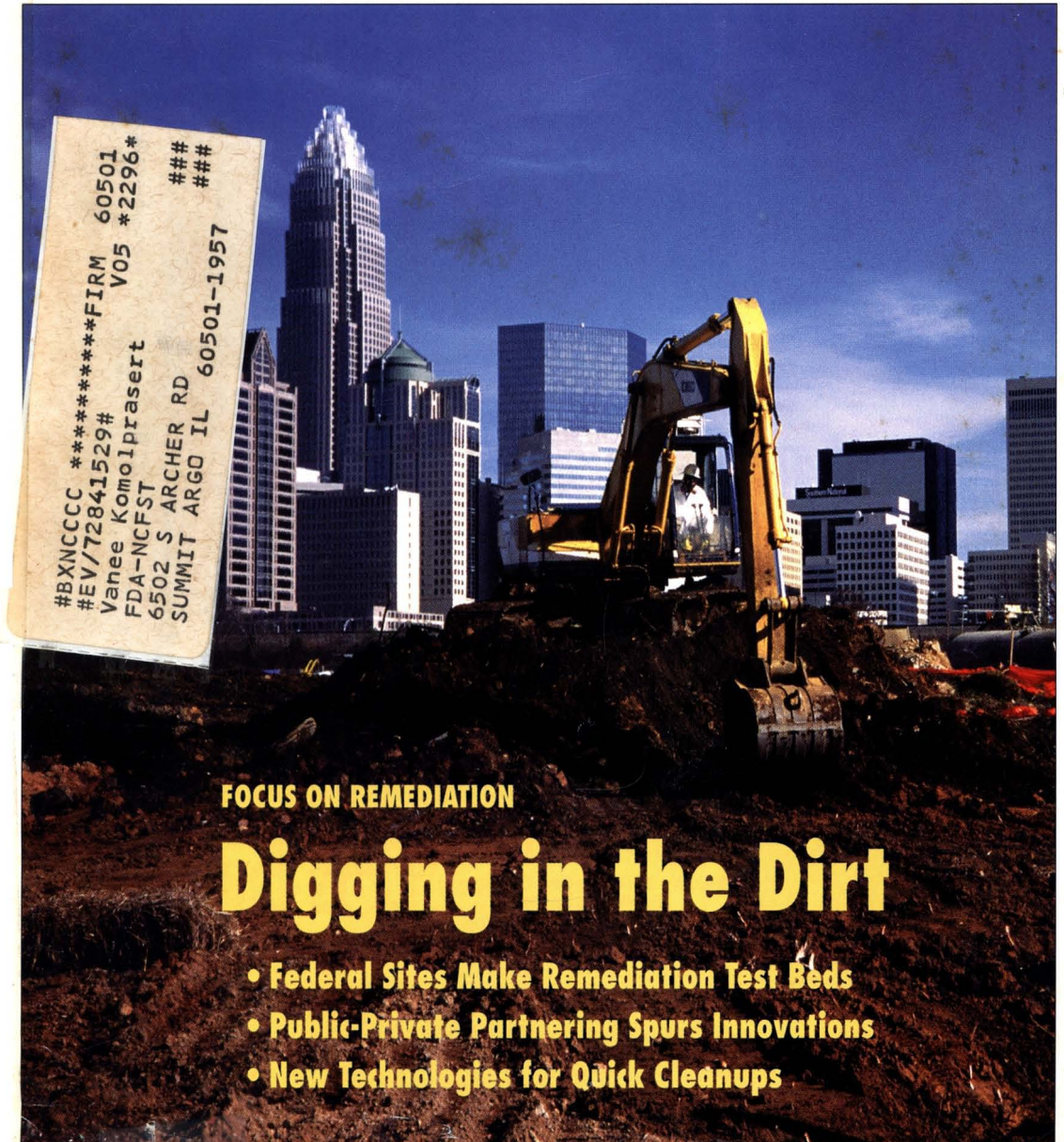


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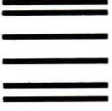
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- B Instrumentation
- C Chemicals
- D Parts & equipment for maintenance operation and control
- E Services/Consulting
- F None of the above _____
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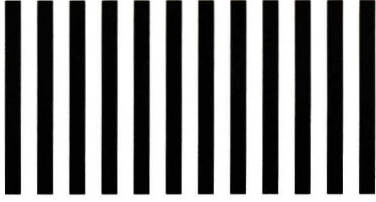
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| B <input type="checkbox"/> Water | G <input type="checkbox"/> Energy control/energy conservation |
| C <input type="checkbox"/> Noise | H <input type="checkbox"/> None of the above |
| D <input type="checkbox"/> Solid waste disposal | |
| E <input type="checkbox"/> Industrial hygiene | _____ |
- (please specify)

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- B Environment Today
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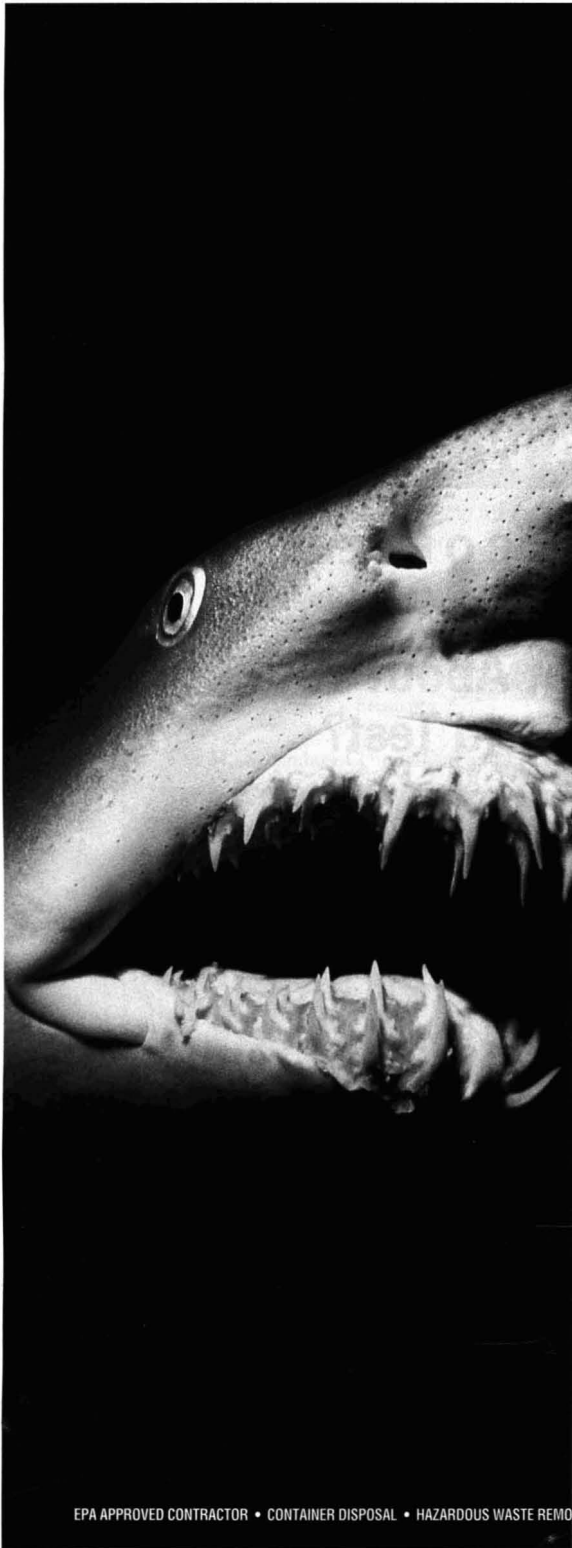


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Cover:

A soil remediation project team on the outskirts of Charlotte, N.C. is using chemical fixation to clean up petroleum, lead, cadmium and PCB contamination at a former industrial site. A new sports stadium will crown the finished project.

Photo © HDR Inc.

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ENVIRONMENTAL PROTECTION (ISSN # 1057-4298, USPS #006-703) is published 12 times a year, © 1995 Stevens Publishing Corp., 3630 IH-35, Waco, TX 76706. Phone (817) 776-9000. Second Class postage paid at Waco, TX 76702-2573 and additional mailing offices. Subscription rate for Environmental Protection is \$113 for 1 year. Subscriptions mailed to Canada please add \$22, to Mexico, please add \$18. For all other foreign countries, please add \$30.

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Some Exciting Times Ahead

For the last six years, *Environmental Protection* has been relied upon by corporate environmental managers, consultants, plant managers and municipal compliance officers as the definitive resource on environmental issues. We at Stevens Publishing appreciate your confidence in us to provide practical information you need in your everyday activities.

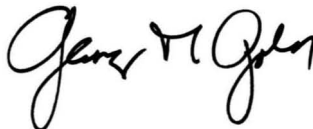
But even though *Environmental Protection* is the most widely-read publication for environmental professionals, we can't rest on our laurels. In our ongoing efforts to achieve publishing excellence — to make the magazine as good as it can be — we have made significant additions to our magazine staff.

For one, we have a new publisher — Richard "Dick" Young. Widely known and respected in the environmental profession, Young, an award-winning environmental engineer, author, consultant and publisher, has been involved in virtually every aspect of the industry. He is a founder of the Institute of Hazardous Materials Management and currently serves as executive director of the National Registry of Environmental Professionals, the world's largest organization to certify environmental professionals. Young is a recipient of EPA's Environmental Quality Award. Indeed, he is known in many quarters as "Mr. Pollution Control," an appellation conferred by the American Institute of Plant Engineers.

Young, who will be based at Stevens Publishing's Chicago offices, holds a number of professional designations, including Registered Professional Engineer, Registered Environmental Manager, Certified Environmental Auditor and Registered Environmental Property Assessor.

And taking over as editor-in-chief is Thomas E. Barron. An environmental journalist with wide-ranging contacts, Barron has covered environmental issues since 1988. Most recently, he was managing editor of *Environment Today* magazine and, before that, Washington correspondent for *Waste Tech News*.

With you, our reader in mind, we will be making graphic improvements to the magazine. Together with editorial and other publishing enhancements, we will advance our long-term goal of providing you with a publication worthy of your continued readership and support. In this regard, your comments and suggestions are solicited and, indeed, welcome.



George M. Gold
Vice President, Editorial

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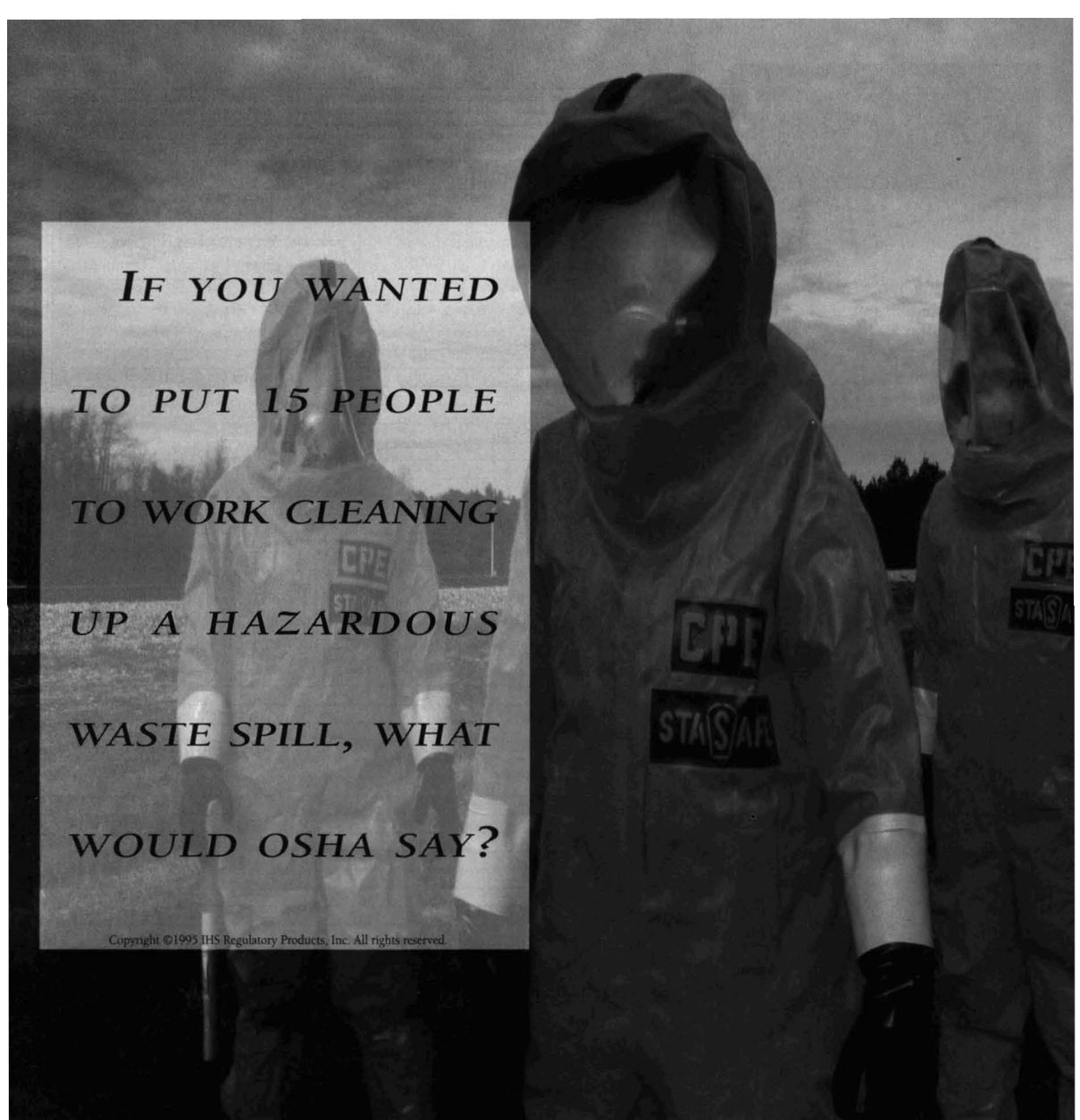
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EPA to Streamline Industry Reporting

For companies that complain about the patchwork of EPA reporting requirements, which differ in frequency and often ask for similar information, there may be some relief in sight.

EPA officials are working to eliminate duplicative reporting in order to save both industry and the agency time and money. They also want to improve public access to information.

Top-level EPA officials are proposing "one-stop" reporting for the major information collection programs. "Under this approach, the major EPA information collections which obtain information concerning environmental releases, transfer, emissions and permits . . . generally would be consolidated into a single, once-a-year report to EPA," said Lynn Goldman and Jonathan Cannon in a recent memorandum to EPA Administrator Carol Browner. Goldman is assistant administrator for prevention, pesticides and toxic substances; Cannon heads the Office of Administration and Resources Management.

The information collected would include the Toxics Release Inventory (TRI), the Aermetric Information Retrieval System (AIRS), the Resource Conservation and Recovery Act Information System, the Permit Compliance System and RCRA biennial reports. Certain specialized reports, such as monthly discharge monitoring reports, would not be part of the single report, the officials said.

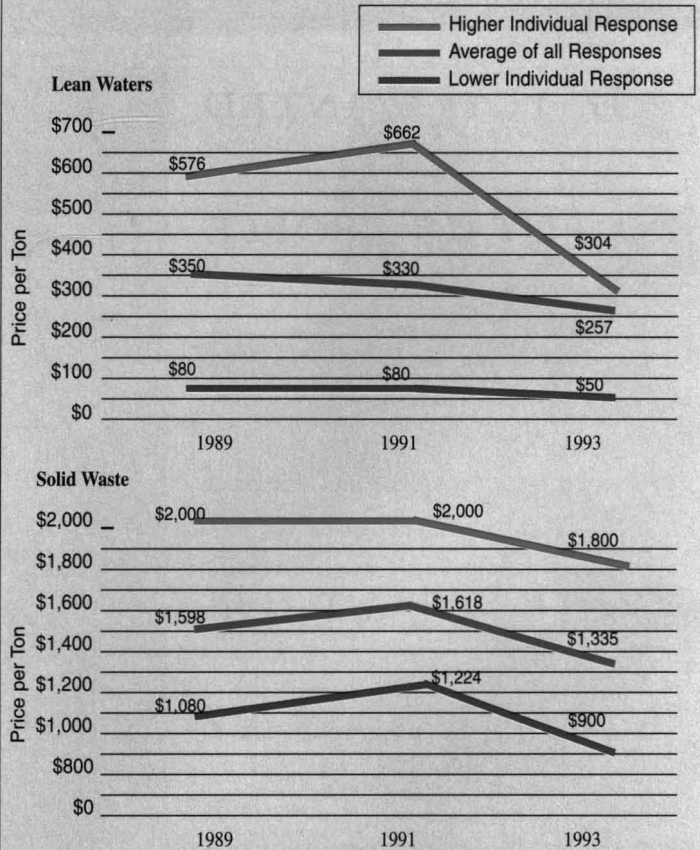
They cautioned that the effort will take a while, and proposed phasing in the changes over five years. The first step in the initiative is to publish a proposed rule this fall addressing the way in which facilities identify their location and report chemical identities.

Moratorium Bill Survives Challenge

Republicans on the Senate Governmental Affairs Committee have rejected recent Democratic efforts to allow more regulations to be issued during a proposed regulatory moratorium. Democratic senators argued that the Regulatory Transition Act of 1995 would halt the implementation of important health and safety regulations. However, they failed to win passage of several amendments to modify the bill.

Committee Republicans countered that the moratorium is to be put in place as a temporary measure until Congress can enact long-term reforms in regulatory procedures. The bill

Hazardous Waste Incineration Disposal Prices, 1989-1993



Hazardous Waste Incineration Business On Upswing

Prospects for the depressed hazardous waste incineration sector may be on the rise.

