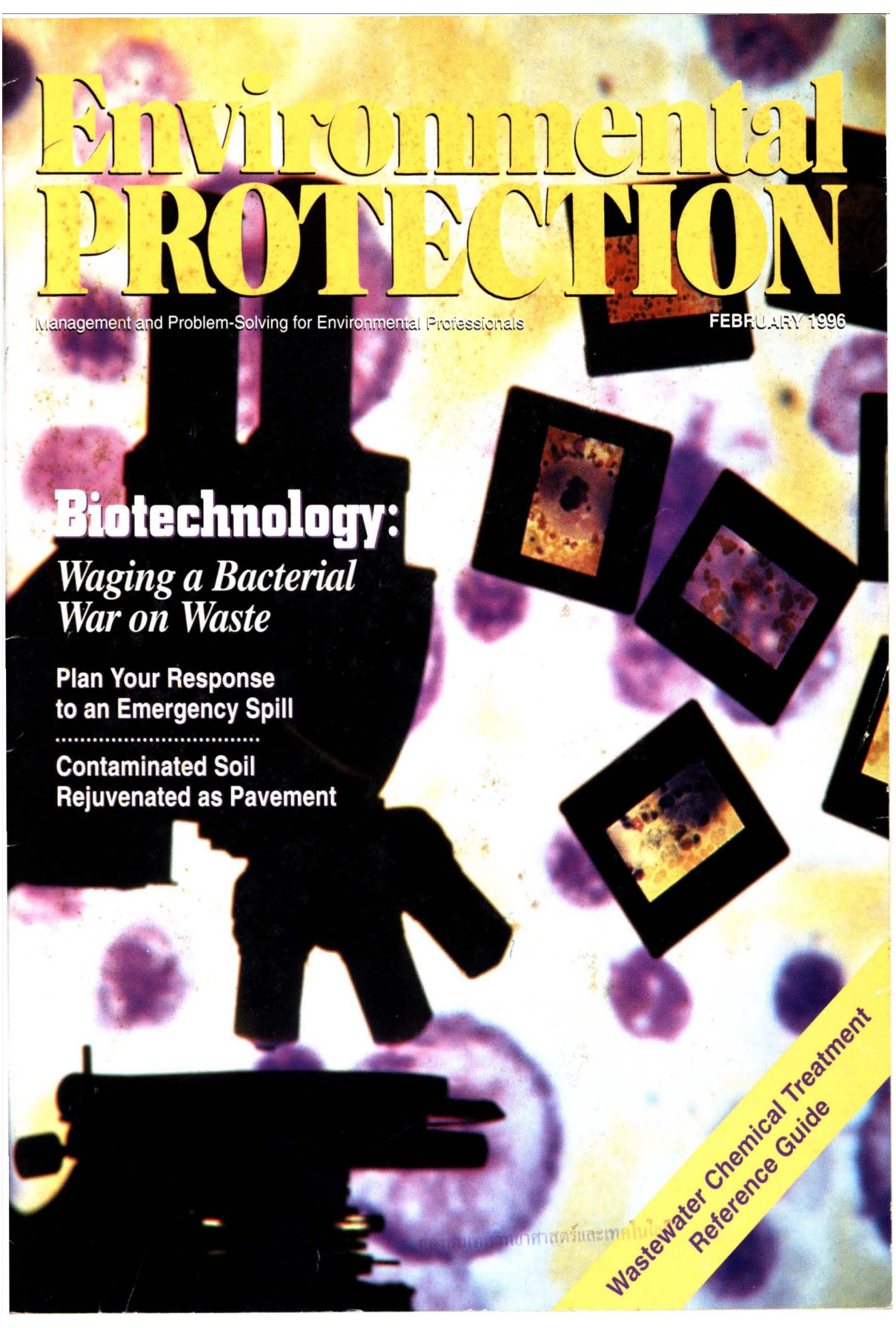


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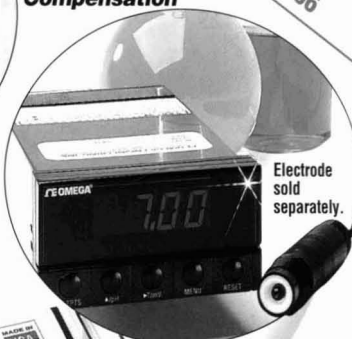


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- Z ☐ Other (please specify) _____

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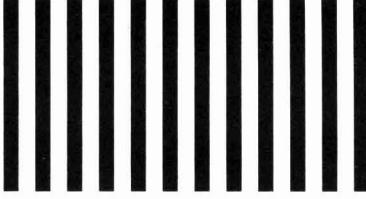
- A ☐ Air F ☐ Toxic & hazardous materials
- B ☐ Water G ☐ Energy control/energy conservation
- C ☐ Noises H ☐ None of the above (please specify) _____
- D ☐ Solid waste disposal
- E ☐ Industrial hygiene

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

- A ☐ Pollution Engineering
- B ☐ Environment Today
- C ☐ Environmental Solutions
- D ☐ Pollution Equipment News
- E ☐ The National Environmental Journal
- F ☐ Water Environment & Technology
- G ☐ None of the above (please specify) _____



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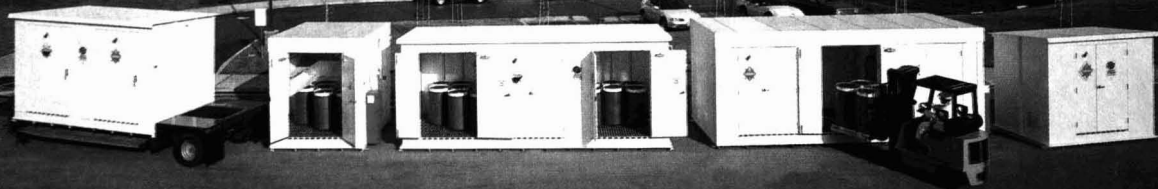


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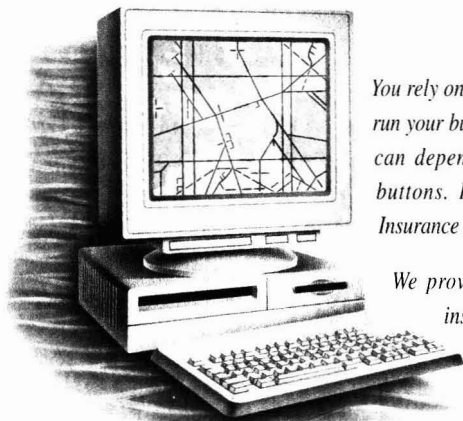
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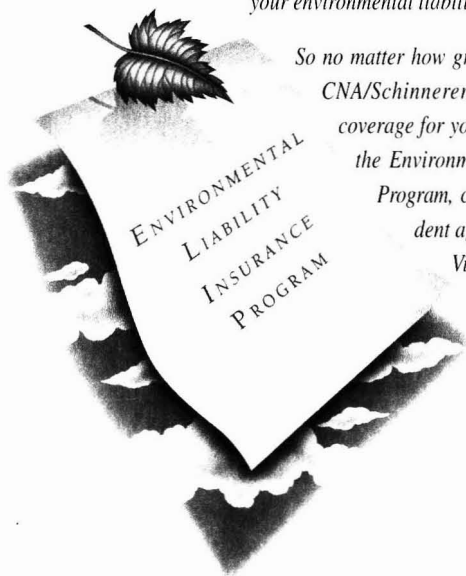
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Cover:

Biotechnology harnesses both natural and genetically modified microorganisms to clean up contaminated sites. Turn to page 26 to find out about a Texas company that raises waste-munching bacteria to handle the dirty work.

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From Swiss Cheese To Superfund Cleanups

Biotechnology is nothing new. For centuries, society has used biological processes for the production of various foods and beverages, such as cheese, yogurt, wine and beer. On the other hand, bioremediation is a newcomer to the field.

Beginning in the 1980s, financial concerns prompted the development of bioremediation, a new type of biotechnology using microbiological processes to treat environmental contaminants.

The reason for bioremediation's growth is that it is cheaper than the traditional methods of incineration or disposal in landfills. Bioremediation also is attractive because it effectively destroys most organic wastes by degrading them into less-hazardous constituents and thereby eliminates future liability for landowners.

In contrast, when hazardous waste is entombed in a landfill, the waste generator still has potential liability that extends beyond "cradle to grave" if there were an accidental release of the generator's waste from the landfill.

Obviously, the treatment of hazardous waste requires more sophisticated bioengineering than the production of Swiss cheese. Recently, environmental engineers and scientists have developed an impressive variety of bioremediation techniques to treat different kinds of environmental contaminants.

In-situ remediation is the treatment of the contaminated material in place without removal off site. In-situ technologies include land treatment, bioventing, air sparging and liquid delivery systems. Ex-situ remediation involves moving the contaminated material to another area for treatment. Bioreactors, soil pile treatment and composting are examples of ex-situ technologies.

Bioremediation is quickly becoming one of the leading remediation technologies for large contaminated sites. In a recently released Environmental Protection Agency report, bioremediation and other "innovative technologies" were selected more often during 1993 and 1994 for treatment of soil, sludge, sediments and other contaminated solids at Superfund sites than "established technologies," such as incineration.

The most frequently chosen innovative technologies for treating soil were bioremediation, soil-vapor extraction and thermal desorption, according to the EPA report. Air sparging and in-situ bioremediation were the most commonly selected innovative technologies for groundwater remediation.

The use of traditional technologies has decreased primarily because communities are unwilling to accept incineration, due to dioxin concerns and other negative perceptions, said John W. Kingscott, an engineer with EPA's Technology Innovation Office. Nearby residents resisted EPA's efforts to locate temporary incinerators.

Many environmental professionals are also forecasting the continued rise in bioremediation's use. In an article beginning on page 26, J.M. Morales, the founder of a company that raises bacteria for bioaugmentation, predicts that an increasing number of Superfund site owners will choose bioremediation because of a lower cost relative to other cleanup technologies.

Coming trends in bioremediation include the use of molecular genetics to develop new bacterial strains able to break down formerly "recalcitrant" contaminants and the creation of new engineering technologies to improve the rate and extent of hazardous-waste degradation. And as these new breakthroughs occur, bioremediation promises to grow even more in popularity.

Angela Neville

Angela Neville
Editor-in-Chief

Environmental PROTECTION

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NEWS UPDATE

Most Companies Favor Voluntary ISO 14001

A large percentage of North American companies think a proposed international standard for how companies manage their environmental performance will be important to their future success, according to a recent survey. The Arthur D. Little survey queried 260 U.S. and Canadian companies about the potential importance of ISO 14001.

Sixty-two percent of the respondents said third-party certification to the ISO 14001 standard would be important to the future of their business. Nearly 86 percent said it was important their environmental-management systems at least be equivalent to the ISO 14001 standard.

Though the standard would be voluntary, a majority of companies said it would be important in helping demonstrate good environmental management as well as offering potential competitive advantages.

Arthur D. Little Environmental, Health, and Safety Consulting mailed a 12-question survey to the senior managers of environmental, health and safety at 260 U.S. and Canadian companies asking about the potential importance of the standard. Responses were received from 115 companies, most reporting more than \$1 billion in sales apiece.

Old Tires Given Second Life

An innovative approach to recycling discarded rubber auto and truck tires offers significant improvements in material properties as well as raw material cost savings in the production of polyurethane parts, according to a recent study.

Funded by the California Integrated Waste Management Board, the study by Champion Recycling Inc. of Apple Valley, Calif., showed that finely ground rubber can be used successfully as a cost-effective filler in polyurethane bicycle tires, industrial wheels, shoe outer soles and other products.

Champion subcontracted the technical development and testing procedures to Urethane Technologies Inc., a Santa Ana, Calif., firm that holds patents on processes used to treat ground rubber.

Earlier attempts to use ground crumb rubber as a filler in high-performance polyurethane systems had limited success because of problems getting the rubber to bond with the polymer. But a process developed by UTI modified the surface of the crumb rubber and helped enhance adhesion of the rubber particles to the polymer.

Louisiana Taxpayers Get Stuck with Cleanup Bill

The Louisiana state agency that regulates hazardous-waste generators does not adequately enforce regulations, leaving taxpayers to pick up the tab for millions of dollars in cleanup costs for abandoned sites, according to a state audit report. That means companies responsible for their cleanup could contest any Department of Environmental Quality decision because the department has no regulations to support its position, according to the audit.

At least 155 inactive hazardous-waste

sites could have to be cleaned up by Louisiana at a cost of more than \$250 million. The state, however, hopes responsible parties can be identified and forced to pay for as many as 100 of those sites. A bigger problem may be the other 561 sites under evaluation, because it may be harder to find the parties responsible for those sites.

Biotech Growth Prompts O.K. of Patent Law Bill

Concerned about current patent laws keeping pace with the rapid growth in biotechnology, President Bill Clinton recently

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NEWS UPDATE

signed a bill updating current patent laws.

"Process patents are especially important in biotechnology, since part of the genius of that field is to produce commercial quantities of breakthrough products through new and inventive processes," Clinton said as he signed Senate 1111 into law. "If the innovative process used to make a biotechnology product is not protected by patent, American biotechnology will remain vulnerable to foreign imitation."

In less than two decades, the biotechnology industry has created more than 100,000 American jobs and currently generates annual sales of more than \$7 billion.

Get the Scoop on Petro Release Sites

PS 3, Provisional Standard Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases, has been approved by Subcommittee E50.01 on Storage Tanks, part of the American Society for Testing and Materials Committee E-50 on Environmental Assessment.

The provisional standard covers a process available to site owners, contractors, consul-

tants, regulators and other interested parties to rapidly and accurately assess a confirmed or suspected petroleum release at a site. A framework is provided for interested parties to use in conjunction with or in the absence of regulatory policy or statute to accelerate site characterization activities.

The provisional standard also serves as a model for streamlining the regulatory processes so that the site characterizations and corrective actions can proceed in an efficient and cost-effective manner.

For more information, contact Gilberto Alvarez, Environmental Protection Agency, HRU-8J, 77 W. Jackson, Chicago, IL 60604, (312) 886-6143; or Pat Barr, ASTM, (610) 832-9736.

16,000 Arkansas Homes Have Unsafe Drinking Water

More than 16,000 Arkansas homes that draw drinking water from wells are getting contaminated water, according to a U.S. Department of Agriculture report.

The four-month-long survey found that of the 16,208 Arkansas households in need of improved drinking water, 10,328 "suffer

from such severe quality and dependability problems that their in-house water is seldom, if ever, drinkable." The households were found in 50 communities in 32 counties.

The assessment was part of President Bill Clinton's "Water 2000" initiative, which aims to deliver safe drinking water to the estimated 1 million rural Americans currently living without water piped directly into their homes.

