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Environmental PROTECTION

Management and Problem-Solving for Environmental Professionals

JUNE 1996

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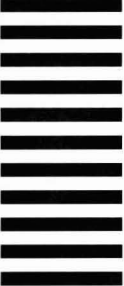
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101	118	135	152	169	186	203	220	237	254	271	288	305	322	339	356	373	390
102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391
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110	127	144	161	178	195	212	229	246	263	280	297	314	331	348	365	382	399
111	128	145	162	179	196	213	230	247	264	281	298	315	332	349	366	383	400
112	129	146	163	180	197	214	231	248	265	282	299	316	333	350	367	384	401
113	130	147	164	181	198	215	232	249	266	283	300	317	334	351	368	385	402
114	131	148	165	182	199	216	233	250	267	284	301	318	335	352	369	386	403
115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405

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 (21) Tobacco (31) Leather
 (22) Textile (32) Stone/Clay/Glass
 (23) Apparel (33) Primary Metal
 (24) Lumber & Wood (34) Fab. Metal
 (25) Furniture (35) Mach., except Elect
 (26) Paper (36) Elect. & Electron Mach
 (27) Print/Publish (37) Trans. Equip
 (28) Chemicals (38) Instr./meas./analyzer/controlling
 (29) Petrol. & Coal (39) Miscellaneous Mfg

B. Mining L. Consulting
 Agriculture Insurance
 Engineering & Contracting Utilities, public, private & cooperative
 Govt. including municipal or district sanitary water or wastewater treatment sys. or plants

C. Approximate number of employees at this address (check only one):
 A J 1-19 D J 100-249 G J 1000-1499
 B J 20-49 E J 250-499 H J 1500-2499
 C J 50-99 F J 500-999 I J 2500 and up

D. In your job function do you recommend, specify or purchase? (check all that apply)
 A J Pollution Control Equipment
 B J Instrumentation
 C J Chemicals
 D J Parts & equipment for maintenance operation and control
 E J Services/Consulting
 F J None of the above

E. What types of Pollution Control are you responsible for? (check all that apply)
 A J Air F J Toxic & hazardous material
 B J Water G J Energy control/energy conservation
 D J Solid Waste H J None of the above
 E J Industrial Hygiene

F. Which of the following publications do you receive personally addressed to you? (check all that apply)
 A J Pollution Engineering
 B J Environment Today
 C J Environmental Solutions
 D J Pollution Equipment News
 E J The National Environmental Journal
 F J Water Environment & Technology
 G J None of the above

A. Function which best describes your activity in Pollution Control (check only one):
 A J Corporate responsibility for Pollution Control at this location
 B J Manage all Pollution Control Operations
 C J Supervise sub-group in Pollution Control Operations
 D J Provide professional consulting service on Pollution Control
 E J Provide staff environmental service on Pollution Control
 Z J Other _____

rs123a

G. Which of the following AIR QUALITY INSTRUMENTATION PRODUCTS/SERVICES(S) do you plan to purchase in the next 12 months? (Select all that apply)
 A J Continuous Emission Monitor
 B J Weather Instrumentation
 C J Ambient Air Monitor
 D J Test Kits
 E J Calibration Gas
 F J Gas Monitors
 G J Gas Chromatograph
 H J GC/MS Analyzer
 I J Leak Detectors
 J J Particulate Sampler
 K J Tubing and Connectors
 L J Hydrocarbon Analyzer/Monitor
 M J Vapor Analyzer
 N J Portable Emission Monitor
 O J Instrument Leasing
 P J Recorders

H. What is your reason for purchasing the selected products/services? (Select one)
 A J New Construction
 B J Plant Upgrade
 C J Replacement/Maintenance

I. What is your projected budget for the selected products/services? (Select one)
 A J Over \$200,000 D J \$10,001-\$50,000
 B J \$100,001-\$200,000 E J \$5,000-10,000
 C J \$50,001-\$100,000 F J Under \$5,000

J. How immediate is your need for the selected products/services? (Select one)
 A J 0-3 months D J 9-12 months
 B J 3-6 months E J Over 12 months
 C J 6-9 months

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 I GC/MS Analyzer
 J Leak Detectors
 K Particulate Sampler
 L Tubing and Connectors
 M Hydrocarbon Analyzer/Monitor
 N Vapor Analyzer
 O Portable Emission Monitor
 P Instrument Leasing
 Q Recorders
 R Leak Detectors

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- G City H County
 I State J Federal
 K Transportation
 N Labs O Training P Real Estate
 Z Misc. Services

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About the cover:

Many companies are going beyond the Clean Air Act requirements in the fight against air pollution. The article on page 52 looks at one facility's strategy for cutting emissions.

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Forecast Brightens For Clean Air Act

Companies that have to comply with Title V permit requirements under the Clean Air Act can breathe a little easier now. In March, the U.S. Environmental Protection Agency released its second white paper outlining steps state and local agencies can take to streamline operating permitting requirements under Title V. The guidance report attempts to simplify the procedures set out under the controversial Clean Air Act Amendments (CAAA) rules.

In 1990, when the winds of change under CAAA rules first blew in, companies geared up for rough weather. Compliance with the rules meant dealing with a relentless onslaught of rigid timetables and extensive monitoring, record keeping and reporting requirements. Environmental managers found obeying the rules to be complicated, frustrating and costly. The rules also created a storm of disagreement that included litigation and political disputes.

Of all the CAAA changes enacted in 1990, Title V proved to be the most burdensome to industry. Title V mandated all states to implement programs requiring companies to obtain permits for their emission sources. In addition, Title V required states to seek the federal government's approval of permitting programs already in operation.

Largely because of pressure from companies beleaguered by mounds of paperwork, the EPA decided to modify the original CAAA rules. As spelled out in the new guidance report, the EPA will start allowing state and local agencies to approve plans by sources that "distill" overlapping permitting requirements on a single emission source into one set of rules. Multiple emission limits on a single source can be combined into a single limit, as long as that limit equals the most stringent limit applicable to the source.

The EPA's recent guidance report signals the agency's recognition that companies will cooperate in seeking better air quality if given reasonable, clear-cut regulations to follow. Industry's basic commitment to cleaner air is exemplified in this issue's article, "Meeting MACT Head On," beginning on page 52. The feature describes how Borden's Columbus Coated Fabrics installed a pollution-control system so effective it cut total air emissions by 93 percent and exceeded the current abatement requirements under federal and state air-quality standards.

The trend is for more companies to go beyond EPA requirements and try to control as many emissions as possible as part of their overall pollution-prevention programs. It is hoped this growing attitude on the part of industry coupled with the EPA's willingness to streamline the CAAA rules will usher in a calmer period in which regulators and companies can work together to improve our nation's air quality.

Angela Neville

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Appeals Court Rejects Garbage Firm's Suit

A garbage company's constitutional rights were not violated when the San, Calif., district attorney allegedly linked the company to organized crime, a federal appeals court ruled recently.

Regardless of the report's truth, a company's reputation is not a property right protected by the Constitution, said the 9th U.S. Circuit Court of Appeals in a 2-1 ruling.

