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

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From the editor

Soil in a day's work

I am sorry I feel the need to devote one of my precious editorials to a defense of state regulatory people, but I do. I am sorry I need to do this because, let's face it, state environmental regulatory agencies and personnel do not have a very good reputation. There are a number of reasons why this bad reputation persists—some legitimate ones, probably, but many of the reasons are not fair. For example, many are contemptuous of state personnel because state workers are notoriously low paid. This is ridiculous...ridiculous because they should not be underpaid, and ridiculous because pay rate is not directly or necessarily related to talent and skill...(I am certainly proof of that! And you are free to interpret that however you want.) Who ultimately pays government workers, anyway? Whose fault is it that state jobs pay less than the private sector? But more importantly, size of a person’s paycheck is very low on the list of judgment factors smart people use to judge another’s professional performance. The abilities and attributes of state staff range from A+ down to failure—just exactly like the abilities and attributes of personnel in the private sector.

Another factor that plagues state regulatory people is the fairly dismal scorecard people give to government in general. It’s fashionable and fun to take shots at the government at all levels. And, to a large extent, government earns a large measure of this perception with their million dollar toilet seats and million dollar cow flatulence research and million dollar blah, blah, blah.

But beyond these excuses to feel free to disrespect state regulatory people, I think our industry fails to take the state’s point of view on protecting human health into proper consideration. It only takes a few moments’ thought to realize how awesome this charge really is. It’s a high stakes “What if...?” game. “What if we discover that over time, 100 ppm of X mutates component Y which results in babies born with purple hair—or worse?” I would not want PHS (Purple Hair Syndrome) to be traced back to my 1994 decision that 100 ppm of X was a safe and benign level—no matter what my salary! And, what would you consider to be a fair salary to take on such a responsibility?

Consequently, we need to be more patient and respectful with the states’ regulations and the people who carry them out. After all, whose health are they ultimately protecting? We are all guilty of getting caught up in the day-to-day, short term goals of the task at hand, and losing sight of why we are really doing all of this remediation and cleanup.

The next time you are tempted to roll your eyes with contempt over a state regulation, or the apparent intractability of a state level regulatory person, take a deep breath and remember why the regulation or person is the way it is. If it helps, just visualize a gaggle of purple-haired grandchildren coming to visit you in a few years.

Change of topic: You’ll notice a few little changes in this issue—peppier design, a new “Product Pocket” feature (page 40) which will spotlight a new category of products in every issue. And, I have ruthlessly converted all measurements in Soils articles to the metric system—no babyish equivalents in parentheses. I’m already hearing your moans and groans, but it is a magazine’s job to lead its industry, so come on, everybody, “meter” me halfway. Happy New Year!

Susan Parker

January-February 1994 Soils 5
Is it really contamination—
or is it just plastic?

Common component of
plastic emits acid
that can yield false
alarm sample
results

By Brian Sullivan and David Carty

Did you know that the plastic tubing and vials commonly used in sampling contain— and emits— phthalic acid, which is a semivolatile organic compound? And did you know that the widespread presence of phthalic acid in laboratory instruments may well be contaminating your environmental samples?

Phthalic acid is the ortho isomer of benzene dicarboxylic acid. The most common use of this compound is to esterify its carboxylic groups with various alcohols to produce phthalic acid esters (PAEs) to incorporate as cross linking agents in plastic formulations—along with vinyl chloride, styrene and propylene. The PAEs help confer elasticity and malleability to plastic products. PAEs are readily released from plastic materials in potentially significant quantities. The characteristic smell associated with the vinyl interior of a new car—as well as the eventual brittleness and cracking of the vinyl over time—are, in large part, due to the release of PAE constituents. PAEs are ubiquitous environmental contaminants and are known to have toxicological effects on biological organisms.

Current PAE analytical methodologies are inadequate to allow for the exclusion of inadvertently introduced PAE contamination during analysis of environmental samples.

Problems arising from cross contamination of PAEs originating in the laboratory environment have been recognized for at least 30 years. Studies in the late ’60s and early ’70s documented the occurrence of PAE cross contamination from containers, laboratory water, tubing, packaging, solvents and filter paper.

The EPA approved, solid waste method for analysis and quantification of PAEs is Method 8060. A report based on research conducted under the auspices of the EPA Single Laboratory Evaluation Program identified the following sources as contributing to potential PAE contamination in the course of using Method 8060: organic solvents, reagent water, common laboratory materials such as Florisol, alumina, silica gel, sodium sulfate, glass wool, filter paper, paper thimbles, aluminum foil and glassware.

For all reagents and materials tested, PAEs were detected in the parts per trillion to parts per billion range. Washing glass wool and sodium...
sulfate with 1-1 hexane-acetone solutions for two consecutive 16 hour sessions was insufficient to remove PAEs. Solvent pre-cleaning of paper filters in a Soxhlet extractor also failed to consistently eliminate detectable levels of PAEs. Even after three days of washing with hexane-acetone with daily replacement of solvent and solvent flasks a Soxhlet extractor still yielded sample blank levels of PAEs as high as 0.5 ppb.

This same report concludes that EPA Method 8060 is inadequate to address background contamination, and recommends stringent measures to eliminate background PAEs—such as use of pesticide-grade solvents, testing all solvent batches received from commercial suppliers, and exhaustive Soxhlet extraction of paper thimbles and filter paper.

However, it is not certain that even such extraordinary precautions would be uniformly effective. Evaluation of heat-treated, PAE-free glassware after two weeks of shelf storage detected measurable quantities of PAE contamination. Thus, the possibility of ubiquitous airborne PAE contamination must be considered. For instance, in 1965, M. Blumer reported in *Contamination Control*, the discovery of heavy PAE contamination in solvents which had recently been double distilled. Plastic materials used in the lab's ventilation system were eventually identified as the source of the PAEs. Another report detected PAEs from air conditioning vents with levels of bis(2-ethylhexyl) phthalate measured as high as 35 ng/m3.

In its newly revised form 18, Method 8060 is designed to evaluate 11 target PAEs. EPA Method 8270, which uses similar reagents and materials as 8060, lists six PAE constituents among 188 semi-volatile target constituents. The adequacy of Method 8270 to address background PAE contamination must also be questioned.

**PAEs and hydrocarbons**

The hydrocarbon constituents of petroleum constitute an extremely complex and heterogeneous mixture. The colloidal nature of soils permits significant quantities of these materials to be adsorbed to the soil matrix. This is especially true for soils of refinery waste land treatment units, which typically receive large volumes of refinery wastes over a long period of time. Due to differential degradation rates, soils at such sites typically exhibit much higher proportions of non-hazardous macromolecular compounds, such as saturated aromatic and asphaltene constituents compared to lighter (one and two ring) aromatic hydrocarbon constituents.

For successful sample analysis, gas chromatograph retention capacity and mass spectrometer calibration limits must not be exceeded. Therefore, evaluation of low molecular weight sample constituents in soil samples continues on page 39→
The largest on-site thermal desorption soil remediation project ever is taking place on land leased by the Port Authority of Los Angeles. Over 270,000 metric tons of soil contaminated with marine diesel, bunker fuel and other petroleum distillates in concentrations up to 30,000 ppm are being treated at average rates over 900 metric tons per day.

The low temperature thermal desorption process reduces hydrocarbon concentrations to less than 200 ppm, and reduces polynuclear aromatic hydrocarbons to less than 1 ppm in a single process. The plant, custom built for Clean-Up Technology of Santa Monica, Calif., by Tarmac Equipment Co., Kansas City, Mo., features a modified thermal oxidizer and baghouse to control air emissions.

This thermal desorption application is the first of its kind for the Los Angeles Basin, and its performance is being used by the South Coast Air Quality Management District to benchmarked air standards. Treated material will be reused by the Port Authority for clean backfill within the port. The project is expected to be completed by May.

Over half the oil-refining capability of the entire state of California is located within 20 miles of the Port of Los Angeles. Early in the 1990s, the Port Authority began leasing land and facilities to handle crude oil and petroleum products. As the need for these facilities decreased and as

W.B. Reese is president, K.J. Weston is senior technical specialist, and P. Rodrigue is senior thermal desorption manager for Clean-Up Technology, Santa Monica, Calif.
<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Range</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Petroleum Hydrocarbons</td>
<td>N.D. to 110,000</td>
<td>mg/kg TPH</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.005 to 170</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Toluene</td>
<td>0.005 to 200</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Xylene(s)</td>
<td>13 to 590</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>0.005 to 580</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Polynuclear Aromatic Hydrocarbons</td>
<td>Up to 101</td>
<td>mg/kg</td>
</tr>
<tr>
<td>Lead (STLC, EPA 7420)</td>
<td>Most samples &lt;&lt; 2</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

**Figure one: Contaminant Summary**

The land value increased for other operations—such as demand for overseas container terminals, the Port Authority decided to lease these sites for better economic return. However, many of the sites have soil and groundwater contaminated with hydrocarbons. Facilities which had been used for fuel storage had to be remediated to enable development to progress. One such 14 acre site, leased since 1917 and used for the storage and processing of petroleum products, is being dredged to provide additional maneuvering room in the harbor for large ships. Dredged soil, contaminated with a variety of hydrocarbons, including gasoline, kerosene, diesel fuel, bunker fuel and other heavy products, is being cleaned and reused for construction elsewhere in the Port.

Beginning in 1987, site investigations were initiated to determine the extent of contamination. Figure one, above summarizes the soil contaminants, based on 254 soil and groundwater samples from 166 sample locations down to nearly 5 1/2 meters. Hydrocarbon contamination was determined by EPA Method 418.1 and Method 8015 modified. Contamination was mostly in diesel range, with some contamination in the gasoline range. Lead contamination was found only in the top ½ meter of soil in very localized areas. Sand blasting of tanks painted with lead-based paint was believed to be the primary source of the lead contamination.