Landfill Methane Woes May Be Power Boom for Town

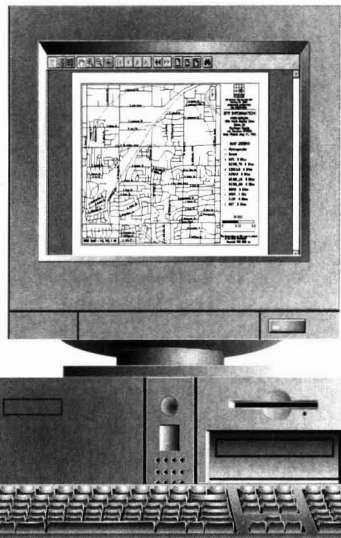
A Minnesota company hopes that a power plant it plans to build to convert methane gas produced by rotting garbage will turn a chronic headache into an energy resource. The Tacoma, Wash., City Council signed an agreement with NEO Corp., a subsidiary of Northern States Power, granting NEO an exclusive lease on the methane from the 200-acre city dump.

The firm already operates five landfill-gas power plants in Minnesota and is developing 20 more in seven states, including a project in Spokane, Wash.

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Whether the Tacoma project goes forward, however, will depend on power prices and other market forces.

The leaking gas and other contamination problems landed the Tacoma dump on the Superfund list.

As part of a multimillion-dollar cleanup, the city installed a network of wells to suck up the landfill gas and keep it from creeping onto neighboring property. The gas currently is burned off in open flares, a process that wastes the equivalent of 8,700 gallons of oil every day.

Environmental Firms Top 1995 Most-Profitable List

Using the ability to generate a profit as a basis, The Environmental Benchmark ranked the top performing public companies in the environmental services industry.

Leading the pack of most profitable companies was Bandag Inc., a \$600 million internationally diversified recycler and retreader of tires. The firm generated a net after-tax return on sales of 14 percent and a return on stockholders' equity of 23 percent.

Close behind were two instrumentation companies—Dionex Corp. and Hach Co.—and two from the integrated water and wastewater sector—Betz Labs and Osmo-nics. Dionex manufactures laboratory instruments, and Hach is the leading international producer of field water-testing kits.

Betz manufactures water treatment chemicals, while Osmo-nics provides water-treatment services and technologies. The other two companies cited were Severson Environmental, an environmental-remediation contractor, and Newpark Resources, a handler of nonhazardous oil-field wastes.

Idaho Agencies, Dairies Join Together to Fight Dairy Wastes

The U.S. Environmental Protection Agency, the Idaho Division of Environmental Quality, the Idaho State Department of Agriculture and the Idaho Dairymen's Association have formed a new program to ensure all dairy waste-management systems in the state are inspected in conjunction with routine milk inspections. In the past, the EPA and the state Division of Environmental Quality were only able to

check 50 of the state's dairies each year.

Idaho's dairy industry has experienced rapid growth during the past few years, particularly in the south-central Magic Valley area. With the growth came concerns about potential surface-water contamination caused by manure. Currently the state has about 1,440 dairies.

Under the new arrangement, the state department of agriculture will be able to revoke a license to sell milk when dairy wastes are illegally discharged. It will also be responsible for reviewing and approving design plans for lagoons.

Plan to Cut Western Park Haze Irks Environmental Groups

A government commission's draft plan to get rid of the haze over the Grand Canyon and other Western parks doesn't do enough to clean up the air over the Colorado Plateau, environmentalists said. The plan, drafted by governors and their representatives from eight states, contains recommendations running the gamut from capping emissions to requiring industries to install smoke-stack scrubbers. Included in the rec-

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NEWS UPDATE

ommendations are changing fuel standards or doing nothing at all, which bothers some environmental groups.

The haze hanging over the parks is from a variety of sources—some from as far away as Mexico—and includes automobiles, power plants, copper smelters and prescribed burns designed to cut down on wildfires in forests.

The report offers eight options to reduce the haze, the most drastic of which would improve visibility by 25 percent by the year 2010. Others would take up to 30 years longer. Costs would be between \$70 million and \$1.1 billion.

Explosive Contaminants Creep Into Nearby Groundwater

Traces of high explosives discovered in groundwater near the nation's nuclear bomb assembly plant outside of Amarillo, Texas, may require cleanup or other control measures, according to regulators. The explosive, RDX, was found in a test boring at a level of 77 parts per billion. The state's residential cleanup standards for RDX are set at 3 ppb for the Pantex site.

It is the first off-site contamination linked to the U.S. Department of Energy weapons plant. In March 1995, officials expected the explosive contamination to leave the Pantex site because sampling around the boundaries had detected contaminants.

No contamination has been detected yet in the Ogallala Aquifer, which serves as a water source for much of the High Plains, but it has been detected at a depth of about 280 feet in a perched aquifer above the Ogallala.

Lead-Acid Batteries Lead List of Most-Recycled Products

For the past eight years, lead-acid batteries—the kind used to start cars, trucks and boats—have been the most recycled consumer product, according to a survey by the Battery Council International. With a recycling rate of 98 percent for battery lead, batteries beat aluminum cans (65 percent), glass bottles (37 percent) and newspapers (59 percent).

Virtually 100 percent of the lead and plastic in a lead-acid battery can be reclaimed through recycling, and new lead-

acid batteries are manufactured with the reclaimed materials.

Duke Receives \$20 Million Gift for Environmental Studies

In one of the largest gifts to support environmental education and research, the family of Boston business executive Peter M. Nicholas gave \$20 million to the School of the Environment at Duke University in Durham, N.C.

Until the recent announcement, a \$20 million gift by the Bass Foundation and Philology Trust of Texas to Yale University was believed to be the largest private donation to support environmental education and research.

As a result of the gift, Duke will rename the school the Nicholas School of the Environment. University officials said the gift will provide \$10 million in endowment to help pay for a wing of the \$80-million Levine Science Research Center. The gift also will provide \$6 million to endow four new professorships, \$2 million to fund a fellows-in-residence program and \$2 million in unrestricted endowment. **EP**

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THE GRAPEVINE

Berryman & Henigar, a San Diego, Calif.-based consulting engineering firm, named Donald R. Allison as vice president....**Roy F. Weston Inc.**, of West Chester, Pa., announced third-quarter 1995 net income of \$748,000, or 8 cents a share, compared to a break-even third period a year ago....**The Dow Chemical Company** and the **Hartford Steam Boiler Inspection and Insurance Company** announced plans for two of their wholly owned subsidiaries to form a new company—Dow Radian LLC.

Bethlehem Steel, of Greenville, S.C., awarded a contract to **Rust Environment & Infrastructure Inc.** to design and engineer a demonstration plant for a new de-oiling technology that recovers iron and oil from mill sludge....**Fluor Daniel** of Greenville, S.C., selected Toth Aluminum Corp. as the prime engineering contractor for a three-phase project to design and construct a metal chlorides plant....**The Washington Department of Ecology** awarded a \$432,375 grant to the Port of Pasco to begin cleaning up petroleum and agricultural chemical contamination at the port.

Enviro Inc., of Philadelphia, Pa., received the Pennsylvania Governor's Export to Excellence Award in the service sector, new-to-export category....Joe Pinkul joined **Ransomes America Corporation**, a Lincoln, Neb., manufacturer of Cushman personnel and burden carriers, as regional sales manager....**The International Society for Measurement and Control** elected Ronald B. Jones, P.E., as president, and Paul T. Arbuckle, president-elect secretary and for 1995-96.

Spectronics Corp., of Westbury, N.Y., settled its Canadian patent infringement lawsuit against Cliphlight Manufacturing Co. concerning the perylene-based AR-GLO® ultraviolet-flourescent leak detection additives....The West Chester, Pa., consulting firm, **Roy F. Weston Inc.**, received a \$17 million contract for technical and support services at the U.S. Department of Energy's Waste Isolation Pilot Plant near Carlsbad, N.M....Pacific Northwest Laboratory is now **Pacific Northwest National Laboratory** to more accurately reflect the lab's role as a major research facility working on many of the nation's toughest science and technology problems.

ENSR, of Acton, Mass., opened an office in Oak Ridge, Tenn., to support its Department of Energy project efforts.... Barry J. Franz, P.E., P.G., and Gordon S. Horn, P.E.—engineers with **Weston**, of West Chester, Pa.—were accepted into the American Academy of Environmental Engineers as diplomates with specialty certification in the hazardous waste management category....The Department of Energy and the Las Vegas, Nev.-based **FCI Environmental Inc.** are cooperating on a research project to develop rugged, miniature fiber optic sensors to monitor for petrochemicals and other pollutants.

Praxair Inc., of Danbury, Conn.; **Corning Inc.**, of Corning, N.Y.; and **Gallo Glass Co.**, of Modesto, Calif., received DOE's Technology Commercialization Awards for a joint project demonstrating the environmental, energy-saving benefits and commercial viability of oxygen use in glass melting....**Battelle**, based in Columbus, Ohio, has won an environmental remediation contract valued at up to \$50 million with the Naval Facilities Engineering Command.

Dow Environmental Inc., a wholly owned subsidiary of The Dow Chemical Co. based in Rockville, Md., was awarded a long-term construction contract from the Army Corps of Engineers for the Higgins Farm Groundwater Treatment System. **EP**

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Down in the Dumps

New EPA regulations may cause many landfill operators to install costly gas-collection systems and implement additional monitoring and control measures.

By James A. Mennell and Daniel S. Schleck

Early this year, the U.S. Environmental Protection Agency will publish new source performance standards (NSPS) and emission guidelines for municipal solid waste landfills (MSWLF).

The regulations will affect the way MSWLFs operate landfill gas-collection systems and will require additional monitoring and control measures at many sites.

The standards will address emissions of nonmethane organic compounds (NMOCs) and methane from landfills. NMOCs include a variety of volatile organic compounds (VOCs), hazardous air pollutants (HAPs) and odorous compounds.

According to the EPA, the new standards will protect against adverse health effects from NMOCs and methane emissions. The EPA estimates the standards will cost about \$100 million for new landfills and approximately \$1.3 billion for existing landfills.

Applicability

The final regulation will require each active landfill with a maximum design capacity of more than 2.5 million megagrams (one Mg is about 1.1 tons) or 2.5 million cubic meters in place to calculate and re-

port its annual NMOC emission rate. Any facility that emits more than 50 Mg/year of NMOCs must install required emission controls.

The regulation will establish operational and control requirements for new and existing landfills. A new MSWLF is defined as "a landfill for which construction, modification or reconstruction commences on

existing landfills that emit more than 50 Mg/year of NMOCs to implement a "well-designed and well-operated" gas-collection system and install a control device capable of reducing NMOC emissions by 98 weight percent.

Under the regulation, the system must be capable of handling the maximum gas generated by waste that has been at the facility for more than five years if the facility is active or more than two years if a facility is closed.

It must be designed to allow adjustments in system operation based on monitoring results, be able to collect gas effectively from all areas of the landfill that warrant control, and be expandable to collect gas from new areas of the landfill.

In addition, the system must collect gas from each area, cell or group of cells at the site with waste older than five years, and be able to operate with each wellhead under negative pressure while meeting regulatory requirements for nitrogen and oxygen levels. It must maintain a landfill gas temperature of less than 55 degrees Celsius at each wellhead and must limit surface methane concentrations to 500 parts per million or less over the landfill surface.

In addition to implementing the gas-collection system, landfills must install an

Implementation of the regulations will force landfills to spend significant money and effort to satisfy design, operation and control requirements.

or after the proposal date of May 30, 1991, or that began accepting waste on or after that date."

Modification includes lateral expansion of a facility where the overall design capacity is increased. An existing landfill includes any that accepted waste after Nov. 8, 1987, and is currently accepting waste or has additional design capacity.

Major Requirements

The new standards require qualified new or

emission-reduction-control device.

Under the regulation, the emission-reduction-control device must satisfy the Clean Air Act's best developed technology (BDT) requirements. According to the EPA, the BDT for landfill gas treatment is a control device that can reduce NMOs by 98 weight percent.

Potential Effects

Implementation of the regulations will force landfills to spend significant money and effort to satisfy design, operation and control requirements.

In addition, the regulations will increase permitting requirements under state and local regulations and Title V of the Clean Air Act. For example, any facility emitting more than 50 Mg/year of NMOs and subject to the NSPS is required to obtain an operating permit under Title V. The regulation will impose additional requirements on closure of facilities.

Before removing controls required by the new regulation, landfills must be permanently closed and satisfy 40 CFR 258.6 requirements. They also must have a collection system in continuous operation a minimum of 15 years and have been tested three times, each at least three months apart, where monitored emission levels are less than emission levels from the control device.

The regulation also may impose additional requirements on cleanup of MSWLFs under the Comprehensive Environmental Response, Compensation and Liability Act, commonly known as Superfund. Remediation may constitute a "modification," causing many landfills to fall under the new standards.

In addition, the regulation's preamble suggests the standards are likely to be an applicable or relevant and appropriate requirement (ARAR) for cleanups at MSWLFs. Accordingly, in addition to direct design, operational and control requirements for landfills, the regulation may also have significant effects on permitting requirements, closures and cleanups of MSWLFs.

Unresolved Issues

Several issues remain unresolved involving the scope and implementation of the regulation. They include the type of modification that will make an existing facility subject to the requirements of the regulation, the applicability of the new regulation to cleanups of MSWLFs and decisions as to whether an area of a MSWLF "warrants control" of

landfill gas.

The regulation also lacks provisions to deal with potential interference with measurement of surface methane and NMO concentrations caused by compost operations, on-site fuel storage and on-site leachate collection and storage.

In addition, the regulation fails to spell out the requirements that a passive landfill collection system must meet in order to be considered a "well-designed and well-operated system."

The EPA will have to deal with the issues as it begins implementing the new

regulations.

Because the new regulation imposes significant and expensive requirements on new and existing MSWLFs, landfill operators should be prepared to comply with new design, operation and control requirements. The EPA's regulation will become effective when published in the *Federal Register*. **EP**

James A. Mennell and Daniel S. Schleck are environmental attorneys for Popham, Haik, Schnobrich & Kaufman Ltd., Minneapolis, Minn.