The ruling upheld a federal judge's dismissal of a suit by WMX Technologies Inc., formerly Waste Management Inc., against former District Attorney Edwin Miller.

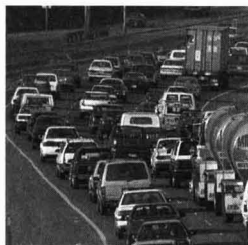
When the company applied to build a new county landfill, Miller was asked by county supervisors to investigate rumors about Waste Management's possible connections with organized crime.

His report, sent to the supervisors and news media in April 1992, concluded that the company was connected to the Mafia, the court said. The county's lawyer said the report did not actually link Waste Management to the mob but was interpreted that way by the company.

The company, which denied any such connections, did not sue for libel in state court. Instead it filed a federal civil rights suit, which has the advantage of providing attorneys' fees to a winning plaintiff.

Denver's New Air Pollution Regs Clouded

Even though Denver, Colo., made it through the winter with the fewest air-pollution violations in a decade, an environmental group has filed a lawsuit seeking tougher air-pollution standards.



The lawsuit, filed by Earthlaw, asked the U.S. Environ-

mental Protection Agency to quickly approve Denver's air-quality standards. The agency's approval of the rules would allow Earthlaw to move forward with its complaint that the standards are not strict enough.

An Earthlaw attorney said the Regional Air Quality Control Commission used optimistic projections when

it implemented high-occupancy vehicle lanes, wood-burning bans and strict vehicle emissions.

Earthlaw contends the restrictions are not enough to keep pace with rapid development throughout the Denver metropolitan area.

Wade Buchanan, air-quality commission chairman, said Earthlaw is "barking up the

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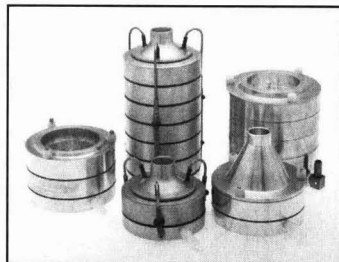
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wrong tree" and pointed out that the number of air quality emergencies has sharply declined since the commission recommended the pollution restrictions in 1994.

Buchanan also noted that the recent five-month high pollution season ended March 31 with the fewest number of brown-cloud violations in the 1990s.

Clear Air Over Grand Canyon Could Cost Billions

Reducing what pours from power plants, vehicle tailpipes and deadwood fires could improve the Colorado Plateau's near-pristine air but at a cost, according to a recent commission report.

The Grand Canyon Visibility Transport

Commission said the 130-square-mile region has the "best visual air quality in the United States." But the region also has problems. To improve visibility and keep the air clean, the committee recommended clamping down on power plant and tailpipe emissions and minimizing smoke from fires set to burn off deadwood.

By the turn of the century, pollution from stationary and mobile sources should be cut by nearly one-third from 1990 levels, the committee said. The committee also said emissions from Mexican industry contribute to the visibility problem, and the United States and Mexico should work together to reduce migratory air pollution.

The proposals potentially could cost billions of dollars.

The Colorado Plateau is a geological uplift centered at the four corners of Arizona, Utah, New Mexico and Colorado. Visibility problems stem from the region's high, thin air and low humidity, which allows the human eye to see not dozens, but hundreds, of miles when conditions are good.

A minor change in the amount of pollutants that causes "light extinction" in the air can cut the visibility distance from 174 miles to 118 miles or even 90 miles. The committee's recommendations will be discussed at public meetings held throughout the region.

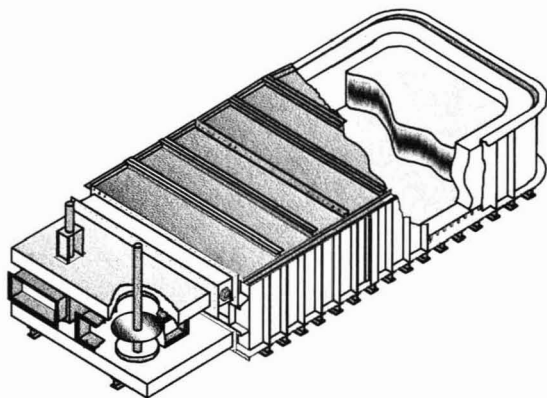
Former Mine Owner To Pay Cleanup Bill

The former owner of a Colorado gold mine has stepped forward and offered to pay to clean up one of the country's worst environmental disasters. An attorney for Robert Friedland, who formerly owned Summitville Consolidated Mining Co. near the Continental Divide town of Del Norte, Colo., contacted the Environmental Protection Agency last month.

The mine leaked cyanide and heavy metals into the Alamosa River, killing 17 miles of trout stream and tainting irrigation supplies in the San Luis Valley, a large agricultural area.

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the mine in 1993 when the Canadian company that owned Summitville filed bankruptcy. Galactic Resources Ltd. of Vancouver, British Columbia, shut down the mine.

So far, the cleanup has cost about \$104 million and is about 70 percent complete. Friedland could avoid civil penalties if he reaches a settle-

ment with the EPA, but he wouldn't be exempt from criminal charges.

Couple Is Down In The Dumps Over Court Ruling

After 14 years of court battles, a Hillsborough County, Fla., couple is bankrupt and their property scarred by a court-ordered toxic-waste

hunt that turned up little. As if things couldn't get worse, the court recently ordered them to pay as much as \$700,000 to a Largo, Fla., contractor for the excavation on a family-owned dump.

The excavation yielded only a five-gallon bucket filled with chemical sealant. Pinellas Circuit Judge Fred L. Bryson ruled there was no ev-

idence that KBH Construction Co. cheated James and Pat Martin during the three-year job.

The Martins' fight began in 1982, when Pinellas County sued them, claiming a pair of dumps they owned with James Martin's two brothers were poisoning a nearby well-field. The judge ordered Bobby Martin, one of the brothers, to clean up his landfill. Instead of hauling off toxic waste, Bobby Martin mined \$250,000 worth of clean dirt. So Bryson threw him in jail on contempt charges and appointed KBH to do the job.

The company dug up tons of debris and clean dirt, finding only a five-gallon bucket of hazardous waste.

Their attorney said they will appeal the judge's ruling.

Delaware Leaders Call For Changes In Superfund

Sussex County, Del., officials estimate they will have spent \$3.2 million to survey and sample the Laurel Landfill Superfund site, and \$2 million of taxpayers' dollars could have been saved if federal environmental regulations didn't interfere with a cleanup program already underway.

Rep. Michael N. Castle (R-Del.) said the county's problem is an example of how the federal Superfund program needlessly drives up cleanup costs. He called on Congress and the Clinton administration to work together to reform the program.

W. Michael McCabe, the Environmental Protection Agency's regional administrator, agreed that the Superfund program needs changing. He said the agency originally believed the threat to drinking water supplies from the Laurel site was greater than it actually was.

THE LATEST NEWS

EnSys buys Millipore EnviroGard line

Research Triangle Park, NC. EnSys, first to bring the speed and portability of immunoassay to environmental testing, has acquired the environmental analysis product line from membrane filtration leader, Millipore.