In 1991, the storage tanks and processing equipment were removed to provide access to the affected soils. Initially, bioremediation of soil was considered, but was rejected, primarily due to the large laydown area required for on site treatment, as well as uncertain time requirements. A series of soil washing treatability studies was effective in bringing total petroleum hydrocarbons in the soil below 100 mg/kg, and was cost-effective. But, the client decided not to proceed with soil washing due to the formative status of soil washing at that time.

To test the feasibility of thermal desorption, 234 metric tons of material from the affected site was processed at a
Figure two

Rotary dryer: 49 MBtu/h, natural gas, 36-63 metric tons per hour  
Afterburner: 44 MBtu/h, low NOx, natural gas  
Baghouse: 3.5 air to cloth ratio, .04 grains per cubic foot  
Feed belts: 90 metric tons per hour  
Gas coolers: 870° C inlet, 190° C outlet  
Dust control: single cyclone, 3 meter diameter, 2 lwg for +200 mesh  
ID fan: 20,000 acfm, 300 horsepower

portable thermal desorption system in Oregon in 1992. Test results showed soil hydrocarbon concentrations could be reduced to detection levels, while meeting expected air quality requirements for the Los Angeles basin.

Clean-Up Technology was chosen because of its ability to process the soil at rapid rates. Successful treatability studies, and a history of successful applications of the technology elsewhere reduced risk for all parties concerned. The treatability studies prevented costly over design, yet thermal desorption was able to handle the inevitable off-specification conditions that often result in delays and extra expense. The client was also able to avoid transport of solids to a landfill, and able to eliminate liability from any residual contaminants that might remain from a non-destructive treatment.

As soils are heated, volatile organic compounds and soil moisture are desorbed and vaporized into a gas at temperatures that prevent ignition. At the design point, volatile material in the gases leaving the desorber unit is limited to approximately 25 percent of the lower explosive limit (the concentration of a compound in air below which a flame will not propagate if the mixture is ignited). The degree of hydrocarbon desorption is a function of time, temperature, soil type and hydrocarbon composition. Obviously, the lighter hydrocarbons can be processed at faster rates and lower temperatures. Clay soils, to which the hydrocarbons tend to be more tightly adsorbed, require longer desorption time or higher operating temperatures than sandy soil.

In contrast to incineration systems, the desorption process operates below temperatures where detectable amounts of metals can be released to the gas stream. It is common to see temperatures as high as 1,200° C for the gases and solids leaving an incineration system, while soil temperatures in a thermal desorption system might never exceed 285 to 315° C.

The exhaust gases from thermal desorption can be treated by a number of processes, including oxidation,
adsorption or absorption. For this project, thermal oxidation was chosen to completely convert the hydrocarbons to carbon dioxide and water.

The process is illustrated in figure two, page 10. Contaminated soil is excavated and stockpiled prior to treatment. This allows much of the sandy and silty soil to dewater to specified levels. Any free water with oil from the stockpile is treated separately. Even after dewatering, excavated soil typically shows a great deal of variability in contamination levels and moisture content. Since the composition of the soil is not monitored continuously, this variation can create a process control problem if moisture and hydrocarbon contents vary over extreme ranges. It is not uncommon for moisture to vary from 4 to 25 percent, and for hydrocarbon content to vary over an order of magnitude, and for Btu factor to vary by a factor of two or more. Heat content of the soil can represent a significant fraction of the rated heat capacity of the afterburner system. To reduce this variability in the feed, the stockpile is mixed with a bulldozer prior to temporary storage in the “day pile,” which is a day’s feed into the system. When the plant is not operating, the stockpiles are kept covered, and wetted to control dust and volatile emissions.

Contaminated soil is fed to Tarmac’s portable, natural gas fired rotary dryer. The 12.1 meter long, 2.5 meter diameter dryer is directly fired in a counter flow orientation with respect to the soil flow through the unit. This arrangement prevents the potential, sudden flashing of highly volatile materials and steam if the soil were exposed to the hottest flame temperatures, as might be expected in a parallel flow dryer. The solids feed rate and the dryer burner rate are the primary variables to control the system pressure—the entire process operates under a slight vacuum—and the dryer outlet gas and outlet soil temperatures.

Soil is gradually heated to approximately 290° C during a retention period of 10 minutes. Gases and dust exit the dryer at temperatures

Continues on page 34→
Scientists in Britain and New Zealand have discovered that a small, but growing number of plants can accumulate very high concentrations of metals in their stems and leaves. More than 70 species are now known to be classified as hyperaccumulators. These varieties contain hundreds to thousands of times larger metal concentrations in their aboveground parts than normal, and range from herbaceous flowering plants to trees. Dr. Steven McGough from Britain's Institute of Arable Corps Research at Harpenden, near London, says that the discovery of an increasing number of hyperaccumulator plants opens up the prospect of seeing contaminated and abandoned sites "growing clean" with a cover of yellow and white flowers. At present, there are no techniques for such a cleanup which are as low in cost and retain soil fertility after the metals contamination has been removed.

Examples of hyperaccumulator plants include Sebertia acuminata, which is native to nickel and chromium rich soils in New Caledonia. The latex in this tree contains more than 11 percent nickel, which gives it a blue color. "An obvious application would be to tap such trees for nickel, analogous to rubber trees," says McGough.

With financial backing by the European Community, the Leverhume Trust and the U.S. Army, scientists in Britain and New Zealand have been carrying out field experiments on a site where metal contaminated sludge from London had been spread for 20 years. Ten species of plant were grown to test their efficiency to remove metals. "This method shows promise for cleaning a modestly polluted site, where the remediation can be considered over a number of years. Mixtures of species might be grown, rather than the monocultures used in our tests, in order to remove several metals simultaneously where there is multiple pollution," says McGough.

Because hyperaccumulator plants are still rare, and found in remote areas, McGough says there is an urgent need to collect and cultivate them. Future work could involve genetic engineering to further improve metal uptake characteristics, once the genes for metal accumulation have been identified. The possibility may then exist to transfer genes for metal hyperaccumulation into a productive, but indigetous host plant.
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Write in 397
Fiber optics crest next wave of leak detection technology

System can differentiate between new release and background levels

By Richard de Filippi and Thomas Cody, Jr.

When the EPA established the underground storage tank regulations in 1988, external vapor sensing for leaks was clearly the preferred choice of the EPA. A portion of even very small volumes of leaked liquid product vaporizes immediately and can be detected quickly, because of relatively rapid movement of vapors in the backfill. Moreover, studies show that external vapor sensors can detect a leak one thousand times smaller than the in tank leak rate specification of .38 liter per hour.

Since the regulations came out, no vapor sensors have been developed that could discriminate between a new leak and background levels of contamination that are present at virtually every storage tank site. Background levels vary widely with time and location, even within one site. False alarms from vapor sensors caused by changing background levels, as well as from hardware problems (such as electrical connections corroded by weather) are an ongoing problem for the site owner.

EPA’s logic in recommending vapor and other external monitors was based on the common sense approach that changes in the external environment indicating that a leak had occurred would be easy to detect, certainly easier than detection by measuring fluctuations in the tank’s contents. Those internal fluctuations, which are calculated based on precise measurement of in tank liquid level, can be caused not only by a leak, but by other normal factors as well—daily temperature cycles, heating and cooling after filling, tank deformation, even vibrations from passing traffic.

Despite these problems, because available vapor sensors failed to do the job, tank owners turned to various automatic in tank gauging systems and statistical inventory reconciliation techniques. However, tank gauging and inventory reconciliation, typically designed for the coarse liquid level measurement acceptable for inventory control, are inherently inaccurate to monitor the very small volume changes that often occur as the result of a leak, and have difficulty detecting a leak rate of .76 liters per hour specified by EPA, or the .38 liter per hour specified by many states. Moreover, even those leak rates can produce considerable environmental damage over a month, the maximum monitoring time interval allowed by EPA.

Using a new fluorescent chemical technology, Ariano Technologies, Inc., Boston, Mass., has developed a hydrocarbon sensor for vapor detection without false alarms. The sensor is combined with microprocessors and telecommunications technology to produce a system that permits wireless, external central monitoring of underground storage tanks for leakage of petroleum derived fuels. Leakage is detected either as a vapor, or when dissolved in groundwater, or as pure liquid product, found as a floating layer on groundwater. The chemical specific response patterns of the sensor’s fluorescent reagents enable it to distinguish a new leak from the background.

The instrument consists of a hydrocarbon sensing element...
that embodies technology licensed from Dr. David Walt, chairman of the Chemistry Department at Tufts University in Boston. The sensing element is an optical fiber which is end coated with fluorescent reagents that can detect the presence of hydrocarbon vapor, hydrocarbon dissolved in groundwater or free product. The sensor is reversible—in fact, the signal returns to very near baseline value within tens of seconds after passage of the detected analyte.

The patented technology is based on the fact that when a fluorescent material is placed in chemical environments with different polarities, significant changes in the fluorescence spectrum occur. Portions of the spectrum shift, and/or relative intensities at different points on the spectrum change. The magnitude and type of change depends whether the chemical environment surrounding the fluorescent species is made more or less polar.

It is important to note that methane gas, a product of anaerobic biodegradation of organic matter, can be present in soils at almost any location—in fact it is another contributor to the false alarm reaction of vapor sensors. Concentrations of methane gas vary significantly, however, typically, levels rarely exceed 5 percent by volume. The Ariano sensor responds insignificantly to methane gas, even when it is present at levels of 15 to 20 percent by volume.

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Write in 342

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The microprocessors and telecommunications link provide detector signal processing, conversion to alarms, data storage and data communications. There are two microprocessors: one with the sensing unit and the other with a central, on site reporting unit that can be coupled via modem to an offsite data processor for archiving.