A new report from Environmental Information, Ltd., a Minneapolis-based research firm, surveyed U.S. and Canadian incinerator operators and found the total volume of waste processed in 1994 is expected to be 6 to 7 percent higher than 1993. Market prices for hazardous waste incineration services also appear to have stabilized during the last two quarters of 1994.

EPA failed to take into account the waste-burning capacity of cement kilns and other boiler and industrial furnaces, the division of wastes into "liquid" and "solid" categories, fuel-blending technology and on-site management of contaminated soil from Superfund locations, the report said.

By the early 1990s, the prediction of a shortfall of capacity became an illusion. The average market prices for all categories of waste fell dramatically between 1991 and 1993 (see chart).

However, EI's survey showed a strengthening of market prices for incineration services in the second half of 1994, while volumetric growth tapered and may stagnate within the next few years. EI predicts an oversupply of incineration capacity.

EI's findings are published in the annual *EI Guide to Hazardous Waste Incinerators in Canada and the U.S.* The 1995 edition contains "detailed information on thousands of environmental services providers;" according to Jon Hanke, associate editor. EI's guide also includes comprehensive annual market reports on the hazardous waste incineration sector.

Environmental Information, Ltd. provides original research findings to the hazwaste industry through special reports and a monthly journal. For more information call (612) 831-2473.

—By Jim McKewon

would prohibit the adoption of rules proposed between Nov. 9, 1994, and Dec. 31, 1995. The committee has, however, adopted other modifications that would block environmental regulations.

Among changes from the original version of the Senate bill introduced in January, Committee Chairman William Roth (R-Del.) has proposed a \$100 million threshold for determining whether or not a significant regulatory action would be subject to the moratorium. The revised version also would bar judicial review of the Clinton administration's actions during the moratorium, Roth said.

Despite Roth's changes, the administration continues to oppose the measure. It outlined its opposition in a letter requested by Sen. John Glenn (D-Ohio), the committee's ranking Democrat. Quoting from the letter, Glenn said it is "far from clear whether the bill would permit the administration to take sufficient measures to ensure that the American people are not needlessly put at risk."

Risk Assessment Bill Faces Fight in Senate

Although passing by a wide margin in the House, a measure to bolster use of risk assessments for environmental regulations faces a serious Senate challenge. Senate Environment and Public Works Committee Chairman John Chafee (R-R.I.) last month sounded a note of caution over the ambitious proposal.

"Some of these bills have been designed to promote regulatory gridlock ... to prevent agencies from acting by tying them in a morass of procedures and paperwork and endless rounds of review," Chafee said in an address to environmental policymakers in Washington.

Senate Majority Leader Bob Dole (R-Kan.) and Sen. William Roth (R-Del.) have each introduced companion bills to the measure.

The House bill calls for cost-benefit analyses on regulations whose economic effect would amount to more than \$25 million annually, requires peer review for major new rules, opens up agencies to judicial review and puts in place a "supermandate" that would apply risk assessment and cost-benefit tests to future rules based on laws already on the books.

In the Senate, the Roth bill would require cost-benefit analysis for rules costing \$100 million or more and would limit judicial review to major rules. Dole's bill, S 343, sets the trigger at \$50 million and also would let Congress block a rule within 45 days of its implementation. Additionally, it provides for greater judicial review than the House bill does and allows people affected by rules to petition

agencies to do cost-benefit analyses.

EPA officials, warning that risk assessment could bring the regulatory process to a halt, have sharpened their criticism in recent weeks. Calling it a "simplistic and ill-advised approach," Administrator Carol Browner has hinted at a likely Presidential veto, an option the Clinton administration has not ruled out.

The nonpartisan Congressional Budget Office has said the surge in risk assessments created by the bill could cost \$250 million a year to administer. Republican backers counter that the figure doesn't factor in the savings garnered by the regulatory efficiencies gained from the new approach.

"Flexibility" Bill Passes in House

A bill that would bolster the Regulatory Flexibility Act of 1980 by requiring agencies to prepare regulatory impact analyses for new rules has cleared the House and is awaiting Senate action.

The Regulatory Reform and Relief Act also directs the president to come up with rules for agencies that would protect people from regulator abuse and retaliation.

A provision of the bill grants a judicial review option to small entities affected by regulations – which would give new powers to small businesses that have been hard hit by environmental rules. It also requires advance notice of rulemaking and allows citizens to request public hearings or to extend public comment periods for regulations.

Agencies must publish cost-benefit analyses for rules having an annual effect on the economy of \$50 million or more, or for those that result in a major cost increase for certain sectors. The Office of Management and Budget and the Small Business Administration would oversee regulations under the bill.

The nonpartisan Congressional Budget Office estimates the bill will cost the federal government \$150 million annually. The price tag for EPA alone would be between \$50 million and \$100 million a year, CBO said.

GAO: Hazwaste Worker Safety Must Be Ensured

EPA and OSHA have not fully implemented recommendations from a 1991 joint EPA-OSHA task force aimed at ensuring worker safety at hazardous waste incinerators, a report from the General Accounting Office said.

EPA inspections do not go far enough to ensure that employees know about environmental requirements and emergency procedures, ac-

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NEWS UPDATE

According to the report. "[S]ome of the EPA regions and states did not adopt the task force's checklist as suggested or directed because, according to regional compliance and enforcement officials, they were not aware of headquarters' instructions" to revise their interview procedures, the report said.

The report also recommended that EPA issue a draft guidance on waste feed cutoffs and vent stacks, so agency permit writers "have the necessary guidance to place controls on automatic waste feed cutoffs and emergency vent stacks."

While both the waste feed cutoffs and vent stacks are considered safety devices, EPA "considers their frequent use an indication of poor operating practices," GAO said. Frequent use "may be a sign of unsteady operation and may cause the residue to be treated less efficiently," the report said.

EPA chief financial officer Jonathan Cannon said the head of EPA's enforcement office had sent a memorandum to the agency's regional offices requiring both the regions and the states to use the task force's interview procedures.

Common Sense Initiative Committee Discusses Goals

The Metal Finishing Subcommittee of the EPA's Common Sense Initiative, which met for the first time late February, is seeking to develop recommendations for improvements in the way EPA administers rules affecting the industry sector.

The subcommittee has divided into five working groups, which are delving into regulatory and reporting programs, research and technology, promoting improved performance, environmentally responsible transition, and compliance assistance and enforcement.

Specific goals for this working group is to evaluate federal, state and local worker-training program requirements for redundancies; to improve dissemination of technical information to finishing facilities; and to seek a long-term plan to characterize "tier 3" finishers.

Other objectives include establishing environmental goals for the industry and developing incentives that go beyond awards and exploring ideas for obtaining greater access to

capital for environmental improvements. Lastly, subcommittee members are researching supplemental environmental projects that reduce fines and obligate the violator to invest in pollution prevention activities.

The Common Sense Initiative Council, which was spawned by the Federal Advisory Committee Act, has six such subcommittees that will coordinate program efforts and develop recommendations for improvements in the way EPA administers environmental rules and laws. Launched by EPA last year, the program is designed to improve regulations and point up areas where legislation is needed.

The other CSI groups are exploring automobile manufacturing, computers and electronics, iron and steel manufacturing, petroleum refining and printing.

CWA Bill Introduced as "Starting Point"

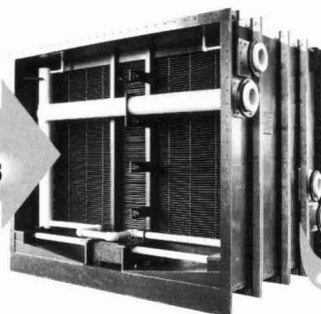
A Clean Water Act reauthorization bill based on the "bipartisan alternative" crafted last session has been resurrected in the House.

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Rep. Bud Shuster (R-Pa.) emphasized that his bill is meant only as a starting point, and he anticipates "significant revisions to the bill's provisions on unfunded mandates, risk assessment and cost benefit analysis." Revisions to the funding provision, which authorizes \$2 billion annually through fiscal year 2000, are also expected.

A wetlands provision would require wetlands to be classified according to their function and value and would require property owners to be compensated when wetlands regulations decrease the value of their land.

Among the bill's other provisions is a requirement for risk assessment for every standard, effluent limitation or other regulatory requirement and abandon any requirement where "social, economic and environmental benefits are not reasonably related to anticipated costs." The bill would also require EPA to consider factors such as a pollutant's persistence, toxicity and degradability before promulgating standards for toxic chemicals.

HR 961 also calls for delays in compliance deadlines for state nonpoint source management programs; exemptions from stormwater discharge permits for smaller municipalities and nonindustrial commercial activities; and requires EPA to perform cost-benefit analyses prior to issuing CWA regulations.

New Land Disposal Rules Proposed

EPA has issued a proposed Land Restriction Disposal Phase III rule that would set concentration-based treatment standards for underlying hazardous constituents found in ignitable, corrosive, reactive (ICR) and toxic wastes.

The rule would apply to Clean Water Act systems as well as underground Class I non-hazardous injection wells regulated under the Safe Drinking Water Act.

The proposed rule comes in response to a 1992 D.C. Circuit Court ruling that EPA's deactivation standard for ICR wastes did not fully comply with RCRA. Specifically, the court found fault with EPA's policy of allowing dilution to count as "deactivation," the removal of hazardous characteristics from waste materials. Dilution fails to destroy or remove the hazardous constituents from waste and is thus inconsistent with the statutory mandates of RCRA, according to the court.

In order to comply, EPA's proposed rule also would prohibit combustion of inorganic metal-bearing wastes. Such combustion is an illegal treatment strategy because it qualifies as dilution, according to EPA.

The rule also includes treatment standards

for spent aluminum potliner, organobromine, and carbamate wastes. EPA recently listed six wastes generated during the production of carbamate chemicals as hazardous. Final hazardous waste listing determinations for organobromine wastes and aluminum potliner wastes are scheduled for April 30 and June 30, respectively.

House May Cut Drinking Water SRF

Money earmarked for the proposed drinking water state revolving fund is on the chopping block under a House Appropriations Committee fiscal 1995 rescissions package. If the recommended cuts are adopted, EPA would lose \$1.34 billion from its FY'95 budget.

GOP leaders are seeking to rescind about \$17 billion in selected FY'95 appropriations in order to pay for supplemental FY'95 appropriations, including disaster aid to California for the 1994 earthquake in Los Angeles.

Of the \$1.34 billion EPA rescission recently approved by the Appropriations Committee, \$1.29 billion would come from the money Congress previously appropriated for the drinking water SRF — \$599 million in FY'94 and \$700 million in FY'95.

"We're pretty unhappy with this," says an EPA budget division official. "These [SRF] funds would be targeted to systems that aren't in compliance with federal and state drinking water standards — about 10 percent of all households on public water systems get their tap water from a system that has violated drinking water standards.

"This will also cost jobs — approximately 29,000 jobs would be supported by that investment," adds the official.

DOE Report: MSW Is Reusable, Safe

Ash produced during municipal solid waste combustion has vast reuse potential as a road construction aggregate and as landfill cover, states a recently-released Department of Energy report. Such reuse options can make it easier for incinerator operators to close the recycling loop, extend current landfill life, and lower tipping fees at waste-to-energy plants, the study concluded.

The report comes on the heels of a recent EPA decision to permit the mixing of fly ash and bottom ash before testing for hazardous constituents at municipal solid waste incinerators. The new mixing policy means that most solid waste ash will be deemed non-hazardous, and thus free from EPA reuse restrictions.

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Savannah River Site

A Test Bed for Cleanup Technologies

By Dr. Terry C. Hazen

The effort to develop faster and cheaper ways to clean up the environment can be divided into three basic steps. Between the conceptual spark for developing innovative technology to accomplish the task and performing the actual cleanup lies what is arguably the most crucial step: demonstrating, evaluating and fine-tuning the cleanup method.

The Savannah River Site (SRS), a U.S. Department of Energy facility near Aiken, S.C., provides an ideal proving ground for fulfilling that second step – testing innovative technologies to clean soil and groundwater contaminated with volatile organic compounds (VOCs). Westinghouse Savannah River Co. and several partners have been working since

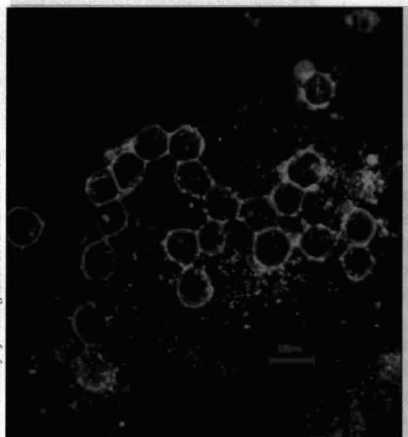


Photo Courtesy of Westinghouse Savannah River Co.

Fungal spores on bacterial biofilm taken from a hazardous waste bioreactor at the Savannah River Site.

1990 at the contaminated site, which is known as the Integrated Demonstration Site, with funding from DOE's Office of Technology Development. The project has proven so successful that the remediation systems developed by the

Westinghouse partners have been transferred to the site's Environmental Restoration Department for actual cleanup of the site.

New Role for Federal Facilities

Historically, SRS supported national defense through the production of nuclear materials. Today, the focus has shifted to waste manage-

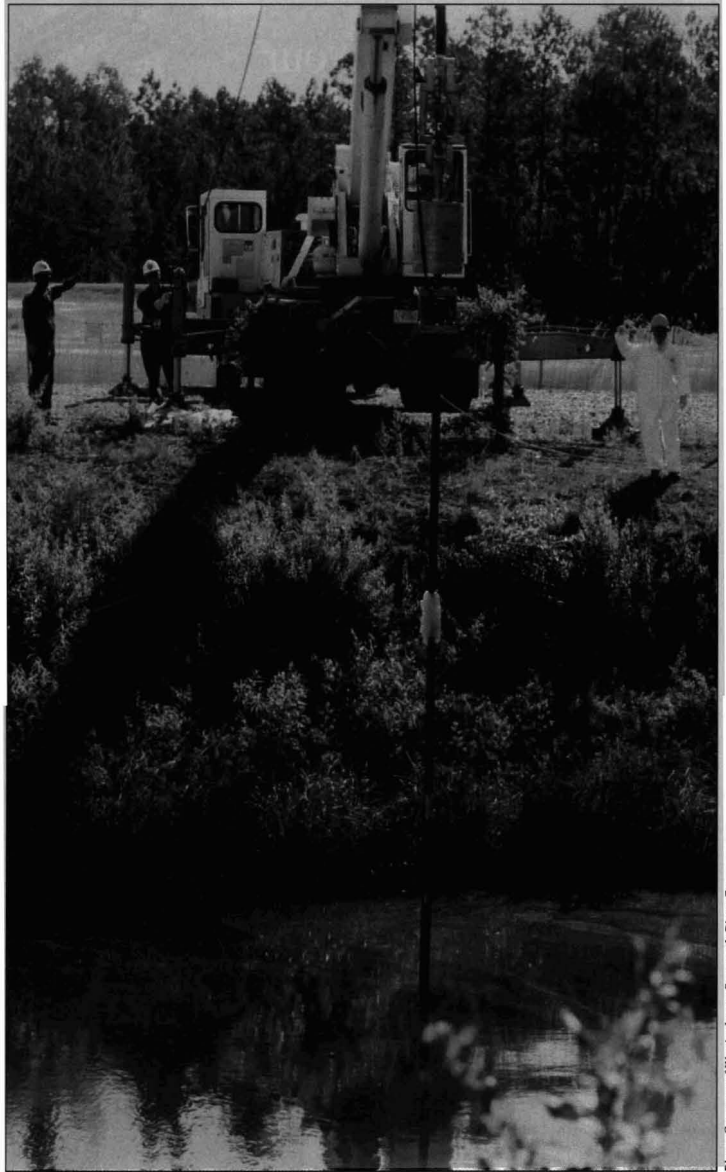


Photo Courtesy of Westinghouse Savannah River Co.

ment and environmental restoration. Savannah River Technology Center—the site's research and development arm—has turned its attention to developing and demonstrating environmental technologies. If a technology solves a common problem, such as VOC contamination, DOE will transfer it to other government facilities and to private industry.

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VOC contamination is one of the nation's most common environmental problems. In the past, federal and industrial facilities used a variety of VOCs as degreasers and cleaning agents, which sometimes resulted in serious soil and water contamination. Traditional technologies such as pump-and-treat have proven only marginally effective in cleaning up contaminated sites to regulatory standards in a reasonable time—and in a cost-effective manner.

From the 1950s to the early 1980s, VOCs used at the SRS site's fabrication facility were disposed of in a settling basin — an unlined, open air pit. As many as two million pounds of solvents may have been disposed in this manner. The solvents (trichloroethylene, tetrachloroethylene) spread from the settling basin through the vadose zone, and entered the groundwater below the basin. An air stripper installed in 1985 stopped the contaminant plume, which occupies about one square mile below the surface, from spreading further. The stabilized contaminant zone makes an ideal proving ground to test new remedial technologies for this common contamination scenario.

The Technology Center uses the site to orchestrate "integrated" demonstrations, in which various technology developers are brought together with independent experts. They work side-by-side in many facets of the demonstration, sharing site characterization, modeling and monitoring information. Cleanup technologies are studied in context with new methods for characterization, monitoring and related evaluation technologies. Successful systems are fine-tuned and scaled-up for use at other federal sites and licensing to the private sector.