This addition gives EnSys the greatest number of rapid, economical analytical methods. EnSys, the industry

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Third Time Not A Charm For Washington Dairy

A Washington state dairy owner has been fined \$16,000 for allegedly allowing manure wastewater to overflow and discharge into a ditch that ultimately flows into the Nooksack River. The state Department of Ecology also said the Carl Post Dairy in Whatcom County failed to complete a farm plan and a permit procedure required by state law. After the discharges, the farm failed to contact the agency as required by its waste permit.

Fecal coliform levels in nearby ditches were 3,100 times higher than ditch standards.

The discharge is not the first for the dairy operator, either. Post received earlier fines of \$1,500 and \$3,000.

Tribe Raising A Stink Over Smelly Landfill

Coeur d'Alene Tribe tribal members are raising a stink about the county's new landfill, which they say smells worse than the old one. To help ferret out the odor's source and possible solutions, the tribe is seeking a \$20,000 federal grant from the Environmental Protection Agency. The Fighting Creek landfill, less than a half mile from the northern boundary of the tribe's reservation, emits a different odor than the old dump because the county recirculates liquid waste through the trash.

Solid waste director Steve Wulf said Kootenai County is willing to cooperate with the tribe, but he doubts an easy solution can be found. **EP**

Petroleum Group Challenges Oil Spill Assessments

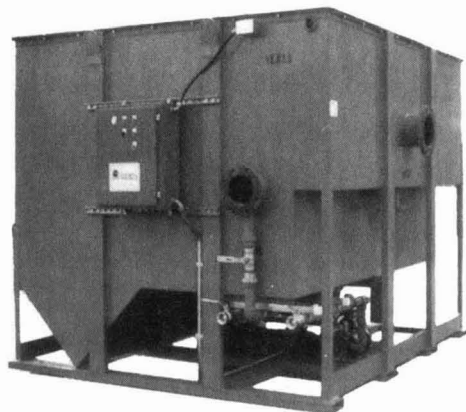


The American Petroleum Institute recently filed a petition in the U.S. Court of Appeals for the District of Columbia seeking review of regulations on how natural resource damages are assessed when oil spills occur.

The regulations were issued earlier this year by the National Oceanic and Atmospheric Administration under the federal Oil Pollution Act of 1990.

At the heart of the petroleum industry's objections is NOAA's abandonment of standards that would ensure that environmental restoration measures were based on sound methodology and reasonable cost. The final regulations, for example, permit public trustees to inflate liability claims by choosing restoration approaches that may not be necessary or cost-effective, according to an American Petroleum Institute press release.

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Superfund Liability Expanded To Parent Corporations

The U.S. Court of Appeals for the Second Circuit departed from traditional notions of corporate law in the recent case, *Schiavone vs. Pearce*. Under corporate law, the concept of "piercing the corporate veil" refers to a case in which a plaintiff is seeking to hold a corporate shareholder personally liable for a claim against the corporation, even though the corporation was validly formed at the time the claim arose.

Courts are generally reluctant to grant such plaintiffs' claims, since one of the primary reasons people form corporations is to limit liability. Similarly, state corporate laws typically allow parent corporations to insulate themselves from liability through the creation of subsidiaries that carry out high-risk business operations that could lead to litigation.

In the *Schiavone* case, the court held that corporate veil-piercing can be disregarded. It can be replaced by the federal court's own interpretations of the degree to which the Comprehensive Environmental Response Compensation and Liability Act, commonly known as Superfund, imposes "operator" liability on corporate parents for the actions of their subsidiaries.

The court ruled that Superfund liability could be imposed on parent corporations without regard to the state common law principles of corporate insulation.

New Plan To Streamline Air Permitting Process

The U.S. Environmental Protection Agency plans to simplify how it determines which new and modified industrial facilities must be reviewed for significant environmental impact. The proposed change is projected to cut in half the paperwork involved in issuing air emission permits under the New Source Review (NSR) program and save industry and states more than \$13 million a year in administrative costs.

NSR requires large industrial facilities and power plants to obtain permits before they build facilities or significantly increase emissions at existing ones. The nonattainment part of the NSR program applies to facilities in areas where atmos-

pheric (ambient) air pollution levels violate federal standards. The Prevention of Significant Deterioration (PSD) part of the NSR program affects U.S. plants in areas with clean air.

The EPA's proposal includes several key reforms. Facilities that would be exempted from NSR requirements include any plants that install effective pollution-prevention measures, innovative pollution-control technology or any pollution-control projects substituting environmentally safe alternatives for stratospheric ozone-depleting substances, like chlorofluorocarbons.

The EPA is also proposing to allow facilities in nonattainment areas more leeway in using their emission reductions from plant shutdowns to offset emissions from new sources. **EP**

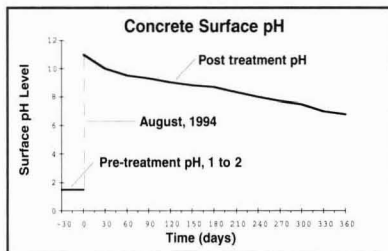
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A NEW SIX-PAGE full-color brochure describes Control Instruments Corp.'s complete line of gas detection equipment. Systems are available for monitoring hazardous gases and vapors, toxic gases, oxygen levels and parts per million concentrations.

Control Instruments Corp.
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CLIMATRONICS CORP. announces the availability of data sheets describing the new Sonic Anemometer. The Sonic Anemometer features no moving parts, no periodic maintenance, digital and analog outputs, optional automatic north alignment and ice-free operation.

Climatronics.
Circle 151 on card.

THE INSIDER'S GUIDE to SF254/255 Preparation will help firms get to the short list by covering details of the federal marketing procedure, including important updates for 1996. The book is appropriate for beginners who need a "crash course" in the federal marketing program, for veterans who are looking for insights or anyone who would like to pick up some "tricks of the trade."

Zweig White & Assoc.
Circle 152 on card.

DESIGNED AS A GUIDE to hands-on, day-to-day environmental management, *Industrial Environmental Management: A Practical Handbook* is the first book to cover the "nuts and bolts" technical and management aspects of environmental compliance and the basic regulatory issues.

Government Institutes.
Circle 153 on card.

UNITED AIR SPECIALISTS announces the release of a newly designed, free eight-page brochure packed with photos, unit options and accessories for its DUST-HOG® Supra-Pulse Cartridge Dust Collector.

With standard models ranging from 500 to 100,000 cfm, the DUST-HOG gives customers the flexibility to configure a system that meets their specific air volume, static pressure and air-to-media requirements. Enhanced by a downward airflow design, the Supra-Pulse delivers superior collection efficiency while remaining cost-effective to operate and maintain.

A unique feature of the Supra-Pulse is the Supra-Series, an extensive family of cartridge filters engineered with application-specific filter media and cageless enclosures. Unlike past cartridge filters, it eliminates the expanded metal external cage to create 25 percent more collection surface.

Other features include horizontal filter design, fully welded construction, inlet baffle, converging/diverging pulse nozzle, large capacity compressed air reservoir, 500-hour salt spray polyurethane paint finish, modular design and a variety of customized options and accessories.

United Air Specialists.
Circle 180 on card.