The system is battery powered, and can be placed in remote locations to transmit to the on-site reporting unit. When it reaches the market, the cost of the system is expected to be less than $1,000.

Applications for the fluorescent hydrocarbon sensor include deployment in a backfill monitoring well, in the interstitial space of a double wall or double floor tank, in perimeter wells to measure thin layers of floating hydrocarbons, and in tank or dispenser sumps.

Other possibilities for the technology may be developed for fugitive emission monitoring under the Clean Air Act, for contaminated site assessment, remediation and post-remediation monitoring, for industrial property transfer audits and even indoor air quality monitoring.

The earliest possible warning of a leak comes from monitoring for vapors in the soil. A small volume of leaked liquid evaporates to form a large volume of vapor, and the migration rate of vapor through soil is several orders of magnitude faster than liquid. Relatively little environmental damage may have been done at the time a vapor front is detected, and remediation measures to clean up the spill would be simple and inexpensive, compared to later detection. In contrast, by the time even a third of a centimeter thick layer of motor fuel is found on the groundwater surface, the tank owner is likely to be responsible for expensive and long term groundwater remediation costs as well as soil extraction. Similarly a .38 or .76 liter per hour leak detected by automatic tank gauging creates a sizeable problem regardless of the measurement cycle chosen.

Double wall tanks are effective for secondary containment in the event of leakage of the inner tank wall, but they are expensive—they cost 30 to 50 percent more than single wall tanks. As a result, only about 5 percent of USTs are double wall, but their popularity is growing. Presently they are used primarily in the most environmentally sensitive areas, or where required by state regulation: Massachusetts, Florida and California.
require secondary containment for new tanks—which includes the choice of double wall tanks.

But for other areas, use of double wall tanks may be limited because of their expense and the recognition of the fact that most leaks occur from pipes and connections, not from the tank.

Interstitial monitoring of double wall tanks provides a good early warning method for tank leak detection. Four techniques are used in a double wall tank:

- fill the space with a liquid (only possible in fiberglass tanks) and monitor the hydrostatic pressure
- fill the space with a gas and monitor the static pressure,
- monitor the unfilled space for hydrocarbon liquid collecting at the bottom,
- monitor the unfilled space for hydrocarbon vapor content.

In fiberglass tanks, monitoring the pressure of interstitial fluid (typically 30 percent calcium chloride) is sometimes preferred because of its simplicity, but it is expensive. And, tank shape distortions and temperature variations can cause volume changes that could be misinterpreted as a leak. Of course, in double wall steel tanks, interstitial brine liquids cannot be used because of their corrosive effect.

Inert gas or air typically is used as a pressure test in the transport of double wall tanks to the installation site. If the pressure is maintained to the level recorded on the side of the tank as shipped, then the requirement for an on-site pressure test in accordance with EPA protocol is often waived. But, the use of pressurized gas for long term leak detection can create false alarms because, inevitably, there is leakage through any threaded fitting.

Hydrocarbon liquid sensors typically are either conductive electrical elements or a simple prism. Conductive electrical elements operate on the basis of a change in resistance that results from swelling of a conductive polymeric tape in the presence of hydrocarbons. However, the polymers tend to take a long time to recover and sometimes have to be removed and cleaned after contact with hydrocarbons. They tend to become brittle with age, and generally are not useful as an indicator for diesel liquid.

The prism technique simply detects the presence of any liquid via a change in refractive index in combination with a conductance device that can detect the presence of water. Simple deduction indicates the presence of hydrocarbons. The prism is often used in the interstitial space of a double wall tank. Liquid sensors must reside precisely in the lowest point in the system and wait for sufficient liquid to activate the sensor. The delay can cause a minor leak to mature into a larger problem.

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Write in 496

January-February 1994 Soils 17
Look at labs from all sides

Regulators do—so should you

By Nick Adolfo

Regulators evaluate environmental data and laboratories with specific procedures and criteria—and so should users of lab services. All things being equal, cost is often the most important criteria in selecting an environmental lab. But, “all things being equal” is the tricky part. Discount or low price labs can cut corners to keep expenses down. And, while an inexpensive laboratory may save money at the beginning of a project, the generation of data that are not legally defensible leads to much higher costs if resampling and reanalysis is required later. Quality data is key to the success of any environmental project.

Qualified environmental laboratories are rarely listed in the yellow pages. The best way to start to find a good lab is to ask the opinions of other professionals in the environmental field about labs they have used. Then, contact the state environmental agency. Many states certify environmental labs, and can provide a published list of labs that are certified to perform work in their state. Off the record, some state certifiers may be willing to identify a few labs that they consider to be of good quality—valuable information, since most environmental data is evaluated by state agencies.

Once a few possible labs have been identified, the selection process begins. First, contact the lab and discuss the nature of the project at hand and the types of analyses involved to determine if the lab can perform the required work. Most project require that specific testing procedures be used, depending on the regulation. If the lab can indeed perform the particular analyses, ask if their detection limits compare to those specified in the published method, or to the levels required for the project. The lab’s detection limits must be below any regulatory limit that the results will later be compared with. It is also important to discuss the lab’s turnaround time—how long it takes to deliver results after sample receipt.

With this basic qualifying information in hand, the next step is to evaluate the lab’s quality assurance (QA) documentation. Get a copy of the lab’s QA manual, the document which describes the procedures they use to ensure that the data generated will be technically valid and legally defensible. The manual should explain the lab’s:

• departmental organization and management structure,
• key job descriptions and responsibilities,
• analyst training and certification,
• sample handling and custody procedures,
• procedures for calibration, including standard traceability,
• specific testing methods and procedures to document deviations from published methods,
• internal quality control with specific acceptance criteria,
• documentation of results and calculations, including procedures for lab logbooks,
• data review and approval,
• data security and long term storage,
• performance evaluation and systems auditing,
• facilities monitoring (refrigerator and water bath temperatures, deionized water conductivity, etc.)
• preventive maintenance of equipment,
• quality assessment—how the lab determines if data quality objectives are met,
• corrective action,
• quality assurance reporting.

Also ask to see an example analytical report and copies of the lab’s policies for acceptance and scheduling of work, turnaround time, handling complaints and confidentiality.

The example reports should be evaluated to determine if:

• data is clearly presented and easy to understand,
• dilutions, sample specific

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Write in 300
Look at labs from all sides, from page 18

detection limits, specific methodology used, sample identifications and date of analysis are clearly presented for each analysis performed,
• quality control data is reported,
• specific problems or limitations of the data are footnoted or summarized in a case narrative.

Also, the lab should be asked for its policy on providing copies of the raw data, that is, copies of instrument printouts or analyst’s logbooks. An additional fee may be charged for these materials.

The quality assurance manual and example report can reveal a great deal about the adequacy of the lab’s procedures. However, just printing a manual does not guarantee that the lab is actually following the procedures. To determine if the lab is actually practicing what is in their manual, nothing takes the place of a visit to the lab.

The scope of the visit, actually an audit, should be determined based on the length, complexity and legal sensitivity of the project at hand. For a small project, it may only be necessary to select certain items from the quality assurance manual and verify compliance with those sections. Such a review gives a general indication if the lab is following its procedures, usually in a couple of hours.

For larger projects, or projects which will be subject to legal scrutiny, it may be necessary to examine every point in the manual. This process would probably take a couple of days for most labs. But, a day or two invested at the beginning of the project is well spent to verify the lab’s quality performance.

Most quality labs across the U.S. that perform either drinking water, wastewater and hazardous waste or radiological testing, participate in the EPA’s performance evaluations for these types of testing. Ask for copies of the lab’s most recent EPA Water Supply, Water Pollution or Radiological performance evaluation sample results. In these evaluations, the lab receives samples of unknown concentration for a variety of tests. The lab’s results are compared with results from EPA labs to determine whether the lab’s results are within acceptable limits. These results are invaluable to assess the ability of an environmental lab, as they give specific information about the lab’s accuracy.

The results for the specific tests that will be performed for the project at hand should be studied. If any of the parameters were outside acceptable limits, ask the lab to provide a copy of the specific corrective action measures that were taken to correct the problem.

Performance evaluation samples can be provided to a candidate lab to analyze for any unacceptable or questionable parameters. There are several commercial vendors who send performance evaluation samples directly to an environmental lab, and evaluate the results.

For larger and longer term projects, it is wise to send a set of performance evaluation samples to the lab for each of the tests that will be performed in the project. The few hundred dollars it may cost to conduct a performance evaluation sample study can save thousands of dollars in the long run if the lab demonstrates it cannot perform the work. While there is some cost to generate performance evaluation samples, most labs will analyze them at no cost if they know it is part of the process to win a contract.

After all the lab performance data is collected—the quality assurance manual, performance evaluation results, audit results—then it is time to look at the lab’s price schedule. Generally, if several candidate labs were chosen carefully for evaluation, more than one will meet the performance criteria. Only then are “all things equal” to default to price as the deciding factor.

But, in judging prices, find out whether the lab provides a courier, who pays shipping costs for samples, whether the lab supplies sample containers at no extra charge, and whether there is extra cost for specific turnaround times.

Once the lab has been selected, keep them fully informed of the sampling schedule, the number of samples to be taken, and when they will arrive at the lab. This allows the lab to ensure that both hold times and turnaround times can be met. Sending samples to a lab that is not informed and not prepared to receive them can result in the samples being given less attention or priority.

Using these procedures to select an environmental lab helps ensure that projects are cost efficient, technically valid, legally defensible—and ultimately, acceptable in the eyes of the regulators who will be evaluating the data.

Write in 5003 for more information

Write in 493
20 January-February 1994 Soils
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Innovative problem-solving products and plant conversions for the soil remediation industry.

