applies is that of STLC as shown in Figure 2, which is well under the acceptable level of 250 ppm. As demonstrated, the asphalt end product produced by the AMS process is non-hazardous per California regulations. The TCLP concentration of lead is 3.97 ppm, well below the regulatory level of 5 ppm.

Analytical summary

Pretreatment STLC concentration of Cadmium was .42 times greater than the regulatory limit, lead was 87.6 times greater than the regulatory limit. For zinc, the concentration was 1.34 times the regulatory limit. No other metals were in excess of their regulatory levels. Consequently, further analysis was conducted on Cadmium, lead and zinc only. As the finished product was neither friable, powdered or in a finely divided state, levels do not apply to the finished asphalt product. The TCLP analytical showed Cadmium as non-detectable. The lead concentration was 3.79 ppm, well below the regulatory level of 5 ppm. No zinc TCLP levels were set forth, however, the zinc concentration was below the STLC regulatory limit overall and the asphalt end product was classified as non-hazardous.

Cost comparison

The savings of the the AMS process as opposed to disposal in a hazardous waste landfill is shown in Figure 4, page 34. Use of the AMS process in this field test project saved at least $173 per ton in state and county taxes. Comparative disposal cost savings were $110 per ton. Naturally, transportation fees vary, but the cost effectiveness of transporting the AMS asphalt plant to the remediation site on projects of 500 tons or more can be even more dramatic. Add to the fact that the finished product is a commercially viable asphalt product and was used by the client as pavement produced a $20 per ton credit against the already low cost. Overall, this project saved the client $287 per ton, net. To complete this project by disposal in a hazardous waste landfill would have cost the client $13,331. The AMS method cut the cost to $6,351. When compared to incineration, the cost savings of AMS is over $1,700 per ton.

A successful project

All objectives were met for this project. Metals were stabilized into a useful product. The generator's liability was reduced to nil by avoiding disposal in a landfill. And, the tests proved that AMS is a true stabilization technique, not just one of dilution or attenuation. Cost effective, time efficient and environmentally sound—the three main criteria met.

Perhaps more importantly, this field test provides a case history of the applicability of California's current environmental laws and the fact that the development of alternate technology by the private sector is encouraged to overcome the environmentally unsound techniques of the past. The alternate technology of AMS demonstrates that the classification from "hazardous material" to "recyclable material" to "non hazardous end product" is within the letter, spirit and intent of California regulations.

Write in 548 for more information

---

**PAVING THE WAY TO SOIL REMEDIATION**

**THE PROBLEM**

The former Johnson Steel and Wire Company site in Worcester, Massachusetts, presented a challenge to both the Massachusetts Department of Environmental Protection (DEP) and Intransit Container, Inc. who wanted to develop the site as a major intermodal rail terminal in Worcester. The soil was contaminated with both petroleum products (fuel oil) and high levels of lead. American Reclamation Corporation (AmRec) was contacted and asked to solve the problem.

**THE SOLUTION**

Through the AmRec Process, AmRec demonstrated that the soil from the site could be recycled into an environmentally safe asphalt paving. After review and approval by DEP, over 4,000 tons of soil and 8,000 tons of other recyclable materials were screened, crushed and blended to produce 12,000 tons of asphaltic concrete. These, about 14 acres of the site were covered with the recycled paving made from the AmRec Process. By using the recycled asphalt, not only was $800,000 saved in paving costs, but a major environmental problem was transformed into a safe and productive site.

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Write in 148

May 1992 Soils 35
Implementing bioremediation at a large site can be an organizational challenge for contractors. Keeping track of the treatment is often accomplished by plotting the site into small, manageable land treatment units (LTUs). A large oil field site illustrates the LTU approach.

After 25 years, a 40-acre oil field in Yorba Linda, Calif., was closed. Testing revealed that about 100,000 cubic yards of soil contaminated with petroleum hydrocarbons to levels ranging as high as 40,000 parts per million (ppm) would have to be treated before development could begin on a residential project.