STOCKHAM TRIANGLE® catalog STV-95 has been released, providing complete information on the cast steel valves produced by Triangle in ANSI Classes 150 through 1500. Included are gate, globe and swing check valves with sizes ranging from 2 inches to 36 inches, in flanged or butt weld ends.

Stockham Triangle Valve Co. Ltd.
Circle 154 on card.

CONSPEC ANNOUNCES the availability of its full-color gas detection/radio communication brochure. The brochure gives the company's mission and history and highlights the recently acquired underground radio communication division, RIMtech.

CONSPEC.
Circle 155 on card.

A NEW SIX-PAGE brochure illustrates and describes the guaranteed environmental maintenance services provided by Carylon Corp. A full range of wastewater, water and sludge maintenance services for municipalities,

industries and utilities is available nationwide.

Carylon Corp.
Circle 156 on card.

A NEW CATALOG by Xomox outlines a broad selection of valves and actuators, including plug, ball and butterfly models. The valves and actuators include many patented features for unmatched sealing and service longevity.

Xomox.
Circle 157 on card.

A NEW CATALOG by National Draeger Inc. features detector tube products for determining contaminant levels in soils, liquids and air. Laid out in a color-coded and user-friendly format, sections include pumps, monitoring devices, gas detection units and tube selections.

National Draeger Inc.
Circle 158 on card.

LEEMAN LABS ANNOUNCES the release of a new product brochure describing its second-generation AP/PS200II Mercury

Analyzer and Preparation System, which provides automated digestion and analysis of water, soil, blood and fish tissue samples.

Leeman Labs Inc.
Circle 159 on card.

FLOMATIC ANNOUNCES its 1996 full-color price list, a 28-page brochure that contains its complete product line, including pictures, pricing and technical information for each product. It is the perfect application guide for a wide variety of valve requirements.

Fromatic.
Circle 232 on card.

A NEW, 12-PAGE brochure illustrates how critical shafting properties affect the performance of linear bearings. These properties are roundness, cylindricity, straightness, surface finish, hardness and corrosion resistance.

Photographs, drawings and graphs show how properties are measured and what specifications ensure full

continued on page 16



One shoe doesn't fit every foot... and one oxidizer technology is not right for every process.

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continued from page 14
system life. **Thomson Industries Inc.**
Circle 181 on card.

A NEW EIGHT-PAGE brochure showcases Troemner's extensive line of precision stainless steel weights and includes the newest additions, the



UltraClass weights. Precision hook, slotted and other special weights are also highlighted.

Troemner Inc.
Circle 182 on card.

A 12-PAGE BROCHURE on cyanide detoxification with hydrogen peroxide is now available from Solvay Intertox. The brochure reviews treatment alternatives and the advantages of using hydrogen peroxide, details the peroxide chemistry and process used, and offers an overview of typical applications.
Solvay Intertox.
Circle 183 on card.

SAFE WORK PRACTICES FOR WASTEWATER TREATMENT PLANTS can reduce the risk to workers on the job by helping plant managers install safe work practices in their own

facilities. It is the only comprehensive text that details exactly how to set up an entire OSHA-required safety program in a wastewater plant or industrial setting. **Technomic Publishing Co. Inc.**
Circle 184 on card.

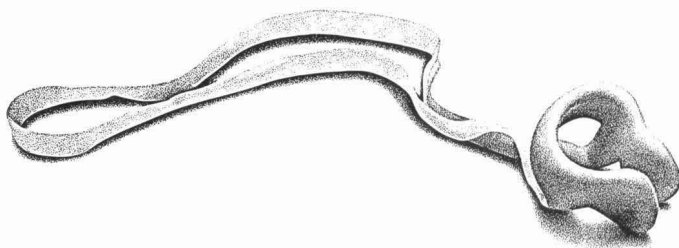
USCO INTRODUCES its new 104-page catalog that includes one of the most compre-



hensive selections of products for water/wastewater treatment and corrosive liquid handling in the industry.

The catalog represents more than 40 top manufacturers and features pipes, valves and fittings, pumps, blowers, tanks, measurement instrumentation tools and more. **Utilities Supply Co.**
Circle 185 on card.

PACKARD INSTRUMENT CO. announces the availability of its new Counting Solutions LSC Technical Tip on sample preparation by solubilization for LSC. This publication discusses many of the problems in the preparation of a variety of sample material for isotopic determination by LSC. **Packard Instrument Co.**
Circle 186 on card.



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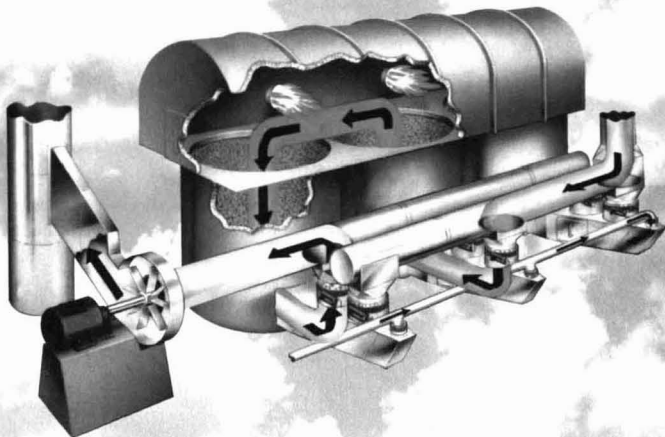
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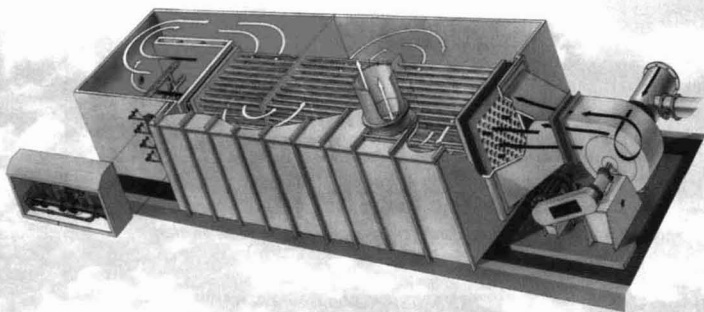
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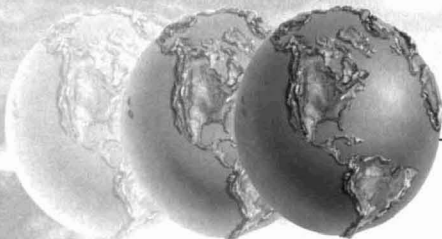
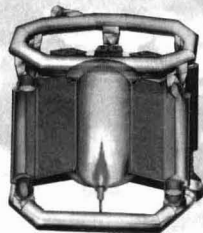
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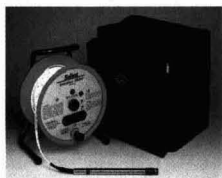
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on tight jobsites.

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The Gradall Co.
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New Environmentally Safe Cleaning System

Progressive Recovery Inc. has developed an environmentally safe structural honeycomb cleaning system for aircraft repair applications. The system cleans and dries honeycomb parts up to 4 feet by 6 feet in less than an hour.