In Situ Alternatives

The conventional way to remove groundwater contaminants — pump-and-treat — has been used extensively at SRS. Indeed, more than 300,000 pounds of solvents have been removed from more than two billion gallons of groundwater at the site. But pump-and-treat has its limits. It can be a slow, costly process, with little guarantee of reducing contamination to drinking level standards.

Cleaning up contaminated soil and water in place, rather than removing and treating, promise improved effectiveness while reducing time, cost and worker exposure. At the

SRS Integrated Demonstration, several new in situ technologies using horizontal wells were tested and compared.

Horizontal drilling, developed by the petroleum and utility industries, has proven very effective in conjunction with various cleanup technologies because it provides improved access to the subsurface. Although the wells initially cost more to install, their increased efficiency saves on overall cost. Four different drilling methods were compared for technical performance and cost effectiveness.

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Air Stripping

In the first of many remediation technologies demonstrated at the site, two horizontal wells were installed into highly contaminated soils under an old process sewer line that had leaked VOCs into the subsurface. One well was installed below the water table, within the contaminated zone; air is injected into this lower well. The second well, installed above the water table, is used for vapor extraction.

In the first phase of the demonstration, the upper well was used alone in a simple soil vapor extraction demonstration — basically "vacuuming" contaminants out of the soil. With only the single horizontal well, rather than traditional vertical wells previously

tested at the site, the contaminant removal rate increased five-fold. When air was pumped into the lower well and removed through the upper well, the removal rate increased another 15 percent and added aquifer cleanup to the process.

During the 20-week demonstration, 16,000 pounds of solvents were removed. That feat equalled the work of 11 pump-and-treat wells pumping 500 gallons per minute.

Los Alamos National Laboratory conducted cost analyses of the two technologies — and found a cost savings of approximately 40 percent using horizontal well air stripping over pump-and-treat.

In situ air stripping proved most effective at removing VOCs from the vadose zone, above the water table, spurring them out of the soil before they entered the groundwater. This fact makes it attractive as an enhancement to pump-and-treat systems, in which the older technology is used to control migration of the entire contaminant plume while in situ air stripping is deployed at source areas and hot spots.

Bioremediation Techniques

A concurrent demonstration at the site examined techniques to spur naturally occurring bacteria to degrade VOCs where they lie.

Bioremediation offers several advantages. First, contaminants are destroyed, not merely moved from groundwater to air. The process does not produce toxic "daughter" products such as vinyl chloride and dichloroethylene. Bioremediation can also reduce the cost and time of remediation projects — Los Alamos National Laboratory analyses show that it could take more than 10 years to remove 95 percent of solvent contamination, while bioremediation would take less than four years. At the SRS Integrated Demonstration site alone, this time reduction would represent a cost savings of \$1.6 million. Along with the increased efficiency and decreased cost comes growing public and regulatory acceptance.

To demonstrate bioremediation technology at the site, methane mixed with air was injected through the lower well; gases were extracted from the vadose zone by vacuum and catalytically oxidized to ensure that no VOCs escaped into the atmosphere. The methane/air mixture was held constant; then the methane mixture was alternated with

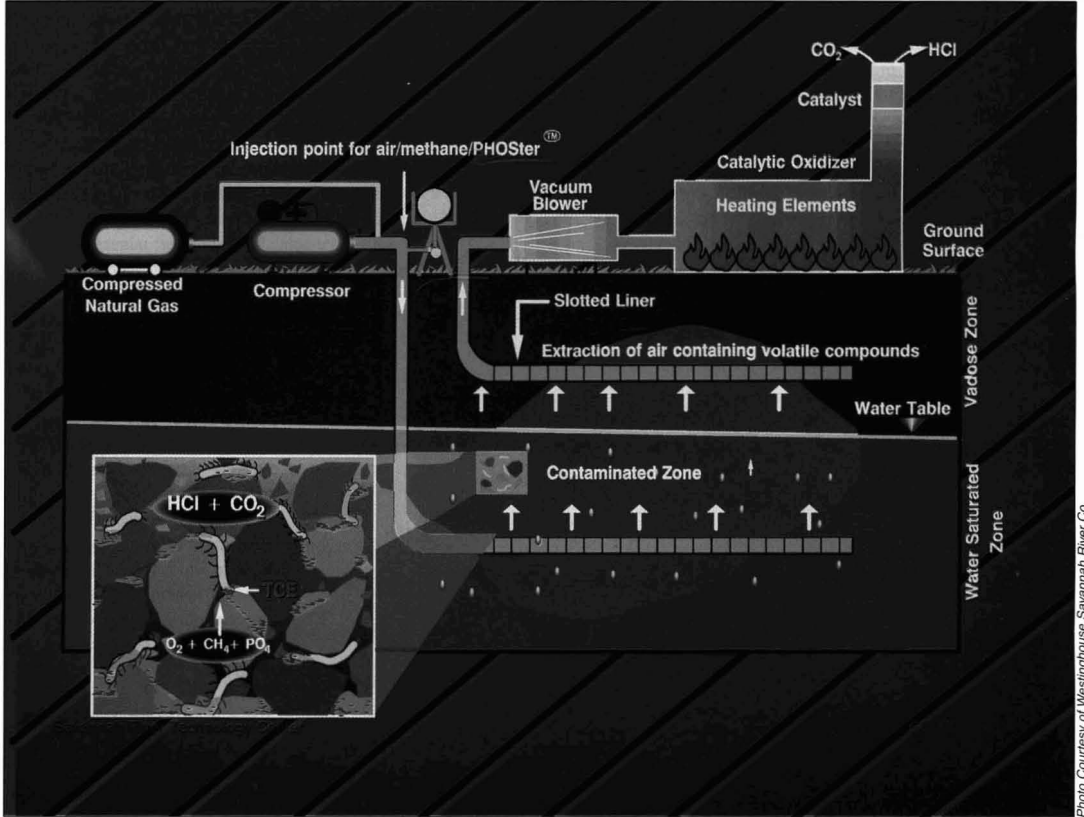


Photo Courtesy of Westinghouse Savannah River Co.

A demonstration project at DOE's Savannah River Site combines air stripping and bioremediation to treat solvents-contaminated soil. The system uses phosphate to enhance microbial degradation.

plain air on eight-hour and 36-hours shifts. Pulsing proved to be more effective than a constant flow of methane. First, the methane stimulated bacterial growth. When it was taken away, the stimulated bacteria turned to VOCs for nourishment.

Phosphate Added

In a later refinement, phosphate, another bacterial nutrient, was added to the injected air. The mineral, which fuels biomass growth and reaction rates, was shown to reduce the time needed to destroy contaminants.

Working with Oak Ridge National Laboratory, Pacific Northwest Laboratory, the University of Tennessee and Ecova Corp., the SRS team developed a system called PHOSter, which involves controlled addition of a relatively safe form of organic phosphorus (normally triethyl phosphate) to the injected air. This provides for a more uniform "time release" stimulation. The addition resulted in major improvements in the in situ destruction of chlorinated solvents. In another test, by a customer who used the

PHOSter technology at a petroleum bioventing site, the result was a five-fold increase in the bioremediation rate in the first 40 hours.

The demonstration yielded a marked decrease in the concentrations of TCE and PCE. Water contamination decreased by as much as 95 percent, below drinking water standards and even below the detectable limit of two parts per billion in some wells. Concentrations in soil gas declined by more than 99 percent; by the end of the demonstration, we were unable to detect any soil gas concentrations of contaminants in most areas. Sediment concentrations of TCE and PCE declined from 100 parts per billion to non-detectable concentrations in most areas.

Licensing Opportunities

DOE has received a patent on the bioremediation technology and 14 companies have purchased licenses to use it. One, Phillip Environmental Services Inc. (formerly Burlington Environmental), is already successfully applying it at a private industry cleanup site and is also using the technology

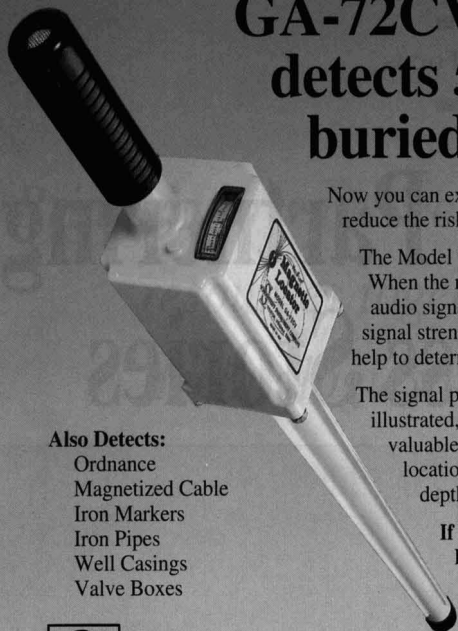
as the basis for bids on several additional remediation projects.

DOE actively encourages the sharing of expertise with private industry, either through licensing agreements like these, or through Cooperative Research and Development Agreements. Moving the technologies developed or demonstrated at SRS into the marketplace is one of the best ways to ensure that the nation gets full benefit from its investment in the site.

New technologies hold great promise for our ability to clean up and restore the environment. To be used effectively, however, they must be chosen carefully, with great attention to applying the right technology to a given problem. When a technology is adequately demonstrated, using our federal facilities as a test bed, these decisions can be made with confidence.

Terry Hazen, Ph.D., is a Fellow Scientist at the Savannah River Technology Center, Aiken, S.C., specializing in environmental microbiology and bioremediation.

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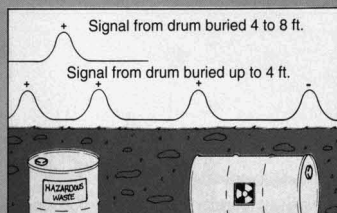
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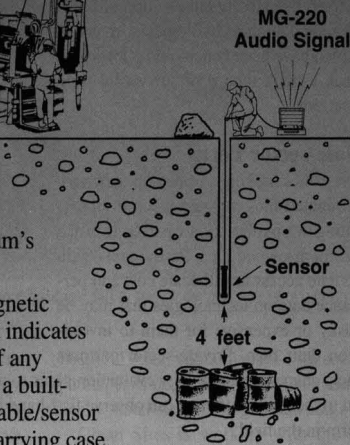
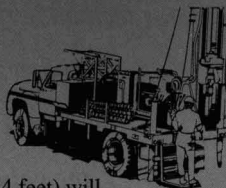
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Public-Private Partnering Gains Success Stories

By Jessica Cogen

Public-private partnerships are fast becoming a preferred way to develop innovative remediation technologies. Many companies, including AT&T, Dow Chemical, General Electric, Phillips Petroleum, Southern California Edison and Xerox are taking part in such programs, which seek to harness both private-sector and public resources to spur development of innovative remediation technologies.

In recent years, Clean Sites, a non-profit organization that seeks to improve the process of cleaning hazardous waste sites, has worked under a cooperative agreement with EPA's Technology Innovation Office to develop these partnerships. One key aim is to gather hard data on performance and costs for full-scale implementation of innovative remediation technologies — many of which have been bench- and pilot-tested but lack a track record of successful field applications.

Private-sector Perks

Companies seeking to clean up their own contaminated sites can gain much from participating in a public-private partnership at a government-owned site. Participants gain immediate access to full-scale cost and performance data on technologies that may be too risky or expensive for them to investigate on their own. Private-sector partners can help shape the technology evaluation plans to make them meaningful to their own sites and can observe first-hand how technologies perform in the field.

Another important benefit is the close involvement of federal and state regulators in these partnerships. By participating, private firms gain access to federal and state technical expertise and opinions on remediation problems. This degree of interaction can lead to new ideas and a better understanding of the issues regulators must consider in making decisions concerning site remediation. If remediation technologies meet the cleanup objectives at partnership sites,

the regulators involved have an incentive to approve the technology's use at similarly contaminated sites elsewhere. When private companies return to their own sites, they can propose to their regulators a technology with an established record of regulatory reviews and approvals.

Partnering with the federal government also increases opportunities for funding a full-scale demonstration. DOD, DOE, and EPA each invest significant resources in the demonstrations. In one case — the McClellan Air Force Base Public-Private Partnership — on-site activities are funded almost exclusively by the U.S. Air Force and EPA.

Future Partnerships

Three new public-private partnerships are currently being developed by Clean Sites: **Joliet Army Ammunition Plant.** Located outside of Joliet, Illinois, the Joliet Army Ammunition Plant is an Army ordnance manufacturing plant and depot. Shallow soil and groundwater at JAAP are contaminated with explosives and metals. Innovative remediation technologies at the facility will be influenced by its future land use.

An Illinois commission has recommended that the site's 37,000 acres be divided into two industrial parks, a National

Cemetery, a county landfill, and the balance to Federally or State-managed conservation and recreation areas.

Several private companies, including Alliant, DuPont, Hercules, ICI, and Thiokol have indicated an interest in partnering with the U.S. Army, EPA and the State of Illinois to evaluate innovative approaches for remediating the site.

Massachusetts Military Reserve. Groundwater at the Massachusetts Military Reserve (MMR) in upper Cape Cod, Massachusetts, has been contaminated by a variety of industrial practices over the last 50 years. Three plumes targeted by the project contain

*By working
collaboratively to shape
technology development
and evaluation,
the partners enhance
the value of cost
and performance data —
and applicability
to other sites.*

Bringing private sector know-how and federal resources together to spur cleanup technologies is winning converts.



More than 200 remediation managers, technology developers and others gathered at McClellan Air Force Base last fall to review the progress of two innovative technology demonstrations.

Photo Courtesy of Clean Sites

tetrachloroethylene, trichloroethylene, dichloroethylenes, and dichloromethane.

Under the partnership, MMR will implement an experimental remediation technology – which incorporates a passive wall of fine iron particles that stimulates the reductive dechlorination of certain solvents – and pay all costs associated with site cleanup. Participating companies will provide input on the technical issues relating to design and monitoring of the field-scale system

and may share the cost of the evaluation program. EPA may evaluate the technology and prepare a report to the public and EPA regional offices. State agencies may serve as regulatory and technical advisors and work with EPA to disseminate data to technical and regulatory staff, and to the public.

Naval Air Station, North Island. The Naval Air Station, North Island, San Diego, has 12 sites targeted for restoration. Of particular interest is Site 9, the Chemical Waste

Disposal Area, contaminated with solvents, paints, caustics, acids, plating solutions and heavy metal sludges, degreasers and oils.

Clean Sites is working with the Navy Environmental Leadership Program to identify, test, and evaluate innovative remediation technologies at the facility. One technology, catalyst-enhanced bioremediation, has already been identified for potential partnership evaluation. Additional technologies will be reviewed in summer 1995.

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Current Partnerships

Field work is already underway at three public-private partnerships: McClellan Air Force Base, DOE's Pinellas Plant and DOE's Paducah Gaseous Diffusion Plant.

The partnership at McClellan Air Force Base in Sacramento is evaluating two promising hazardous waste cleanup technologies: Two-Phase Extraction — a high vacuum extraction system for remediation of volatile organic compounds in soils and groundwater; and a photolytic destruction process that uses ultraviolet light combined with a chemical reaction to destroy vapor-phase chlorinated hydrocarbons.

At the Pinellas Plant, a former weapons component manufacturing complex in Pinellas County, Florida, contamination includes trichloroethane, methylene chloride, and vinyl chloride, in a very shallow, sandy aquifer covering approximately three acres at the plant. Innovative technologies that could be tested at the site include rotary steam drilling, dynamic stripping, in-situ anaerobic bioremediation, and membrane separation. Selected innovative technolo-

gies will begin their demonstrations this fall, with evaluations expected to run between one and two years.

Funding for the partnership is provided by DOE's Office of Environmental Restoration and the ITRD Program. Research efforts being conducted by some of the private partners are funded jointly by the ITRD Program and private partners themselves. The private partners are also contributing significant research and development experience to the technology evaluation.

Installation of a large-scale electro-osmosis test is underway at a TCE-contaminated site at DOE's Paducah Gaseous Diffusion Plant. The demonstration, which will operate throughout the winter, is being conducted under a DOE contract with Monsanto. The goal is to jointly research, develop, and demonstrate the ability of the so-called "Lasagna" technology to treat multiple contaminant types in situ. Named for its layered structure, this technology relies on low-voltage electrical current to move contaminated groundwater through specialized treatment zones. Depending on

contaminants and site conditions, the system can be designed to move groundwater either horizontally or vertically through the zones.

Technical papers reporting the results of this test will be developed and made available to the public through DOE and Monsanto. Phase II, pursuing bioremediation techniques, will take place at two U.S. Air Force Base sites offered through the Air Force Center for Environmental Excellence.

These partnerships mark the first time that potential users, developers and communities near sites are working together to try new technologies. There is much to be gained for all involved in this cooperation. By working collaboratively to shape technology development and evaluation, the partners enhance the value of cost and performance data — and applicability to other sites. Success at these sites may well pave the way for better, faster and cheaper cleanups.

Jessica Cogen is manager of public affairs with Clean Sites, Alexandria, Va.

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Photo courtesy of Groundwater Technology

Cost or risk factors may influence site managers to consider aggressive cleanup methods.

Using Ozone to Speed Up Air Sparging

When time is of the essence, substituting ozone for air can make fast work of in situ sparging of organics-contaminated soil and groundwater.

By Christopher H. Nelson

Typically, the objective of soil and groundwater remediation is to achieve compliance at the lowest possible annual cost. But in some instances, time may be more important than money. When potential liabilities involve too much risk, a facility may opt to eliminate the risk as soon as possible. Or, environmental liabilities at a site may stand in the way of unrestricted property use or transfer. A site owner may even calculate that a quick cleanup will achieve the lowest total cost for remediating the site.