Shelton Construction Co., of Yorba Linda, general contractor on the job, contacted Pacific Stabilization, Inc., of Escondido, Calif., to implement bioremediation. Pacific’s primary business is soil stabilization, but Bobby Klamburg, field superintendent, expects to see bioremediation grow throughout the 1990s.

“The first thing we do is lay out the area in LTUs,” explains Klamburg. “That way, you separate the soil into isolated areas where you know exactly what you’ve got. A typical LTU is about four acres. You excavate one LTU until testing shows acceptable soil. The excavated soil is spread on another LTU. Then, you begin treating the contaminated soil.”

Shelton Construction uses elevating scrapers to excavate, haul and spread the soil for treatment. Pacific uses soil stabilizers to blend the soil in the treatment process. At the Yorba Linda site, urea, a liquid fertilizer, was chosen to restore the soil. The dry

---

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Environmental Remedial Specialists

Write in 250
bagged fertilizer and water were tank-mixed at the site and the liquid was applied to the LTUs by a spray truck.

“Our job is to blend the liquid fertilizer to a consistent depth and keep the mix aerated,” says Klamberg.

Oxygen and moisture speed up the reaction between the chemical and the petroleum hydrocarbons. That’s why it is important to have consistent and frequent blending.

Pacific equips their soil stabilizers with deep mix rotors with an 18-inch deep mixing capability. The first pass mixes in the liquid fertilizer and breaks up the soil. A 3/4-inch maximum particle size is a typical sizing specification for bioremediation. Later passes aerate the soil to provide an oxygen-rich environment. Depending on goals and time pressures of the project, aeration may take place daily, three times a week or weekly.

Once a week, each 18-inch lift of treated soil is tested. If the soil meets California Air Quality Control Board standards, the clean lift is removed and returned to the excavated LTU. If unacceptable levels of petroleum hydrocarbons remain, more fertilizer or more water may be added and more aeration passes made until the lift passes the test. This process continues until the original LTU is filled. Then, another LTU is created and the process of excavation, bioremediation and backfilling continues until the entire site has been processed.

Klamberg emphasizes an important key to successful bioremediation is in keeping the surface of each LTU level. This helps ensure that each layer is identical and the correct thickness. “If the depth of a lift varies—say it’s 22 inches thick in places, you may not be able to get a good total petroleum hydrocarbon reading. You may end up having to excavate a portion of the lift to get the job done. That wastes time and money,” he says.

Pacific’s soil stabilizer delivers precision of depth control up to the 18-inch level. Machine working speed depends on the type of material. On the Yorba Linda job, the working speed on aeration passes was about 70 feet per minute.

Klamberg chooses a low rotor speed on the first pass to break up the dense material—clay at the Yorba Linda site. Then, for aeration, he shifts to a higher rotor rpm to fluff the material more. The rear door of the rotor hood is at maximum opening so the soil is ejected quickly so the lift has many air voids to oxygenate the soil.

Moisture control is another key element. Water is added periodically to keep the chemical reaction going, but too much water creates muck holes that can slow production.

“We’re starting to use the on-board water spray system to avoid overwatering,” says Klamberg.

Another tip from Klamberg, “Watch out for buried obstacles,” he cautions. “Sections of pipe and concrete chunks are likely to be anywhere and everywhere. Usually, you can spot this stuff during the excavation stage. Be sure to load it out or you’ll spend a lot of time rewelding on the rotor.”

Dividing a large site into small, treatable units is the key to efficient management of bioremediation activity.

Write in 550 for more information
What's New

SLT has fire-proof membrane liner
SLT North America, Inc., Conroe, Texas, develops a flame retardant Polyethylene Flexible Membrane liner, HyperFlexFR™, that can be used in oil and petrochemical applications. The HyperFlexFR™ utilizes the same liner resins as the HyperFlex™ FML and exhibits similar physical properties and chemical resistance.

Write in 554 for more information

EI's vapor detector has bar code reader
Environmental Instruments, Concord, Calif., introduces the first UL approved field photoionization detector, the OVM 580 B, that can be configured to accept a Bar Code Reader, for under $4,500. The 580 B features maximum signal hold, signal linearization, over range indication and flexibility in programming test parameters. The PID detector design provides on-site detection over the 0.1 to 2000 ppm range. A positive displacement pump enables sample collection and remote detection.