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Recycle Inc. East.
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Manufactured by Noise Cancellation Technologies



and distributed by illbruck, the SONEXactive line is a breakthrough for workers in a

wide range of noisy environments. By electrically coupling bothersome low-frequency noise (LFN) waves with their exact mirror image, called "anti-noise," SONEXactive effectively cancels all broadband and/or tonal waves that make up LFN. Traditional passive hearing protectors are easily penetrated by low frequency noise, making ANR technology an excellent way to combat LFN.

illbruck inc.
Circle 191 on card.

New Technology Prevents Electrical Fires

A new electrical protection product can save hundreds of lives and millions of dollars in property losses by helping prevent fires originating in electrical appliance and extension cords. Fire Shield™, a new product line by Technology Research Corp., focuses on fire prevention by detecting the electrical conditions that cause fires and shutting down the power source before the fire even begins. **Technology Research Corporation.**
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Material Handler

The new 544C material handler is the first big machine of its kind designed for simplified operation with a no-shift hydrostatic drivetrain. Setting a standard for all long-reach, large-capacity material handlers, it is able to lift six stories, maneuver easily and square big loads

Portable Screening Plant

The Construction Department of Portec Inc. introduces the Environmental Model 271B single axle, portable screening plant for contractors involved in remediation, recycled asphalt, compost and other environmental projects. The new 271B — with a capacity of up to 350 tons per hour, depending on the material density and moisture content—is the next evolution in affordable, portable screening plants.

Major hopper design advancements reduce wet, sticky, high-density material bridging problems and production delays with a 90-degree vertical front-end hopper wall and a 70-degree rear and side wall. The hydraulic grizzly features a unique scissors action with simple, individually replaceable round bars.

In field tests, the 271B effectively screened clay soil, compost, petroleum-contaminated soil, shell, rock and wood chips with moisture contents as high as 46 percent with virtually no bridging or sticking of materials. **Portec.** Circle 193 on card.



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Emission Control Equipment

SO₂ Scrubber Technologies Paper

TBI-Bailey is offering a technical paper titled "pH Measurement and Installation Guidelines for SO₂ Scrubbers." The paper outlines sulfur dioxide scrubber technologies, explains how scrubbers operate and offers guidelines for optimizing sensor performance in scrubbers. TBI-Bailey.

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Filament Wound/Contact Molded FRP Tanks, Scrubbers and Custom Fabrication

Belding Tank Technologies Inc. offers a complete line of




computer-designed filament-wound and contact-molded FRP storage tanks. Standard mold sizes are available from 2 feet to 14 feet diameter. Capacities range from 50 gallons to 50,000 gallons. Large, fabricated tanks up to 20 feet diameter are also available. Belding Tank Technologies Inc. Circle 195 on card.

Chrome Mist Eliminator

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Air Pollution Control Systems



United McGill provides effective, economical air-pollution control systems for particulate, acid gas and VOC emissions.

Electrostatic precipitators and fabric filters are available to control particulate emissions. Wet and dry electrostatic precipitators reduce costs by requiring less energy than standard precipitators. Fabric filters have been proven effective on some of the newest and most difficult combustion processes, including those with high temperatures and variable process conditions.

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Regenerative thermal oxidizers are also available to control VOC emissions. **United McGill Corp.** Circle 199 on card.

Wet Tubular Electrostatic Precipitator System

Beltran Associates Inc. has developed the wet tubular electrostatic precipitator system for applications that cannot use the standard plate-type, two-stage electrostatic precipitator. They are ideal for such applications as cement plants, textile finishing plants, glass furnaces, fly ash control, solid waste and liquid waste, and municipal



sewage sludge incinerators. **Beltran Associates Inc.** Circle 197 on card.

Scrubber Brochure

A new brochure from Misonix Inc. describes the company's complete line of

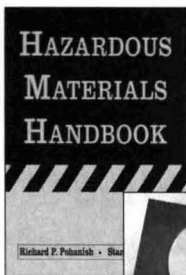


pre-engineered MYSTAIRE® Scrubbers for laboratory, pilot plant and semi-conductor systems. The field-proven scrubbing systems are reliable and designed for easy and economical customization for a wide variety of applications. **Misonix Inc.** Circle 198 on card.

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HAZARDOUS MATERIALS HANDBOOK

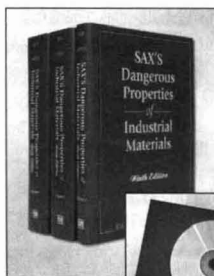
By Richard P. Pohansch and Stanley A. Greene

This corrected, updated and expanded version of the U.S. Coast Guard's Chemical Hazards Response Information System (CHRIS) Manual features widely used and transported industrial materials including, practical hands-on data and technical data as well as chemical properties. This book is a portable and easier to use version of the CHRIS Manual. This new

resource covers more than 1,240 substances, while also improving on the original by including a CAS index, synonym index, and a helpful identification section with new fields and vital ID information moved to the front of each record for easy accessibility. Also available in CD-ROM.

PRINT version: 1,620 pages, \$149.95, ISBN 0-442-02212-3 (Available July 1996)

CD-ROM version: \$400, ISBN 0-442-02422-3 (Available September 1996)



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SAX'S DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS, Ninth Edition

By Richard J. Lewis, Sr.

A vast, reliable source of critical information on health and safety data, regulatory standards, toxicity, carcinogenicity, and physical properties of over 20,000 chemical substances. New: • 2,000 completely new chemicals, drugs, and biological agents • Streamlined toxicity data • New or additional physical data added

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Three-Volume Set: \$499.95, ISBN 0-442-02025-2, (Available)

CD-ROM version: \$500, ISBN 0-442-02335-9 (Available)

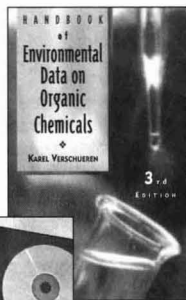
HANDBOOK OF ENVIRONMENTAL DATA ON ORGANIC CHEMICALS, Third Edition

By Karel Verschueren

All the information you need to prudently use potentially dangerous chemicals is in this fully revised edition of our classic handbook. Pesticides, detergents, phthalates, polynuclear aromatics, and polychlorinated biphenyls are all investigated in detail. Includes physical/ chemical properties; air, soil, and water pollution factors; aquatic toxicity, and biological effects; odor thresholds; sampling and analysis data; and structural formulas of over 3,000 chemicals. Tables have been refined to focus on environmentally related materials. Also available in CD-ROM.

PRINT version: 2,080 pages, \$199.95, ISBN 0-442-01916-5 (Available)

CD-ROM version: \$400, ISBN 0-442-02421-5 (Available June 1996)



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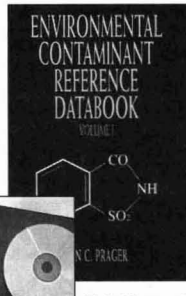
ENVIRONMENTAL CONTAMINANT REFERENCE DATABOOK, VOLUMES I AND II

By Jan C. Prager

Comprehensive coverage of environmental effects of regulated chemicals. Identifies regulated chemicals and chemicals of special interest to environmental and safety professionals due to widespread contamination or considerable hazard. A reference compendium of physical, chemical, and biological dangers of environmental chemicals and selected simple and complex mixtures. Listings include CAS number; sampling, analysis, and detection limits; environmental transport, fate and effects; structural formula; molecular formula; common uses; manufacturers; odor thresholds; regulatory jurisdictions and authorities; standards; reactions; monitoring methods; international data; synonym index. Also available in CD-ROM.