Aggressive Techniques

Whatever the motivation, aggressive treatment technologies occupy an important niche in the remediation arsenal. And over the past five years, one such technology, soil vapor extraction (SVE), has been widely used to quickly remove volatile organic compounds and promote bioremediation of semi- and non-volatile compounds in unsaturated soils. An

otherwise successful advancement in in situ remediation, SVE is hampered when the contamination lies in saturated soils, which present a barrier to vacuum-induced air flow.

More recently, SVE technology has been enhanced by providing a controlled injection of air into the saturated zones to maximize contact with contaminants. This subsurface injection technique, called "sparging," can finish in less than two years what would have taken 5-10 years to clean up with pump and treat systems.

The newest enhancement – one that promises to speed in situ treatment of organics-contaminated soil even further – involves use of ozone. Careful application of ozone in sparging treatments can remove recalcitrant organic compounds, such as chlorinated ethenes and complex aromatics which are often resistant to more traditional approaches such as aerobic bioremediation and volatilization.

Ozonation, as it's known, promises to be a "power tool" that

can aggressively treat contamination and yield a rapid cleanup. It also holds value as a final polishing step to bring contamination to regulatory target levels when removal rates by traditional means have declined.

Oxidizing Ability

When ozone, a highly reactive gas, is sparged into hot spots of contamination, what used to take years to clean may be accomplished in a matter of months. There are several reasons: when ozone makes direct contact with contaminants, oxidation occurs very rapidly, often in seconds; ozone is 12 times more soluble than oxygen in water, so it dissolves easily in groundwater when properly mixed; complex organics are generally broken down to carbon dioxide, water or simpler molecules that are amenable to secondary aerobic biodegradation; ozone gas moves easily through soil and groundwater when introduced properly.

Over the past two years, Groundwater Technology has used ozonation in 15 laboratory and field studies at diverse sites rang-

ing from Montana to Australia. Removal efficiencies ranging between 35 and 98 percent have been achieved in a matter of months for contaminants resistant to conventional on-site treatment systems such as bioremediation and volatilization. More pilot testing, laboratory studies and the first commercial applications will take place later this year.

Key Applications

Ozonation is likely to be used as a key component within an integrated, multi-technology treatment system, rather than as a stand-alone technology. For example, a proposed approach for site restoration involves removing high concentrations of contaminants with air sparging or separate-phase recovery. Ozone can be used at this stage for rapid degradation of contaminants not readily treated with volatilization. Introducing ozone in the saturated and unsaturated zones can quickly complete the degradation of residual solvents. It can also be applied in a vapor reactor to ensure all harmful off-gases have been destroyed and

Ozonation: How It Works

Ozone oxidizes organic contaminants in two ways: by direct oxidation and by generating free radical intermediates such as hydroxyl radicals. Contaminants most conducive to direct oxidation include aromatics such as PAHs and chlorinated ethenes such as trichloroethylene and dichloroethylene.

A wider range of organic contaminants can be oxidized by free radicals, including halogenated solvents, pesticides and aliphatic hydrocarbons. Free radicals are commonly formed by decomposition of ozone in water under alkaline conditions, exposure of ozone to UV radiation, and reaction of ozone with hydrogen peroxide.

The generation of free radicals is directly related to site-specific soil and groundwater conditions. The concentration of free radicals can be limited by the presence of high organic carbon, alkalinity (in the form of carbonates and bicarbonates) and certain metals. Treatment rates for free radical reactions are generally much faster than direct ozone reactions.

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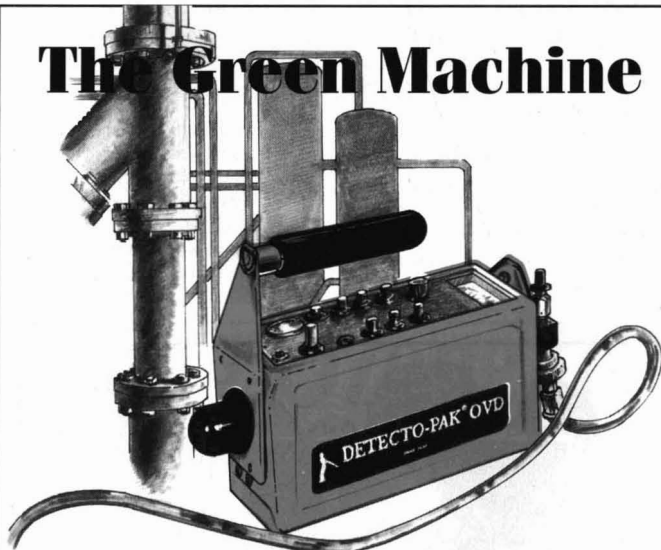
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used aboveground to remediate soils in engineered treatment cells.

Ozone can even provide a boost to bioremediation. Ozone decomposes to oxygen, which is necessary for aerobic bioremediation. It can also break down some contaminants into constituents more amenable to bacterial degradation. At high concentrations, however, ozone can act as a sterilizing agent and stifle microbial activity.

Not a Cure-all

Of course, ozone does not react effectively with all contaminants at all sites. The key to using ozonation is a treatability study. The study determines if ozonation will work within a site-specific soil or groundwater matrix, and what design and operational steps might be utilized to enhance system performance.

There are several health and safety concerns in using ozone to treat contaminated soil and groundwater. Ozone is very reactive and will attack incompatible system materials. Also, it is an OSHA-regulated substance that requires control of ambient discharges and strict adherence to health and safety procedures.

A Promising Tool

The power of ozone for treating organics has been known for more than 100 years. The Dutch began using ozonation as a disinfectant and to remove organics from drinking water in 1893. This application is still widely used today. Ozone has also been used to treat organics in industrial waste streams. What's novel is the application of ozone to treat hazardous wastes on site.

At present, the best commercial candidates for ozonation are sites with chlorinated solvents, polycyclic aromatic hydrocarbons (PAHs) and PCP. A substantial body of research exists on these contaminants, and they are proving to be highly treatable with ozone. Because the application of in situ ozonation is closely connected with air sparging, companies that have ongoing air sparging systems are ideal candidates for ozonation, if faster or more thorough removal is desired.

In the past decade alone, new treatment technologies have halved the time needed to treat many environmentally impacted sites. Ozonation could well halve treatment times once again.

Christopher H. Nelson is technology commercialization manager with Groundwater Technology Inc., based in the company's Norwood, Mass. headquarters.

Case Study:

Vacuum Extraction Harnessed for Emergency Cleanup

When benzene was found in the municipal drinking water of a Louisiana municipality, there was no time to waste – and aggressive use of two-phase vacuum extraction solved the problem in a month's time.

By Michael J. Costa

Editor's Note: The cleanup project described below was selected by the Consulting Engineers Council of Pennsylvania for a 1994 Engineering Excellence Honor Award.

A routine groundwater quality investigation conducted by the Louisiana Department of Environmental Quality in 1993 revealed water supply contamination in a municipal well. Underground gasoline storage tanks, which had been removed in 1990, were the suspected source of the contamination. The tanks sat just 70 feet away from one of the city's water supply wells, and testing revealed gasoline hydrocarbons, including benzene, in one of the wells.

While the hydrocarbon concentrations were within regulated levels, state authorities asked the former tank owner to investigate. At that point, my company, BCM Engineers, was called in to trace the source and pathway of the hydrocarbons, recommend response actions, design, install, and initiate a cleanup, conduct sampling and document results.

We collected and analyzed soil samples and constructed wells to collect and analyze water samples and determine the hydraulic characteristics of the groundwater system. It became clear that the site of the former USTs was in fact

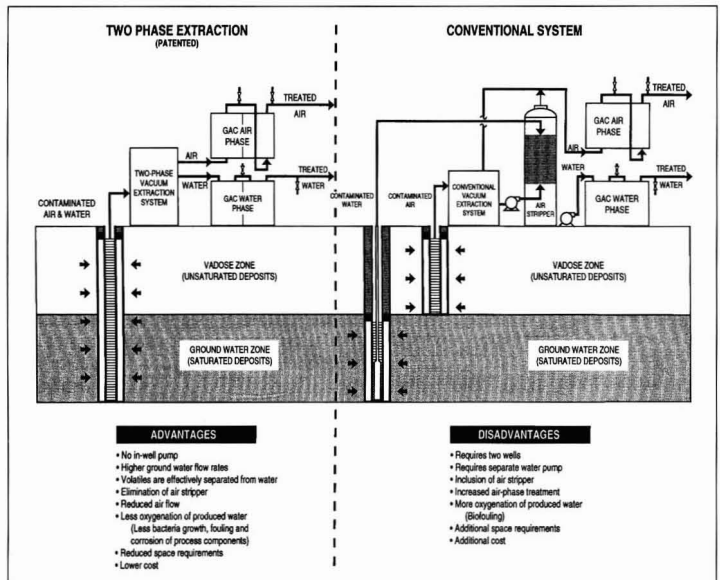


Illustration courtesy of Smith Environmental Technologies Corp.

the source of the hydrocarbons; that significant quantities of hydrocarbons were still present in the shallow soil and groundwater; that those hydrocarbons were likely to migrate towards the well; and that cleanup of the source area was essential to restore groundwater quality.

The traditional response to this type of contamination has been to treat the tainted water at the wellhead – using carbon adsorption or air stripping, for example. But experience has shown that many years of treatment is often needed and the annual cost of maintenance,

Vacuum Extraction

monitoring, and reporting can reach tens or hundreds of thousands of dollars. Our goal was to provide a rapid treatment solution at a low one-time cost.

Vacuum Extraction Selected

We chose to remove the highest concentrations of hydrocarbons in the soil and groundwater using Two-Phase Vacuum Extraction (TPVE). The technique extracts vapor (Phase 1) and liquid (Phase 2) from the subsurface by applying a vacuum to a well or trench in the contaminated region to induce flow out of the

well or trench. The vapor flow through the ground causes the volatilization of some substances that may be present in the vadose zone and can accelerate the natural biodegradation of others. The water flow out of the ground helps remove substances dissolved or suspended in water and can help to control or reverse the spread of a groundwater plume.

With TPVE, two-phase flow is established by controlling the flow of air and vapors into the trench conduit or well casing so that they enter at the rate needed to carry liquids to the point of removal. Air/vapor flow is controlled

by the selective placement of screening, taking into account the hydrology and the pneumatic conductivity of the site. A priming method can also be used. Since liquid is transported pneumatically, no mechanical pumps are needed in the subsurface. Equipment and maintenance requirements are fairly straightforward compared to other soil and groundwater remediation technologies.

One major benefit of TPVE is that the rate of liquid extraction can be greatly increased over that of conventional pumping. The application of vacuum to a well or trench increases the driving force (head) that causes liquids to flow in the subsurface hydraulic system. Liquid flow is further accelerated by entrainment by the vapors sucked to the TPVE extraction point. The combined effects of increased driving force and entrainment can result in a hundred-fold increase in the yield of a low-yielding aquifer. Increasing the yield of a groundwater extraction point has the beneficial effect of creating a greater capture zone so that fewer extraction points are needed to achieve hydraulic control of the contaminant plumes.

A second benefit of TPVE is that it lowers the water table, exposing contaminants that were previously trapped below the water table. This results from the greater total head pressure and from eliminating the maximum drawdown constraint of mechanical water pumps.

Speedy Cleanup

BCM recommended a one-month emergency response action at the site, using TPVE to remove hydrocarbons from the shallow subsurface and to minimize the potential for continued migration to the deeper portion of the aquifer.

With Louisiana's approval, we commenced the cleanup. One month's operation resulted in the removal of 450,000 gallons of contaminated groundwater and more than 1,000 pounds of hydrocarbons. The speedy removal of contaminated water and the bulk of the hydrocarbons and quick restoration of groundwater quality exceeded all expectations. The Rayville water supply was remediated within a one-month period for less than \$30,000. Analysis of water samples showed no detectable benzene more than a year after the cleanup ended.

Michael J. Costa is lead design engineer for TPVE projects with Smith Environmental Technologies Corp. (formerly BCM Engineers Inc.), in their Plymouth Meeting, Pa. office.

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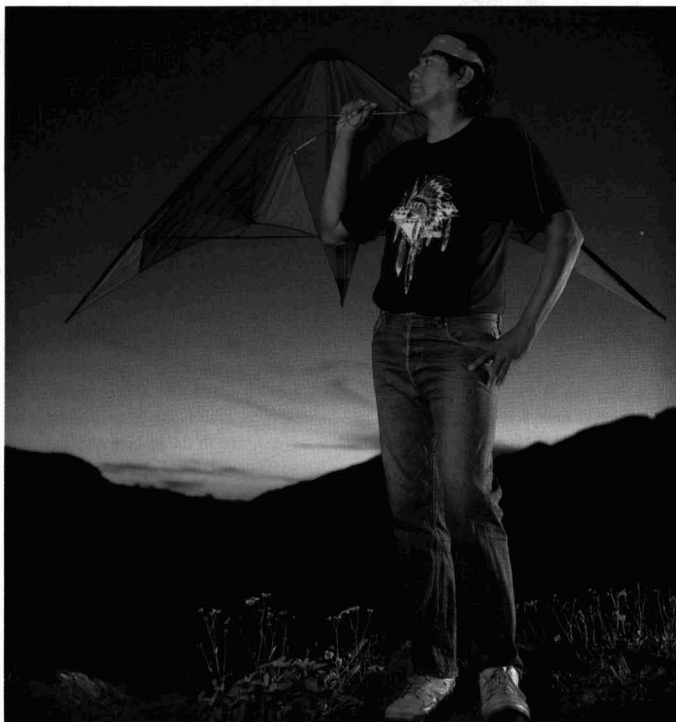
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Sky King.



Frank McCowan, a Mohave, keeps an eye on the sky, as well as on operations at Westates Carbon reactivation facility built on Colorado River Indian Tribes land, Parker, Arizona.

"Trust the sky to tell you when something is wrong. The sky is beautiful and very clear here. Except when the smoke blows in from the fires at Santa Ana, some 400 miles away." Frank McCowan, a full Mohave Indian, lives once again in his ancestral home, the Colorado River Indian Tribes reservation. "I came back here from a big city because the sky was polluted." It is only natural that Frank feels as much at home in the sky as he does on the ground. An ardent basketball player and kite flier, he is always striving to get airborne, to reach a little higher. Frank is also the head operator for our Westates Carbon reactivation facility, located entirely on the reservation. "The plant recycles used carbon, making sure that impurities are safely removed. Getting approval for this plant was not easy. We are very protective of the land here and 'Avil Asquil', our sacred mountain, stands only a few miles from this spot. So the plant had to meet our strict tribal guidelines as well as pass all federal and state restrictions. I know everything is right with this plant because I also helped to build it. As a Mohave, I have a sense of being part of a great scheme. It is in my blood memory. The sky, the water, the land belong to us only as long as we belong to them. Many things are different today, but these universal truths remain the same."

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Commentary

Scott H. Segal

EPA's EM Rule: Gone Too Far?

The implementation of the Clean Air Act Amendments of 1990 has recently come under intense Congressional scrutiny as the U.S. Environmental Protection Agency is forced to consider the twin reform objectives of risk assessment and cost-effectiveness. Indeed, the Senate Republican Regulatory Relief Task Force listed pending Clean Air regulations among its top two worst-case examples of regulatory abuse. And the House Majority Whip has even proposed repealing the 1990 Amendments altogether.

In recent testimony, EPA Administrator Carol Browner responded to these criticisms by pledging to implement the Clean Air programs flexibly and to eschew an "out-moded, top-down, one-size-fits-all solution to every environmental problem." Unfortunately, as EPA undertakes the implementation of its "enhanced monitoring" (EM) program, many of the same claims of regulatory excess are being made.

Some Specific Objections

Based simply upon two words in Section 114(a)(3) of the Act, the EM proposal has been used to justify a far-reaching continuous monitoring program for stationary sources that many industry critics believe is un-

justifiable on a cost-benefit basis. Even after extensive presentations by the regulated community, EPA persisted in proposing a program based upon protocols under which the stringency of the underlying regulations are increased.

Among the many groups that have commented upon the EM proposal, is the Gas Processors Association (GPA), a group of 150 companies engaged in the processing of liquid products from natural gas. The GPA recently pointed to these specific objections:

- **Use of Protocols:** In its current form, the proposed EPA program is based upon the use of "presumptively approvable protocols" which are to be developed by EPA. Even with the use of these protocols, it is inevitable that innumerable case-by-case protocol reviews will be required by a state agency, due to the diverse emission sources and variety of equipment used by owners and operators, not only in the natural gas liquids industry, but in other industries as well. Due to the complexity of the EM program requirements – easily the equivalent of the Internal Revenue Code – it will be nearly impossible for a permittee to predict reliably the outcome of its EM plan submittal. Because an EM plan may be part of the

continued on page 49

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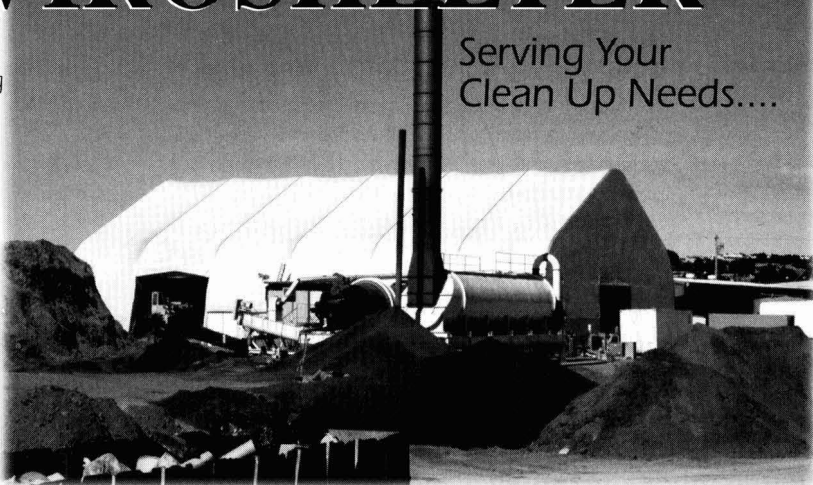
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Enhanced Monitoring: A Compliance Primer

The EPA's proposed rule on Enhanced Monitoring is among the most far-reaching requirements under the Clean Air Act Amendments of 1990. The objective of the EM rule is to create a continuous means of certifying compliance under CAA's Title V Operating Permit Program. The rule is complex, requiring companies to develop their own monitoring protocols. It will likely result in substantial monitoring costs to industry.