Write in 499
Before successful completion, many hard lessons are learned

By Daniel Oakley and Mark Nickelson

The world’s longest, deepest horizontal environmental well is installed at Williams Air Force Base near Phoenix, Ariz. It is 758 meters long and 71 meters below land surface. And getting it there wasn’t easy. Two installation attempts failed before the final successful installation. The story of the two failed attempts and the successful installation teach several lessons about what to do, what not to do, and what can go wrong. Here’s the story...

Williams Air Force Base, about 32 kilometers east of Phoenix, was added to the EPA’s National Priorities List in September, 1989. A liquid fuels storage area on the base has stored jet fuel since 1942. The compound consists of numerous underground storage tanks and several thousand feet of 10.16 centimeter and 15.24 centimeter diameter delivery pipe. Numerous spills and leaks over the years resulted in a free product plume on the uppermost unconfined aquifer at approximately 67 meters below land surface. The plume is estimated to be between 2,470,000 liters and 5,320,000 liters. The associated dissolved product plume, as defined by the 5 ppb benzene line, is approximately 516 meters long and 182 meters wide.

The uppermost unconfined aquifer which contains the plume extends from approximately 67 to 76 meters below land surface, and consists of intermixed clay, silt and sand. The uppermost aquifer is underlain by a 6 meter thick clay aquitard. Below the aquitard is a semiconfined aquifer that is several hundred meters thick and is used as an irrigation and drinking water supply.

River crossing technology, developed to install utility conduits under rivers, was adapted for the well installation. The custom made rig for the installation included a hydraulically operated, gear-driven, feed frame trailer, a control trailer and a mud tank mixer trailer. The gear driven feed frame trailer is raised at one end, and the other end is placed in a mud pit to set the entry angle.

The plan was to start by drilling a 22.86 centimeter diameter pilot hole at an angle of 20° to the ground surface. Then, a curved section would be drilled to make the borehole horizontal. After drilling the 152 meter long horizontal section, the borehole would curve upward to an exit point approximately .8 kilometer from the entrance. The borehole would be reamed to a 40.64 centimeter to 45.72 centimeter diameter, and well materials pulled into place from the exit to the entrance point.

During pilot hole drilling, the drill string is steered using a bent subassembly. Increasing the borehole angle up or down, left or right, is achieved by orienting the bent subassembly in the desired direction and jetting while advancing the drill string without rotation. Drilling a straight hole without changing the angle is accomplished by advancing the drill string while rotating and jetting.

A downhole magnetic guidance system, located in the probe directly behind the drill bit, is connected to the surface by wire line, and determines the real time inclination and azimuth of the bent subassembly. Based on this information and the pipe length, trigonometry calculations determine the borehole location. Secondary confirmation of the borehole location is gathered by stopping operations every 9.1 meters—one joint length—and applying an electrical current to the wire loop on the surface, creating a magnetic field of known geometry.
and intensity over the path of the borehole. The magnetic field is measured and modeled, and the location of the probe is determined relative to the proposed borehole path. Drilling of the first attempt began on April 23, 1993. Workdays were typically 12 hours long. The pilot hole was drilled to 192 meters length, and the curved section was drilled by building angle. At a drilling distance of 254 meters from the surface location (71 meters below the surface), the horizontal section began. After drilling 151 meters of horizontal section, the angle was again built to reach the exit angle of 16°. The pilot hole was successfully completed 383 meters from the end of the horizontal section, 789 meters from the entrance location. At approximately 45 meters true vertical depth, the secondary confirmation survey began to vary considerably from the downhole magnetic tool for depth measurement. The confirmation survey located the borehole up to 3.64 meters below the location measured by the downhole magnetic tool. The azimuth readings were in agreement between the two tools. Because of the discrepancy in borehole depth determined by the two methods, a gyro tool was pulled through the borehole for depth confirmation. The gyro tool indicated the horizontal section was between 70 and 71 meters below the surface. This measurement was within the specification that the horizontal section be between 70.52 and 72.04 meters below the surface.

The pilot hole was enlarged by push reaming with a 40.64 centimeter diameter bit. During both pilot hole drilling and reaming, a guar-gum based drilling mud was used as the drilling fluid. A guar-gum based drilling fluid was selected because after two to three days, it naturally breaks down—an advantage over bentonite drilling fluids during well development. During drilling of the initial borehole, less solids than expected were generated from the shale shaker and desander, a fact which would take on greater significance in retrospect. Because borehole integrity appeared to be

Continues on page 24→

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good, installation of the well materials began after the reaming step.
The original installation called for installing 264 meters of 15.24
centimeter diameter stainless steel riser, followed by 151 meters of 15.24
centimeter diameter prepack stainless steel screen, followed by 373 meters
of 15.24 centimeter diameter, high-density polyethylene riser. This plan
would allow two access points to the well. Two tremie pipes were pulled
through with the casing so that additional sandpack could be placed
around the prepack screen and the risers could be grouted in place.
Backfilling would originate from each end of the borehole, beginning at
the middle of the 151 meter well screen. The well materials and tremie pipes
would be attached to a specialized, swiveling pulling head which allows
rotation of the drill string without rotating the well materials or tremie
pipes.

Borehole reaming was completed on April 29, and 21 meters of
casing/tremie pipe were pulled in at the exit hole. Installation of the
remaining materials began the next day. Because the crew was welding on
each piece of casing screen and two
tremie pipe lines, installation
proceeded slowly but steadily until all
the riser, screen, and 188 meters of
exit riser were installed. At this point,
approximately 14 hours after
installation began that morning, and
27 hours after reaming was completed,
the well materials broke. The tremie
pipes were still intact at this time. A
second rig was mobilized to try to
locate the break—but was not
successful. After working the string
some more, the swivel assembly
failed, and all well materials were
abandoned downhole.

Several factors could have
contributed to this failure, including:
• The guar-gum based drilling mud
did not sufficiently clean sand and
gravel from the borehole because
guar-gum based drilling mud, like all
polymer muds, has no gel strength to
keep sands and gravels in suspension,
causing borehole clogging at the
curved section of the borehole—which
was in a gravel zone.
• The borehole was not sufficiently
stabilized by continued circulation of
drilling fluids.
• The installation process, which
required welding the casing and tremie
pipes together, took too much time,
and the borehole was left open too
long after reaming and collapsed on
the well materials.
• The outside diameter of the well
materials ranged from 15.24
centimeter stainless steel riser to over
17.78 centimeters for the prepack
screen, resulting in a funneling effect
as the materials were pulled through.
The result was eventual sediment
buildup and sticking around the
riser/screen connection.
• The tremie pipes got wrapped
around the casing materials downhole,
contributing to the sticking problem.

Based on these problems, the
installation was redesigned. A
dentonite based drilling mud was
substituted to maximize borehole
stability and enhance solids removal
from the borehole. A polymer additive
would be used as much as possible in
an effort to minimize downhole
dentonite while maintaining gel
strength. The well materials were
changed to 23 centimeter diameter
epoxy coated carbon steel, and a
custom made prepack screen with
15.24 centimeter inside diameter, and
27.3 centimeter outside diameter. This
provided a 4.32 centimeter thick sand
prepack, thereby eliminating the need
to install sandpack around the screen
with tremie pipes. The larger diameter
well materials also increased the
tensile strength of the installation
materials string. The exit hole riser
was eliminated to help minimize
installation time. Installation time
would also be reduced by welding the
well together and placing it on rollers
prior to installation. This would allow
for continuous pullback of the well
materials, eliminating the wait for
welding during the installation.

Drilling for the second attempt began
on June 16. At the 174.4 meter drilling
length, the threads on the bottom hole

Continues on page 26→
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The $10,000 will be deducted from the final payment(s) on the 850th contract awarded to Geo-Con. Determination of the winning contract award will be made by Deloitte & Touche, CPA's, Pittsburgh, PA.
In the event that the 850th contract is awarded by an agency of the federal, state or local government, this offer will not apply to that contract. It will apply to the next eligible contract award.

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Horizontal well, from page 24

assembly stripped and the assembly was lost downhole. It took two days to fish it out. The threads were remachined, and the borehole was re-entered and drilled to 201.7 meters when a short occurred in the wireline to the downhole magnetic guidance system. The drill string was tripped out of the borehole to repair the short. Drilling resumed to 305.8 meters, two joints into the horizontal section, before a gyro survey was run to confirm borehole depth. The tool was pushed downhole inside the drill string with a router truck. After four attempts, the tool was successfully pushed to 206 meters for surveying. But, when the gyro tool was removed from the drill string, it had broken the wireline to the downhole magnetic guidance system. The drill string could not be moved, and had apparently become differentially stuck. Differential sticking can occur when the hydrostatic head in the borehole is substantially higher than the hydrostatic head in the formation being drilled. The higher hydrostatic head in the borehole causes water in the drilling mud to be forced into the formation, causing the drill string to become stuck against the borehole wall. This effect is particularly likely to occur in curved boreholes. The drill rig motor mounts were damaged trying to free the drill string, so a new rig was mobilized at the site.

A jarring tool was brought in to try to remove the drill string. The jarring tool was attached to the top of the drill string on the feed frame trailer. Acting somewhat like a snapped rubber band, the jarring tool is pulled back until it releases an instantaneous downward force on the drill string. Because the drill string was at a 20° angle to the ground surface, the force of the jarring tool was diminished. If the drill string had been at 90° to the ground surface, the entire weight of the drill string would be released downward. The jarring tool was operated for three hours before it failed.

An 20.32 centimeter diameter overwash casing was brought on site. The overwash casing was drilled over the drill string to a depth of 215 meters before it also became stuck. At this point, the drill string was abandoned in place.

In order to prevent future sticking problems caused by letting the drill string sit in the borehole too long, a second crew was brought in to enable a continuous, 24 hour per day schedule. The drill string would also be kept moving as much as possible to reduce the chance of differential sticking.