PRINT version: \$129.95 (each volume), ISBN 0-442-01918-1 (Vol. I), ISBN 0-442-01969-6 (Vol. II) (Available)

CD-ROM version: \$400, ISBN 0-442-02420-7 (Available)

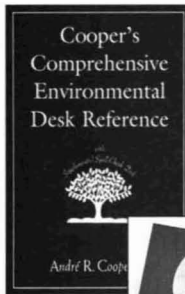


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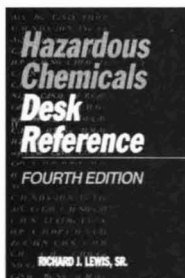
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access to environmental officials who can offer advice and assistance. Destined to become a classic work for all environmental, hazardous waste and safety engineers and managers, industrial hygienists, environmental lawyers, and students in these fields.

PRINT version: 1,039 pages, \$99.95, ISBN 0-442-02159-3 (Available December 1996)
CD-ROM version: \$200, ISBN 0-442-02161-5 (Available July 1996)



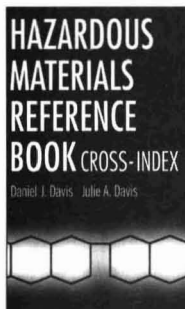
HAZARDOUS CHEMICALS DESK REFERENCE, Fourth Edition

By Richard J. Lewis, Sr.
The new Fourth Edition offers you immediate access to vital information on over 6,000 compounds used in industry, manufacturing, labs, and the workplace. An abridged version of Sax's *Dangerous Properties of Industrial Materials, Ninth Edition*, it presents new or updated Safety Profiles for each chemical, which assesses their hazardous potential as poisons, irritants, corrosives, explosives, and carcinogens.

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Includes • 1-to-3 hazard ratings, which quickly and concisely identify the hazard or toxicity level of a chemical • Synonyms • CAS, NIOSH, and DOT numbers, and other identifiers • Consensus reports from the World Health Organization and other major bodies.

1,750 pages, \$119.95, ISBN: 0-442-02322-7 (Available November 1996)



HAZARDOUS MATERIALS REFERENCE BOOK CROSS-INDEX

By Daniel J. Davis and Julie A. Davis
Hazardous Materials Reference Book Cross-Index is a one-stop reference that gives firefighters and emergency response personnel immediate access to the page number where chemical data on nearly 1,000 substances can be located in 13 of the most frequently-used references. It speeds up research time by alphabetizing chemicals by name and with UN/NA numbers.

400 pages, \$49.95, ISBN 0-442-01965-3 (Available)

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RAPID GUIDE TO CHEMICAL INCOMPATIBILITIES

By Richard P. Pohanish and Stanley A. Greene

The inadvertent mixture of industrial chemicals can have devastating consequences. This concise guide gives all those who handle, store, or transport industrial chemicals the information they need to respond instantly to these potentially perilous situations. Bringing together data on over 1,500 substances, this book alerts the reader to chemical combinations believed



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to be dangerously reactive. It features: • Listings organized alphabetically and by reactive group • Over 30,000 common synonyms • Entries keyed by CAS number • Foreign language entries.

PRINT version: 320 pages, \$29.95, ISBN 0-442-02394-4 (Available December 1996)

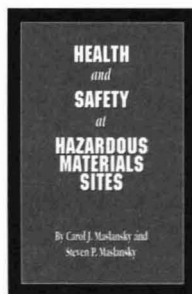
CD-ROM: \$150.00, ISBN 0-442-02395-2 (Available)

HEALTH AND SAFETY AT HAZARDOUS MATERIALS SITES

By Carol J. Maslansky and Steven P. Maslansky

This manual provides basic background information necessary to perform investigative and remedial activities at hazardous waste sites within a safe and efficient framework. It is the basic text for the standard 40-hour HAZWOPER course and is appropriate for any related safety and hazardous materials courses. The organization and thoroughness of the information along with over 65 illustrations make it a stand-alone reference as well as a text. It provides the best available current information from various federal agencies including the EPA, OSHA, NIOSH, U.S. Army Corps of Engineers, Coast Guard, and the Department of Transportation. A generic site-specific health and safety plan, and an emergency response plan are also included.

400 pages, \$59.95, ISBN 0-442-02398-7 (Available December 1996)

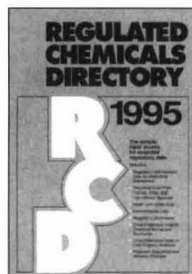


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REGULATED CHEMICALS DIRECTORY 1995

By ChemADVISOR
This is a convenient source of information for everyone who needs to keep up-to-date regarding the regulations and recommendations that pertain to chemical substances. Every regulatory or advisory list used in this resource is keyed to its source, to help readers who need more detailed information on regulations, recommendations, or guidelines readily locate source documents.

1,988 pages, \$299.95, ISBN 0-442-02124-0 (Available)



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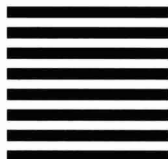
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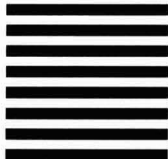
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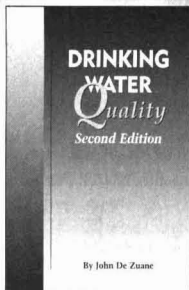
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DRINKING WATER QUALITY, Second Edition

By John De Zuane
Keeping up with EPA regulations for drinking water may be a requirement for engineers, water supply and treatment personnel, and public health officials, but few have time to wade through the more than 10,000 pages of technical and legal jargon these regulations include. This book provides concise explanations of the latest regulations and current issues in water quality. It provides coverage of the many challenges water management professionals face today, including:

- Current EPA regulations, with comparisons to World Health Organization and European Economic Community standards
- Updated and expanded information on contaminants including lead, copper, radon, coliform, cryptosporidium, and trihalomethanes
- Guidelines for writing new standards or evaluating existing standards for drinking water quality.

520 pages, \$74.95, 0-442-02344-8 (Available October 1996)



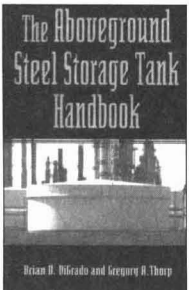
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HAZARDOUS WASTE MANAGEMENT COMPLIANCE HANDBOOK, Second Edition

By Environmental Resource Center
A comprehensive handbook that interprets the CFR and provides information regarding the implementation of RCRA and DOT regulations. Includes technical data on hazardous materials and a step-by-step approach to compliance. Enables industrial health and safety professionals to fully understand federal enforcement activities, to interpret and comply with current RCRA

and DOT laws and training requirements, and to implement emergency response procedures and training programs. New chapters cover waste minimization, corrective action, and universal wastes.