When adopted in final form, the EM rule will be codified in a new Part 64 of 40 CFR. But the final rule, already delayed once while EPA sought further comments, could be pushed back further as concerned state and industry representatives continue to request changes. Most recently, EPA proposed a phased-in approach that would implement EM rules over a five-year period. Under this proposal, facilities would be required to meet EM regulations under EPA protocols – non-mandatory guidelines that apply to specific industries. Changes afoot in Congress, including a proposed regulatory moratorium, could further delay the rulemaking.

When it does become effective, the EM Program will be implemented primarily through the Title V Operating Permit Program, as well as through state preconstruction programs for new and modified sources (under Subtitles C and D of Title I). Sources will have to suggest EM protocols in their operating permit applications. State Implementation Plans (SIPs) will be revised to clarify that other testing and monitoring methods may be used for determining compliance with standards.

EM Objectives

The rules establish a process for choosing monitoring methods and require that monitoring data be used for determining and certifying compliance as either continuous or intermittent over a given period of time. The stringency of the underlying limitation or standard will not change.

EM will make enforcement much easier for EPA, states and citizens and substantially increase liability exposure for affected facilities. EPA has stressed some of the net benefits associated with the EM program, including their claim that it will lower the long-term overall cost of air pollution control by decreasing the need for command and control regulations. Better monitoring will also help cut operating costs by alerting owner/operators to potential control

device or operating process problems, the agency says. And the program could pave the way for emissions trading and other economic incentive programs by generating detailed baseline emissions data.

Industry representatives have countered that the cost of installing and operating continuous emissions monitoring systems are prohibitive.

In a July 15, 1994 letter to EPA Administrator Carol Browner, representatives of the American Petroleum Institute, the Chemical Manufacturers Association and other industry groups expressed "grave concerns" that the rule would "derail the Title V program ... by imposing massive additional burdens on the states."

Who's Affected

The enhanced monitoring program's applicability provision is contained in Section 64.1. Applicability is based on characteristics of the facility and particular emissions units at the facility.

The latest version of the proposed EM rule would apply only to emission units with the potential to emit more than 100 percent of the applicable "major source" threshold. The original proposed rule would have applied to units with potential emissions exceeding 30 percent of the major source threshold. The applicable emissions levels at unit sources are still subject to change, however.

For example, in an attainment area where a major source emits 100 tons per year (tpy) of a criteria air pollutant, enhanced monitoring is required for any emissions point that is subject to federally enforceable limits and has the potential to emit 100 tpy. In a serious non-attainment area, on the other hand, where a major VOC source emits 50 tpy, EM is required for any applicable emissions unit or point that has the potential to emit 50 tpy.

EM will not be required at all major sources, however. Many large sources contain numerous emissions units and although aggregate emissions may be high, emissions from any particular unit may be low.

To ensure that emission reductions, whether under a "bubble" formula or other averaging scheme, are actually achieved, the source must add the emissions potential of all the units included in the averaging or trading scheme. If the total number exceeds 30 percent (or 100 percent, if revised as anticipated) of the major source threshold, enhanced monitoring must be conducted at all of the units. Industry representatives are clearly not happy with this provision, since

By Daphne V. Economou

Enhanced Monitoring

in their view it would discourage use of more cost-effective market-based emission reduction methods. The expected increase in the applicability threshold should improve this situation.

Fugitive emissions – releases from sources other than stacks or vents – may be looked at collectively on a process-wide or a facility-wide basis. If collectively they exceed 30 percent (100 percent under the proposed revisions) of the major source threshold, they're subject to Part 64 requirements. Multiple point monitoring of fugitive emissions is allowable, but might not be cost-effective, especially if these hard-to-measure emissions constitute a large percentage of the source's total emissions. Thus, protocols may include facility-wide visible emission observations; source-wide work practice standards; or operation and maintenance procedures.

All emissions units covered by Hazardous Air Pollutant (HAP) standards promulgated before the 1990 CAAA Section 112 (i.e., those NESHAPs found in Part 61 of 40 CFR) will be subject to EM obligations. That does not necessarily mean that the existing monitoring requirements found in the pre-1990 NESHAPs

will be considered "enhanced," however. Unlike the "Maximum Available Control Technology" (MACT) and "Generally Available Control Technology" (GACT) standards, there is no assurance the NESHAP specifications will meet EPA's concept of enhanced monitoring.

Enhanced monitoring requirements do not apply to the following: HAP sources subject to new Section 112 CAAA provisions (40 CFR Part 63); HAP sources that achieve early reductions; stratospheric ozone-depleting substances such as chlorofluorocarbons (CFCs); and asbestos demolition and renovation.

For HAP sources subject to 40 CFR Part 63, EPA will incorporate enhanced monitoring requirements directly into the standard itself. For example, the MACT and GACT standards will include extensive monitoring provisions. Therefore, Part 64 does not apply.

For HAP early-reduction-program participants, EPA believes that the monitoring required pursuant to the permits program is enough "enhancement."

But the early reductions program is a temporary program, and these early reduction partici-

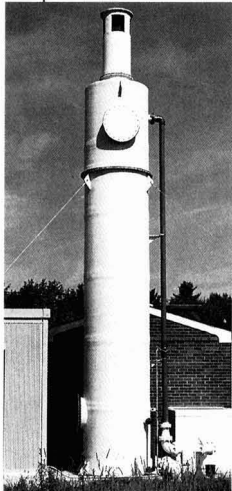
pants will ultimately need to comply with the new standards.

Vague Wording

EPA's proposed rule is deliberately vague as to what "enhanced" means. The preamble states that this determination will depend on the circumstances at the particular emissions unit. In order to achieve "continuous" compliance, EPA says the EM protocol also requires data collection and analysis capable of quickly detecting emission deviations. A facility that thinks its existing or planned monitoring is already "enhanced" should be prepared to show that it meets this litmus test.

The proposed rule requires that facilities specify technical criteria for meeting EM protocols – and demonstrate that their proposed EM protocol is best for each emissions unit. This option provides significant flexibility in proposing the best type of monitoring for the specific process. Companies should evaluate several site-specific factors, such as emissions unit, control system design, facility operating processes, the demonstrated margin of compliance, and the potential variability of emissions.

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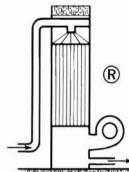


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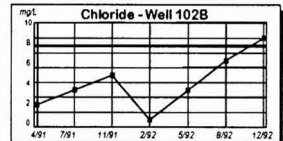
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EPA encourages the use of previously established EM protocols. In their view, use of established monitoring protocols would decrease the review burden for permitting authorities and increase standardization in the selection process. If an established EM protocol is not appropriate, however, the affected facility must suggest an alternative. EPA will release EM protocols covering a variety of industries – among the first to be released will cover industrial boilers, some coating operations, and certain sources subject to new source performance standards.

To select an EM protocol, companies should first research EPA protocols, Control Technology Guidelines (CTGs), and/or NESHAPs for similar processes. EPA's draft "Enhanced Monitoring Reference Document" will provide additional information and guidance. In addition, EPA has proposed a national clearinghouse and electronic database which will contain acceptable EM protocols for various processes.

Certification Requirements

Compliance certification under Title V pro-

vides two options: continuous or intermittent. Compliance certification must be conducted with the original application submittal, and at least once a year thereafter. In addition, quarterly monitoring reports must be submitted for each EM protocol. All enhanced monitoring records must be maintained for five years.

If monitoring data is missing, or a violation of a limit or standard occurs due to malfunction, act of God, start-up/shut-down or other federally acceptable deviation, an owner/operator would be able to make a certification that the facility is in compliance but that compliance was on an intermittent basis. In the quarterly report, the facility owner/operator would notify the agency summarizing any deviations from the protocol. The operator would identify the deviation duration and indicate that there was some excusable explanation.

Are There Alternatives?


While EPA's proposed rule saddles affected facilities with new monitoring burdens, the best way to avoid the regulatory burden is to reduce emissions below prescribed thresholds. Limiting production through federally

enforceable permit restrictions and other emissions control methods can help in this regard. Some common controls include scrubbers, bag houses, oxidizers, adsorption units, emission control seals, biotreatment technology, cyclones, valve seals/sleeved valves, electrostatic precipitators, and other combustion devices.

Regulators hope that the EM rule will improve compliance with standards that did not previously require much emission monitoring – and make enforcement much easier for EPA, states and citizens. Industry representatives will continue to negotiate with the states over EM terms, which they consider impractical and too complex.

States have the flexibility to be more stringent than the EPA, however, EPA hopes to guide consistency throughout the states by having the general criteria set out in Part 64 and by providing the states with guidance in the EM reference document.

Daphne V. Economou is an air quality manager with Dallas-headquartered environmental consulting firm CURA Inc.



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Secondary Containment and Leak Detection: A Great Marriage

New tank designs, including double-walled tanks, simplify leak detection and minimize contamination risks.

By Wayne B. Geyer and Wayne A. Stellmach

The past decade has seen a proliferation of sophisticated release detection systems for both underground and aboveground storage tanks. But leak detection alone will not ensure against contamination. The storage tank owner who has to spend \$100,000 or more to clean up contaminated soil – and much more if groundwater becomes tainted – could have avoided real headaches by investing in sound secondary containment in addition to leak detection.

Combined with release detection devices, secondary containment provides the best insurance for UST owners through containment of the primary tank and its piping. We call this a great marriage between two technologies – and EPA agrees.

Monitoring Your Tank

Interstitial monitoring – checking the spaces between the secondary containment and main tank – can only be done if the system is designed, constructed and installed to detect a leak from any portion of the tank that “routinely contains product.” Double-walled tanks must incorporate a sampling or test method that can detect a release. Some of the most common methods for interstitial leak detection include positive- or negative-pressure testing of the inter-

stice or liquid sensing devices that can sense water or hydrocarbons. Other technologies include devices that optically “see” the liquid or sense liquid pressure forming in the bottom of a release detection port.

The “low-tech” method is simply to tie a rag to the bottom of a gauge pole and insert it into the interstice every 30 days to check for existence of any liquids.

Typical Choices

Underground secondary containment tanks come in a two basic varieties. A “Type I” tank – as defined by Underwriters Laboratories – is a primary tank wrapped by an exterior shell that is in direct contact with the primary tank. The exterior shell might or might not wrap the full 360-degree circumference of the primary tank.

A Type II tank is wrapped by an exterior shell that is physically separated from the primary tank by

standoffs and wraps the full 360 degree circumference of the primary tank.

The technology for secondary containment of steel UST’s has advanced significantly over the past 15 years, and under today’s standards, several types of secondary containment tank constructions are permissible. All these

continued on page 37

Combined with release detection devices, secondary containment provides the best insurance for UST owners through containment of the primary tank and its piping. We call this a great marriage between two technologies – and EPA agrees.

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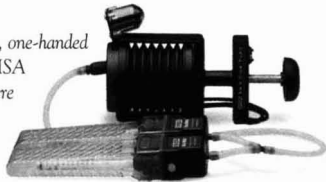
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Leak Detection

continued from page 34

technologies incorporate some sort of corrosion control along with containment protections. Common materials used to contain steel primary tanks are steel, fiberglass reinforced plastic (FRP) and high density polyethylene (HDPE).

Among double-walled steel tanks, the most common are the sti-P3, a Steel Tank Institute quality control standard for a pre-engineered, factory-fabricated, cathodically protected steel storage tank. Another popular standard is the ACT-100, which is an STI specification for external corrosion protection of FRP composite steel USTs.

Another type of containment system is a jacketed tank where the outer containment is not steel but a plastic material such as FRP or HDPE. Two of the more widely known systems are the Permatank system (utilizing FRP) and Total Containment's system (utilizing HDPE). Other systems exist for FRP secondary contained steel primary tanks.

Some of the most important factors for a good secondary containment tank system are the workmanship of the tank and its testability. The tank should be built to a national standard and be subject to quality control standards typically provided by UL or STI. Make sure both the primary tank and secondary containment interstice area are tested in the factory before the tank is delivered, as well as at the job site prior to final backfilling by the installer.

Maintaining Integrity

Vacuum use has become a very common method to ensure secondary containment integrity and many manufacturers are applying a vacuum in the interstice between the steel walls, or between the steel and the plastic walls, at the factory.

A tank with the vacuum in the interstice should be monitored at the job site. Typically, these tanks are shipped with a minimum of 13 inches of mercury negative pressure. (We've noted that many manufacturers are actually applying a vacuum of 20 inches of mercury or more, which is comparable to a 10 lb. psi negative pressure.) The tank must hold that vacuum, with a slight tolerance for variations in atmospheric conditions, for at least 12 hours for 10,000 gallon tanks and 24 hours for larger tanks.

If the vacuum should drop beyond its tolerance, you should do some further investigations to make sure it's tight.

After you verify that the interstice still

has a vacuum, the installer need not conduct a separate air pressure test of the primary tank and the interstice. The vacuum already ensures that both vessels are tight.

If a vacuum isn't applied at the factory, the primary tank will typically be tested at a 5-lb. psi positive pressure. Air from the inner tank will be brought over to the interstice, where there's a very small volume of space, assuring the tanks never test beyond 5 lbs.

Some air compressors can put out very significant volumes of air and it's important

that the interstitial space not be over-pressurized.

After the tank has been installed and the integrity of the tank has been ensured, the system is backfilled. Many installers then release the vacuum and place a release detection probe into the secondary containment monitoring tube.

Wayne Geyer is vice president and Wayne Stellmach is marketing manager for the Steel Tank Institute, a Lake Zurich, Ill. trade association representing fabricators of underground and above-ground storage tanks.

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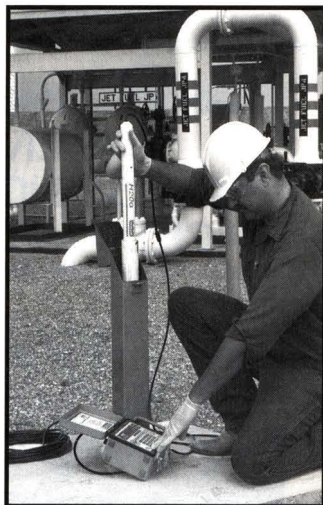
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State Programs Help Light the Way

Although high-profile pollution prevention programs, such as EPA's 33/50 program, garner much of the attention, many state programs play a key role in fostering corporate and municipal participation in these larger initiatives.

Ohio provides an example of how federal and state voluntary P2 programs work together to provide businesses opportunities to achieve pollution reductions. Ohio EPA's Office of Pollution Prevention (OPP) supports and promotes a variety of federal voluntary P2 programs, such as U.S. EPA's Green Lights Program. This unique public/private partnership demonstrates that energy savings and environmental protection do not need to be mutually exclusive.

In 1992, Ohio demonstrated its support for the Green Lights Program by becoming the

first large industrial state Green Lights Partner. The state works with U.S. EPA to promote Green Lights to businesses and industries, provides technical support to program participants and implements lighting upgrades in each of its 8,000 state-owned buildings.

Their efforts have already had a big payoff. Officials expect the upgrades for state-owned buildings alone will reduce energy-associated costs by more than \$4 million annually and will prevent the generation of millions of pounds of carbon dioxide and other energy-related pollutants from being generated.

Voluntary P2 programs provide companies with non-threatening ways to raise awareness of environmental issues, improve lines of communication between business and government and save money. More importantly, in signing up for such programs, companies signal law-

makers that they are willing to work to achieve environmental objectives without the need for additional regulatory mandates. They also provide an outstanding means of improving public relations with the community.

Successful state programs, which may be developed independently of federal input, can provide incentives to other states to initiate similar programs. One of Ohio's most effective P2 programs is a state voluntary initiative known as Ohio Prevention First, which derives its name from the waste management or pollution prevention hierarchy established in the federal Pollution Prevention Act of 1990. The program targets all organizations that generate pollution or have specific interest in achieving pollution prevention.

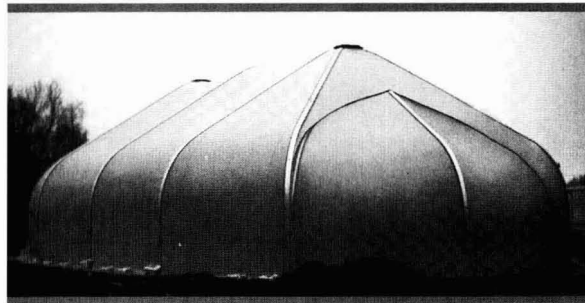
The objective of Ohio Prevention First is to cut the amount of all waste generated in Ohio in half by the turn of the century. The State wants Ohio organizations to participate by making reduction commitments and preparing detailed P2 plans. These plans will identify cost-effective P2 and pollution reduction options to make Ohio businesses more efficient and competitive. The initiative looks beyond state-specific programs by asking companies to join several federal P2 initiatives as a portion of their participation commitment. To date, more than 140 Ohio businesses have joined Ohio Prevention First and are utilizing a wide range of state and federal resources to increase efficiency and reduce pollution generation.