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COMPANY	PRODUCT	DESCRIPTION	LIQUID SOLID	PACKAGING	SPECIAL FEATURES
NALCO CHEMICAL CO. 1 Nalco Center Naperville, IL 60563-1198 708-305-1545 Fax 708-305-2942 Circle 37 on card.	Ultion SVC®	Low molecular weight organic polymer designed to replace sodium aluminate and other inorganic coagulants.	✓	200- and 400-gal. units, bulk and 55-gal. drums	Obtains greater COD, BOD and color removal than with inorganic coagulants. NSF-approved for use in clarification in drinking water. Effective across broad pH range.
	Nalco 21200®	Traced low molecular organic polymer that is ideal for flows with high degree of variability in solids content and volume.	✓	200- and 400-gal. units, bulk and 55-gal. drums	Allows precise dosing at optimum settling rates. More effective than inorganic coagulants and results in lower sludge volumes. Effective across broad pH range.
	Optimer®	Modified acrylamide cationic polymer that speeds settling in primary and secondary clarifiers. Provides sludge conditioning prior to dewatering, DAF thickening, gravity thickening.	✓	200- and 400-gal. units, bulk and 55-gal. drums	Produces large floc that holds up to pressing and gives superior water release. Provides fast settling to improve effluent clarity. Reduces BOD, COD and TSS. Effective across broad pH range.
	Ultimer®	Modified acrylamide polymer that speeds settling in primary and secondary clarifiers. Provides sludge conditioning prior to dewatering, DAF/IAF thickening, gravity thickening.	✓	200- and 400-gal. units, bulk and 55-gal. drums	Free of VOCs and requires no expensive feed equipment. Provides fast settling to improve effluent clarity. Reduces BOD, COD and TSS. Produces large floc that holds up to pressing and gives superior water release. Effective across broad pH range.
	Nalclear®	Anionic/nonionic modified acrylamide/acrylic acid copolymer. Speeds settling in primary and secondary clarifiers. Provides sludge conditioning prior to dewatering, DAF/IAF thickening, gravity thickening.	✓ ✓	200- and 400-gal. units, bulk and 55-gal. drums. Dry products available in 50-lb bags.	Produces large, sheer floc that hold up to pressing and gives superior water release. Provides fast settling to improve effluent clarity. Reduces BOD, COD and TSS. Reduces insoluble metals to very low levels. Effective across broad pH range.
	Nalmet®	Solution polymer modified with chelating groups that is effective in reducing soluble metal concentrations to low levels.	✓	200- and 400-gal. units, bulk and 55-gal. drums	Acts as a stand-alone program to settle out soluble metals from aqueous solutions across broad pH range. Effective even when metals or chelating agents are present. Produces up to two-thirds less sludge than conventional metal removal programs.
PROBIOTIC SOLUTIONS 201 S. Roosevelt Ave. Chandler, AZ 85226 800-961-1220 Fax 602-961-3501 Circle 38 on card.	Actival	Emulsifies grease in wastewater sewer.	✓	5-gal. plastic containers	Nontoxic, concentrated and safe to handle.
	Bio Energizer™	Reduces grease problems in sewer lines and lift stations. Increases bio-oxidation of wastewater that reduces sludge and odor levels.	✓	5-gal. plastic containers	Nontoxic, concentrated and safe to handle.
	Bio Feed	Provides nutrients and energy to support probiotic bioremediation systems in wastewater.	✓	5-gal. plastic container	Nontoxic, concentrated and safe to handle.
	Micatal	Catalyzes the breakdown of chemical and petroleum compounds and promotes microbial proliferation causing biodegradation into carbon dioxide and water. Effective in detoxifying chemicals in soil and wastewater.	✓	5-gal. plastic container	Nontoxic, concentrated and safe to handle.
ASHLAND CHEMICAL CO. Drew Industrial Division 1 Drew Plaza Boonton, NJ 07005 201-263-7600 Fax 201-263-4483 Circle 39 on card.	Drewfloc® 2270 Polymer	Anionic polycrylamide emulsion polymer used as flocculant for clarification, thickening and dewatering of wastewater and sludges. Used as coagulant aid for potable water and wastewater requiring pretreatment with cationic coagulants.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55-gal. drums	Recently reformulated for better product stability, quicker dissolution and higher molecular weight.
	Drewfloc® 2478 Polymer	Cationic polycrylamide emulsion polymer used as flocculant for clarification, thickening and dewatering of wastewater and sludges. Dewater biological sludges on a wide variety of dewatering equipment.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55-gal. drums	New product for dewatering that has high cationic charge and molecular weight. Highly buffered to be effective over wide pH range.
	Drewfloc® 480 Polymer	Cationic polyamine blend used as coagulant for treatment of oily wastewaters, laundry effluents and secondary clarification systems.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55-gal. drums	All-organic coagulant designed to reduce sludge volume and improve dewaterability of solids fraction.
	Chargepac® 12 Coagulant	Polyaluminum chloride blended with cationic polyamines used in industrial liquids/solids separation applications. Useful as coagulant for metals removal and oily wastewater.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55 gal. drums	Inorganic fraction provides efficient removal of solids while the organic fraction reduces sludge volume. Designed to work over wide pH range, thereby minimizing acid and caustic use.
	Amersep® MP-3R Metals Precipitant	Organosulfur compound that binds to soluble metals in industrial effluents and creates an insoluble compound that precipitates. Used in metals plating, semiconductor, auto and primary metals industries.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55-gal. drums	Recently found application in Ashland's patented Ashfix process for stabilizing metals in combustion ash, in which heavy metals in treated ash are strongly bound and will not leach back into the environment.
	Amerfloc® 492 Polymer	Cationic polyquaternary amine used in potable water clarification, secondary clarification and general wastewater treatment systems.	✓	Bulk, 325-gal. bins, 275-gal. bins and 55-gal. drums	All organic product with higher molecular weight than previously available. Creates large floc with good resistance to hydraulic shear and low levels of pinfloc and carryover in plant effluent. Often eliminates need for coagulant aid.

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EAGLEBROOK INC. 833 W. Lincoln Highway Suite 410W Schererville, IN 46375 800-428-3311 Fax 219-322-0438 Circle 40 on card.	FerriClean™	Hydroxy ferric sulfate used as coagulant.	✓		Bulk, drums and totes	Trace metal removal by coprecipitation, absorption and interstitial entrapment.
	Ferric chloride	Ferric chloride used as coagulant.	✓		Bulk, drums and totes	Used for odor control.
MARTIN MARIETTA MAGNESIA SPECIALTIES 2323 Eastern Blvd. Building E Third Floor, East Wing P.O. Box 15470 Baltimore, MD 21220-0470 410-780-5500 Fax 410-750-5555 Circle 41 on card.	FloMag®MHP	Magnesium hydroxide used for acid neutralization, heavy metal precipitation and heavy metal stabilization in sludge.	✓		50-lb. bags and 1,000-2,000-lb. bulk sacks	Can be added directly as a powder or a slurry. Recommended for use where treatment time is critical.
	FloMag™HP & HP-ER	Reactive grades of magnesium oxide used for acid neutralization, precipitation of heavy metals and stabilization of heavy metals in sludge.	✓		Bulk carloads, truckloads, 50-lb. bags and 1,000-2,000 lb. bulk sacks	Recommended in treatment systems with short retention times.
	FloMag®H	Highly reactive magnesium hydroxide aqueous suspension used for acid neutralization, heavy metal removal.	✓		Bulk tank trucks and railcars	Excellent flow and storage properties.
	FloMag®HUS	Highly reactive magnesium hydroxide aqueous suspension used for acid neutralization and heavy metals removal.	✓		Bulk tank trucks and railcars, totes and drums	Designed for prolonged stability.
	MagneClear™95	Technical grade of magnesium oxide used for acid neutralization and heavy metals precipitation.	✓		Bulk trucks and 2,200-lb. bulk sacks	
	MagneClear™58	Stabilized aqueous suspension of magnesium hydroxide used for acid neutralization and heavy metals precipitation.	✓		Bulk tank trucks	Good storage and handling properties.
SOLVAY INTEROX 3333 Richmond Ave. Houston, TX 77098 713-525-6500 Fax 713-525-7880 Circle 42 on card.	Technical grade hydrogen peroxide	Oxidizer.	✓		Drums and tank trucks	
	PeroxCard™ 50 hydrogen peroxide	Oxidizer.	✓		Drum and tank trucks	
	EnviroFirst™ Granules	Oxidizer.	✓		Bags and drums	
GENERAL CHEMICAL CORP. 90 E. Halsey P.O. Box 393 Parsippany, NJ 07054-0393 1-800-631-8050 Fax 201-515-2468 Circle 43 on card.	Aluminum sulfate	Coagulant and flocculant used for removal of phosphorus, fluoride and TOC.	✓	✓	Liquid sold in bulk, and solid sold in bags	
	Polyaluminum chloride and aluminum chloride	Coagulant and flocculant used for removal of phosphorus, fluoride, color and TOC, oily wastewater treatment, dye wastes treatment.	✓		Bulk, semibulk and drums	
	Clar-Ion™ and Hyper-Ion™ formulated coagulants	Coagulant and flocculant used for phosphorus, fluoride, dye, ink and color removal, oil wastewater treatment.	✓		Bulk, semibulk and drums	
	Calcium chloride	Oily wastewater treatment, fluoride, phosphorous, ink and color removal, coagulant precipitant and emulsion breaking.	✓	✓	Sold as liquid in bulk and sold in bags	
	Dechlorination chemicals—sodium metabisulfite, sodium sulfite, ammonium thiosulfate and ammonium bisulfite	Used for dechlorination.	✓	✓	All sold as solids in bulk and bags except for sodium bisulfite, which is sold as a liquid in bulk.	
	Soda ash	Used for pH adjustment, water softening and heavy metals removal.	✓	✓	Sold as solid in bags and bulk and as a liquid in bulk	
	Sulfuric acid	Used for pH adjustment, oily wastewater, color removal and emulsion breaking.	✓		Bulk	
OSPREY BIO TECHNICS 2530 Trailmate Drive Sarasota, FL 34264 941-755-7770 Fax 941-755-0626 Circle 44 on card.	Munox®	Bacterial culture product used as environmental bacteria inoculant.	✓	✓	Bags and jugs	Nonpathogenic. Naturally occurring.
CYTEC INDUSTRIES 5 Garret Mountain Plaza West Paterson, NJ 07424 201-357-3275 Fax 201-357-3065 Circle 45 on card.	Magnifloc® Flocculants Excel® Flocculants	Coagulants, flocculants and polymers.	✓	✓	Drums, tote bins, bags and bulk	High performance for sludge dewatering and clarification applications.
CHEMICAL LIME CO. P.O. Box 121874 Ft. Worth, TX 76121 817-732-8164 Fax 817-732-8144 Circle 46 on card.	Lime	Used to control odor and pH and to neutralize acid waste streams.	✓	✓	Package, bulk and bags	Nonhazardous substance.

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DAVIS WATER & WASTE INDUSTRIES Process Division P.O. Box 29 Tallahassee, FL 34270-0029 800-345-3982 Fax 941-351-4756 Circle 47 on card.	Bioxide®	Patented biochemical solution which controls odors and corrosion caused by hydrogen sulfide and other compounds in wastewater systems.	✓	Bulk, delivered by Davis tankers. Davis supplies and installs storage tanks, pipes, pumps and other metering equipment.	Provides bacterial population that oxidizes dissolved hydrogen sulfide and other reduced sulfur compounds. Eliminates odors caused by mercaptans, amines and other organic compounds.
BETZ WATER Management Group 200 Wimmer Road Horsham, PA 19044-0998 Fax 215-773-6133 215-355-3300 Circle 48 on card.	Novus®	Series of patented cationic emulsion copolymers used for dewatering, primary settling, secondary waste and oily wastewater.	✓	Pails, 55-gal. drums, semi-bulk containers and bulk.	Unique molecular design provides superior performance at lower cost than competitive cationic emulsion flocculants.
	Terrus™	Series of proprietary all-organic, polymeric coagulants designed to replace alum, ferric or other organics, especially when used for oil-in-water separation or low-turbidity influent applications.	✓	Available in pails, 55-gal. drums, semi-bulk containers and bulk.	Unique self-precipitating design may eliminate need for pH adjustment and significantly reduce volume of sludge generated.
	CDP® Polymers	Series of custom polymer blends, including organic and inorganic coagulants and flocculants, designed specifically for each individual customer's wastewater application.	✓	Pails, 55-gal. drums, semi-bulk containers, bulk and Betz PDP® delivery service.	Custom-designed blends reduce cost and enhance performance over single component treatment by providing targeted site selectivity.
	Betz® 5636	Patented polymeric molecules used to precipitate soluble metal ions for removal from industrial wastewater.	✓	Pails, 55-gal. drums, semi-bulk containers and bulk.	Unique technology used to reduce amount of heavy metals, including Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn to low residuals in effluent streams. Effective across wide pH range.
	Foam-Trol®	Series of antifoams designed for wide variety of industrial wastewater applications.	✓	Pails, 55-gal. drums, semi-bulk containers and bulk.	Designed to control foam that may be inherent in certain industrial wastewater applications.
	Rec-Oil®	Designed to break oil-in-water emulsions as part of industrial waste treatment process.	✓	Pails, 55-gal. drums, semi-bulk containers, bulk and Betz PDP® delivery systems.	Improves water quality, better oil/water separation, increased oil recovery and higher grade recovered oil.

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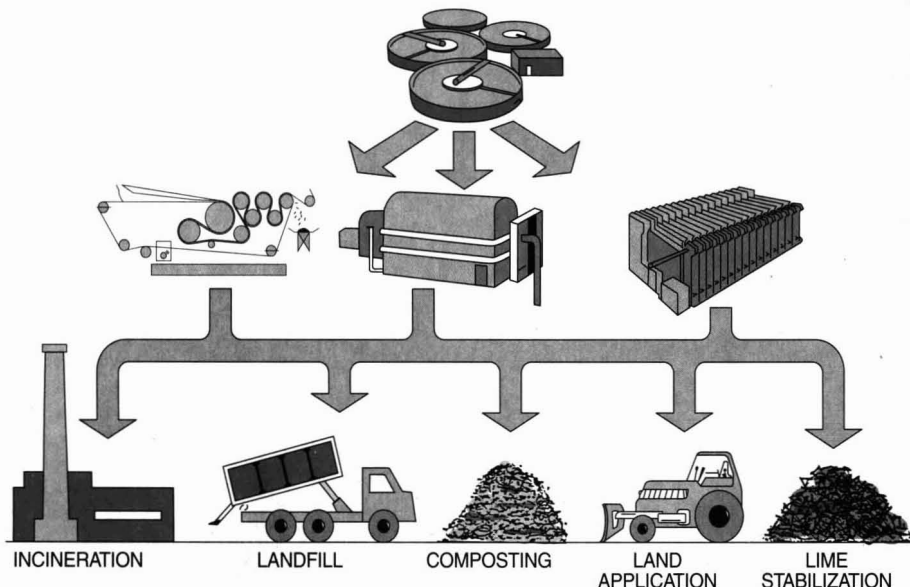
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TECHNOLOGY PROFILE

A GUIDE TO PORTABLE AND HANDHELD AIR INSTRUMENTATION

The ability to efficiently and safely monitor air and gas is an important need in potentially dangerous atmospheres. This profile highlights just a few of the portable and handheld instruments used to detect and monitor air and gas.

Combustible Gas Transmitter

This new combustible gas transmitter by Sensidyne is designed with a comprehensive range of operating features and benefits, providing accurate, reliable and safe monitoring.



Utilizing non-intrusive calibration, the transmitter is designed for easy and safe calibrations without opening the viewing cover. Calibrations require only a small magnetic tool that allows zero and span adjustments directly at the face of the monitor. Lithium cells ensure the calibration settings are maintained, even in the event of a power interruption. Housed in a durable explosion-proof enclosure and coated for chemical resistance in highly corrosive environments, the transmitter has been rigorously tested and is suitable for installation in hazardous areas rated Class I, Division I, Groups B, C and D. **Sensidyne Inc.** Circle 49 on card.