Drilling for the third attempt began on July 6. After 428 meters, a short occurred in the wireline to the bottom hole assembly. Eight drill rods (72.8 meters) were tripped out and the short was repaired. Drilling resumed, and another short occurred. After tripping out 12 more rods, the drill string became stuck. Spotting fluid, formulated to break down the mudcake, was added to the borehole. Twenty 209 liter drums of spotting fluid were added to the borehole. An additional barrel was added on the hour for eight hours. The jarring tool was placed at the top of the drill string and used during the second half of this operation. After nine hours of working the jarring tool, the drill string finally was jarred free. All the drill rod was tripped out of the borehole.

On July 11, the borehole was re-entered. To further reduce the possibility of sticking, the drilling mud was thickened. After pushing the drill string 273 meters into the old hole, the secondary confirmation survey indicated the old borehole was 10.3 meters to the left. The drill string was tripped out of the hole to 129 meters. At this point, the driller was sure he was in the old hole. At 264 meters, the secondary confirmation survey again indicated the old borehole was 9.1 meters to the left. Magnetic interference was apparently causing miscalculations by the secondary confirmation survey.

At 611 meters, the wireline shorted again. The supervisors were tempted to go on and drill out to the exit hole without the steering. But, because of buildings near the exit target location, they decided to trip out and fix the short.
Figure one

The pilot hole was then successfully completed to the exit location at a total drilling distance of 796 meters. A 40.64 centimeter diameter reamer bit was attached at the exit location and pulled back to the entrance. Drill pipe was shuttled from the entrance to the exit and attached to the drill string so a complete string remained in the borehole at all times.

After completing the 40.64 centimeter pull ream, a 45.72 centimeter diameter pull ream was completed. Solids removed from the drilling mud during drilling and reaming were approximately five times those removed during the first attempt. This demonstrates the importance of having a drilling fluid with sufficient gel strength to remove cuttings when drilling deeper installations.

The well materials had been welded into one continuous run on rollers so they could be pulled into place as quickly as possible, without welding delays. A 40.64 centimeter diameter reamer bit was followed by a swivel assembly, followed by the well materials. It took only five hours to successfully pull the well materials into place—considerably faster than in the first attempt, which took 14 hours to pull 606 meters of well materials.

Lessons:
1. Streamline the installation as much as possible. Pre-weld well parts; have replacement parts and equipment at hand.  

Continues on page 28→

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2. Guar-gum based drilling muds do not have the gel strength to remove enough cuttings from deep boreholes. Too many solids left in the borehole can lead to clogging problems during well materials installation.

3. If sandpack around the well screen is required, a prepacked screen should be installed—avoid using tremie pipes to install a sandpack.

4. Drill string location information provided by surface magnetic systems is unreliable below 45 meter depths. The downhole magnetic guidance systems offers reliable location information at depths to 71 meters below the surface, so if there is a discrepancy between the two systems used for position verification, the downhole magnetic guidance system should be trusted.

5. Drilling around the clock is recommended to minimize the possibility of borehole collapse.
Figure three

Though it took three attempts to successfully install this horizontal environmental well, a wealth of information was learned. Sharing these lessons learned from the experience will advance this new technology to help reduce costs for future installations.

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Versatile big mixer churns through subsurface soils

It solidifies, stabilizes, delivers air and chemicals to the depths

Any method that remediates soil in place has advantages over plans that require soil to be excavated for treatment. One in situ strategy involves mixing, aerating and chemically treating soils in place with a powerful, crane-mounted mixer blade assembly.

The mixing system, manufactured by Geo-Con, Inc., of Monroeville, Pa., consists of a mixing head enclosed in a bottomless cylinder to allow for closed system mixing of soil with treatment chemicals. The tool can be used for solidification and stabilization, as well as to enhance soil vacuum extraction. The mixing equipment breaks up the soil and aerates it with hot air injection. The mixer can also create cutoff and retaining walls to prevent contaminant migration.

Geo-Con is mobilizing the mixer at the Portsmouth Gaseous Diffusion Plant of the U.S. Department of Energy near Piketon, Ohio to extract volatile organic compounds from soil and groundwater to depths of over 6 meters. At this site, Geo-Con proposes to enhance conventional soil vacuum extraction wells with a large diameter mixer.

Conventional methods of in situ mixing, typically using mechanical mixers or backhoe buckets, in many larger scale cases, produce non-uniform mixtures of waste and treatment chemicals or cause emission of volatile organics during mixing, explains the company. The bottomless cylinder is lowered into the waste and the mixing blades start in an up and down motion as chemicals are introduced. A negative pressure is kept on the headspace of the bottomless cylinder to pull any vapors or dust to the vapor treatment system. The vapor treatment system consists of a dust collector, followed by in line activated carbon treatment to capture any organic vapors. An induced draft fan exhausts treated air to the atmosphere.

Geo-Con’s mixing system offers a variety of treatment approaches.

As a column reaches its target depth, the blades retract inside the bottomless cylinder and the cylinder is pulled out and replaced adjacent and overlapping the previous column. This process is repeated until all waste has been treated.

The mixer was used to stabilize contaminated soils at a former manufactured gas plant site adjacent to the Chattahoochee River in Columbus, Ga. that was to be converted to a city park.

The site assessment revealed coal tar was present in the soil and groundwater on the site. Petroleum hydrocarbons were present at depths ranging to more than 10 meters. Total polyaromatic hydrocarbon concentrations in the soil ranged from 1,545 to 26,416 ppm. Site soils consisted of fill material and stream alluvium underlain with saprolite, a relatively impervious weathering product of igneous and metamorphic rock.

The remediation goal called for treated soils to have a

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The plant pictured here is cleaning up in Las Vegas. It’s just a few blocks from world-famous casinos, such as the Golden Nugget. Unlike playing the casinos, it makes money for its owners without the element of chance. The amazing thing about this plant is its close proximity to the downtown area. It works quietly without polluting the atmosphere.

The plant is presently cleaning contaminated soil from a maintenance and refueling yard used over 50 years. About 35 acres of the yard will be used for the new seat of Clark County.

SPI built this plant and similar ones throughout the country. SPI is a company operated by people with years of experience in building this type of equipment. Moreover, SPI builds it all at one facility. Thus, the components are designed to work together as a complete system.

Most SPI plants are designed to clean soil contaminated with petroleum products. They clean either by low-temperature thermal desorption or high-temperature treatment. SPI can also design plants for high temperature remediation of soils contaminated with hazardous materials. The plants are custom designed and are either portable or stationary. They may include the following:

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minimum unconfined compressive strength of 60 psi after 28 days, and permeability of less than 1 x 10⁻⁸ cm per second. And, leachate from the treated soil obtained from TCLP (Toxicity Characteristic Leaching Procedure) extraction must not contain total polyaromatic hydrocarbons greater than 10 mg/1.

Bench scale treatability test results indicated these goals would be met with the addition of 10 percent portland cement by dry weight of soil.

The first phase of the job was to construct a cement stabilized soil-crete containment wall parallel to the river bank. For additional strength and impermeability requirements against the river, this section used a 25 percent portland cement amendment. The wall is 121.3 meters long and 2 1/2 meters wide. It was keyed about a meter into the saprolite, and had permeability of 10⁻⁸ cm per second and a 28 day unconfined compressive strength of over 300 psi.

The barrier wall acted as a retaining wall to allow for removal of contaminated soils on the river side of the wall, and it prevents any potential migration of contaminants from the site into the river.

The remaining area (.64 hectare) was treated with an overlapping 2.5 meter diameter bore pattern. The stabilization columns ranged from 7.9 to 10.6 meters deep.

Crews worked around the clock, seven days a week to treat nearly 62,700 cubic meters of soil. The company says the ability of the stabilization system to deliver the correct dosage, thorough mixing and coverage of the subsurface zone was confirmed by the fact that only one column of over 1,800 was remixed due to a questionable unconfined compressive strength test result.

Analytical results of the quality assurance/quality control sampling program revealed permeabilities in the 10⁻⁷ cm per second range. Unconfined compressive strength test results averaged in the 100 to 200 psi range. Total polyaromatic hydrocarbons in the TCLP test were well below the 10 ppm target limit, as shown in figure two, above.

A different approach was taken at a manufacturing site on the bank of the Saginaw River in Bay City, Mich. In this case, the plan was to create an underground vertical barrier (cut off) wall to isolate two areas of PCB (polychlorinated biphenyl) contaminated soils—to prevent leaching into the river.

The cut off wall needed to be placed just 1.2 meters from the river’s edge, in very soft, contaminated soils against the hydraulic forces of the river.

Geo-Con mobilized a four auger deep mixing rig to the site. This unit is equipped with overlapping hollow shaft augers, teamed with staggered, angled mixing paddles. The four auger design enables this unit to install .7 cubic meters of wall for every vertical .3 meter drilled. As the augers advance vertically, grout is injected and blended into the soil. Geo-Con’s continuous mix grout plant supplies the large volumes of grout required by the four shaft rig.

Over 15 soil mix designs were evaluated to achieve a wall with permeability of 10⁻⁷ cm per second. The soil mixes were tested for compatibility with the leachate, permeability and strength before a cement-bentonite grout mix was selected.

Crews ran on two shifts to install the total 7,080 cubic meters of cut off wall. The wall was keyed .61 meter into a dense glacial till layer which, in some areas extended almost 21 meters below the surface. The client requested that approximately 790 meters of the cut off wall be structurally fortified by the addition of structural steel beams to allow for excavation of the contaminated soils inside the wall area—away from the river.

Taking another approach against PCB contamination at a Hialeah, Fla., site, Geo-Con mixed a proprietary stabilizing chemical into soils to six meter depths in an EPA (SITE) Superfund Innovative Technology Evaluation. The company used its single auger test rig, consisting of a hollow stem mixing auger capable of mixing to depths greater than 7.5 meters, to demonstrate in situ mixing of the fluid chemical with the soil. Two plots of 13.5 square meters each were stabilized with overlapping drilling patterns.