Participation Essential

The success of voluntary programs, both nationally and in Ohio, has demonstrated that environmental progress can be achieved through non-mandatory P2 initiatives. To that end, Ohio EPA is committed to continuing the integration of voluntary programs into current regulatory structures to maximize the range of environmental and economic benefits associated with P2 activities. However, if voluntary programs are to be realized as long-term environmental policy tools, more participation is needed. Business and industry should not ignore this opportunity to show that cooperation can help protect the environment.

R. Kent Dunn is a program manager with the Ohio Environmental Protection Agency's Office of Pollution Prevention.

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Building Owners Face New Asbestos Requirements

Lower exposure tolerances and new recordkeeping/reporting requirements are among new asbestos requirements facing commercial and industrial building owners.

Last year the Occupational Safety and Health Administration (OSHA) adopted new asbestos regulations that, for the first time, may extend to many previously unregulated commercial and industrial buildings. The new regulations lower the permissible asbestos exposure level in the workplace. They also make a number of technical changes both in the way various regulated activities are classified and in the practices required when asbestos is used, removed, managed or disturbed. The biggest change, however, is to afford regulatory protection to more workers in more workplaces. The new regulations' various requirements were originally slated to go into effect over the first few months of this year. However, except for the exposure level provision, implementation has been delayed until July 10, 1995.

Who's Covered?

The new OSHA standards regulate occupational exposure to asbestos in many business and industrial settings. They cover general construction and shipyard industries. The general industry standard covers not only work commonly associated with asbestos, such as brake and clutch repair, but also custodial workers who clean surfaces, sweep, buff and vacuum floors, and wash wall and windows in manufacturing plants.

Workers in commercial buildings and offices that may have been built with asbestos-containing materials are also covered. Thus, many building owners and employers previously bypassed by OSHA asbestos regulations will now be covered.

Notification, Training Rules

By focusing on the people most likely to know of previously installed asbestos-containing materials — building owners, tenants and any other party responsible for managing and maintaining records relating to a building — OSHA intends to protect employees from asbestos hazards in the buildings in which they work. Specific aspects of the new regulations are:

Employee Notification. Building owners are required to notify employees who work in or adjacent to areas known to contain asbestos materials — or materials suspected of containing asbestos — of the hazards associated with asbestos exposure. Building owners are also required to inform tenants whose employees occupy areas containing asbestos or the hazards associated with the material. Even those applying or bidding for work in or adjacent to areas containing such material must be notified of asbestos hazards. Tenants and contractors must in turn relay the asbestos information to their employees.

Recordkeeping: Building owners and tenants or contractor employers must exercise due diligence when complying with these regulatory requirements. Building owners must communicate the hazards of asbestos-containing material (ACM) or presumed asbestos-containing material (PACM) to employees or employers. The building or facility owner must obtain and maintain information concerning the presence, location, and quantity of ACM or PACM and relay that information to workers who may be exposed to the material. Records concerning ACM and PACM must be transferred to successive owners. Even if a tenant or building manager is charged with maintaining records or notifying workers, the building owner will ultimately be held responsible for non-compliance.

Presumption Concerning Asbestos: As part of the effort to communicate asbestos hazards to workers, the regulations establish new presumptions concerning ACM. Employers and owners must now presume that thermal system insulation, sprayed or troweled surfacing materials, and asphalt and vinyl flooring installed in buildings constructed before 1980 contain ACM. In addition, any materials the building owner should have known contained asbestos, based on due diligence examination of the material, will be treated as asbestos-containing for purposes of regulatory enforcement.

The only way an employer or building owner can overcome the ACM presumption is by performing a survey of the PACM to establish conclusively it has no asbestos content. An accredited inspector must perform the survey by taking

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samples of the PACM for submission to a licensed laboratory, or an industrial hygienist must use analytical techniques to determine that the material is asbestos-free. In any area where airborne concentrations of asbestos exceed or possibly exceed the permissible regulatory exposure limits (now .1 f/ccm, down from .2 f/ccm) the building owner or employer is required to post warning signs and establish an appropriate protective program. The sign must read: "Danger: Asbestos: Cancer and Lung Disease Hazard, Authorized Personnel Only, Respirators and Protective Clothing Are Required In This Area."

Employee Training: Employers are required to institute employee training programs for all employees who are exposed to airborne concentrations of asbestos at or above the permissible exposure limits. The training program must inform the employees of health effects associated with asbestos exposure; the specific procedures implemented by the employer to protect employees from exposure to asbestos; and the purpose, proper use, and limitations of respirators and other protective equipment.

Although the regulatory drop in the expo-

sure limit from .2 to .1 f/ccm is not expected to have a significant impact on how most commercial building operate, the drop could change how general maintenance and custodial workers perform their duties. It is easy to imagine a situation in which a maintenance worker causes a minor disturbance of asbestos-containing pipe insulation, for example. Prior to these regulations, unless the quantity of asbestos released reached the level of .2 f/ccm, the disturbance would be considered minor and would not warrant any further action.

Now, disturbing a significantly smaller quantity of asbestos would be classified as an asbestos exposure problem, requiring any employee working in the impacted area to use respirators.

For those employees who perform custodial or housekeeping operations at a building or facility which contains ACM or PACM, the owner or employer must provide an asbestos awareness course. At a minimum, the course must inform employees of the health effects associated with asbestos exposure, locations of ACM and PACM, recognition of ACM and PACM damage and location of a copy of

OSHA regulations relating to housekeeping and the proper response to the release of asbestos fibers. All employees must be retrained annually. All records concerning employees training, the location of ACM and PACM and results of any ACM testing must be maintained as part of the building owner's written compliance program.

July Deadline

The major regulatory phase-in date of these regulations is July 10, 1995. Originally OSHA had planned for some of the asbestos provisions to go into effect as early as last January. Now, barring further delays, most of the rule will become effective on the July date.

Building owners that lease property will have to decide how active a role they should take in implementing these new regulations, recognizing that liability for non-compliance rests ultimately with the property owner. Because a great deal of planning is needed to establish training programs and make the required notifications to employees, building owners must act now to ensure that this new program is up and running by July.

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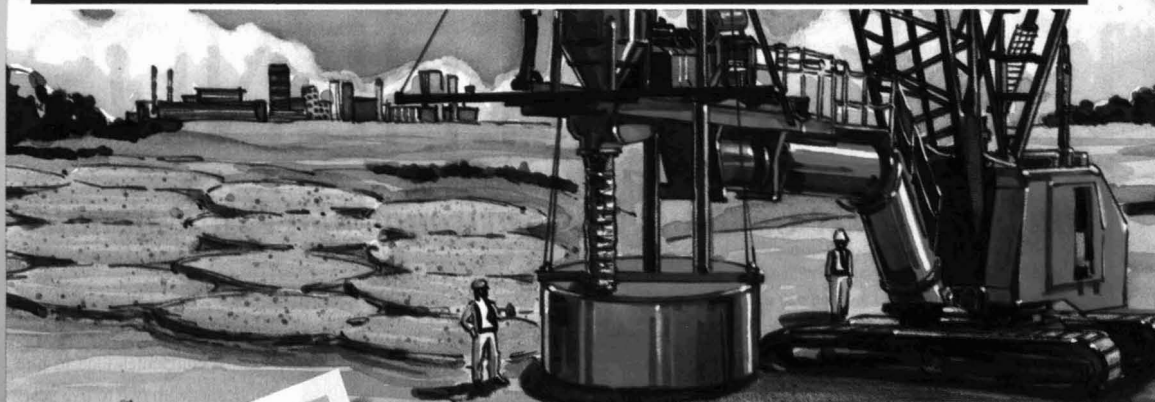

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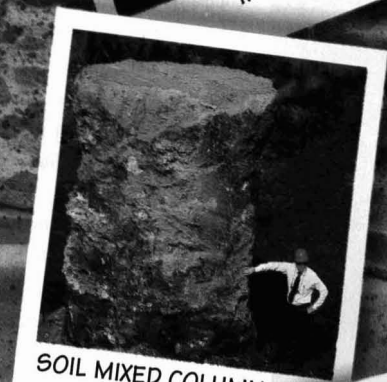
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SALARY TRENDS

Buyers' Market Continues for Environmental Professionals

By Frank Ahaus

Another in a string of years of tightening job opportunities for environmental professionals best characterizes the past 12 months. However, despite the continuing corporate trend toward leaner operating budgets, environmental opportunities still exist in some key growth areas.

In greatest demand, thanks to the Clean Air Act, are professionals with staff level Title V air compliance permitting experience. Companies are just now beginning to feel the effects of Title V permitting provisions – as well as a Title III rule that expands permitting requirements. A professional with experience in developing these permit applications is a hot commodity in today's market.

Plant-level managers and/or environmental health and safety coordinators are also in demand. Many larger companies are decentralizing their EHS management, placing these responsibilities with division and plant-level managers. Their efforts, often the result of "Total Quality Management" programs, have made environmental skills for these posts a premium.

Most of the hiring activity in the past year centered on mid-level positions at the plant and division levels. But we continue to see a narrowing of opportunities higher up the hierarchy. Specific hiring trends are detailed below.



Illustration by Scott Snow, The Image Bank

Plant-level Opportunities

Most companies tend to hire applicants with two to five years experience to oversee and complement outside consultants. A majority of those candidates have an engineering background.

Companies often look at potential candidates in light of addressing short-term technical problems, such as the recent demand for air compliance skills. A typical scenario is that of a company, recently fined for a CAA violation, searching for an environmental engineer who can jump in and resolve the compliance problem and then stay on board to ensure compliance in that and other matters.

However, that company may also want the candidate to have skills in other areas, such as hazardous waste and wastewater compliance. The candidate who has a multidisciplinary background, a multimedia outlook and a pollution prevention ethic

enjoys a clear advantage in today's market.

Salaries for plant-level staff range from \$38,000 to \$50,000. You may see a salary of more than \$60,000 if there are some very unusual or severe compliance problems.

Opportunities in plant-level management were consistent in 1994 in both large and small facilities. Typical positions include an EHS manager or plant coordinator. Salaries for plant-level management averaged from \$45,000 to \$65,000, depending on

plant size.

Many of the positions at this level combine safety and health with environmental responsibilities and sometimes also include all-media compliance. The multi-media approach encompasses air, water, wastewater, hazardous waste and remediation associated with environmental compliance and restoration.

Division-level Declines

There has been a slight decline in opportunities for division-level environmental professionals over the past year. Again, the trend is to let the plants have more responsibility for environmental compliance. With more plant-level staff personnel, there's a reduced need for additional division staff.

However, we've seen an occasional posting for a division-level compliance staffer to perform environmental audits. Most of these positions were with multinational manufacturers seeking candidates with an engineering or chemical background. Salaries are usually higher at the division level, averaging between \$65,000 and \$85,000.

Limited Corporate Turnover

Corporate environmental positions have seen little growth because of downsizing trends and limited upward mobility. When openings occur at this level, many firms promote from within, using division or plant-level personnel versed in the facility's compliance challenges.

Management and technical abilities are both highly valued at the corporate environmental level. Salaries range from \$75,000 to \$90,000 and above.

Position titles at the top of the environmental management hierarchy are somewhat misleading. They can range from director to manager to vice president. "Environmental Affairs" increasingly appears in position titles. Many companies appear to be assigning more responsibilities to these positions – including such recent add-ons as "green marketing" and strategic environmental management.

Most of the opportunities at this level lie within large, multinational companies that have manufacturing facilities worldwide. Salaries range from \$90,000 to \$125,000, but also could include special benefits and bonus opportunities.

Contract-starved Consultants Face "Right-sizing" Pressures

Contracts for environmental consultants, already scarce compared to the field's heyday in the late '80s, will become even harder to land. So says environmental recruiter Glen Higgins, vice president of Kimmel & Associates, who bases his views on a salary survey of more than 850 environmental consultants just released by the Asheville firm.

In the current political climate, many in industry see the potential for a relaxation of key environmental provisions. And business owners are more inclined to delay cleanups until the regulatory dust settles.

Increasingly savvy industrial managers are squeezing consultants further, he adds. "Facility owners are more sophisticated, so profit margins are shrinking," Higgins says. "We've got the same number of consulting companies out there, but the contracts and profit levels don't come close to what they were four to five years ago – and the competition is fierce to win what little work is available in the commercial and industrial markets."

The scarcity is particularly bleak in the Southwest and Northeast, says Higgins, "because these regions are struggling with too many consultants and not enough clients. "However, we are seeing environmental consulting for real estate and land development clients going up, as opposed to hazardous waste jobs. These are not very technical contracts, but they are profitable," he adds.

Positions Dwindle. Are Salaries Next?

Hiring has stagnated at many firms as consultants try to hold the line on overhead. "If anything, positions are diminishing," Higgins states. Salary levels, on the other hand, have remained about the same. The exceptions are those individuals "right-sized out," who find it nearly impossible to match their previous salary.

"Right-sizing" – another word for downsizing – is rampant in the consulting industry. A Higgins example: "A consulting firm has a senior technical manager on staff who makes \$90,000 a year. But because he doesn't contribute to new business, he's targeted to be right-sized out and replaced with a \$65,000-a-year professional doing the same job. If the new person also knows how to find business, the firm's way ahead of the game."

"Technical and project management skills are not enough for top-paid consultants," says Higgins. "You must be what I call a 'triple threat' – equally strong in business development, technical expertise, and management skills. In other words, the top-paid consultants are no longer just 'techies,' but have a strong business grounding."

Rough Going for Start-ups

Consultants who are thinned by right-sizing trends often attempt to go it alone – or try to put together a new start-up firm. "Typically," says Higgins, "they'll try this for six months and become disillusioned with the lack of clients and capital. It's easy to tire of the peaks and valleys, and we often see these individuals pursue opportunities as employees again – at reduced salaries from their previous posts." Higgins' advice for those consultants considering a job move:

- Continue your education in business or marketing.
- If you are currently employed but unhappy, don't quit until you secure another position.
- If you are right-sized out, network and get that resumé updated immediately. Do not take time off to collect your thoughts. The longer you are unemployed, the harder it is to find a position.
- Unemployed or not, don't "float" your resumé – be selective about who you send it to. This can create the perception that you're desperate.
- Once you have received an offer, expect a counter-offer, but don't even consider it. A counter-offer from your current employer is often just a means of buying time to find your replacement. You'll likely be looking for work again within twelve months – one way or another.

– By Beth Cahape

Regional Trends

The Midwest, upper Midwest, and Southeast have experienced the most growth in environmental opportunities in the past year. This is due largely because small- to mid-sized manufacturing companies supporting the automotive, appliance, and construction products industries have numerous manufacturing facilities in those regions. Many of these smaller industries are pursuing proactive environmental programs once exclusively the purview of their larger brethren.

Headhunting of environmental professionals by competing firms appears to have waned. The large salary increases that were offered to rising stars by rival firms in past years had dwindled to five to 10 percent increases over the past year. The reason? There are more qualified people to choose from, and employers are willing to wait until they find someone who better fits into their salary structure.

Tougher Interviews

Companies now tend to interview numer-

ous candidates for the same position. Indeed, in today's buyers' market, most companies will not accept a candidate with five of six requirements for the position;

The past year has seen little growth in corporate or divisional environmental positions – but the trend toward decentralizing environmental management promises new opportunities.

they'll keep interviewing until they find the person that meets all six requirements.

Environmental candidates will likely face interviews among various levels in a company. They also have to be well received from the president on down to the produc-

tion employees, because they must interact with a broad spectrum of the people of the organization.

Looking Ahead

1995 will not witness a significant change in career opportunities for environmental professionals due, in large part, to the new congressional tone. In essence, companies are reluctant to pursue aggressive remedial/compliance programs without some clear definitions.

Nonetheless, good opportunities still abound. Why? Because public concern for environmental protection remains high, and our legislators are aware of the importance of sound environmental policy. As the environmental profession evolves, more opportunities will be sure to arise.

Frank Ahaus is president of Environmental Personnel Services, a Cincinnati-based firm specializing in recruiting environmental professionals nationwide. EPS is an active member of Network Interchange Services, a computerized network of over 500 recruiting firms coast to coast.