Multigas Monitor

Designed for rough handling in harsh workplace environments, a sturdy new portable instrument that detects up to five gases simultaneously is available from Mine Safety Appliances Co. (MSA). The Watchman™ Multigas Monitor combines state-of-the-art instrumentation with strong, aluminum housing. Ideal for personnel working in dangerous atmospheres, it monitors concentrations of combustible gases and oxygen and up to three toxic gases. **MSA.** Circle 50 on card.

Lead Air Sampler

The Model PST-2 Personal Air Sampler samples worker exposure to airborne lead, asbestos and other toxic particulates in workplaces. It samples flowrates from 0.5 liters to 2.5

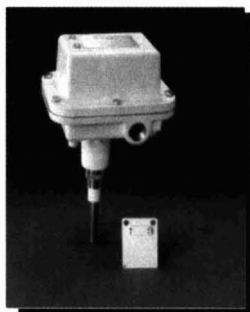


liters per minute using a built-in rechargeable battery pack. The worker wears the sampler—weighing only 32 ounces—for a full work shift. The air samples collect on a pre-loaded filter cassette for inexpensive lab analysis. The

personal air sampler features a fully adjustable electronic flow control, a built-in flow meter, heavy-duty belt clip and flexible tubing with lapel spring clip. **The Staplex Company.** Circle 51 on card.

Broken Bag Detector

The Bindicator Flo-Guard broken bag detector detects the flow of dust, granular or powdered materials in material handling or dust collection systems. It senses the dust from a broken bag or cartridge and



senses solid particles in pneumatic conveying systems. Bindicator's patented design allows for instant indication of power or alarm status. In the event of a broken bag or cartridge, the red LED will illuminate to show alarm status and the need to replace the failed filter. A green light indicates power to the unit. Other features include temperature compensation, external fob function test, sensitivity selection, time delay and fail-safe logic.

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Compact Multigas Monitor

The MiniGas® 4 offers one, two, three or four gas monitoring and data logging for the detection of oxygen, carbon monoxide, hydrogen sulfide



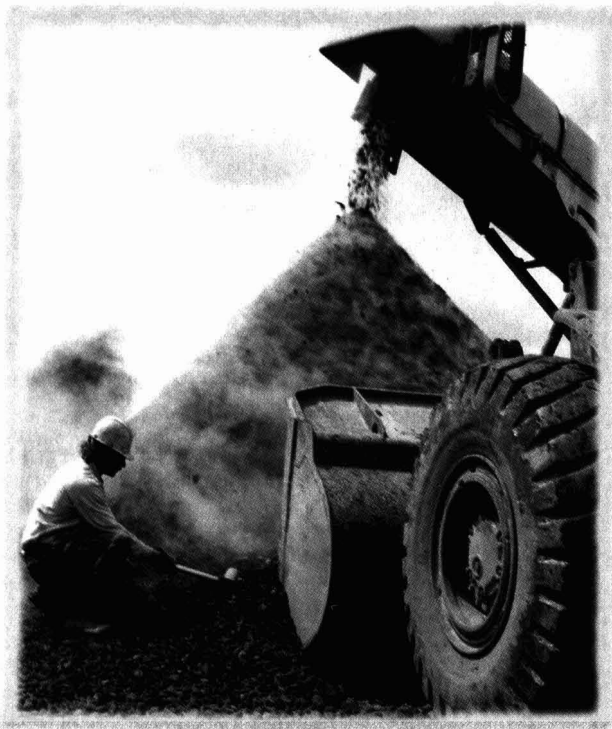
and flammable gases. It has a simple calibration procedure, allowing its user to quickly and easily verify the unit is responding linearly at low, medium and high concentrations of gas. It can be used with a D-cell or rechargeable battery pack that clips on the monitor. A visual "watchdog" signal is emitted periodically to ensure that the unit is functioning properly and a low battery warning indicates when the power source is 30 minutes from exhaustion. **Neotronics.** Circle 53 on card.

Digital Gas Detector

The Sec 1500 is a digital gas detector for nonhazardous industrial environments. It dis-



plays the concentration of the gas and provides an alarm when gas concentration reaches preset levels. The detector continually sniffs the air and has an internal trouble-shooting circuitry. It requires only one person to calibrate and has a user-friendly sequence. **Sensor Electronics.** Circle 54 on card.



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EMERGENCY Spill Response

Training employees how to react to a hazardous spill helps reduce their apprehension and your downtime.

By Chuck McJilton

Small spills in the industrial environment are fairly common and may disrupt the work flow, depending on how they are handled. An efficient, well-thought-out action plan can minimize the risk of employee injury and control production interference.

The key to effective action—whether a large or small spill—depends on what has been done beforehand. Among the essential elements of the response are:

- Defining "small" in the context of your facility.
- Assessing or inventorying chemicals that may spill, including a way to keep the list current.
- Determining or assigning a decision-making chain of command.
- Training all employees in being aware or recognizing a spill.
- Having a communication system for alerting plant personnel who may be affected.
- Practicing the system periodically.
- Planning to address possible scenarios.

Defining "small": It is important for employees who may be at the spill site to know if the "small-spill" response is appropriate or if a commercial spill-response team must be called.

For discussion purposes, "small" in-

volves less-than-reportable quantities and generally less than five gallons of liquid. While it is important to respond to a spill promptly, it is also important to avoid an unnecessary evacuation of the area.

Chemical inventory: A chemical inventory and file of material safety data sheets have been required since the HAZCOM standard (1900.1200) was adopted. The

cleanup or in the area, and potential environmental contamination.

Odor and odor thresholds for a specific chemical is also important, since even a small mercaptan spill will probably affect a large area.

It is important to tell employees this beforehand to answer concerns about possible health effects.

With a limited number of chemicals in use, it is possible to keep brief chemical-specific instructions in a readily accessible form at possible spill sites.

Chemicals with similar physical/chemical properties can be grouped. There are a number of resources, such as the Department of Transportation manual on handling hazardous waste, to help prepare instructions.

Chain of command: Employees should know who to call when a spill occurs, even if it is small enough they can handle it themselves, according to the plan. On each shift, a person should be designated who will decide whether to designate a spill "small" or call outside assistance. Employees also should know who is responsible for deciding to evacuate the area or building.

Training: Employees should receive specific training on the chemicals they handle and the area in which they work. The information should be part of the

*While it is important to respond
to a spill promptly, it is also important
to avoid an unnecessary
evacuation of the area.*

physical and chemical properties important to spill response should be highlighted. For example, a small PCB spill at room temperature is very different than a small ethyl ether spill.

A highly flammable, volatile chemical spill will require controlling ignition sources immediately, while the relatively non-volatile PCB presents a different problem.

The response and the cleanup must reflect protecting the worker doing the

right-to-know training done to meet Occupational Safety and Health Administration regulation 1910.1200. Since employees usually are confronted with a chemical they are used to handling and equipped to handle, it should be easy to move into dealing with a spill—either clean it up or simply contain it until a cleanup team arrives.

Training should build on what employees already know and are comfortable with.

Communication: It must be determined who needs to be notified if there's a "small spill" and what system will be used. Employees must know who to call when a spill occurs, and the reporting chain should be clearly defined.

Because "small" is less-than-reportable, communication will be in-plant only. Each company must decide how and to what extent such spills will be documented.

Plan/anticipate: A component of the job-safety analysis should be to consider the possible chemical spill scenarios. It needs to be job specific and involve input from the employees handling the chemical. It is also possible to predict the most likely spill and the largest spill.

Practice system A spill-response exercise should include:

- Identifying the spilled material and assessing the approximate spill volume. Refer to the prepared information on the appropriate response distributed as part of HAZCOM.
- Quickly assessing the potential for fire or explosions and taking appropriate action.
- Assessing the ventilation requirements and taking appropriate emergency action, if necessary.
- If emergency medical care is required, begin first aid and medical response according to company policy.
- If the spill exceeds the "small" definition, it should be referred to the appropriate trained spill-response team.
- If possible, shut off the spill source and follow the predetermined cleanup process.

The cleanup details must be chemical specific and should be part of the action plan to give employees the most confidence in handling small spills.

A well-thought-out plan before the spill can do a lot to keep the overall impact small.

Chuck McJilton is senior industrial hygienist with Delta Environmental Consultants, St. Paul, Minn.



Soil Recycling Paves the Way for Treating Brownfields

A soil recycling and stabilization process allows once-contaminated soil to be incorporated into paving materials.

By Richard Gladdys

A local developer found an unexpected problem. The 10-acre parcel of urban real estate that he recently purchased, vacant for many years, seemed ideal for a new mini-mall development. The selling price was extremely reasonable, because the lot had repeatedly been passed over by developers seeking suburban locations for their commercial expansion.

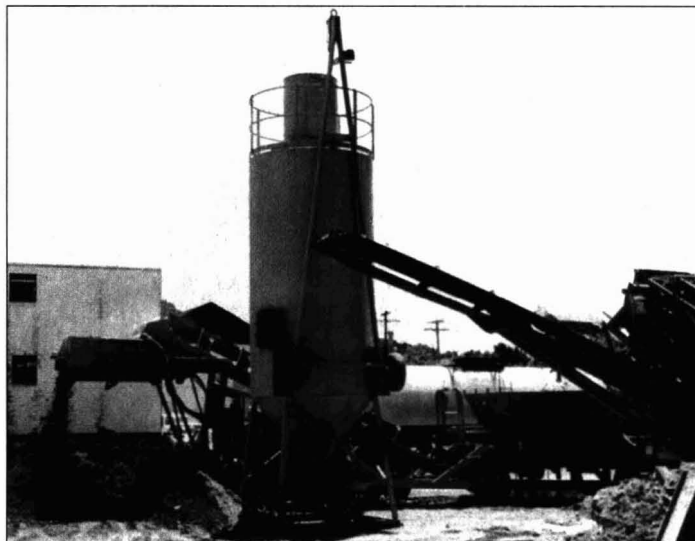
The site, which previously housed a service station and light manufacturing company, is known as a "brownfield." Its development will attract business and help revitalize the neighborhood.

During the site assessment phase, however, the developer discovered that 3,000 cubic yards of soil has been contaminated by fuel oil and heavy metals (lead). Underground storage tanks that leaked into the soil caused part of the problem; the rest came from years of manufacturing use. This once "great deal" now looked considerably less so.

The Options

Contaminated soil is more widespread than often realized, emanating from a variety of sources. One of the more common sources is petroleum products, such as fuel oil and gasoline. A recent Environmental Protection Agency report placed the number of underground storage tanks in the United States at 1.56 million, with nearly 167,000 reported as leaking.

Until recently, the conventional manner



Contaminated soil is fed into a pugmill, where it is mixed with an asphalt-emulsion formulation that binds the hydrocarbons.

of dealing with such a situation was to have the material excavated, separated from the remaining soil and trucked to a landfill site that accepts hazardous waste. Problems associated with that strategy are becoming more obvious, and include excessive costs and time delays, a decreasing number of landfills that will accept contaminated soil, and Superfund regulations which often place liability for such contaminated soil on the shoulders of the developer. Litigation and financial hardship, not

relief, were often the result of this attempted solution.

Move the Solution, Not the Problem

The concept of on-site recycling and beneficial on-site reuse embraces the philosophy, "Move the solution, not the problem." One of the first applications of this process was at Boston's Morgan Memorial Goodwill Industries, where a seemingly

continued on page 32



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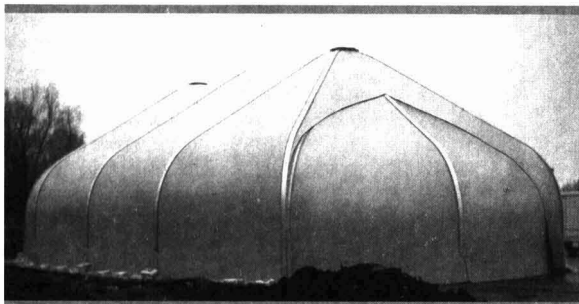
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This Bug's for You

A blend of organisms specially selected for their waste-munching abilities can enhance bioremediation.

By Vicky Boyd

JM. Morales is a mechanical engineer by trade, but he's caught "the bug."
"I believed back when I started the company and I still believe today that 80 percent to 85 percent of all problems can be solved with bacteria," Morales said. "With our environmental pollution problems, there's no doubt about it."

As founder of Micro-Bac International Inc. of Round Rock, Texas, Morales commercially produces various blends of beneficial "bugs," or microbes, that help treat contaminated waste sites and handle daily industrial-waste problems. If the contaminants prove to be out-of-the-ordinary or are an unusual mix, the firm's researchers can develop a custom mix of microbes especially suited to the problem. Microbes are used for more than degrading contaminants. Special blends are also effective in breaking emulsions, such as an oil blend in a pond or controlling paraffin in oil wells.

But bioremediation, the process of using bacteria to help degrade contaminants, isn't as easy as spraying beneficial microbes on a contaminated site and walking away, Morales said.

Treating a contaminated site involves problem identification, pretreatment analysis, reviewing alternative technology and, if necessary, conducting field studies before making a treatment choice. As part

of the studies, researchers may conduct treatability tests to establish site toxicity and the feasibility of bioremediation.

It also involves confirming the federal or state ARARs (Applicable or Relevant and Appropriate Regulations) that apply, field surveys to determine the extent of contam-

proper time frame.

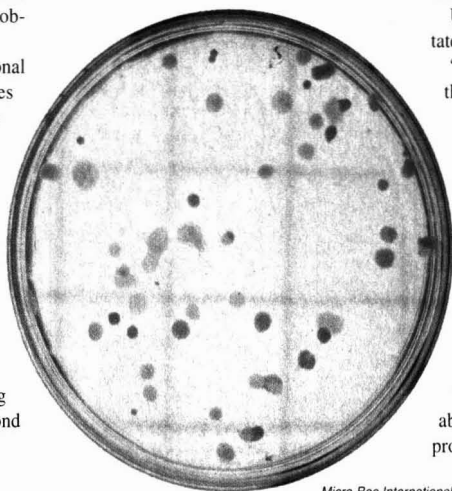
And bioremediation may not be appropriate for every contaminated site. "Many technologies work faster but bacteria are more complete," Morales said. "You also have time considerations for the client. You always have to temper the time element with the cost."

Ultimately, the client's budget will dictate the treatment choice.

"Dollars, which also includes time, are the major driving factor," said Michael Hargett, Micro-Bac vice president. "It's not so much the consumer's acceptance or ultimate liability."

Throughout the years, other entrepreneurs have shared Morales' belief that bacteria are the answer to many of the waste-treatment problems. At the peak of the bioaugmentation or bioremediation craze, there were about 120 companies throughout the country dealing in beneficial bacteria.

Today, that number has dwindled to about 15, which includes companies that produce bacteria for other than waste-treatment uses.



Micro-Bac International Inc.

Hydrocarbon-degrading bacteria on a petri dish.

ination and engineering to design the project. Even if the review shows bioremediation is appropriate and the microbes are applied, the site still requires frequent monitoring to ensure the organisms are producing the desired results along the

Bioaugmentation

Bioaugmentation involves boosting the naturally occurring micro-organism population with a specially formulated mix of organisms that helps speed the natural degradation process.