The company says that the demonstration proved that Geo-Con’s equipment and techniques can mix treatment fluids with contaminated soils for chemical fixation in situ.

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up to 190° C. This exhaust is drawn through a cyclone which separates most particles over 200 mesh from the gas. Collected solids are recycled through the rotary dryer. Experience has shown that less than 10 percent of the dry solids are entrained with the gas to the cyclone separator. Volatile gases are oxidized in a natural gas fired afterburner at 780-870° C to destroy any hydrocarbons. The combustion products are cooled in an air-to-gas heat exchanger to bring exit temperatures to 176° C. A baghouse at the tail end of the process reduces particulate emissions to below .04 grains per dry standard cubic feet of PM10 particles. Dust collected by the baghouse is incorporated into the soil product. The baghouse and afterburner system are the designated Best Developed Available Technology for controlling emissions in the South Coast Air Management District. Use of natural gas as a fuel, and low NOx burners enable the system to meet requirements for NOx, sulphur dioxide and particulate emissions. Cleaned soil from the rotary dryer is re-wetted in a pugmill and temporarily stored while monitoring confirms the product specification.

Figure three, page 11, summarizes the project requirements. The specifications for the untreated soil reflect the expected mixing and blending that occurs in the process of excavating the site and managing the storage pile. Even so, the untreated soil is highly variable in composition, the site having been exposed to at least 25 different products.

The most limiting requirement for the thermal desorption process is the specification for total polynuclear aromatic hydrocarbon (PAH) compounds. The system is required to reduce the total of 13 PAH compounds to less than 1 ppm total. The quantification limits for EPA Method 8270 used are 66 µg per µg. However, the cleanup requirements negotiated with the Regional Water Quality Control Board require that analyses reported as non-detected be treated as 66 µg per kg. Thus, the samples are treated as having a minimum of 858 µg per kg total PAH.

The system can process 36 to 63 metric tons per hour of solids, depending on moisture and hydrocarbon content. The plant operates six days a week, round-the-clock. Sundays are reserved for plant maintenance.

The project was given the go-ahead in December 1992, and production started in May 1993. The first week was spent in training and arranging test burns. The plant was first fired on May 11 for a few days of tests and produced 289 metric tons of clean soil on the second day of operation. The first full week of operation saw 2,502 metric tons of soil processed to an average contamination level of less than 160 total petroleum hydrocarbons.

During the second week, the plant reached a pace of 58.5 metric tons per hour, exceeding all applicable specifications for the product soil. Since then, the plant has exceeded process rates of 900 metric tons per day—above design capacity. Based on accumulated soil production during the first four months of operation, the learning curve for the system was very short. By the end of November, 159,300 metric tons of soil had been processed to an average hydrocarbon content of less than 71 total petroleum hydrocarbons. This production was achieved despite downtime for maintenance or slack times due to lack of suitable soil to process because dredging is only a five day per week, eight hour per day process. And, low hydrocarbon concentrates were achieved with soil that sometimes exceeded 30,000 total petroleum hydrocarbons and 25 percent moisture content. The overall system efficiency has been over 97 percent. System reliability has steadily increased since startup, and was averaging 92 percent by the fourth month of operation.

The Los Angeles Port Authority plans to recycle the clean soil product for construction fill elsewhere in the Port.
Authority to support new commercial development. The Port Authority has several other contaminated sites for which this process now appears the most promising technology. The process, as demonstrated, is well suited to remediate hydrocarbon contaminated soil—including polynuclear aromatic hydrocarbon compounds. The destruction of these compounds eliminates future liability. The process treats large quantities of diverse contaminants in a predictable manner in a short period of time. By combining Tarmac’s reliable equipment with thorough treatability testing, risk to all parties is lowered, and costs are ultimately reduced.

The thermal desorption process as demonstrated has consistently reduced total petroleum hydrocarbons to levels below 100 mg/kg—from soil with initial hydrocarbon levels up to 30,000 mg/kg. The efficacy of Clean-Up Technology’s process has been shown to be 100 percent. In general, the process removes 99.5 percent of the contamination entrained in the soil. Over 99.99 percent of the volatilized organic compounds desorbed from the soil are destroyed in the afterburner.

Regulatory agencies are familiar with the process, which reduces permitting time. Thermal desorption has been successfully applied to numerous sites since 1986, and is being expanded to other types of contamination, including pesticides and polychlorinated biphenyls. The portable system alys in surrounding communities that often arise at the prospect of a permanent installation, and the on site treatment eliminates the transportation of large quantities of contaminated materials. However, smaller volumes of similar contaminants can still be treated efficiently by the same process at an off site facility, such as one operated by Clean-Up Technology in Mecca, Calif.

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January-February 1994 Soils 35
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How many enlarged bladders do you need?
Geoguard Inc., of Medina, N.Y., thinks you cannot have too many of their Master-Flo™ bladder pumps which feature enlarged bladders and an oversized sample train to produce highest flow rates for purging and consistent low flows for sampling. Enlarged porting reduces pressure gradients between the bladder and discharge tubing to minimize the potential for orifice outgassing. In diameters from 3.5 to 4.82 centimeters, up to 2 meters long, the stainless steel pumps meet all EPA/RCRA requirements.

Write in 5011 for more information

New instruments make measuring easier
Omega Engineering, Inc., Stamford, Conn., introduces several measuring instruments with specialized uses. Their compost thermometer monitors the internal temperature of compost piles and windrows. A bimetal helix in the bottom of the stem drives the dial. The company’s new infrared pyrometer measures non contact surface temperature from -50 to 500°C. The detachable probe can measure close objects or can be attached to the unit for one-hand operation. And, the company has a new dewpoint monitor that uses a fundamental chilled mirror sensing technology to monitor the dewpoint of the sample gas with a 4 wire RTD within .2°C.

Write in 5014 for more information

NET to offer Quantix immunoassay screening
National Environmental Testing, Inc., now offers Quantix (formerly Agri-Diagnostics Associates) of Cinnaminson, N.J., laboratory-based immunoassay screening for pesticides, petroleum and gasoline contamination in soil and water samples through their nationwide network of environmental labs. The Quantix kits deliver results in ppm and ppb ranges with fast turnaround time at low cost. The 96-micropet format enables the lab to test up to 80 samples in a half day.

Write in 5012 for more information

Bugs and bug food come in single package
WIK Biosystems, Inc., New Castle, Del. packages BUGS+PLUS™ as a complete bioremediation system, including a container of oil- and petroleum-degrading microbes and a pack of nutrients—with step-by-step instructions.

Write in 5013 for more information

Enhance sludge handling with return pump
Smith & Loveless, Inc., Lenexa, Kan. has added a double mechanical seal and fresh water seal lubrication system to their Wet Well Mounted Pump Station so it can now be used as a return sludge pump. It can manage up to 5 percent sludge solids and can be adapted to fit any system with a clarifier, says the company.

Write in 5025 for more information

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January-February 1994 Solis 37
**What’s New**

**EI unveils new FID, PID**
Environmental Instruments Co., Concord, Calif., says their new portable flame ionization detector, left, is designed for EPA Method 21 testing. Their new portable photoionization detector, right, (the Determinator™) detects toxic vapors in the .1 to 2,000 ppm range.

Write in 5015 for more information

**Shroud protects wells**
Atlantic Screen, Inc., Milton, Del., says their pump protector is a shroud to prevent foreign material (sand, grass, debris in lakes and streams) from fouling wells.
In various sizes up to 6 meters long, it is available in either PVC or stainless steel.

Write in 5016 for more information

**Detector finds oil**
Horiba Instruments, Inc., Irvine, Calif., says their new analyzer uses solvent extraction and non-dispersive infrared spectroscopy to detect minute levels of hydrocarbons in water and soil samples in about one minute. Two dual range versions measure 0-5 and 20 ppm or 1-50 and 200 ppm.

Write in 5017 for more information

**Screen within a screen**
The Timco Mfg., Inc., Prairie du Sac, Wis., Insta-Pack is a screen within a screen unit for wells, where normal filter pack installation is difficult. It can be custom filled in the field with clean sand or gravel. It comes in 1.5 to 6 meter length in regular or high flow slot design.

Write in 5018 for more information

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Write in 5019 for more information

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**New GC is automated for continuous monitoring**

HNU Systems, Newton, Mass., says their new model 501A automated continuous gas chromatograph provides continuous, unattended monitoring with choice of detectors (PID, ECD or FUVAD). The user can program up to 20 sample points in any order. It accepts other flow and temperatures, has an alarm function and is easily networked, says the company.

Write in 5019 for more information
obtained from such sites often require extensive cleanup treatments and/or sample dilution to remove sample interferences. In general, samples of refinery waste affected soil are more likely to come into contact with a greater quantity of laboratory materials and be subject to higher solvent-to-sample ratios as compared to other waste-media combinations.

Should PAE contamination be introduced when samples are already at a high level of dilution, ppb or even ppt quantities of introduced PAEs will yield significant PAE concentration values when measurements are back-calculated to adjust for dilution factors. As a result, hydrocarbon contaminated soils may be particularly susceptible to the problem of PAE contamination.

Six PAEs appear on the EPA Skinner List of commonly occurring hazardous constituents in petroleum refinery waste. The Skinner List originally appeared in an April 3, 1984 memorandum from John Skinner, director of the Office of Solid Waste, to the Hazardous Waste Permit branch chiefs of all the EPA regions. But, in 1984, EPA was just developing the Resource Conservation and Recovery Act (RCRA) facility permitting program. The source of much, if not all, the refinery wastewater semi-volatile organic analytical database in the Skinner List was obtained with EPA Method 625 (base/neutrals and acids) and possibly Method 606 (PAEs). However, during that time, Methods 606 and 625 were themselves still in developmental stages. Prior to EPA’s 1984 publication of the amended version of Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act (49 FR 2636), there were no mandatory rules for sample containers, preservatives or holding time with those methods. In particular, quality assurance and quality control guidelines were poorly defined at that time. Prior to 1984, the response to PAE analytical interference problems was not uniform, but varied from lab to lab.