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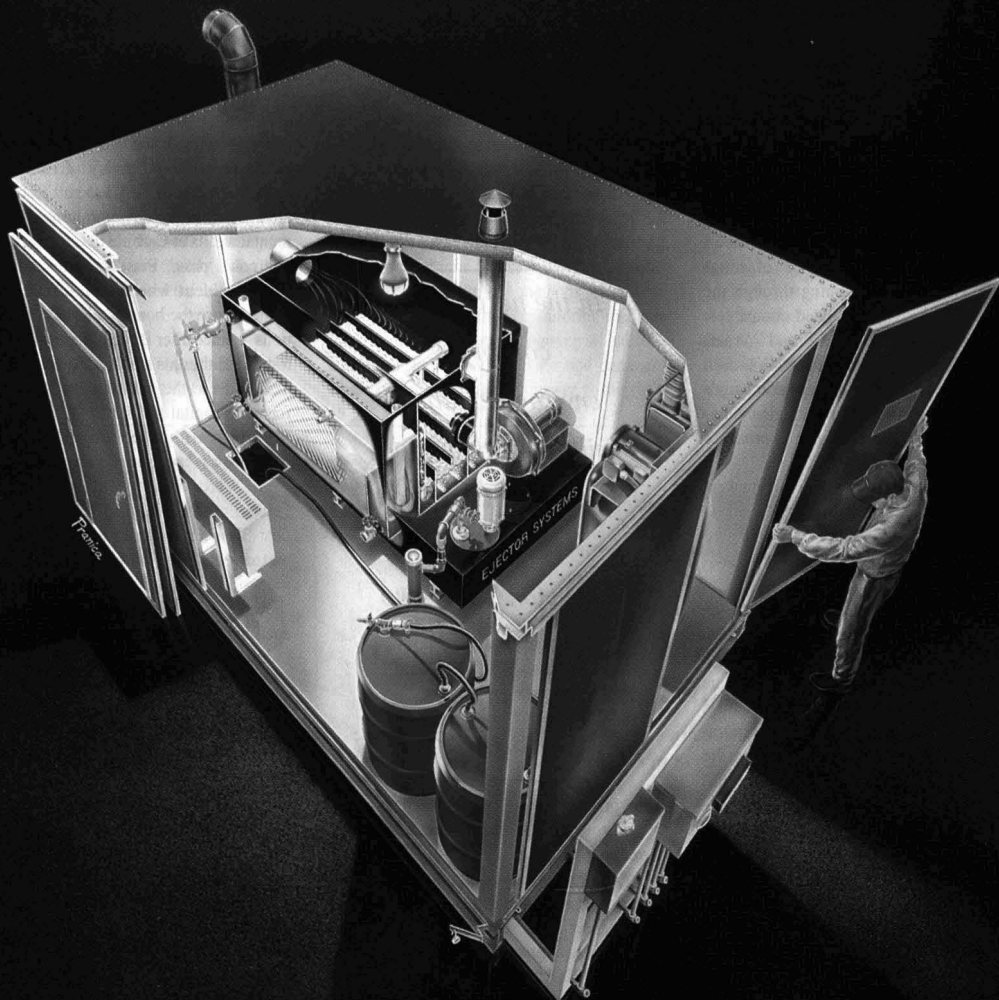
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Corporate Environmental Strategy

The Avalanche of Change Since Bhopal

By Bruce Piasecki

John Wiley & Sons, Inc. 180 pp.; \$24.95

Environmental management consultant Bruce Piasecki's latest book views the growing importance of long-range environmental planning through the sagas of four heavily regulated companies: Union Carbide, ARCO, AT&T, and Warner-Lambert. Through these case studies—each a fascinating account of a large company's compliance efforts—Piasecki gleans enlightening lessons on corporate approaches to environmental management.

Targeted towards corporate policymakers and environmental managers, *Corporate Environmental Strategy* defines the Bhopal tragedy in 1984 as a turning point for environmental management. Following that disaster, chemical companies and others began pursuing more rigorous compliance policies, Piasecki writes.

However, "reactive" strategies of baseline compliance and liability containment have lingered, he adds. "The role that corporations can, or should, play in leading the search for environmental excellence has hardly been asked," says Piasecki, whose last effort, *In Search of Environmental Excellence*, was well-received in 1990. The author is director of the environmental management program at Rensselaer Polytechnic Institute and president of the American Hazard Control Group, a management consulting firm.

Reattaching bottom-line considerations to environmental strategy will enable companies to realize "a new and exciting set of options." New product development, strategic alliances within industries, and research into environmentally friendly substitutes are some of the major options Piasecki details with these four corporate portraits.

Environmental leadership is vividly exemplified in the case of ARCO, eighth

among oil companies in revenues. In response to a growing regulatory inclination towards methanol, the company pursued a daring strategy to develop a reformulated gasoline to counter the methanol movement.

*"In the next century,
corporate
environmentalism
will mean that good
business practices match
good environmental
behavior. These two
principles are no
longer at odds."*

— Bruce Piasecki

That product, EC-1, represented a major breakthrough in the environmental impact of gasoline.

ARCO executives also anticipated future emission regulations and aimed their products to meet more stringent standards. As a result of its aggressive approach, Piasecki writes, ARCO was able to convince California regulators to table a 1991 industry-backed effort to relax California reformulation specifications.

Ultimately, says Piasecki, ARCO has "gained a significant competitive advantage within the intensely competitive oil industry."

The benefits of environmental audits are discussed throughout this text, especially as they relate to Union Carbide's audit strate-

gies following Bhopal. Foremost was Carbide's post-Bhopal policy of routing audit reports directly to the CEO and a newly created environmental committee. "Environmental audits at Carbide became the buck no one could pass," Piasecki states. "The division president who failed an audit would come before the board with only limited options—since after Bhopal there was no place to hide. Either his staff had let him down, or he could use the audit review as an appeal for more capital and staff."

Carbide also undertook a two-year redevelopment of corporate environmental standards. While the former standards were convoluted and oriented toward U.S. laws, the post-Bhopal standards were simple, focused, and direct. "The simplicity standard was met, oddly enough, not by telling people 'how to' meet the grade, but by expressing each higher standard as an executive expectation."

There is much more in the pages of *Corporate Environmental Strategy* that's of value to business executives and environmental managers—including the growing role of strategic alliances, such as the telecommunications industry's approach to CFC elimination led by AT&T. Of importance, too, is the role innovative corporate managers can play.

Strategic business concerns have typically been oriented towards quality, cost, distribution, and service, notes Piasecki. However, every industry—regardless of size or focus—has much to gain by elevating environmental concerns to the strategic level. "Those companies that can't walk this tightrope will be eliminated, victims of poor business judgment and environmental neglect," he warns. "In the next century," he concludes, "corporate environmentalism will mean that good business practices match good environmental behavior. The two principles are no longer at odds."

continued from page 28

new Clean Air Act Title V permit application, the entire permit approval process could be considerably delayed.

• **Increased Stringency of the Underlying Applicable Requirement:** EPA appears to be using the EM rule to impose new monitoring standards that are inconsistent with presently applicable requirements, thus viewing the EM provision as an independent grant of authority. GPA believes that, through the use of the protocol-based program, the stringency of underlying emission standards is being increased without required rulemaking processes.

• **Predilection for Continuous Emissions Monitors (CEMs):** The EM requirement within the Act was intended to be reasonable. Section 504(b) specifically stated that CEMs were not required if other methods were available, timely, and reliable. By setting quality assurance procedures that are unduly inflexible, EPA has effectively mandated the use of monitoring methods that measure emissions on a continuous basis.

• **Failure to Exclude Attainment Areas:** EPA has not accepted the fact that there are few

if any benefits to be gained by applying the EM program in attainment areas. EPA must propose specific, flexible standards for such areas – in order to pass a reasonable test of cost benefit comparison.

EPA should realize that any program requiring a natural gas liquids plant operator or other stationary source to expend these substantial funds for monitoring (rather than reducing) emissions – a parametric emission monitoring system can run \$100,000 per engine to install, or \$300,000 for a CEM – will adversely impact the competitiveness of a plant and the ability of an operator to provide products and services to consumers, manufacturers and other end-users. The first-year cost of compliance with the proposed EM rule as a percent of net operating income at gas processing facilities could range from 16 percent to 133 percent.

Industry and state agencies have proposed that EPA determine which underlying applicable standards require EM methods and, where appropriate, change those monitoring methods through rulemaking, thereby giving all interested parties the chance to review and comment on the proposed changes. However, to this date,

EPA does not appear to have seriously considered this more flexible position.

Legislative Alternatives

The implementation of the Clean Air Act Amendments have come under increasing scrutiny. In the recent EPA budget rescission bill considered by the House Appropriations Committee, EPA faced funds-limitations measures dealing with inspection and maintenance programs, employee trip reduction and federal default implementation plans. However, no consensus has emerged to revisit the Act in general or the EM program in particular.

Senator Kay Bailey Hutchison, co-chair of the Regulatory Reform Task Force, recently wrote to Administrator Browner that the current EM proposal imposes cost that “greatly exceed any environmental benefits.” EPA would do well to consider such opinions as it formulates a final EM rule.

Scott Segal is an attorney in the Washington, DC offices of Bracewell & Patterson, L.L.P., where he specializes in environmental, government and regulatory reform.

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Case Study

Management Commitment Essential to Ensure Compliance

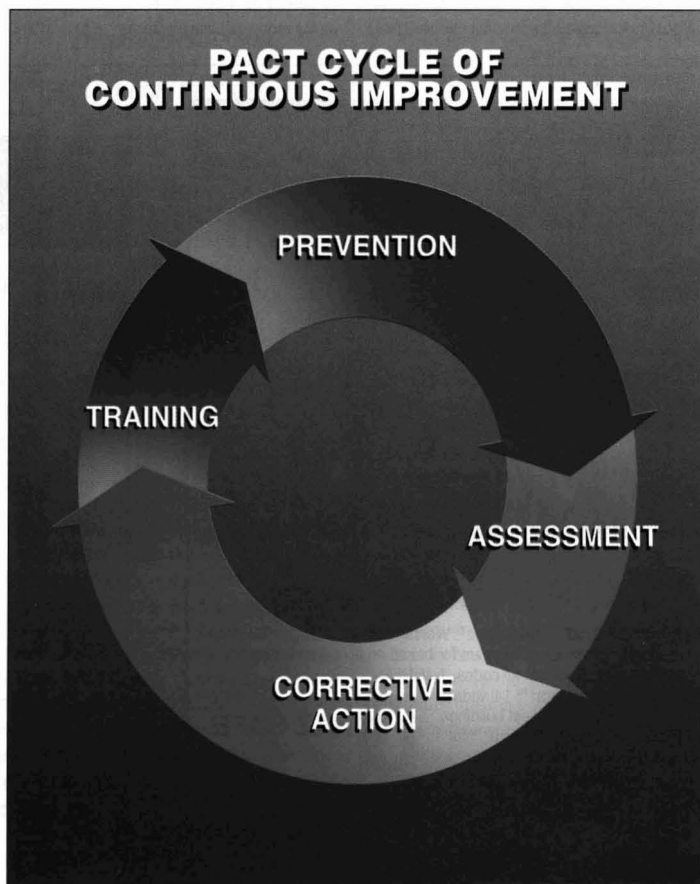
By Kevin Igli

Like many companies, developing an effective compliance program has been a critical issue for Chemical Waste Management. During the 1980s, CWM met this challenge by hiring on-site environmental experts to advise operations personnel, and by subjecting various facilities to independent environmental audits. This approach developed into a program known as ACT: Assess our compliance status; Correct deficiencies; and Train personnel to improve performance.

In 1989, parent company WMX established an Executive Environmental Committee, which developed a set of 14 Environmental Principles that won approval by the WMX Board of Directors in March 1990. These measures, and the identification of environmental management as one of the four fundamental "pillars" of the company, demonstrated a strong management commitment to environmental excellence.

While some gains in environmental performance were made, it became clear that management commitment alone would not ensure that CWM's environmental goals were met. We needed to modify the compliance program by placing the responsibility for maintaining compliance with every employee – especially those in operations.

With the new emphasis on joint responsibility for environmental compliance, the company realized that prevention efforts were a key component of any successful compliance program. Therefore, CWM added "prevention" to the ACT program, yielding what we now call the PACT process.



The PACT program embraces the continuous improvement principles of Total Quality Management by resolving concerns identified through assessment and by incorporating new training and prevention measures to achieve a higher level of performance. What follows is a look at each of the four components of the PACT compliance process.

Prevention

The major preventive programs used by CWM are the Compliance Management System (CMS) and Standard Division Practices (SDPs). Both are proactive programs designed to help facility staff achieve timely environmental compliance.

Compliance Management System.

Many commercial electronic services provide the text of environmental regulations, but none translate the text into compliance assurance tasks for facility employees to complete. In response to this information gap, we developed a system to identify, schedule, assign, and track completion of requirement tasks.

CMS is a personal computer software tool that organizes all relevant environmental require-

ments from regulations, permits, and company policies, and translates those requirements into compliance assurance tasks. Each task includes a synopsis of the requirement, a regulatory cita-

*Many commercial
electronic services provide
the text of environmental
regulations, but none
translate the text into
compliance assurance tasks
for facility employees
to complete.*

tion, the names of assigned staff, the frequency with which the task must be performed, its due date, an estimate of the time required to complete the task and other procedural information.

Tasks are assigned to individual employees, rather than relying solely on environmental professionals. The completion of each task is documented on the work order by the staff and entered into CMS.

Standard Division Practices. Another CWM program seeks to develop Standard Division Practices as a tool to help assure that complex processes are properly managed and regulatory requirements are completed appropriately. SDPs supplement the task assignments in CMS. Where CMS addresses the "what," "who," and "when," SDPs address how a task should be done.

Assessment

Compliance assessments – both facility self-assessments and third party audits – are another essential ingredient in our compliance assurance program.

Self-Assessment Program. The CWM self-assessment program is a new approach to evaluating the compliance status of our facilities. Self-assessments actively involve facility employees in a cooperative, site-wide effort to continuously improve environmental compliance performance and awareness.

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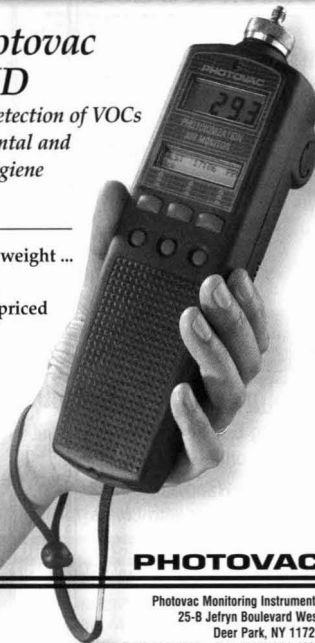
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Case Study

Checklists, derived from federal regulations, provide a baseline for the regulatory scope of each assessment. The lists are divided into 'pre-assessment' and 'assessment' checklists. The pre-assessment checklists, completed by facility managers, determine the applicable management areas – a facility can have as many as 25 management areas – and identify questions to be answered on the accompanying assessment checklist. The assessment checklists are then modified by the site to include all applicable state, local, permit and policy-specific requirements.

The self-assessment program is based on a multi-disciplined team concept. Site managers select a core group to serve as members of the self-assessment team. The team members are trained on the use of the checklists, specific site requirements and basic assessment methods. Following their training, the team performs the assessment. Compliance issues are identified and site managers determine a corrective and preventative action for each issue, which are then entered into a database to be tracked until final resolution. These steps are repeated for each assessment. Self-assessments are usually conducted monthly, covering one or two management areas per assessment.

Environmental Audits. The company's environmental, health and safety audit group measures compliance, evaluates environmental management systems and fosters continuous improvement in the compliance performance of the company. CWM conducts regularly scheduled audits of the company's major treatment, storage, and disposal facilities. Other company operations are audited less frequently.

Customer Audits. CWM customers have a strong interest in making sure our facilities are in full compliance with the law in order to limit their liability for waste disposal. Their inspections provide an additional level of compliance assessment.

Regulatory Agency Inspections. Local, state, and federal enforcement officials regularly inspect CWM sites. In addition, state environmental agency officials are stationed at some company facilities on a full-time basis.

Corrective Action

CARS. A personal computer-based software package – Compliance Action Reporting System (CARS) – is used to facilitate corrective actions by helping employees manage compliance issues in a timely manner.

When a compliance issue is identified, its description is entered in the system, along with planned corrective and preventive actions, a resolution due date, and the person responsible for the resolution. Other data relating to the issue are also entered.

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For every issue, the root cause of the noncompliance is identified, and appropriate measures to prevent recurrence. As a result, the underlying problem is addressed, rather than a "quick fix" that might address only symptoms.

Quantitative reports based on CARS data provides a management tool to track compliance performance indicators. Data analysis is also used to evaluate the effectiveness of the various assessment programs.

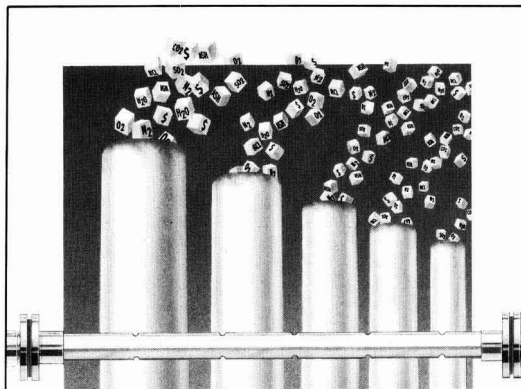
Training

WMX companies provide extensive training to employees on compliance-related subjects. WMX has developed a compliance curriculum available to all facilities that covers the requirements of various regulatory programs and the steps needed to comply. Training includes instruction on the use of compliance tools such as CMS and CARS. Courses have also been developed to help build a culture of environmental compliance and regulatory awareness.

Note: The number of compliance issues identified through the PACT process is not a factor. CWM encourages self-identification of compliance issues by facility operations.

By devoting considerable resources, Chemical Waste Management has demonstrated its commitment to achieving and maintaining the highest level of environmental compliance.

Kevin Igli, vice president of Environment, Health and Safety for Chemical Waste Management, based in Oak Brook, Ill., oversees environmental affairs for the company's 27 hazardous waste treatment, storage and disposal facilities.



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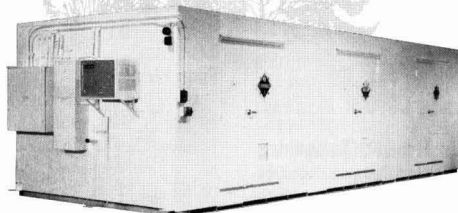
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Panametrics

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ZERO Enclosures

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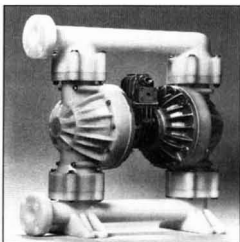


Filter Elements

Ultrafilter International's newest line of filter elements allows manufacturers to produce clean, dry, oil-free compressed air essential for many process applications. This technology increases productivity while reducing service and maintenance costs. The filter design incorporates an improved and unique combination of double 'O' rings and thread between the element and the housing. Each filter element contains a single open-ended confirmation, allowing gas or compressed air to be filtered to 0.01 micron with efficiency of 99.9 percent.