"If you were to dump something hazardous on the ground today, nature would provide the right bacteria to degrade it,"

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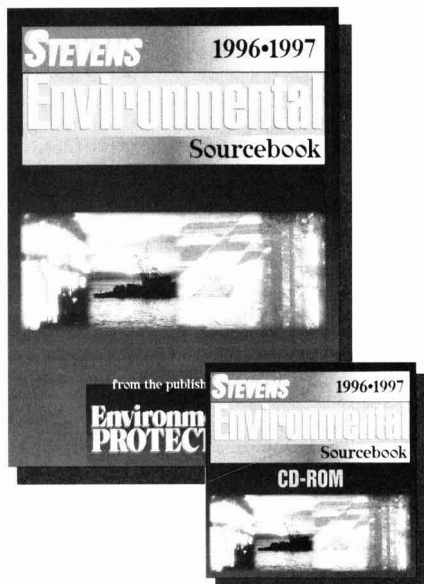
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The lagoon above had a massive grease problem. Three weeks after treatment, the same lagoon after beneficial microbes had digested the wastes.



Photos courtesy of Biosolutions Pty Ltd.

Morales said. "It might take one year, it might take 90 years. We have learned to reproduce the organisms and accelerate the biological processes."

First in a double-wide trailer in 1981, then in a Butler building and now in a newly constructed state-of-the-art facility, Micro-Bac researchers search for the proper blends of microbes for different contaminants.

Each blend of microorganisms contains dozens of different species that complement each other and create a sustainable ecosystem. One organism, for example, may feed on hydrocarbons, breaking down the wastes to simple carbon atoms and water. But the organism also may require certain nutrients or vitamins that only another organism can produce.

A culture containing only one species wouldn't work because the organism couldn't survive over the long run, Morales said.

The complementary mix also assures that it will remain stable and perform the job properly. The microbes are raised in specially formulated medium that assures they are in optimum condition when introduced to the field.

The microbial blends and the medium in which they are raised are trade secrets and trademarked, said Marilyn Osborn Coon, Micro-Bac director of business development. Throughout the entire process, technicians conduct quality control tests to ensure that the microbes being produced

that day are the same quality, concentration and viability as were produced the week or month before.

The technicians also test for pathogens that could possibly cause disease. Though pathogens are never found, the testing is just a safeguard.

Depending on the actual microbial mix and its intended use, one milliliter of medium will contain about 10^8 organisms. The mixtures also are produced after an order is placed and are never kept in the warehouse awaiting purchase.

What happens to the microbes after they leave the plant also can affect their performance, Hargett said. Storing them for six months in a hot shed will kill many of the organisms and reduce their viability, so Hargett recommended applying them as soon as possible after receiving them.

All of the microbes are naturally occurring and have not been tampered with genetically. Because they haven't been altered, the products don't require special biotechnology permits from the U.S. Department of Agriculture, the Environmental Protection Agency or other regulatory agencies.

Wastewater and Agricultural Applications

In the early years, bioaugmentation was used primarily to increase the efficiency of sludge oxidation ponds, Morales said. The Clean Water Act required substantial

improvements in the technical and physical layouts of wastewater treatment plants.

In many cases, the plants simply used oxidation ponds that relied on naturally occurring algae and bacteria to help degrade the sludge. Over time, solids started to fill the ponds, lowering their capacity and reducing the residence holding time.

By adding the right blend of microbes to the ponds, the capacity could be restored, the solids reduced and the useful life of the pond is extended. "In the late '70s and early '80s, bioaugmentation was a very viable solution," Morales said.

In 1981, the firm conducted its first commercial application—a 75-acre municipal sludge oxidation pond treated with Micro-Bac™. Within five months, the bacteria had reduced the sludge content more than 50 percent.

Use of the products continues today and has expanded to agriculture and livestock manure holding ponds. Because of water quality concerns, farmers in many states must construct manure oxidation ponds. Just like the municipal sludge oxidation ponds, the manure ponds can fill with sludge and experience diminished efficiency.

And just like the municipal sludge ponds, the farm ponds's efficiency can be improved by adding a microbial blend. The process has become so commonplace that the company doesn't even need a water sample before prescribing a treatment, Coon said.

The technician on the phone asks the farmer a few simple questions, such as the rate of inflow into the pond, the pond depth, and the number of head and type of livestock served by the pond. Based on the information, the technician can recommend the appropriate treatment.

The microbes also are frequently used to treat grease problems at food processing plants and in restaurant drains. Because they do not contain pathogens, Mega-Bac™ microbial blends can be introduced to waste systems without worry.

At food processing plants, the microbes are used to treat grease problems in effluent ponds. Because the ponds also may contain other contaminants, such as the disinfectants quaternary ammonia or chlorine, water samples must first be analyzed. Both cleaning compounds can be toxic to bacteria.

With sludge treatment as a spring board, the firm's research into new uses for microbes has continued throughout the years.

Oil Field Applications

Known as microbial enhanced oil recovery, or MEOR, the process involves introducing bacteria down the well. Para-Bac™, for example, can remove the hard paraffin from the formation face, improving permeability and increasing well production.

Other products within the same microbial family can control scale and corrosion within the well but without the liabilities that conventional chemical products may

carry. Much of the knowledge gained in the oil field is now being applied to cleaning up sites contaminated with petroleum products, Morales said.

One site, for example, may have been contaminated by petroleum products from an underground storage tank. The contaminated soil can either be removed, piled and treated with one of the M-1000 blends or the soil can be treated in-situ. Some of the biotechnology used in the oil fields can

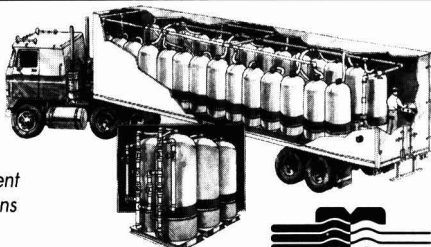
be applied to the UST site.

In the case of a pond holding oil sludge, however, degrading the petroleum initially may not be the best solution, Hargett said. Instead, an appropriate treatment might be applying one of the blends that breaks the emulsification between the oil and water, so the oil floats to the top and can be skimmed off. The small amount of petroleum left in the water can then be treated with microbes that degrade hydrocarbons.

"When you separate the oil, you have less of a problem to address economically, and you get the oil back," Hargett said.

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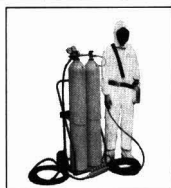
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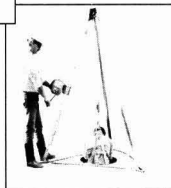


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Other Toxins

Frequently, however, the contaminant isn't a single chemical but a mixture of several. "A pure contaminant is kind of rare," Hargett said. "Usually where a site is contaminated, it has had multiple adulterants."

By conducting an analysis of the contaminants, researchers can either recommend the appropriate off-the-shelf microbial blend or, in rare cases, formulate a special one. Drawing from what Morales called a "library of bacteria," the researchers first mix up a small batch and conduct treatability tests to determine whether the blend produces the desired results.

They then increase the culture to about one liter of product and conduct larger treatability tests in the field.

The Future

Of more than 1,380 Superfund sites, Morales said less than 10 percent are treated with bioremediation. Also playing an important role in bioremediation is enforcement by government agencies. Without enforcement, site owners will have little incentive to clean them up, Morales said.

He said he believed the Superfund will be reauthorized, which will drive owners of Superfund sites to low-cost remediation providers. "Bioremediation, where it's appropriate, is the low-cost provider of cleanup," Morales said. "That's not to say that many of the good technologies are not valid. But we are consistently the low-cost option."

"When applied as a component of a treatment, it reduces the costs of the other components of the treatment." **EP**

Vicky Boyd is managing editor of Environmental Protection magazine.

For more information on Micro-Bac, circle 55 on card.

Proposed Incinerator MACT Limits Are An EPA Smoke Screen

THE ENVIRONMENTAL PROTECTION AGENCY is about to propose maximum achievable control technology (MACT) standards for hazardous-waste combustors that should concern anyone familiar with the issue. The new regulations will force a substantial number of cement

kilns to stop burning hazardous waste without any ensuing environmental benefits. At the same time, it will give commercial hazardous-waste incinerators MACT standards that can only be described as "environmental backsliding."

The EPA's message to incinerator operators is clear—don't invest in high-tech pollution-control equipment, because the EPA is not willing to regulate incinerators stringently.

The Justification

Under-regulation is not a typical complaint lodged against the EPA. The Clean Air Act defines the "MACT floor" as the "best 12 percent

" of the performers in a given industry subcategory but not less than five facilities.

One should expect a MACT limit to represent a level not currently achieved by the vast majority of an industry subcategory. A MACT limit should force industry to achieve higher performance.

Take particulate matter (PM) control, for example. Though it is not sufficient for good metals control, good PM control is certainly necessary.

The 0.03-grains-per-dry-standard-cubic-foot PM limitation rumored to be in the proposed MACT standards for hazardous-waste incinerators does not meet this test. Based on a preliminary analysis of EPA's database found in the docket, more than 50 percent of the hazardous-waste incinerators have maximum PM emissions below EPA's proposed MACT PM limits. The results are similar for the targeted metals.

In a shift from usual rule-drafting procedures, the

EPA published a database on which it based the draft MACT standards before publishing an actual draft. Among the information contained in the database were dioxin, metal, particulate matter and other pollutant levels collected from sampling hazardous-waste incinerator emissions.

If the proposed rules are adopted, cement kilns will be forced to install new control technology, such as upgrading baghouses or electrostatic precipitators.

The EPA estimates that 20 percent to 25 percent of waste-burning cement kilns will not be able to meet the proposed MACT limits with new technology, even if no waste is burned. Cement production is a mineral-driven industry limited by the naturally occurring mineral content of the raw materials found in nearby rock quarries.

How Did We Arrive Here?

The EPA was rushed by deadlines stemming from a settlement agreement in *Horsehead Resource Development Co. vs. Browner*, of which the Hazardous Waste Treatment Council—a trade group representing the incinerator industry—was a party.

Deadlines contained in the settlement agreement did not give the agency enough time to collect and analyze data, and the regulation was too important to be rushed.

Apparently, the EPA bought into the commercial incinerators' argument that they be compared to cement kilns. None of this would have happened if the EPA had simply determined MACT limits for the appropriate industrial categories.

The Clean Air Act emphasizes the concept that if the best 12 percent of an industrial subcategory can economically use a particular technology, so can the rest of the subcategory. As a consultant with both incinerator and cement kiln clients, I think the EPA should rethink its approach to MACT.

The EPA's MACT floor for hazardous-waste incinerators was established by grouping a small number of commercial incinerators together with more than 100 on-site incinerators.

An examination of EPA's database indicates that of the 115 facilities for which PM data are available, only 53 plants had complete metals data for calculating a total semi-volatile metals limit at (cadmium plus lead). And only 39 plants had data for estimating low-volatile



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Commentary

metals (arsenic, beryllium, antimony and chromium).

Of these plants, 34 had maximum emissions below EPA's proposed semi-volatile-metals limit and 22 had maximum emissions below the proposed low-volatile-metals limit. This means more than 64 percent of the plants already met the proposed MACT limits for semi-volatile metals and 56 percent of the plants met the low-volatile-metals limits.

A glaring omission from EPA's database is the WTI incinerator in East Liverpool, Ohio. While WTI is included in EPA's database for dioxins/furans and other organic products of incomplete combustion, the only metals data included are for chromium and lead.

WTI is the most-studied incinerator in the country. WTI's metal emissions are five to 10 times less than EPA's proposed MACT limits. The collective technologies used by WTI and other modern facilities are available and used by both commercial and on-site incinerators. Performance differences may be a function of the quality of operation and the technical expertise in building the air-pollution-control system.

Meeting the MACT Limits

How can the MACT limits be met by so many facilities? The answer may be that only the "best 12 percent" of all facilities with complete data for metals will be able to achieve EPA's proposed limits.

Because many of the commercial incinerators are missing data and many plants are already achieving the proposed MACT limits, the agency needs to reexamine the proposed limits.

The agency also needs to examine whether the unique nature of the wastes sent to the on-site incinerators may impact treatment efficiency, requiring a separate subcategory for on-site facilities.

For the cement industry, where the agency has all of the available data, the problem is clearly subcategories. The EPA should divide the cement kiln industry into dry- and wet-process kiln subcategories, recognizing the natural difference in available control technologies for the two different manufacturing processes. Unfortunately, EPA's focus on baghouse units for developing MACT limits for all cement kilns excludes 60 percent of the industry.

Why Change Now?

One could argue that the EPA is merely proposing regulations. However, the EPA is not the only regulator on the block. The real

danger is that many states will implement their own standards based on EPA's proposed MACT limit as they did with water. States used the development documents for proposed technology-based water regulations as the basis for more stringent permits based on "best engineering judgment."

Cement kilns with open permits could be forced to accept the proposed MACT limits while some incinerators could be given permits allowing for increased emissions.

Other Policy Goals

The EPA has exploited the MACT process to try to achieve other policy goals. By focusing on baghouses—fabric filters widely used for particulate-matter control—the agency has derived a "MACT floor" limit for the cement kiln industry that will force many wet-process kilns to stop burning hazardous waste without achieving much of an overall emission reduction.

By ignoring process differences in the cement industry and relying on incomplete data for the incinerator industry, the agency will propose MACT limits that allow commercial incinerators to avoid virtually any improvement in control technology.

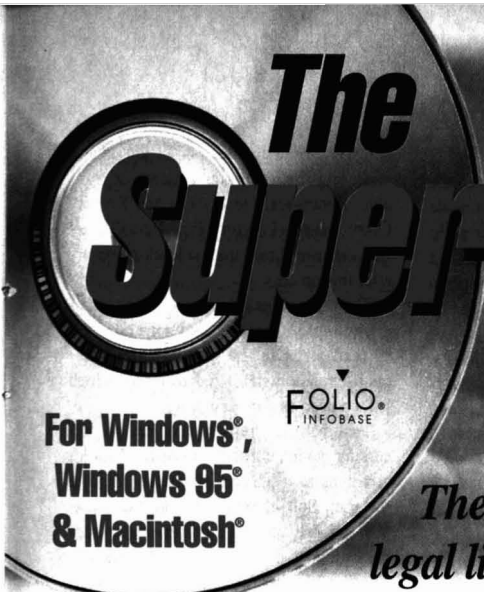
Unlike any other regulations proposed by the EPA, this regulation will not allocate costs to better technology but rather to increased profits.

Many of the wet kilns will stop burning hazardous waste, replacing it with coal as fuel. The capacity glut will disappear, and commercial incinerators will increase profits without incurring capital expenses or reducing emissions. With increased coal use by cement kilns and the lenient MACT limits for commercial incinerators, total emissions of metals could increase.