Write in 553 for more information

New GC analyzes ppb in air, water, soil
SRI Instruments, Torrance, Calif., introduces an expanded chassis that offers enhanced performance in a smaller footprint to conserve benchspace. The new gas chromatographs provide capability for volatile organic analysis at the ppb level in air, water and soil matrices in accordance with EPA protocols.

Write in 555 for more information

KVA develops corer
KVA Analytical Systems, Inc., Falmouth, Mass., has developed a pneumatic hammer-driven corer, the PDI (piston-displacement inner liner), for taking non-contaminated soil samples. For analyses of volatile organics, the PDI soil sampler is driven by a hefty pneumatic hammer system.

Write in 556 for more information

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Fisher Scientific, Pittsburgh, Pa., introduces the Accumet® 50, that provides not only pH, ion-specific, millivolt and temperature but also conductivity readings. It selects the correct range of conductivity, salinity and resistivity for the sample. It tests in any two modes at once. All this is housed in an ultra-compact case sealed against dust and spills. Write in 559 for more information.

Cap vapors with plastic
EBW, Inc., Muskegon, Mich., introduces the 304 vapor cap in lightweight, durable plastic (glass filled nylon) that offers greater corrosion resistance. This cap secures on the 301, 302 and 303 tank truck vapor check valves to prevent dust and debris buildup and fits on the 300 vapor check valve adaptor commonly used in dual point underground storage tank systems. The 304 is orange (to indicate vapor recovery), fits all 4” male quick couplings and is lockable to prevent misuse. Write in 557 for more information.

Firm implements large scale remote monitoring
Product Level Control, Inc., Eagan, Minn., has built the largest remotely operated remediation system of its kind, designed to control up to 72 recovery wells plus treatment equipment, the manufacturer says. The SiteLine remote model system has been used to remediate a major petroleum company’s site in Fairfax, Va., where about 375,000 gallons of petroleum have leaked over the years. The system was specified, according to Sheldon Barth, of Product Level Control, because it gives the operator 24-hour access to the equipment. Sensors and pumps in the recovery wells have been interfaced with the holding tanks, separator tanks, air stripping towers and activated carbon units present at the site. When conditions in one part of the system change, all other equipment effected adjusts accordingly, Barth says. Write in 558 for more information.

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Write in 234

May 1992 Soils 39
Cedarapids offers remediation plant

Cedarapids, Inc., Cedar Rapids, Iowa, introduces soil remediation plants that operate in the low temperature range—450°-550° soil discharge temperature—which is required to vaporize contaminants with characteristics common to #2 diesel fuel or lighter fuels.

Plant components include a feeder unit, rotary thermal treatment unit, baghouse and thermal oxidizer. Contaminated soil is metered by the feed system into the rotary thermal treatment unit to dry it and vaporize the hydrocarbons.

Dust from the process is recaptured in the baghouse and returned to the thermal unit for discharge with the soil. The vaporized hydrocarbons are oxidized at 1400°-1600° in the oxidizer. The remediated soil can be returned to its original site, used elsewhere or stockpiled for future use.

Write in 560 for more information.

Lock monitoring wells to prevent tampering

Enviro Products, Inc., Lansing, Mich., introduces the Enviro Plug designed to prevent monitoring wells from being tampered with or vandalized. It can also prevent costly misfueling. The Enviro Plug is available to fit 2", 4" and 6" well casing. Casing material or wall thickness does not effect the performance of the plug, according to the manufacturer.

Write in 561 for more information.

System enhances remediation

Halliburton Nus Environmental Corp., Gaithersburg, Md., announces an agreement to market Subsurface Volatilization and Ventilation System™ (SVVSTM) developed by Billings and Associates, Inc., Albuquerque, N.M. SVVSTM is an integrated technology for in situ remediation of contaminated soils and groundwater to enhance biodegradation, air sparging and vapor extraction.

Write in 562 for more information.