Ultrafilter International

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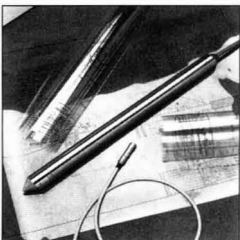


Plastic Series Pump

Versa-Matic Pump has expanded its Elima-Matic line of pumps to include two new 2-inch plastic models available in Kynar and Polypropylene. These materials are excellent for pumping corrosive materials and offer the same anti-stalling, non-icing, lubrication-free air valve system as current metallic models. The added feature of its bolted manifold design offers leak-free construction with ANSI flange porting.

Versa-Matic Pump

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Submersible Probe

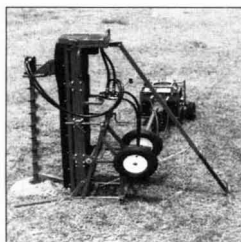
The TROLL (SP4000) from In-Situ is a fully submersible intelligent probe designed for monitoring water level temperature. The TROLL contains a computer, memory, sensor and power all in one unit. The outside diameter of 1.5 inches allows for easy access to 2 inch wells and has a full system accuracy of ± 0.1 percent. With Windows-based software, the TROLL can be easily programmed in the office, car or field. The software is included with purchase.

In-Situ

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Earth Drilling Tool

Little Beaver has introduced a new earth drilling tool for use in foundation repair and environmental drilling, including



test wells. The portable, hydraulic-powered Big Beaver can be operated and moved by one or two workers and drills large holes. The Big Beaver is 80 inches high and 30 inches wide and small and compact enough to perform exterior and interior foundation work. The hydraulic power source is the PS-16 that outputs 5 to 8 GPM at 2,500 psi.

Little Beaver

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Handheld GPS/GIS

Corvallis Microtechnology has introduced the MC-GPS-CM that provides submeter or centimeter-level accuracy by using the full carrier phase signal or 1-5 meter accuracy using C/A code. The unit allows the user to collect multiple layers of GIS data and attach it to the GPS coordinates that are being continuously collected by the hand-held. The GIS and GPS data collected by the MC-GPS-CM is compatible with AutoCAD and ARC/INFO as well as a number of other GIS and CAD systems.

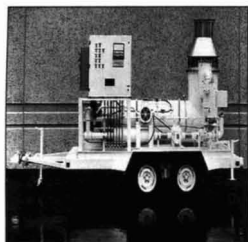
Corvallis Microtechnology

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Remediation System

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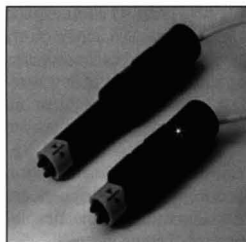
PRODUCTS & SERVICES



groundwater pumping systems. The thermal and catalytic oxidizers have standard flow rates from 150 scfm to 2,000 scfm. Custom systems with higher flow rates are also available. All systems have UL classified control panels, AGA and Electro Energy approvals for mechanical and electrical safety and fire department general approval.

Paragon Environmental Services

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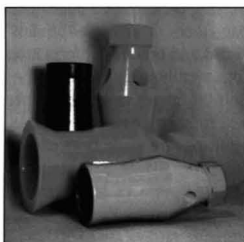
Thermal Dispersion

Flow Switch

OMEGA has designed the FST-200 Series flow switches that use thermal dispersion technology for an accurate and economical method of sensing flow. With these switches, one can monitor fluids from 0.4 to 1.2 specific gravity, 1 to 300 cp and monitor pulsating flow from 10 to 100 pulses per minute. The switches have no moving parts and may be used in pipes or tubing from 1/8 inch to 12 inches.

OMEGA

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Flo Trend Systems

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Dwyer Instruments

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Container Management System for Drum Storage

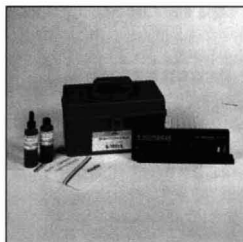
The Container Management System from Discovery Environmental Resources is designed to handle massive quantities of drums in an efficient and economical manner. The system can handle all sizes of steel, poly and fiber drums. Aerosol cans, five- and one-gallon cans and buckets can also be used with the Container Management System. The unit has automated deheading, draining, triple rinsing and crushing.

Discovery Environmental Resources

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Water Test Kit

Taylor Technologies' colorimetric test kits are the reliable and affordable alternative to backup pH meters. The kits are durable and easy to use. The kits also feature slide comparators that compensate for color and



turbidity. Kits are available for narrow and broad pH target ranges.

Taylor Technologies

Circle 69 on card.



Velocity Flow Meter

The Sigma 950AV Area Velocity Flow Meter brochure highlights the competitive benefits of the newest member of the 950 Flow Meter line. The meter can help achieve accurate open channel flow measurements without a primary device under full pipe, surcharged or reverse flow conditions. When pipe slope is unknown and when monitoring shallow and wet weather flow in storm channels and combined sewer overflows, the 950 AV can achieve accurate results. The brochure describes common applications for the 950 AV such as sewer evaluation surveys and infiltration and inflow studies.

American Sigma

Circle 70 on card.

Separation Pilot Plant

A new membrane separation pilot plant from LCI is designed for conducting in-plant evaluation and generating scale-up data under production conditions for manufacturers processing acids. The test unit, can be used to evaluate membranes capable of operation in extreme



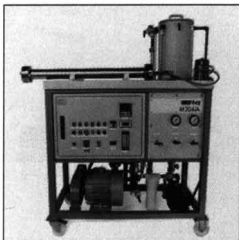
Turbine Agitator

Chemineer has introduced the HT Turbine Agitator for water and wastewater treatment applications. The HT has proven reliability and ease of maintenance in tens of thousands of mixing applications. With 13 right angle drive sizes, a wide range of construction materials, mountings, shaft seals and impellers are available. The HT can be tailored to handle any water treatment process. Power capability ranges from 1 to 1,000 horsepower and higher in special designs.

Chemineer

Circle 64 on card.

PRODUCTS & SERVICES



pH conditions as well as different membrane formats – spiral elements or tubular membranes. The compact, fully instrumented unit allows pressures up to 600 psi and is capable of a range of separation technologies including nanofiltration, ultrafiltration and reverse osmosis.

LCI

Circle 71 on card.



Carbon Filter

The new Cameron-Yakima DVB activated carbon filter is a clean and simple alternative to conventional refillable carbon filters. The disposable Vbank filter features a total dentention design allowing no air to bypass the carbon beds. The modular unit is disposable. With low air resistance and optional impregnated carbons, the DVB is a versatile solution to most any HVAC problem.

Cameron-Yakima

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Emissions Analyzer

The ENERAC 3,000 sem is a new generation of quality assured, portable, compliance level emissions analyzers. The analyzer has advanced SEM technology, quality/assured precision control modules (QA/PCM), integrated sample conditioning and quality assured/calibration certification protocol (QA/CCP). These fea-



tures provide positive assurance of instrument performance.

Energy Efficiency Systems

Circle 73 on card.



Expansion Joint Guide

A new Wastewater Treatment Plant Application brochure is available from Red Valve. The brochure features Redflex Expansion Joints, rubber pipe and rubber fabricated products in different applications. This four-page guide highlights Redflex uses in aeration air blowers, PVC pipe systems, sludge pumping, sewage pump isolation, flow meters, valve installations and lime systems. Specific Redflex products are recommended for each individual applications.

Red Valve

Circle 74 on card.



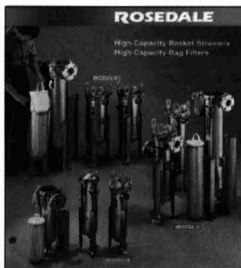
Air Stripper

ORS Environmental Systems introduces the new 60 gpm capacity, LO-PRO Model III Low Profile Air Stripper. The LO-PRO family of low profile air

strippers provides low cost and high removal efficiency of organics from water. The unit uses a multi-stage, counter flow aeration system that requires no packing medium. A bubble plate design resists fouling and significantly reduces maintenance. The LO-PRO air strippers are available with or without explosion-proof components.

ORS Environmental Systems

Circle 75 on card.



Strainer and Filter Catalog

This eight-page color Catalog 468 describes the Rosedale line of single-basket strainers and bag filters. It gives full dimensional and ordering information for seven housing sizes and details the interchangeable strainer and filter bag baskets available. Housings are made from carbon steel, or 304 or 316 stainless steel. All surfaces are electropolished to resist adhesion of dirt. Pressure ratings are to 500 psi.

Rosedale Products

Circle 76 on card.



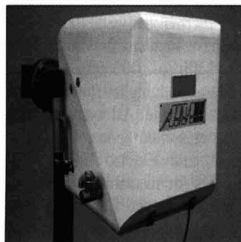
Data Logger

Rustrak Instruments has introduced its newest generation of microprocessor-based data loggers, the Rustrak Ranger III. This latest recording, analyzing and reporting system has eight input channels that accept any type of sensor as well as four additional math channels. The

unit has three I/O ports including a dedicated RS-232 port on the front of the unit for quick and easy downloading. The Rustrak Ranger III also has an auto restart recording mode and a flash reprogrammable memory for easy field upgrades.

Rustrak Instruments

Circle 77 on card.



NO_x Monitor

Air Instruments and Measurements has introduced and demonstrated EPA compliance with its new low ppm NO_x monitor measuring NO and NO₂ separately, with individual NO and NO₂ outputs, as well as NO_x. When separate water measurement is included, NO_x can be measured on a wet and dry basis. In addition, in the same analyzer N₂O is now being measured. These measurements are available in the Model E-6000 across-stream in-situ system, now including an internal flow-through audit cell for cylinder gas calibrations.

Air Instruments and Measurements

Circle 78 on card.

Skimming Device

The Grease Grabber from Abanaki removes as much as 160 gallons per hour of floating grease and heavy oil from water in pits, ponds and tanks. The unit has design features for extremely demanding applications such as drainage pits in primary metal mills and factories, underground tanks and wastewater sumps in parking lots. The Grease Grabber helps users reduce fluid disposal costs by allowing reuse of cooling and wash water.

Abanaki

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PRODUCT LITERATURE



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Airborne Ground Penetrating Radar

This brochure highlights the benefits and applications of Airborne Ground Penetrating Radar that can detect subsurface objects and map plumes of refined hydrocarbons. This system is truly an underground vision that provides an economical alternative for conducting site assessments.

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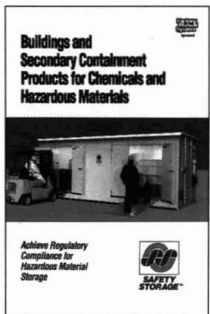
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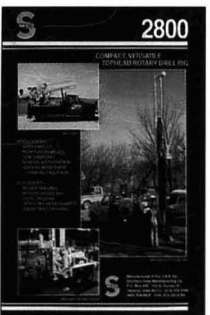
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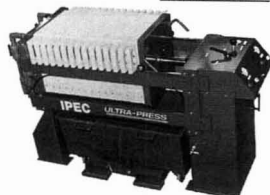
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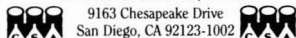
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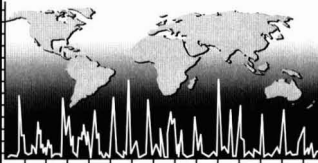
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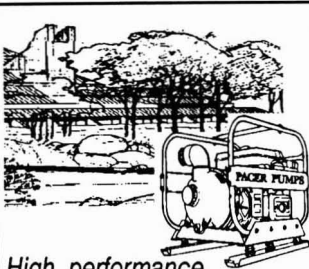
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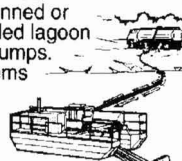
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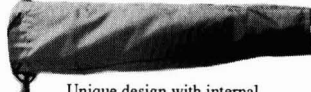
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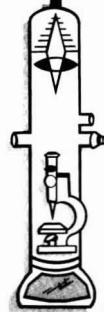


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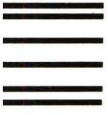
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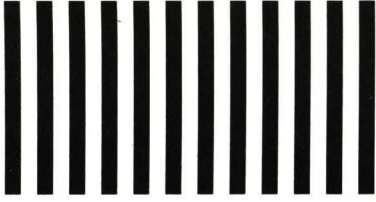
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- D Provide professional consulting service on Pollution Control
- E Provide staff environmental service on Pollution Control
- Z Other (please specify) _____

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- B Instrumentation
- C Chemicals
- D Parts & equipment for maintenance operation and control
- E Services/Consulting
- F None of the above _____

(please specify)

5. What types of Pollution Control are you responsible for? (check all that apply):

- A Air
- B Water
- C Noise
- D Solid waste disposal
- E Industrial hygiene
- F Toxic & hazardous material
- G Energy control/energy conservation
- H None of the above

(please specify)

6. Which of the following publications do you receive personally addressed to you? (check all that apply):

- A Pollution Engineering
- B Environment Today
- C Hazmat World
- D Pollution Equipment News
- E The National Environmental Journal
- F Water Environment & Technology
- G None of the above _____

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Unlike the others, Hach's new immunoassay kits **do** include everything you need to detect PCB and TPH in soil and TPH and benzene in water. You get a direct-reading Pocket Colorimeter™ Instrument for quantitative screening; illustrated, step-by-step instructions; prepared reagents; field-ready apparatus; and consumables. All packed into a tough carrying case. All backed by on-going technical support.

With everything at your fingertips, you can head right to the site and start testing. In 30 minutes or less, you'll get accurate threshold values. Down to 1 ppm PCB in soil. 10 ppm TPH in soil. 220 ppb TPH in water. And 5 ppb benzene in water.

Choose from four kits. Hach's PCB in Soil Kit meets USEPA performance requirements for the SW-846 draft method 4020 for reporting purposes. The Benzene in Water Kit specifically detects benzene—not BTEX. And to monitor TPH, Hach offers both a soil kit and a water kit.

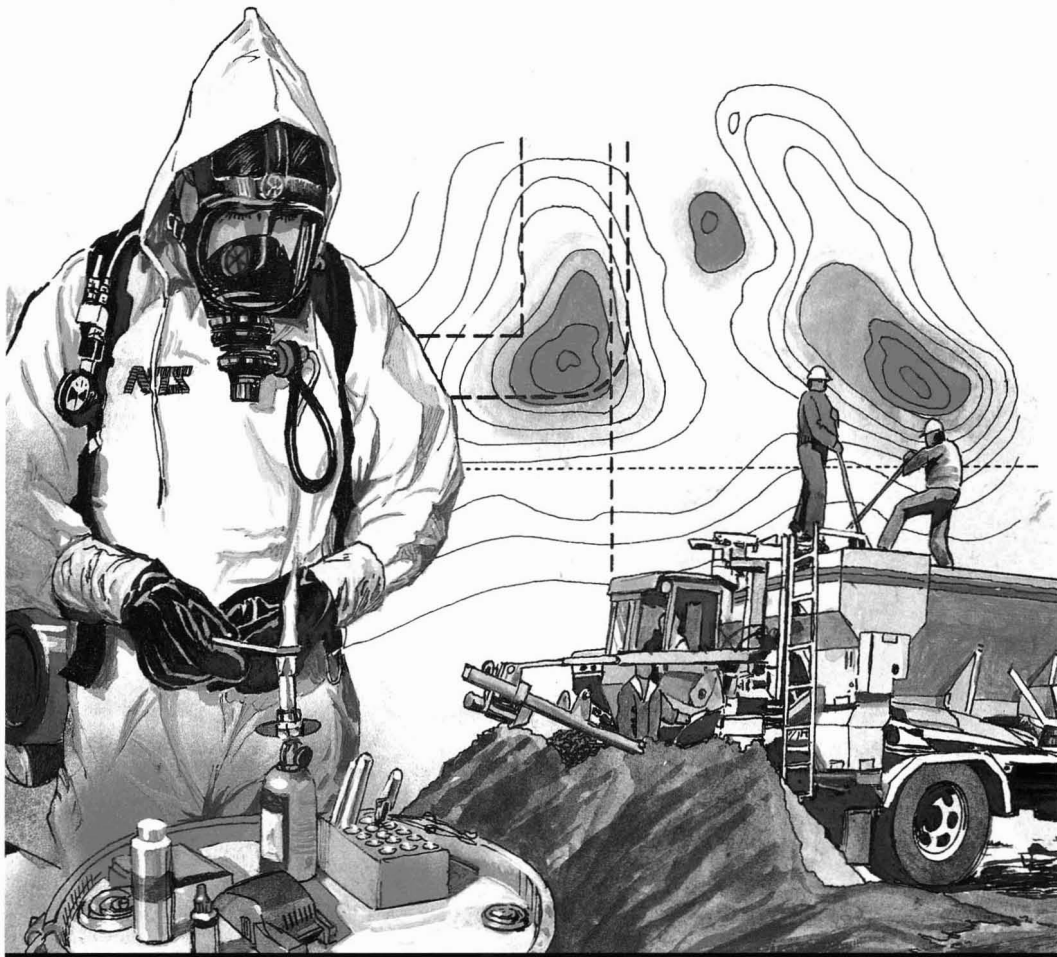
Take the headaches out of immunoassay testing—call 800-227-4224 to order. Or request literature 1367, 1374, 1400 and 1404.



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