The agency needs to be faithful to the spirit and intent of the MACT process. Instead of proposing the current MACT limits, the agency should expand the commercial incinerator database to include WTI and other modern incinerators with superior technology performance. The EPA should also use correct subcategories—commercial vs. on-site incinerators, and wet-process vs. dry-process cement kilns.

The EPA should be developing laws consistent with the MACT process and protective of human health and the environment, not determining market share. **EP**

Gary L. Liberson, Ph.D., is a statistician and risk assessor with Environmental Risk Sciences Inc. in Washington, D.C.



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Soil Recycling

continued from page 25

simple construction project, begun in the spring of 1987, encountered problems. The original plan was simply to dig a foundation and construct a new building. A backhoe ruptured an underground storage tank and hundreds of gallons of #2 fuel oil spilled into the surrounding soil.

The Goodwill Industries board of directors were more than intrigued by the prospect of converting petroleum-soaked soil into an asphalt product. The cost of transporting and disposing this unplanned, unbudgeted "dirty dirt" threatened to kill the entire project. This was a classic "brownfield" site before the term was coined. The land had been sold to Goodwill Industries by the city of Boston for \$10.

The city had foreclosed on the land for nonpayment of taxes by the previous owner. A recycling, stabilization process was put to use at the same location, and the once-contaminated soil became part of Morgan Memorial's parking lot. This was the first time that the recycling technology had been used in Massachusetts. Nearly nine years later, it has been used hundreds of times in the Northeast, and its popularity is growing.

On-Site Recycling

The process takes contaminated soil and turns it into an asphalt "cold mix," suitable for use as base course for paving. In Massachusetts, recycled soil was used in a parking lot for a commuter rail station in Dedham. The soil never left the site. At an airfield, the paving base for a "hanger apron" was created with the same process. In Brewster, N.Y., an access road and large parking lot at the Metro North railroad yard were built with 13,000 cubic yards of material recycled from diesel-fuel-contaminated soil at that location.

This is a mobile process, done on the site where contaminated soils originate. The process is conducted at ambient temperature; no heat is added. It is fairly "forgiving" regarding soil types on which it can be used—even soil with relatively high fines content, considered poor for paving applications, can be a candidate for recycling.

Because the process is conducted at ambient temperature, it is easily permitted. The stabilizing medium is a proprietary asphalt-emulsion formulation containing water, surfactant and asphalt, which in the curing process binds the hydrocarbon contami-

nants, encapsulating them in the matrix and rendering them environmentally unavailable. Bench-scale tests using the Toxicity Characteristics Leaching Procedure (TCLP) method have shown that no leaching occurs after this process.

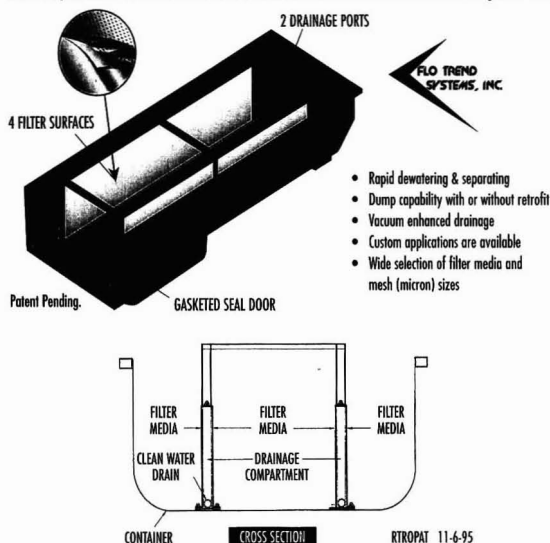
The process includes recycling and beneficial reuse. Contaminated soils are used as feed stock in the manufacture of asphalt-emulsion-stabilized material, which is then used as a paving base.

Treatment in the field requires preprocessing, which consists of crushing and/or screening to produce a physically uniform material. Soil is removed from the stockpile and delivered to a power-screen hopper by loader. The uncovered stockpile can be misted by hand, as necessary, to maintain sufficient moisture and prevent particulate emissions. The soil travels from the hopper, past the misting device and up an inclined belt to the vibrating system.

Suitably sized particles continue through the screen and are delivered by conveyor to the pugmill-inlet hopper. Oversized, nonrecyclable material, plastic and debris are side discharged by conveyor, stockpiled aside, and later rescreened to assure the removal of

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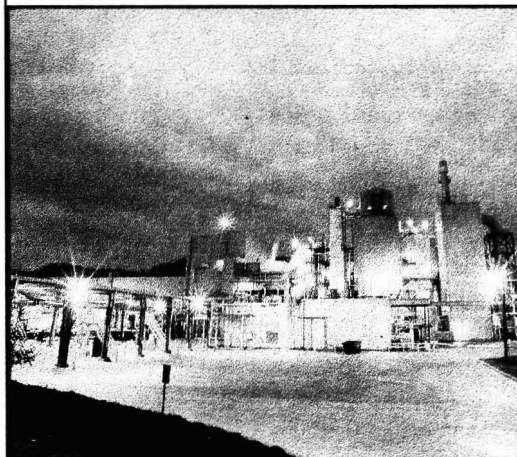


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all contaminated soil prior to containerization and off-site disposal.

Heavy Metals Stabilization

The actual recycling involves blending pre-processed contaminated soils with asphalt emulsions in the case of soil contaminated by petroleum products. When contamination has occurred from another source, such as heavy metals, the fixative may be a combination of asphalt emulsions and pozzolanic additives to achieve stabilization. Pozzolanic additives include such fixatives as Portland cement, quick lime, lime, cement kiln dust and coal fly ash mixtures.

These products allow stabilization of Resource Conservation and Recovery Act (RCRA) hazardous materials that have failed the TCLP standard. Screened soil delivered by conveyor to the pugmill-input hopper will pass through the gate-controlled outlet and up an inclined conveyor to the mix chamber.

The inclined conveyor is fitted with a belt scale to monitor and cumulatively record the weight of soils delivered to the mix chamber. The actual percentages of fixative to be used are determined in the bench-scale treatability study.

In recycling heavy metals, such as lead, that have been characterized by TCLP to be RCRA hazardous (5 parts per million or more), a pozzolanic fixative such as Portland cement is proportionately fed by an enclosed screw conveyor and delivered to the moisture-adjusted soil on the belt under a shroud to preclude particulate emissions. The soil and cement mixture is then discharged from the belt into the enclosed mix chamber, where the correct proportion of water is added to hydrate the cement and aid complete mixing.

In the chamber, mix paddles mounted on two counter rotating horizontal shafts mix, blend and move the soil cement through the mix chamber and discharge it, in a saturated state, to a radial stacker.

The radial-stacking conveyor moves the soil-cement product away from the pugmill output and into the post-process storage area until analysis confirms its TCLP reduction is well below 5 ppm.

In the manufacture of asphalt-emulsion-stabilized material, all soil handling and equipment remains as previously described but using an additional horizontal spray manifold, oriented perpendicular to the flow of soils, the asphalt emulsion is applied at a predetermined rate to the soils inside the mix chamber of the pugmill.

The emulsion is fed from a mobile

tanker stationed alongside the pugmill using a rate controlled positive displacement on the pugmill. The product is stockpiled for curing, which typically takes 72 hours. After curing, the material may be used immediately or kept for later use.

The recycled soil-cement and/or asphalt-emulsion-stabilized material can then be used as a subbase material for paving, landfill capping material and other predetermined uses. The process has successfully reduced leachable lead from soil from as high as 80 ppm to well below the regulatory level of 5 ppm.

This recycling process has been used in Massachusetts, New York, New Jersey and Maryland. Many states, such as Pennsylvania, Tennessee, New Hampshire and Vermont, allow soil recycling on a case-by-case basis. Connecticut has yet to finalize its process for permitting the recycling of contaminated soil. New York has a Beneficial Use Determination approval process to use petroleum-contaminated soil to manufacture cold-mix asphalt products that has proven successful.

Does it Make Economic Sense?

In situations where contamination arises from petroleum alone, it can be economically feasible to recycle as small a quantity as 500 to 1,000 tons of soil. Where co-contamination exists (including heavy metals, such as lead), the process is cost-effective at a far lower amount—in some cases, as few as 100 tons. Most industry experts agree that on-site recycling is generally 30 percent to 70 percent more cost-effective than off-site disposal.

Turning Liabilities into Assets

Recycling contaminated soil remains very much a "cutting edge" technological advance today. It is reasonable to expect its popularity to continue to increase for several reasons. First, Superfund laws weigh heavily against the users of hazardous waste landfills. Secondly, recycling is generally more cost-effective than transporting contaminated materials off site to a landfill. Finally, and perhaps most important, this is an environmentally sound process.

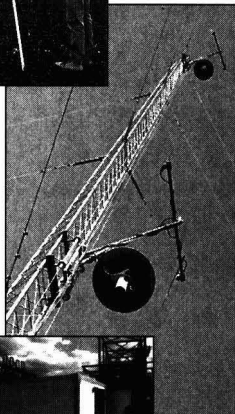
Landfilling transfers the problem to future generations—soil recycling, using this stabilization technology, is a solution.

Richard Gladdys is marketing director of United Retek Corp., Milford, Mass.

For more information about United Retek's soil recycling process, circle 35 on card.

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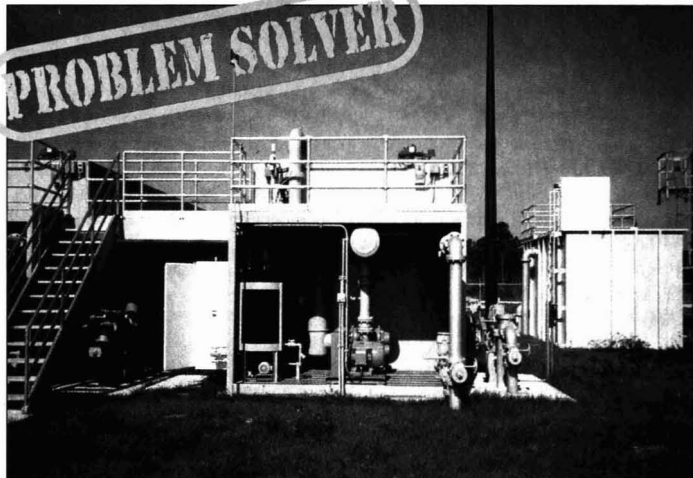
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Zimpro Environmental Inc.

The leachate treatment system at the Zemel Road Municipal Solid Waste Landfill.

Treat Landfill Leachate Florida Style

Leachate treatment must meet the standard for deep-well injection of the final effluent.

Charlotte County, Fla., Solid Waste has selected and placed into service state-of-the-art technology for the treatment and disposal of leachate produced at the county's Zemel Road Municipal Solid Waste Landfill. Leachate treatment must meet the standards for deep-well injection of the final effluent.

At the landfill in South Punta Gorda, Fla., a batch-operated PACT® system and Hydro-Clear® rapid sand filter are designed to treat up to 150,000 gallons per day of leachate and groundwater. The effluent—meeting strict limitations for chemical oxygen demand, biological oxygen demand and total suspended solids—is injected by deep well into a confined brackish aquifer, located about 2,700 feet underground to the south of the landfill.

The Zemel Road facility is on a 308-acre site and accepts municipal solid waste from the county's 125,000 residents.

According to Terrence R. Briggs, wastewater superintendent with the Charlotte County Utilities Department, the effluent "has met or exceeded the quality" set by

the discharge permit since plant startup in mid-April 1993. Effluent COD has averaged 33 milligrams per liter, BOD less than 6 mg/L and suspended solids 3 mg/L.

Bentonite slurry wall cells "key" into a natural confining layer of soil that allows leachate and groundwater to seep into the landfill by a French drain-type collection system. It is then pumped to the on-site treatment facility.

Leachate and groundwater are pumped to a flow equalization storage tank, allowing the plant to better handle seasonal flow variations, and then to a battery of three batch-operated PACT systems. The units are about 48 feet long by 12 feet wide and 12 feet high, each with a volume of 48,000 gallons. In batch operation, the leachate-groundwater is first mixed with powdered activated carbon and aerated in the activated sludge mode. This allows a combination of adsorptive powdered carbon and active aerobic bacteria to simultaneously adsorb and metabolize leachate contaminants in a single stage.

Following treatment by the PACT system, the aeration system shuts off and tank contents are allowed to settle. The

continued on page 50

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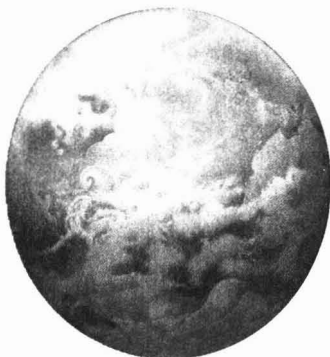
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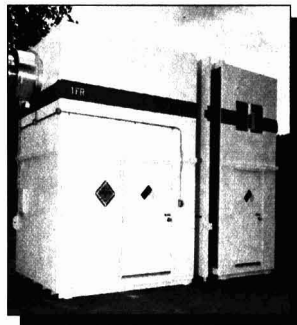
EP Exclusive

Hazmat Building with Disappearing Wall

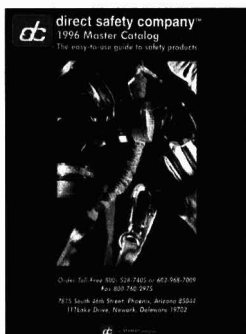
Introducing the first prefabricated Factory Mutual (FM) fire- and blast-rated modular building with removable interior walls. Initially, one room is for testing and the other room is for video recording. Later, a 16-foot-high mid wall can be removed and a floor can be installed for manufacturing on two levels. Too tall to ship, the modules can be lifted up, turned over and laid on open walls on trailers. At sites,

modules can be tilted upright, set down and bolted together. Roof caps seal out the rain at the joint, and patented rods within a tube hide the bolting mechanism under the building. Custom engineered hazmat buildings are available up to 14 feet wide by 17 feet long by 16 feet high.

Haz-Safe Buildings.



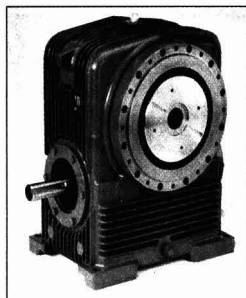
Circle 65 on card.



Customer Friendly Safety Catalog

Designed as the "easy-to-use guide to safety problems," the 196-page full color book features extra large product photographs and copy. The emphasis on the 1996-catalog is on personal protection equipment. **Direct Safety Company.**

Circle 66 on card.



Extruder Drives

A new line of Extruder Drives for main extruders and coextruders with 1 inch to 4.5 inch screws has been engineered for screw pressures up to 10,000 p.s.i. The double enveloping

worm gear speed reducer has rigid housing and shafts with a heavy duty thrust bearing. **Cone Drive.**

Circle 67 on card.