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5. NOT MY AREA
6. OTHER/EXPLAIN:

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COMMENTS:

SOUND OFF! COMMENTS, COMPLAINTS, COMPLIMENTS, CRITICISMS, ARTICLE IDEAS, SUGGESTIONS, FEEDBACK, WHAT YOU LIKE, WHAT YOU DISLIKE, WOULD LIKE MORE...? LESS...?

In the bottom section, there are several lines for comments, but they are empty.
The CleanSoil process is a portable, trailer mounted unit that uses steam to liberate petroleum hydrocarbon contaminants from soil, according to the manufacturer. Volatile hydrocarbons in gasoline vaporize at system steam pressure and temperature. These volatiles (primarily benzene, xylene and toluene) are carried with steam vapor and absorbed by a bed of activated carbon. Other hydrocarbons appear in the condensed liquid phase as free oil. Contaminated soil is loaded into the processor in batch quantities of approximately seven cubic yards. The unit has two identical processors to facilitate loading and unloading. Once loaded into the processor, soil is flushed with high velocity steam. The steam shatters the soil, creating a loose matrix while absorbing volatile hydrocarbons converted to vapor by the heat of the steam which permeates the exposed soil particles. The steam, now contaminated with free oil and hydrocarbon vapor, is drawn from the soil matrix through the porous floor of the processor and exhausted into a cooling unit. Water which is condensed from the steam now carries the bulk of contamination freed from the soil. It carries the hydrocarbons as free oil through an oilphlic membrane filter. Once filtered, the water passes to a feed tank where it is fed back to the boiler in a closed loop. The boiler, a 50 horsepower firetube unit, converts the water to steam for its journey back through the system. In the meantime, exhaust gas, freed from steam in the cooler, passes through an activated carbon bed to remove the remaining hydrocarbon volatiles before it is exhausted into the atmosphere. The carbon bed is backflushed with live steam between batches. The steam is then sent back through the cooler to complete the closed loop.

Write in 551 for more information.
NEW BOOK from the Association for the Environmental Health of Soils

CONTAMINATED SOILS REMEDIATION: CURRENT REFERENCES 1990

Paul T. Kostek ci, 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.

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**HERE'S HOW IT WORKS...**

**In situ Soil Flushing**

In situ soil flushing is a process in which contaminants are washed from the soil by water, water plus an additive—detergent or other chemical—or some other solvent. Aboveground soil flushing tends to yield better results than in situ flushing because the liquid/soil contact can be controlled by mixing, as in solvent extraction/soil washing. Groundwater recovery systems are essentially soil flushing operations, although they are mainly intended to be containment systems. In this illustration in which both surface flushing and subsurface flushing techniques are being used, groundwater is the flushing fluid (which is extremely ineffective for hydrocarbon spills). For in situ soil flushing to be successful, the soil must be permeable to liquid flow (sandy soils). Conventional water flushing is practical only for highly water soluble contaminants. For contaminants with low water solubility (nearly all petroleum hydrocarbons) surfactant solutions or solvents are required. For soils which have free-phase contaminant between the interstices of the soil particles, surfactants can reduce contamination by immiscible displacement due to a lowering of interfacial tension. Solubilization further reduces free-phase and sorbed contaminant. In flushing, there is little control over the flushing fluid's flow path relative to the location of the contaminants. When surfactants or solvents are used, carbon beds can no longer treat groundwater, so air strippers or biotreaters must be used. Oil/water emulsions can form which may cause formation plugging or affect the waste stream treatment. Wells can cost $3,000 to $5,000 to install and over $10,000 per month to operate (flushing fluid expense). Surfactants are generally not recyclable. This information is reprinted with permission from the Shell Development Soil Remediation Workshop handbook, Westhollow Research Center, Houston, Texas. Write in 552 for more information.
It's 11:00 p.m.

Do You Know Where Your Contaminated Soil Is?

You'd better — because even after it's hauled off, you're still responsible (regardless of how much you paid!). When your soil was removed, did you solve your problem or just transfer it? Was it processed to State Clear Fill Standards or was it mixed into other products? Did you entrust it to someone that might not be in business tomorrow?

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