Thus, it is possible that artifact PAE analytical results were included in the database when the Skinner List was compiled.

Senior refinery chemists from five major U.S. corporations engaged in petroleum refining agree that PAEs are not expected to be a constituent of crude oil or of petroleum refining waste. None of the chemists knows of any petroleum refining process in which PAEs are generated or introduced.

Various EPA policies indicate agency recognition of the difficulties regarding sample contamination with PAEs derived from lab equipment and reagents. In some cases, the recognition in implicit in the consideration given to PAEs in terms of overall data evaluation and quality assurance and quality control.

The Superfund program includes PAEs along with four other organic chemicals (acetone, 2-butanone, methylene chloride and toluene) as common laboratory contaminants. PAEs are categorized as organic chemicals which, “may be introduced into a sample from laboratory cross contamination, not from the site.” In addition, the designated common laboratory contaminants are to be considered as positive detections, “only if the concentrations in the sample exceed ten times the maximum amount detected in any blank.”

The EPA’s Contract Laboratory Program (CLP) establishes guidance and performance criteria for analytical laboratories engaged in Superfund work. The CLP Statement of Work for Organic Analysis establishes quantitation limits for target semivolatile compounds. The target compound list includes 97 semivolatile compounds, including six PAE compounds. Flexibility in the establishment of method blank acceptability criteria is conferred solely on the six PAE constituents. For all other semivolatile constituents, method blanks must contain less than or equal to five times the quantitation limit for the six PAEs. Thus, it is apparent that EPA Superfund administrators recognize the difficulty of excluding ubiquitous PAE contaminants from analytical laboratory procedures.

At least one EPA Regional headquarters has publicly commented on the general lack of validity of PAE data. In reference to PAEs, Region VIII stated in a 1991 Record of Decision that, “these compounds are ubiquitous laboratory contaminants and are recognized plasticizers...it is almost impossible to eliminate them from the laboratory environment and consequent detection. They have been reported in almost all data sets, in background, monitoring areas and in quality control blanks. As such, their value as measurements of potential contamination is nonexistent.”

While various segments of the environmental regulatory community are aware of the widespread problem of PAE cross contamination in environmental samples, there is no coherent, uniform policy to address the problem. The potential exists for random and sporadic artifact PAE detections in environmental samples to be misinterpreted as authentic environmental contamination, or to lead to unrealistic demands for total elimination of such data. While such controversies are resolvable, the resolution often comes about only after expensive delays.

Earlier versions of analytical methods may have grossly misrepresented the true frequency of PAE occurrence in hydrocarbon wastes. Current analytical technologies cannot consistently eliminate artifact PAE contamination in environmental samples. The absence of a critical analytical evaluation to address these issues begs the creation of a uniform policy. All the evidence combined indicates that the detection of PAEs, in the absence of other, non-PAE hazardous organic constituents is of little or no value as an indicator of hydrocarbon contamination in environmental soil and water samples.

Write in 5000 for more information
PRODUCT POCKET: Software

- Environmental Systems & Technologies, Inc., has three new software products. Venting version 3.0 estimates hydrocarbon recovery by in situ vacuum extraction during steady gas flow at a specified temperature. It enables evaluation of effects of spill composition, temperature and gas pumping rate on hydrocarbon recovery. SpillCAD version 3.1 provides hydrocarbon spill site assessment and remedial design evaluation in a graphical database that enables monitoring well and soil boring data to be posted or contoured on site maps. The program enables quantitative assessment of spill volume and contaminated soil volume, recoverable product, and design alternatives for plume control and recovery. ARMOS version 4.0 is a design system for areal migration of free phase light hydrocarbon and recovery. It considers nonuniform vertical hydrocarbon distributions governed by soil capillary characteristics, fluid table elevations and residual hydrocarbon associated with changing water and oil tables. For more information, contact EST at 2701 Ramble Rd., Suite 2, Blacksburg, Va. 24060, phone 703-552-0685, fax 703-951-5307.

- ConSolve Inc. says their new SiteManager™ database is used by consultants, site owners and regulators to store soil, groundwater and surface water sample data, track the sources of the data and validate the quality of the data. It helps in site assessment, analysis, during the remeciation phase, and for reporting to regulatory agencies. It stores data from borings, monitoring wells and grab samples and includes a chemical list. For more information, contact Ann Bischoff at ConSolve, phone 617-674-2199.


- EnviroQuest Technologies, Ltd. introduces SIRAS, a statistical inventory system for large tanks up to 228,000 liters. The system meets EPA’s standards of 95 percent probability of detection and .05 probability of false alarm. The system is also suitable for manifolded tank systems up to 228,000 liters. Until now, statistical inventory reconciliation was limited to tanks of 68,400 liters or less. For more information, contact Lyle White at EnviroQuest, 4501 Madison Ave., Kansas City, Mo. 64111, phone 800-878-9747, fax 816-756-1204.
Conway Handyscope

- The Conway Engineering software-based TiePie Handyscopes upgrade IBM-compatible desktops and laptops into integrated storage oscilloscopes, spectrum analyzers, voltmeters, distortion analyzers and transient recorders for audio system testing. For more information contact Conway at 8393 Capwell Dr., Oakland, Calif. 94621, phone 800-626-6929, fax 510-568-1397.

- Mentor Software, Inc. announces MULTRIC, a rubber sheeting system that operates inside AutoCAD for mapping, which honors any number of control points. For more information, contact Mentor at 3907 E. 120 Ave., Suite 200, Thornton, Colo. 80233, phone 800-234-8649.

- Pro-Motion Inc. releases a Windows version of its Advantage software for construction accounting and management. It integrates job cost accounting, estimating and scheduling. Modules include job cost, accounts payable with subcontractor control, accounts receivable, general ledger, payroll, equipment control, critical path scheduling, materials management and estimating. For more information, contact Michael Alsup at Pro-Motion, 5242 S. College Dr., Suite 200, Salt Lake City, Utah 84123, phone 800-521-4562, fax 801-261-8599.

W.L. Gore Screening surveys

- The Gore-Sorber system features patented passive sorbent collection devices, analysis and mapping of the results says W.L. Gore & Associates, Inc. The screening modules are made of Gore-Tex®, are inserted into the ground and sent to Gore’s lab for analysis. Results are mapped as overlaid contour plots on CAD maps. For more information, contact John Cusick at Gore, Box 1100, Elkton, Md. 21922, phone 410-392-3300, fax 410-398-6624.

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January-February 1994 Soils 41
What’s New

Millipore lab products catalog is out


Guide helps lead real estate people through environmental maze

Warren Gorham Lamont Co., New York, N.Y. announces publication of the Federal Environmental Regulation of Real Estate, a source of legal analysis and planning guidance for attorneys and other professionals to keep real estate transactions in compliance with environmental laws, including CERCLA, RCRA, UST regulations, Clean Water Act, storm water runoff, even the Endangered Species Act. The guide includes phone numbers of state agencies, and focuses on preventing problems, as well as dealing with problems. Authored by Frank Cross, professor of Business Regulation at the University of Texas, Austin, the 1,100 page text costs $135. For more information, or to order, phone Patti Heller, 212-971-5516.

Hertz offers used equipment catalog

Hertz Equipment Rental Corp., Park Ridge, N.J. offers their new edition, free, 40 page catalog of used equipment. “The Source” lists manufacturer, model, year, location and selling price of over 1,000 pieces of late-model, well-maintained equipment, including dozers, backhoes, loaders, trenchers, excavators, air compressors, rollers, forkifts, platform lifts, bucket trucks, truck-mounted cranes, flatbed and box dump trucks, light towers, generators, portable welders and more. Call 800-223-0983 for a free catalog.

New ModuTank catalog is available

ModuTank, Inc., Long Island City, N.Y. describes their line of modular containment systems in a new 24 page catalog. Included are details outlining applications, site assembly, capacity ranges, technical features, application case histories and rental programs for the line. For a free copy, write ModuTank, 41-04 35th Ave., Long Island City, N.Y. 11101.

...And, get your New Pig catalog

The New Pig Corp., Tipton, Pa., features more than 1,000 absorbent and safety products to solve leak and spill problems. Also highlighted in the 164 page “Pigalog®” is New Pig’s haz mat training program for customer support specialists. For a free copy, write the company at One Pork Ave., Tipton, Pa. 16684, or call 800-HOT-HOGS.
Recycle cleaners from immersion tanks

Sanborn Technologies, Inc., Wrentham, Mass., says their Aquamate 21 uses crossflow microfiltration to remove oil and solid contaminants from small immersion tank cleaners. The purified cleaner is returned to the immersion tank, while contaminants are concentrated in a collector tank. It can be used continuously or intermittently to reduce contaminants. The unit can process tanks up to 1,900 liters capacity at temperatures up to 82° C, and pH levels up to 12. The company says use of the recycling system can save as much as 98 percent of bath solution costs.

Write in 5023 for more information

Remove VOCs from waste water

Carbtrol® Corp., Westport, Conn., announces introduction of a line of high flow vapor treatment systems to remove volatile organic compounds from waste water collection venting applications. The system use radial flow adsorbers and coconut shell air purification carbon to provide high air volume handling capacity at a low cost, says the company. The adsorbers, each handling 4,000 cfm, are assembled onto skid-mounted packages capable of treating air flows up to 32,000 cfm.

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Baghouses
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Afterburners
GenTec® custom designs all types of thermal oxidizers and afterburners. Illustrated left is a new portable GenTec® afterburner that will be used at three or more facilities.