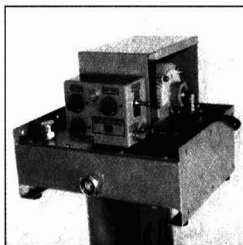
New Signs, Labels and Training Catalog

A new 187-page catalog is one of the most comprehensive sources of safety and industrial marking products on the market. It includes thousands of signs, labels and training products for lockout/tagout, confined space, fire safety and eye wash. A free sample label lets first-time buyers see the quality of the products. **Lab Safety Supply Inc.**

Circle 68 on card.

Modular Liquid Metering System

The complete system comes with a state-of-the-art Linear pump, variable flow control, variable timer control and a choice of reservoirs. Users can specify the pump module or a complete metering system. Features include variable flow control, time-on and time-off settings and a seal-less pump. Applications include lubrica-



tion, pumping chemicals, solvents and dispensing adhesives and foods. **Linear Pump Corp.**

Circle 69 on card.



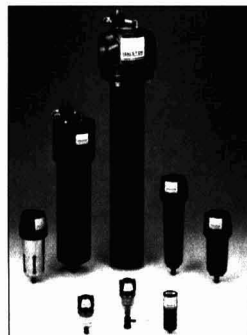
Paint Gun Washer

The Resolv-R2 GIA300 High Output Gun Washer is a long-lasting, industrial-rated, diaphragm with more than twice the performance of a piston pump. It is ideal for tough automotive manufacturing and repair environments. It incorporates a 15-inch-deep cleaning tank and can handle multiple cleaning solutions. Cycle time is 90 seconds. **pbr Industries.**

Circle 70 on card.

Ambient Air Monitor

The new ISA-M stationary, hazardous gas monitor/alarm is



small, lightweight and equipped with a durable MOS sensor that can be remote up to 1,000 feet. Features include explosion proof sensors, audio/visual alarms, meter displays and service relays. **Enmet.**

Circle 71 on card.

Precleaned Sample Container Line

Clean-pak is a new, certified precleaned container product



line from Wheaton that can be used for critical environmental sampling and testing procedures. The new Clean-pak will

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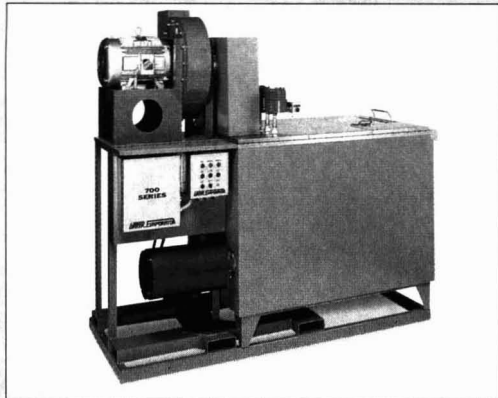
Start to finish, SAMSCO will help integrate the evaporation system into your plant's daily operations. Complete system design of your wastewater handling and specification of ancillary equipment is provided, yielding flexibility, low operating cost and minimal routine maintenance.

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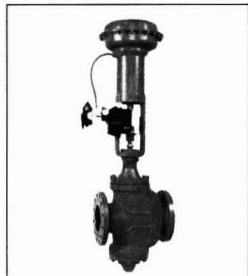
PRODUCTS & SERVICES

be offered through Wheaton laboratory distributors and gives a complete listing of borosilicate glass vials, flint glass bottles and jars and high density polyethylene bottles. **Wheaton Science Products.**

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Double-Seated Global Valves

The V800/801 Series control valve is a double-seated, top-



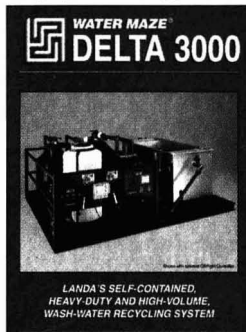
and bottom-guided globe style valve with screwed-in seat rings. They are used for throt-

tling liquids, gases and steam at moderate temperatures and pressures. This style valve is especially useful in erosive fluids and systems where high flow rates are required. **Neles-Jamesbury.**

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Wash-Water Recycling System

The Delta-3000 is a closed-loop, industrial wash-water recycling system for applications



where there is a high wash-water volume and heavy dirt load. It is a self-contained filtration system and capable of handling flows of up to 30 gallons per minute. **Landia.**

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Vertical, Self-Priming Pump

The Vertical Self-Primer (VSP) quickly and safely moves chemicals, wastewater, slurries and spilled materials. Self-priming to 15 feet, the pump is rugged, lightweight, compact and free-standing. It is usable in a wide variety of everyday and emergency situations. **MP Pumps Inc.**

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New Vials Catalog

A new vials catalog contains the Phase Sep range of assorted vials, caps, stoppers, seals and septa for all common autosamplers. Products can be ordered in small quantities, with no minimum order. A compatibility chart shows which vials are suited for each autosampler. **Phase Sep.**

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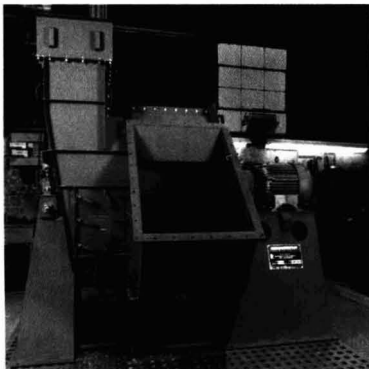
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PRODUCTS & SERVICES

ethyl ketone (MEK). The direct reading dosimeter has a measuring range of 20 to 600 ppm per hour. Break off the pre-scored end and snap it into the lapel mounted holder. After sampling, read the length of stain against the printed scale. Divide the reading by the number of hours or exposure to obtain a time weighted average in ppm. **Sensidyne Inc.**

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Stops Air Pollutants at the Source

The Fume-Gator source capture system and its components stop the spread of fumes, smoke and dusts. Designed to work with almost any air cleaning or exhaust unit, the Fume-Gator offers easy compliance to OSHA standards, improves employee health, decreases housekeeping costs and improves product quality. **Smog-Hog.**

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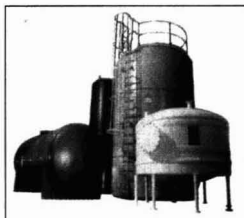
Three-Phase Monitor

The 263 Three-Phase Monitor has been improved to include several new features. The new



model retains all of its original features that monitor for loss-of-phase, low voltage and reverse phase. New features include an improved adjustment control that allows calibration without tools and an optional manual reset that allows the unit to be reset via a switch. **Time Mark Corp.**

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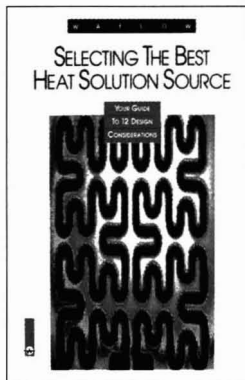
Corrosion Resistant Tank

Viatic-Process/Storage Systems offers more than 1,000 standard tank models of fiberglass construction that have a wide range of chemical resistance for processing and storage requirements. Capacities range from 146 gallons to 50,000 gallons and can be customized to clients' requirements. **Viatic.**

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Heat Solutions Guide

The new Heat Solutions Source Guide features more than 20 "problem/solution" case histories that illustrate how Watlow helps the design engineer solve difficult thermal engineering



problems. The studies involve a full range of heating problems and illustrate exactly how Watlow defined the problem and created the solution. **Watlow.**

Circle 83 on card.

Compliance Software

Terms Windows software handles many problems companies face with MSDS handling and reports-on-demand. A Hazcom Program is included and the Data Entry Service can provide the typing in, proofing and verification of a company's MSDS into the software program for fast, easy retrieval of compliance and



safety information. Key fields, such as emergency information, will be instantly available. The MSDS can be automatically archived to comply with OSHA's 30-year recordkeeping policy. **Corbus.**

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Treatment Technology Database

REMTEC is a user-friendly MS-Windows relational database for the treatment of contaminated sediment, soil, groundwater and

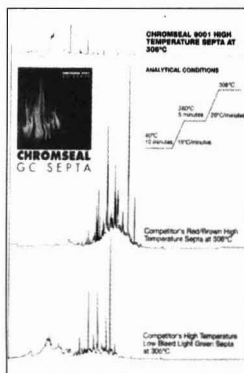


off-gas, featuring powerful search options designed to assist consultants, administrators, developers and vendors. Monthly updates are available on the Internet. **Wastewater Technology Centre.**

Circle 85 on card.

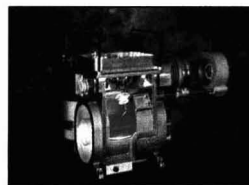
New Level of Performance in GC Septa

The 9001 High Temperature GC septum is both clean and capable of operating at a true elevated temperature of 306°C. Chromseal is available in disk format of varying sizes to accommodate all GC instruments. The



Long Life Chromseal is designed to operate at a slightly lower temperature of 290°C and is suitable for use with autosamplers and the associated high injection rates. The Economy Chromseal is designed for low operational costs and is formulated to operate at more conventional temperatures, such as 265°C. **Chromacol.**

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Ultra-Trace Analysis

Finnigan brings its new LC/MS/MS to laboratories performing ultra-trace analysis by liquid chromatography/mass spectrometry. The new LCQ is a compact benchtop system that offers high-sensitivity, full-scan spectra and the selectivity of MS/MS. **Finnigan MAT.**

Circle 87 on card.

Lead Analyzer

The SEFA-Pb Lead Analyzer sets the standard for safety,

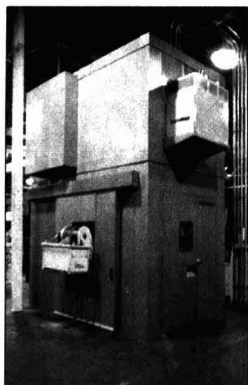


speed, accuracy, reliability and portability in the detection and analysis of lead in paint, paint dust and soil. Its advanced, high-resolution silicon detector and Multi Channel Analyzer eliminates the need to perform any substrate correction, while providing accuracy and precision down to the detection unit of 0.1 mg/cm². **HNU Systems Inc.**

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200-1,000 Ton Press Enclosures

Reducing press noise on large 200- to 1,000-ton presses is achieved by using the exclusive FQF system by Tamer Industries. Daily operation and routine maintenance is performed through large access



doors while major service can be done by removing modular panels in the upper and lower section. This design eliminates the need to disassemble an entire enclosure. **Tamer Industries Inc.**

Circle 89 on card.

Full-Feature Respirator

The new TK2 respirator is a full-feature respirator, crafted



from neoprene rubber with a replaceable panoramic visor, speaking diaphragm and nose-cup. Volume, high reliability production tooling and the latest in materials engineering upgrades this cost-effective respirator. **Neoterik Health Technologies Inc.**

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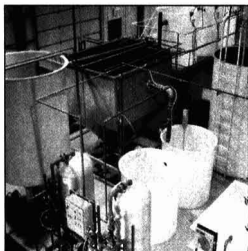
Electrical Heat Tracing Software

CompuTrace® for Windows was developed for the design of electrical heat tracing systems. The software is very user-friendly and addresses all types of parallel resistance cut-to-length heating



cables available today. It includes heating circuits for ordinary locations and designs approved for installation in hazardous locations. **Thermon.**

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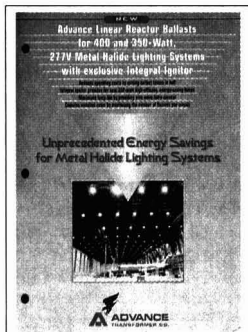
Multi-Source Wastewater Treatment

George Koch Sons Inc. has introduced a comprehensive wastewater-treatment system for all types of finishing operations, as well as speciality manufacturing and industrial operations that involve etching and milling processes. Engineered for either batch or continuous operation, it includes modules for wastewater collection and segregation, chemical treatment, clarification, sludge thickening, pH adjustment, sand filtration, carbon filtration, flow monitoring and water re-use. **George Koch Sons Inc.**

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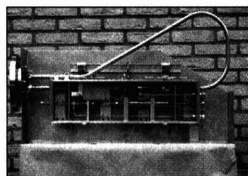
Linear Reactor Ballasts Pamphlet

A new four-page pamphlet from Advance Transformer Co.



features the new line of Linear Reactor ballasts that cut losses in half over standard constant wattage autotransformer ballasts. **Advance Transformer Co.**

Circle 93 on card.



Inertial Filter With Dilution Probe

Sampling gaseous mixtures from stacks and sources containing high levels of particulate matter is now possible with the new Model IF/OOS sampler. The sampler consists of the EPM Out of Stack dilution probe with an inertial filter mounted in the stack by a high-velocity eductor pump. **EPM Environmental Inc.**

Circle 94 on card.

Total Hydrocarbon Analyzer

Buck Scientific offers the HC-404 Total Hydrocarbon Analyzer, a dedicated IR instrument for TPH analysis of water or soil



according to EPA methods 413.2 and 418.1. A wide range of TPH concentrations can be analyzed by using different sized cells for low ppm determinations and scale expansion for high ppm. **Buck Scientific.**

Circle 95 on card.



New Probe Design

ORION® Model 862 Bench-top D.O./BOD System with Auto-Stir™ Probe allows one-step operation for both BOD measurements and calibration. After the system is set up, you can speed from bottle to bottle

without having to touch the meter. It features AUTO-BAR™ Automatic Barometric Pressure Compensation, eliminating errors due to weather fluctuations without operator intervention. **Orion Research.**

Circle 96 on card.



Digital Electronic Gas Flowmeter

The Model 110 Gas Flowmeter is available in 13 ranges from 10 ml/minute to 500 liters/minute. Measurements are displayed on a three-digit LCD digital display with a 0 to 5 VDC output provided for recording data. The compact design includes an AC/DC adapter plug for operation on conventional AC power. **McMillan Company.**

Circle 97 on card.

Triplex Cartridge Mechanical Seals

A complete range of Triplex Cartridge Mechanical Seals for chemical process pumps and



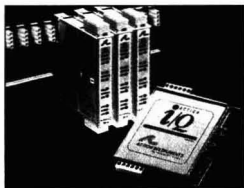
other rotating equipment is ideal for environmental applications where emissions to atmosphere cannot be tolerated. The technology is now available for standard bore, large bore and taper bore seal chambers on all process pumps. **Envronamics Corp.**

Circle 98 on card.

Three-Wire Transmitters

Action I/Q™ models Q414 and Q415 are multi-channel, RTD input, three-wire transmit-

PRODUCTS & SERVICES

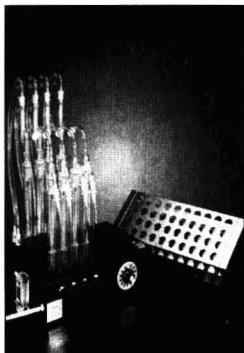


ters that provide dual channels of I/Q in the same space as one conventional instrument. They feature SnapLoc plug-in terminals for easy installation and low mean-time-to-repair. **Action Instruments.**

Circle 100 on card.

Distillation System

The Lab-Crest Midi-Dist System conducts up to four soil, water or sludge cyanide or sul-



fide distillations simultaneously in minimal laboratory space. It also reduces the cost of reagents and consumables. Comprised of four complete borosilicate glass units and a four position aluminum heat block and apparatus holder, it reduces disposal costs and generates less hazardous wastes. **Scientific Marketing Services Inc.**

Circle 101 on card.