490 pages, \$79.95, ISBN 0-442-02397-9 (Available December 1996)



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THE ABOVEGROUND STEEL STORAGE TANK HANDBOOK

By Brian D. DiGrado and Gregory A. Thorp
The U.S. market for ASTs approached \$2.0 billion in 1995 as underground tanks that have caused groundwater contamination are replaced with ASTs. All those who must wade through AST compliance paperwork will find this handbook to be a comprehensive single-source reference guide. Four easy-to-understand sections include markets, regulations, manufacturing standards, and products. Conclusive guidance to new and existing field-erected and shop-built products with installation instructions. Comprehensive appendixes compile manufacturers, trade associations, codes, sizing calculations, and tank data sheets.

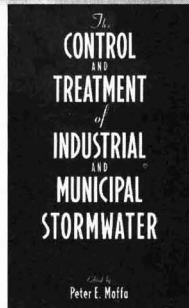
350 pages, \$69.95, ISBN 0-442-01845-2 (Available)

THE CONTROL AND TREATMENT OF INDUSTRIAL AND MUNICIPAL STORMWATER

Edited by Peter E. Moffa

Written by experts in stormwater technology, this resource provides an overview of EPA's 1990 NPDES permitting system and details the steps involved in putting together a stormwater management model that can be used to determine the level of pollutants in a municipal drainage system. Using case studies, it highlights management control techniques that can be used to correct pollutant problems, including watershed area technologies and practices, source treatment, flow attenuation, and storm runoff infiltration strategies.

310 pages, \$69.95, ISBN 0-442-01893-2 (Available)



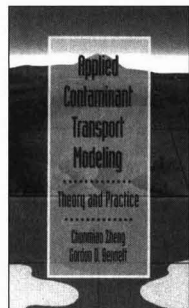
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APPLIED CONTAMINANT TRANSPORT MODELING: THEORY AND PRACTICE

By Chunmiao Zheng and Gordon D. Bennett

This is the first complete resource designed to provide clear coverage of the basic principles of solute transport simulation — including the theory behind the most common numerical techniques for solving transport equations and step-by-step guidance on the development and use of field-scale models. Presents detailed case histories illustrating how hydrologists, geologists, chemists, and environmental engineers apply transport models in real-life situations including landfills, hazardous waste sites, and contaminated aquifers.

440 pages, \$79.95, ISBN 0-442-01348-5 (Available)



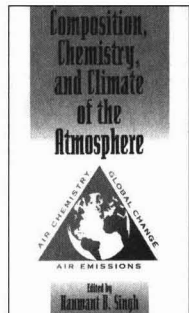
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COMPOSITION, CHEMISTRY, AND CLIMATE OF THE ATMOSPHERE

Edited by Hanwant B. Singh

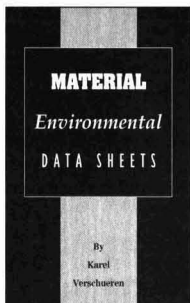
Bringing together world-renowned experts in air chemistry and pollution (including 1995 Nobel Laureates in Chemistry, P.J. Crutzen and M.J. Molina), this unique volume analyzes and integrates the scientific evidence behind the myriad issues of air pollution. Tracing the history of air pollution, from localized microenvironments to regional and global levels, it provides important insights into the mean physical and dynamic characteristics of the atmosphere, the effects of population and industry on atmospheric composition, and quantifiable sources of air pollution. Includes extensive coverage of photochemical smog, tropospheric ozone, stratospheric ozone depletion, acid rain, and global warming.

527 pages, \$79.95, ISBN 0-442-01264-0 (Available)



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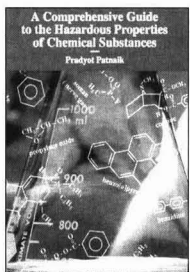
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MATERIAL ENVIRONMENTAL DATA SHEETS

By Karel Verschueren
This handy ring-binder reference responds to the needs of small enterprises who lack the expert staff needed to interpret the raw data in the Handbook of Environmental Data on Organic Chemicals, Third Edition but must acknowledge consumer pressures and government regulations with respect to the very limited materials they employ. It provides datasheets on 300 chemicals, representing some 80% of those common in industrial use. Each year, sheets on 100 new chemicals will be available, as well as updates on the original chemical information.

Volatile chemicals that may pose environmental risks are also indicated. This resource provides expert advice many small chemical manufacturing enterprises can't do without.

336 pages, 8 1/2 X 11 3-ring binder, \$129.95, 0-442-01915-7 (Available July 1996)



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A COMPREHENSIVE GUIDE TO THE HAZARDOUS PROPERTIES OF CHEMICAL SUBSTANCES

By Pradyot Patnaik

Where HAZMAT references merely catalog the various properties and effects of specific chemical compounds, this book correlates chemical structure with toxicity to humans and the environment. Primary characteristics of over 1500 chemicals (46 different groups) are examined including toxicity, carcinogenicity, flammability, explosive reactivity, and safe handling and disposal practices. Chemical structures are clearly illustrated and general properties and trends within chemical groups described. Extensive search of current international literature reviews synonyms, CAS number, physical properties, uses, chemical analyses, EPA regulatory status, and DOT requirements. Relevant U.S. federal regulations — the RCRA, Clean Water Act, Safe Drinking Water Act, and Clean Air Act — are highlighted.

800 pages, \$109.95, 0-442-00191-6 (Available)

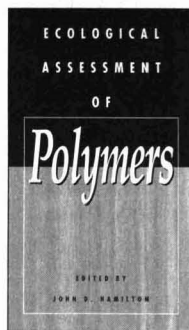
ECOLOGICAL ASSESSMENT OF POLYMERS

Edited by John D. Hamilton

Ecological Assessment of Polymers offers a wealth of essential information on the ecological effects of polymers in a single, comprehensive source. The book includes in-depth, up-to-date information on:

- Available tools and databases for developing environmentally compatible production processes and products
- Current methodology and instrumentation for analyzing the effects of polymers on the environment
- Polymer regulations in the U.S., Canada, Europe, and Pacific Rim
- Development of products with enhanced levels of biodegradability
- Designing better manufacturing processes.

400 pages, \$69.95, ISBN 0-442-02328-6 (Available November 1996)



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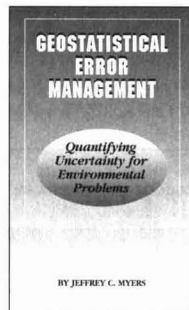
GEOSTATISTICAL ERROR MANAGEMENT

Quantifying Uncertainty for Environmental Problems

By Jeffrey C. Myers

Other works in the field have focused only on mining, but this new book by Jeffrey Myers is the first to exclusively apply geostatistical tools to environmental problems. In addition, this unique resource offers a useful and imaginative new framework, known as Geostatistical Error Management (GEM), for environmental decision-making. GEM integrates the related areas of Data Quality Objectives, Sampling Theory and Practice, and geostatistics to create a complete set of tools for site assessment and decisionmaking. Using GEM, environmental specialists can more accurately characterize the extent and levels of contamination at hazardous waste or other environmentally impacted sites.

450 pages, \$64.95, ISBN 0-442-01429-5 (Available November 1996)



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the grapevine

Michael F. Knapp was appointed vice president of **International Technology Corp.** and David B. Kiser was appointed vice president of its subsidiary, **IT Corp.**, Torrance, Calif.