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Write in 001
January-February 1994 Soils 43
Organic vapor monitor goes on site

Microsensor Systems, Inc., Bowling Green, Ky., says their new line of organic vapor monitors detect and measure organic vapors such as benzene, ethylene oxide, styrene, MTBE at levels below EPA limits. The line includes a general purpose monitor, a wall-mounted unit, and a multi-point sampler to sample as many as four components at up to four remote locations. Typical analysis time is less than six minutes, says the company. Write in 5021 for more information.

New GC is compact for field and lab

SRI Instruments, Torrance Calif., says their new compact gas chromatograph is 1/4th the size of a traditional lab GC, and may be equipped with multiple detectors and injectors to perform complex analytical methods. Only 32 centimeters wide, it is suitable for mobile labs and is designed to be field transportable. Built-in data acquisition communicates with any IBM-compatible laptop or notebook computer. PeakSimple II data system software is included with the unit. Write in 5026 for more information.

KalCon dives into soil washing

Kalkaska Construction Services, Inc., Kalkaska, Mich., has designed and constructed a mobile soil washing unit to remediate chloride affected soils. The process dissolves chlorides from the soil, separates out the contaminants, producing clean soils suitable for backfill at the site. The unit can process about 20-25 metric tons per hour, eliminates liability, and can process a wide variety of soil types and aggregate sizes which may contain varying levels of chlorides, says the company. Write in 5020 for more information.

Sampler rides behind a pickup truck

Concord Inc., Fargo, N.D. says their 9200 series soil sampler is easily trailer mounted, or pickup mounted. It can be rolled in or out of any standard pickup truck box in just minutes, says the company. The chuck allows use of soil probes up to 9 meters long without use of a Kelly bar. The electric control box enables the operator to use electronically controlled hydraulic power for precision sampling to 15 meter depths. In addition to soil sampling, the unit can be used for rock investigations, coring and in shallow water wells. The down force is adjustable from 700 to 14,000 lbs. Drill head speed is adjustable up to 75 rpm. The unit can be equipped with a variety of tools, including an auger, continuous flighted auger or probe. Write in 5022 for more information.
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The annual Contaminated Soils Conference at the University of Massachusetts at Amherst has become the preeminent national conference in this important environmental area. The conference attracts 500-600 attendees annually which includes a wide variety of representation from state and federal agencies; military; a number of industries including railroad, petroleum, transportation, utilities; the environmental engineering and consulting community; and academia.

Streamlining Closures, this conference’s theme, will be supported by the development of a strong and diverse technical program in concert with a variety of educational opportunities available to attendees. Live equipment demonstrations will augment the exhibition section which brings real-world application to the technical theory and case studies which will be presented in the platform sessions. Focused workshops will provide attendees with the type of practical application information which will impact their job performance immediately.

Breakfast discussion forums will be offered by a number of companies to encourage discussion and debate on timely technical and regulatory topics. A book and videotape viewing room will allow attendees to review information that has been, perhaps, beyond their reach previously. Employment opportunities in the field will be identified at the employment posting board.

For those attendees formally working towards professional degrees or wanting academic recognition, the conference will allow them to receive graduate credits through the University of Massachusetts.

The conference promises to be an exciting opportunity for all those concerned with the challenge of developing creative, cost-effective assessments and solutions that can withstand the demands of regulatory requirements.

GENERAL SESSIONS
Contributed Papers and Posters are invited for presentation in the general sessions in the following areas:
• chemical analysis
• hydrocarbon identification
• site assessment / field sampling
• regulatory programs and policies
• environmental fate and modeling
• soil chemistry
• hazard, exposure, and risk assessment
• standard remedial technologies / corrective actions
• innovative remedial technologies
• case studies on any of the above

SPECIAL SESSIONS
Presentations for special sessions related to the following areas are encouraged:
• diesel fuel contamination
• contamination at military installations
• contamination at shipping ports
• chlorinated hydrocarbons, pesticides and heavy metals
• ecological risk assessments
• jet fuel contamination
• state regulatory programs
• innovative technologies

DEADLINE FOR SUBMISSIONS IS FEBRUARY 11, 1994

For either a paper or poster to be considered please submit a one-page abstract containing: presentation title; 300 word narrative; and for each author: name, degree, title, affiliation and complete address and phone number. Please indicate your choice of either oral presentation or poster.

Publication of manuscripts from both platform and poster presentations will be considered for either the general proceedings, to be published as a hard cover book, Journal of Soil Contamination, or SOILS Magazine.

Exhibition Space is available and potential exhibitors can receive information by calling Diane Burns at (413) 545-2591.

Contact us about sponsor/supporter and group rates
Write in 467
The Finch Environmental Corp. incineration system is designed specifically for the thermal remediation of petroleum contaminated soil in coastal production pits, says the West Pittston, Pa.-based company. Such pits require a high capacity system, since they may contain over 150,000 cubic meters of contaminated material. The complete unit, 3.64 meters wide and 31-1/2 meters long, is designed to mount on a spud barge so it can be towed to pit locations in marshes where other cleanup methods are not practical. After a dewatering operation, sludge is mixed with hydrated lime in the contaminated area. It is then pumped from the pit to a pugmill which provides a uniform feed to the 3 meter diameter, 12 meter long rotary kiln. The kiln is equipped with a 125 hp, variable speed electric drive with an in line diesel backup. Operating temperatures in this first stage are 730 to 900°C. Off gases from the kiln enter a secondary combustion chamber maintained at 950 to 1,200°C. A two second retention time ensures complete combustion of the volatile organics. Both the primary and secondary combustion chambers have 50 million Btu per hour, dual feed burners. Before the gas stream is injected into a wet scrubber system, it is quenched to reduce both temperature and volume. A venturi, high pressure drop, cross flow wet emission scrubber removes particulates. A 250 hp induction fan creates negative pressure in the system to eliminate fugitive emissions. Continuous monitoring provides compliance data. Ash from the rotary kiln discharges into a water bath, then is pumped in a closed system to a clean area in the pit to be blended with fill dirt and spread out within the pit area. Grading and revegetation complete pit closure.

Write in 5007 for more information
CHAMA Corp., Roanoke, Ind., says their hollow stem auger kit offers continuous soil sampling and is available for use on a variety of attachment drilling equipment. The hydraulic drive unit drives the 14 centimeter auger to 1.5 meter depth. After removing the head and center rod, a sample can be taken, and more 1.5 meter extension sections added as needed to reach the desired sampling depth.

The company says the system works in most ground conditions, using hydraulic drive units that deliver up to 5,200 foot pounds of torque to drill to 15 meters depth and beyond. In some soil conditions, it may be advisable to retract the hollow stem auger about 15 centimeters before re-driving, to improve penetration for the soil sampler. The center rod operates both the pilot bit assembly and the manually operated soil sampler using a supplied hand driver when necessary.

Kits are available in four auger sizes to facilitate setting observation and monitoring wells. The kit includes three split spoon sampler sizes, starting at 5 centimeter diameter, with optional liners and soil retainers available for discrete soil sampling.

Attachment kits are available for skid steer loaders, front end loaders, backhoes and boom trucks. The hollow stem auger kit adapts to existing hydraulic digger drives, or is available with hydraulic drive and mountings compatible to various allied equipment.

The company also provides a "Screen Placement System" for installing observation wells around underground storage tanks as it drills.

Write in 5008 for more information
Recession punches firms' bottom line

But geoenvironmental engineering firms' billings are up

The recession has had a "devastating impact" on the business of consulting engineers, according to a report conducted by the Consulting Engineers Council of Metropolitan Washington. Overall, the average number of technical persons employed per firm has fallen 52 percent, from 19.4 per firm to 9.3. In the designer/drafter category, the number was down 46 percent, and engineers were down 40 percent.

Average gross billings of all respondents rose 17 percent during 1993, principally due to higher billings by civil and multidisciplinary firms. Gross billings of geoenvironmental firms rose 86 percent.

But gross billings for structural engineering firms fell by 28 percent, and civil and multidisciplinary firms fell 78 percent, from $5.8 million to $1.36 million.

"The questionnaire has about 200 questions, nonetheless, we have a response rate of 50 percent, which gives us excellent data," says John Bachner, executive vice president of the group.

The 48-page report is available from Consulting Engineers Council of Metropolitan Washington, 8811 Colesville Rd., Suite G106, Silver Spring, Md. 20910. Cost is $25 per copy.

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The Amenex Associates, Inc., West Chester, Pa., system consist of two electrical methods to detect and locate leaks in plastic (geomembrane) liners in surface impoundments. A small, battery-powered direct current (DC) voltage is imposed between the water in the pond and the ground outside the pond. The voltage and current are measured, and the apparent resistance of the liner is found using Ohm’s Law (resistance equals voltage divided by current). Using a suitable model for the resistance of a hole in a liner, and taking into account the measured resistivities of the water and the ground, the equivalent hole size and leakage rate are calculated. Using this method, any hole through which water can pass can be detected. To locate the holes, low voltage alternating current (AC) signals of suitable frequency are imposed in the ground beneath the pond using two or more electrodes outside the pond. The pond behaves as a large series AC circuit, with the liner acting as a dielectric between two plates, consisting of the water in the pond and the soil beneath the liner, and with the water acting as the series resistance. The AC signal in the ground couples electrically with the pond through the capacitance of the liner and the resistance of the water so that the AC signal can be detected within the pond. Holes in the liner behave as shorting resistors within the liner capacitance, and cause local anomalies in the AC signal in the pond. A technician wades through the pond (up to three feet deep) with a probe and scans the liner to detect the anomalies. Deeper ponds or toxic ponds require use of a boat. When a hole is located, it is marked for repair and covered with a temporary patch. The DC method for detecting holes is repeated to yield a quantitative estimate of the improvement in liner integrity.

Write in 5009 for more information
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