Flexible Flow Microcalorimeter

The versatile Flow Microcalorimeter is an instrument designed to provide insight into complex surface chemical events. The FMS is suited to

measurement of enthalpy and matter transfer occurring in a wide variety of interactions, including measurement of the heats of evacuation and wetting of an adsorbent sample. It assists the researcher in establishing a dynamic equilibrium as a reference. **Gilson Co. Inc.**

Circle 102 on card.

MSDS Software

MSDSFile is a new Windows application specifically designed

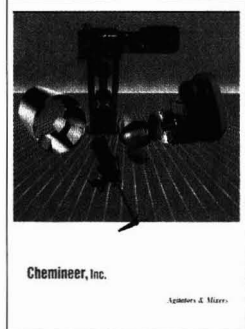


for managing MSDSs and the reporting requirements under Worker and Community Right-to-Know. The MSDSs can be scanned, indexed in a database, printed, retrieved or converted. This high-speed image processing system uses the latest technology for maximum efficiency and speed in storage compression. The scanned MSDS documents become an easy-to-use electronic filing cabinet. **HazMat Control Systems Inc.**

Circle 103 on card.

Product Overview Bulletin

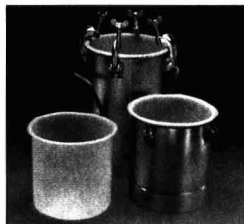
Chemineer Inc. offers a new product overview bulletin describing its complete line of agi-



tators and mixers. The 12-page, full-color bulletin contains photos and detailed information on product features and technology capabilities. Products offered include: top-, bottom- and side-entering agitators,

gear- and belt-driven agitators, portable mixers, static mixers and heat exchangers. **Chemineer Inc.**

Circle 104 on card.



Pressure Pot Liners

Two new disposable plastic liners for pressure pots are available in 2-gallon sizes to fit major brands of pressure sprayers. The new liners will cut cleaning costs and reduce product and environmental contamination by capturing product residue. They are strong, flexible and completely form-fitting. **CDF Corp.**

Circle 105 on card.

Low-Cost Instruments

CHEMetrics announces two new, low-cost instruments to measure dissolved oxygen and chlorine. The instruments,

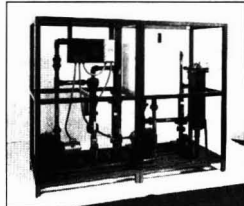


called SAMS (Single-Analyte Meter), read CHEMetrics' self-filling Vacuivials® reagent ampuls. **Chemetrics Inc.**

Circle 106 on card.

For Cooling Towers

The custom-designed, skid-mounted Environmentalist 2000® pulls water from the bottom of the sump of the

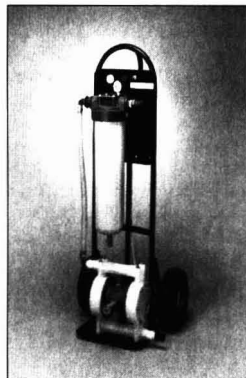


cooling tower to the pump and accelerates the water into a centrifugal vortex separator at high velocity. Large and heavy solids are forced into the collection chamber and held until the computer triggers the motorized ball valve into a periodic daily purge cycle and the dirty concentrated water empties to the drain. **Superior Manufacturing.**

Circle 107 on card.

Portable Filtration System

A self-contained filtration system designed to simplify the cleaning of hydraulic oils, acid baths, solvents, caustic solu-



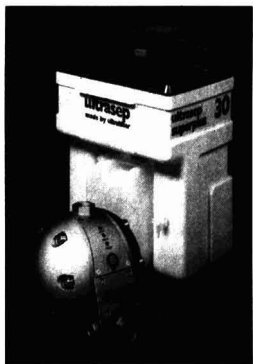
tions and other fluids in machines, tanks and barrels is now available. Totally air-powered, the Yamada Portable Filtration System is capable of processing up to 1,200 gallons per hour and can handle a variety of corrosive, viscous and abrasive liquids. **Yamada.**

Circle 108 on card.

Universal Capillary Injector

The 1078 Universal Capillary Injector delivers up to a four-fold increase in analyte recoveries, allowing the analysis of even the most polar and thermally labile compounds and decreasing injector maintenance time by 50 percent. The injector represents the latest evolution in Varian's injector technology, including split, splitless and temperature-ramped splitless for maximum injector flexibility. The 1078 also includes a new sealing design for easy insert removal and replacement. **Varian.**

Circle 109 on card.



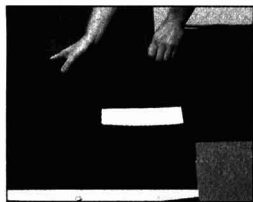
Condensate Management Centers

In its ongoing promotion of the safe, efficient and legal disposal of oil and condensate from compressed air systems, ultrafilter inc. has announced the establishment of 90 condensate management centers throughout North America. Each center is designed to provide technical assistance and service for air systems which isolate, separate and safely dispose of compressor condensate and oil. **ultrafilter inc.**

Circle 99 on card.

Dock Seal/Shelter

The Eliminator-GapMaster™ dock seal/shelter combines the

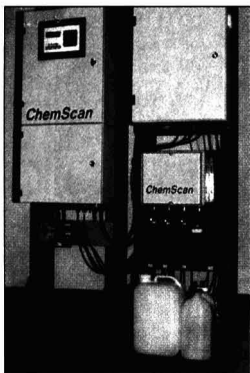


sealing efficiency of a traditional dock seal and the benefit of full access to the back of a trailer opening during the unloading and loading process. It features patented rubber hooks made from ethylene/propylene rubber that seal the hinge gap as a trailer backs into it. **Rite-Hite Corp.**

Circle 110 on card.

Process Analyzers

ChemScan Process Analyzers automatically detect several chemicals for monitoring or control of the treatment processes at public or industrial water treatment plants. The technology involves the measurement and



interpretation of the amount of light absorbed by a water sample at numerous individual wavelengths across the ultraviolet spectrum. The information is used to determine the chemical content of the water sample. **Applied Spectrometry Assoc. Inc.**

Circle 112 on card.

Miniature, Mask-Mounted Voice Amplifier

A new miniature, mask-mounted voice amplifier is avail-



able for use with Draeger's Panorama Nova facepiece. The battery-powered NFPA-approved communications device allows the mask-wearer to speak normally, yet have his voice projected at twice the volume. Called MegaComm Plus, the device can be fitted in seconds without breaking the integrity of the facepiece. Installation does not require tools or a technician. **National Draeger Inc.**

Circle 113 on card.

Easy-to-Program Sampler

The Sigma 900 Sampler is easy to program for basic sampling requirements. It features a



high-speed peristaltic pump and liquid sensing system to assure repeatable, representative samples under varying site conditions. It can be easily configured for time or flow-based sampling, in either single or multiple bottle setups. **American Sigma.**

Circle 114 on card.

Dust Collector Cartridge

The EZ Ultra-Web® cartridge features a soft, urethane endcap



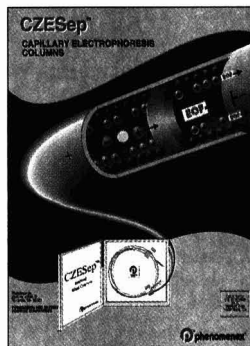
that makes the cartridge easy to crush. Three crushed cartridges can be stored in a 55-gallon drum, compared to only one uncrushed cartridge, reducing the cost of hazardous and non-hazardous waste disposal by 67 percent. **Donaldson Co. Inc.**

Circle 115 on card.

Gas Equipment Catalog

The second edition catalog of high-purity gas handling equipment and related accessories has been expanded to 150 pages and contains hundreds of essential items for the safe and efficient handling of specialty gases. Most items in the catalog can be shipped the same day as ordered. **Advanced Specialty Gas Equipment.**

Circle 116 on card.



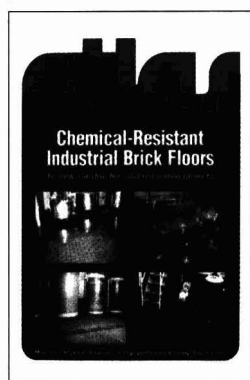
New Instructional Video

A new brochure from Phenomenex describes a highly engaging and informative new video on Capillary Electrophoresis. This up-to-date instructional video explains how and why CE works. Subjects covered include separation principles, electroosmotic flow, determination of mobility, micellar electrokinetic capillary chromatography and others. **Phenomenex Inc.**

Circle 117 on card.

Brick Floors Brochure

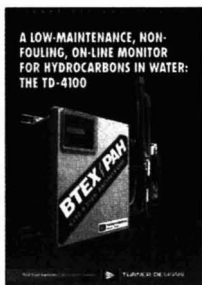
This new brochure describes plant uses, typical systems and



types of floor construction for Atlas' chemical-resistant, industrial brick floor systems. The 4-page, full-color brochure details the use of various combinations of membrane, brick and corrosion-resistant mortar to resist the intense physical demands in the steel, metalworking, chemical, pharmaceutical, textile and food and beverage industries. **Atlas Minerals & Chemicals.**

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Circle 60 on card.



Instruments Catalog

The free 1995-96 instruments catalog contains more than 1,700 full-color products and features more than 40,000 products covering scientific instruments, equipment and supplies. It includes a detailed 40-page product index and informative introductory pages for several sections. "Hot Tops" and an 8-page section of late-breaking products.

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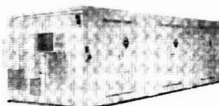
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Water 63,221

Solid Waste 46,488

Industrial Hygiene 29,645

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continued from page 34

treated water is decanted and pumped to the pulsed shallow-bed filter for polishing and suspended-solids removal. Finally, the effluent is chlorinated and pumped to the deep-well injection system.

Sludge remains in the treatment tank and is reactivated when the next batch of liquid is ready for processing. Waste sludge is held in a holding tank before dewatering on sand drying beds, with ultimate disposal on the landfill face as cover material. Each tank completes a treatment-decant cycle about once a day.

Batch operation also contributes to the cost-effectiveness of the system, which is operated by a single licensed wastewater treatment plant operator currently on a five-day work schedule. Operations may be carried out automatically via a programmable logic controller (PLC) or operated manually by simply overriding the PLC. **EP**

For more information on Zimpro's PACT® and Hydro-Clear® systems, circle 36 on card.

Coming in the March issue of Environmental Protection

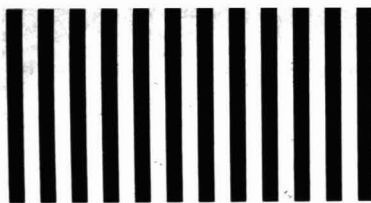
- Mining the Digesters for 'Black Gold'—*Converting treated sewage sludge to a soil amendment*
- Technical Profile on Air-Pollution Control Technology
- Water and Wastewater Software
- Risky Business—*Environmental insurance for brownfield redevelopment*

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- A ☐ Corporate responsibility for Pollution Control
B ☐ Manage all Pollution Control Operations at this location
C ☐ Supervise sub-group in Pollution Control Operations
D ☐ Provide professional consulting service on Pollution Control
E ☐ Provide staff environmental service on Pollution Control
Z ☐ Other (please specify) _____

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A ☐ Manufacturing. If manufacturing, please check the appropriate SIC (check only one):

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- B ☐ Mining
C ☐ Agriculture
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L ☐ Consulting
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Z ☐ Misc. Services
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J ☐ Federal
O ☐ Training
P ☐ Real Estate
(please specify)

3. Approximate number of employees at this address (check only one):

- A ☐ 1-19
B ☐ 20-49
C ☐ 50-99
E ☐ 250-499
F ☐ 500-999
G ☐ 1000-1499
H ☐ 1500-2499
I ☐ 2500 and up
D ☐ 100-249

4. In your job function do you recommend, specify or purchase?

(check all that apply):

- A ☐ Pollution Control Equipment
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 ☐ Noises
D ☐ Solid waste disposal
E ☐ Industrial hygiene
F ☐ Toxic & hazardous materials
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 ☐ Environmental Solutions
D ☐ Pollution Equipment News
E ☐ The National Environmental Journal
F ☐ Water Environment & Technology
G ☐ None of the above
(please specify)

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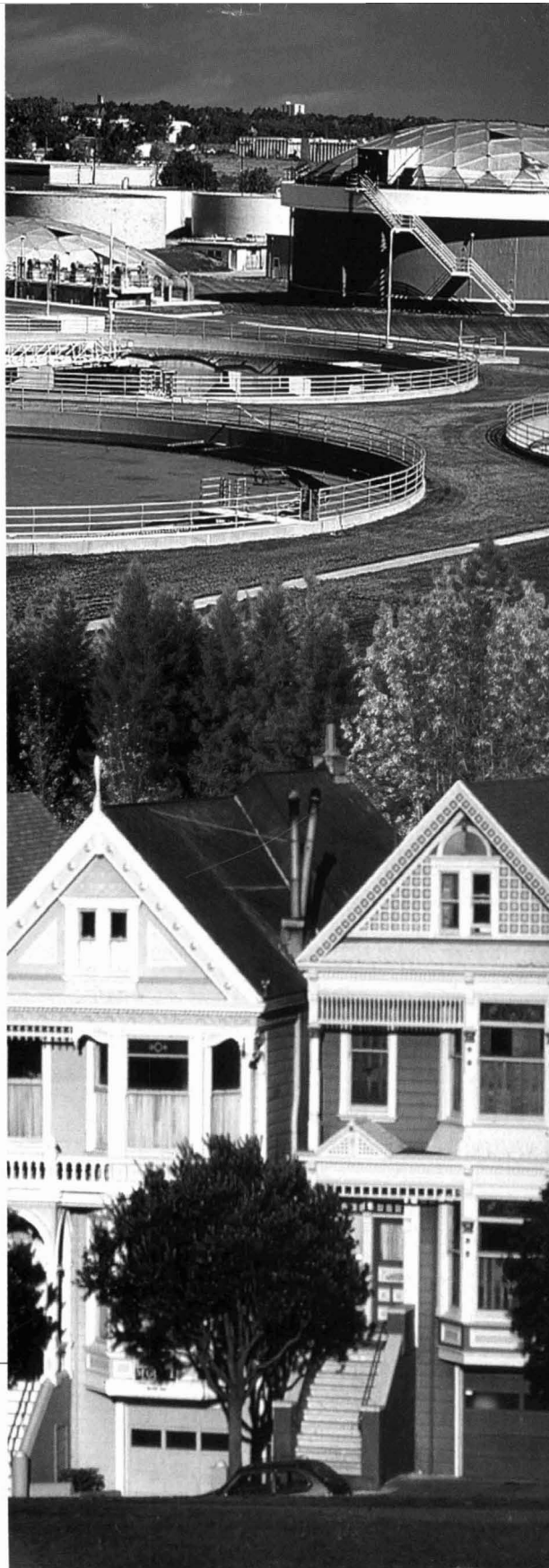
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