The Warren, N.J., engineering firm of **Paulus, Sokolowski and Sartor Inc.** received the 1996 Consulting Engineers Council of New Jersey grand award for engineering excellence and is also a finalist in the 30th annual National Engineering Excellence Awards.

Katherine Chase Reed joined the staff of **Wellington Environmental Consulting & Construction Inc.**, Tampa, Fla., in business development.

Michael S. Dye is the new director of marketing for the Peroxy Chemicals Division of **Degussa Corp.**, Ridgefield Park, N.J.

The **Manufacturers of Emission Controls Association**, which provides technical information on exhaust controls for motor vehicles, elected John Curtin of Degussa Corp. president.

Clayton Environmental Consultants Inc. opened its Chicago, Ill.-area environmental safety and health services group under the direction of Rex W. Moore, CIH, CSP.

Joseph J. Grasso joined **HDR Engineering Inc.** as senior program manager in the company's Omaha, Neb., office.

Metcalf & Eddy, Somerville, N.J., received the 1996 Eminent Conceptor award from the American Consulting Engineers Council/Michigan for its design of the city of Detroit, Mich., 750-million-gallon-per-day pumping station.

Alan W. Katz joined **R&R International Inc.**, based in Akron, Ohio, as vice president, senior program manager.

Clement E. Coulombe, a soil specialist, and Richard G. Whitney, a wetland ecologist and botanist, joined **RGM Inc.**, Escanaba, Mich.

Alan Cohen is the new manager of

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municipal economics at **HDR Inc.**'s White Plains, N.Y., office.

Trinity Consultants Inc. opened a new district office in Philadelphia, Pa., with Kay A. Modi as the district manager.

Mark D. Poole joined **HDR Engineering Inc.** as a project manager and water and wastewater section manager in the company's Pittsburgh, Pa., office.

SBE Environmental Co., a wholly owned environmental subsidiary of **BE&K Inc.** is changing its name to **BE&K Environmental Co.**, New York, N.Y.

Donald R. Lutch was appointed vice president of the water/wastewater division for **Metcalf & Eddy's** central region, based in Itasca, Ill.

SCS Engineers opened a new office in Sacramento, Calif. The office manager is **Ambrose McCready.** **EP**



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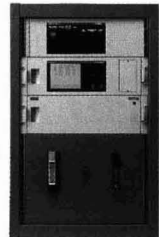
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Southern Methodist University

A Southern Methodist University researcher is trying to modify a promising, wastewater treatment using waste-shot blast fines so it can eventually be used commercially. A technology transfer grant was awarded to Ed Smith of the SMU Mechanical Engineering Department.

Waste-shot blast fines are byproducts created when cast

iron is manufactured. The materials contain pure metals, such as lead, zinc and cadmium. Previously, Smith conducted laboratory and bench-scale studies to determine if the fines could be used to remove heavy metals from industrial and hazardous wastewaters.

Smith said he hoped to develop a process to recycle waste-shot blast fines from cast iron manufacturing.

Eventually, he said he wanted to design and operate a pilot treatment facility at an industrial site to demonstrate how the process works under field conditions.

Smith said he believed the use of fines for wastewater treatment may be most effective when contaminants have pH levels of 5 or higher and pollutant levels are relatively low. The process could be used to pretreat industrial

wastewater, clean up groundwater extracted from hazardous waste sites, and intercept and improve the quality of contaminated streams. The process is cost-effective and uses a material usually sent to landfills.

Ames Laboratory

Zapping contaminants with lasers may be just the answer for safely and efficiently reducing some of the hazardous waste awaiting disposal across the country. Putting the power of a pulsed laser beam to work on contaminants, Ames Laboratory researchers have developed a new method for cleaning highly radioactive metals without exposing workers or expensive equipment to hazardous wastes.

"Not only are lasers proving effective at decontamination, but they offer some important advantages in terms of safety and reduction of secondary waste," said Martin Edelson, a principal investigator at Ames Laboratory.

Unlike many traditional decontamination techniques, Ames' new laser cleaning method uses no harmful solvents and creates little secondary waste.

Edelson's research team has investigated both surface and bulk decontamination with lasers. For surface cleaning, the researchers used a pulsed laser beam to precisely remove the contaminated layer of a metal while high efficiency particulate air filters captured particles, preventing them from resettling on the cleaned area. In bulk decontamination, lasers selectively ionized and removed specific contaminants from metal that were vaporized.

Moving the research from the lab bench to the field, Ames is working with the Department of Energy's Idaho National Engineering

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Lab (INEL) to develop and demonstrate a field operational surface laser decontamination unit.

The new laser technique produces little secondary waste and can reduce waste volumes—or at least lower waste classifications—and the hazards and costs of waste storage and disposal.

Argonne National Laboratory

Argonne, the U.S. Department of Energy's leading nuclear reactor lab, is taking the lead in developing new technologies and techniques to help the nation deal with disposal of spent nuclear fuel.

One problem created for government and industry by

the first generation of nuclear facilities has been the disposal of spent nuclear fuel—the material left after fuel rods have been burned in a reactor. Currently, about 3,000 tons of spent fuel are stored at various DOE sites throughout the nation.

The spent fuel comes from more than 40 years of nu-

clear-reactor research and includes more than 150 different fuel types. Some of it cannot be disposed of safely until it is stabilized to withstand long-term storage in a nuclear waste repository.

The DOE inventory includes fuel that is seriously degraded, highly enriched with fissionable or chemically reactive materials, and lacking the structural integrity to remain stable during long-term storage.

Argonne's nuclear technology program demonstrated a nuclear-fuel electrorefining process in 1995 that could save taxpayers billions of dollars disposing of much of the spent nuclear fuel.

A National Research Council committee reported in a preliminary finding that Argonne's electrorefining technology represents "a sufficiently promising technology for treating a variety of DOE spent fuels" and warrants continued research.

Currently, Argonne's electrorefining process can treat more than 90 percent of DOE's spent-fuel inventory, converting it into a common waste form suitable for treatment and long-term storage.

Argonne's electrorefining system is compact and fast. It was originally developed to treat small amounts of spent fuel from an experimental reactor Argonne operated for 30 years in Idaho. Tests completed in early 1995 indicated that a unit about the size of a bathtub could process a ton of spent DOE fuel a day.

If continued development is successful, small, standardized electrorefiners could be built at sites throughout the country where DOE stores spent fuel.

Argonne engineers are designing a 500-pound-per-day prototype. By 1997, they expect to demonstrate it at Argonne's Idaho site. **EP**

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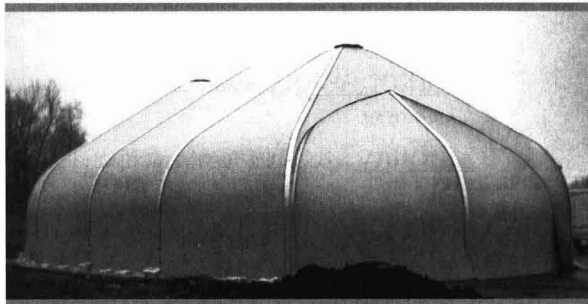


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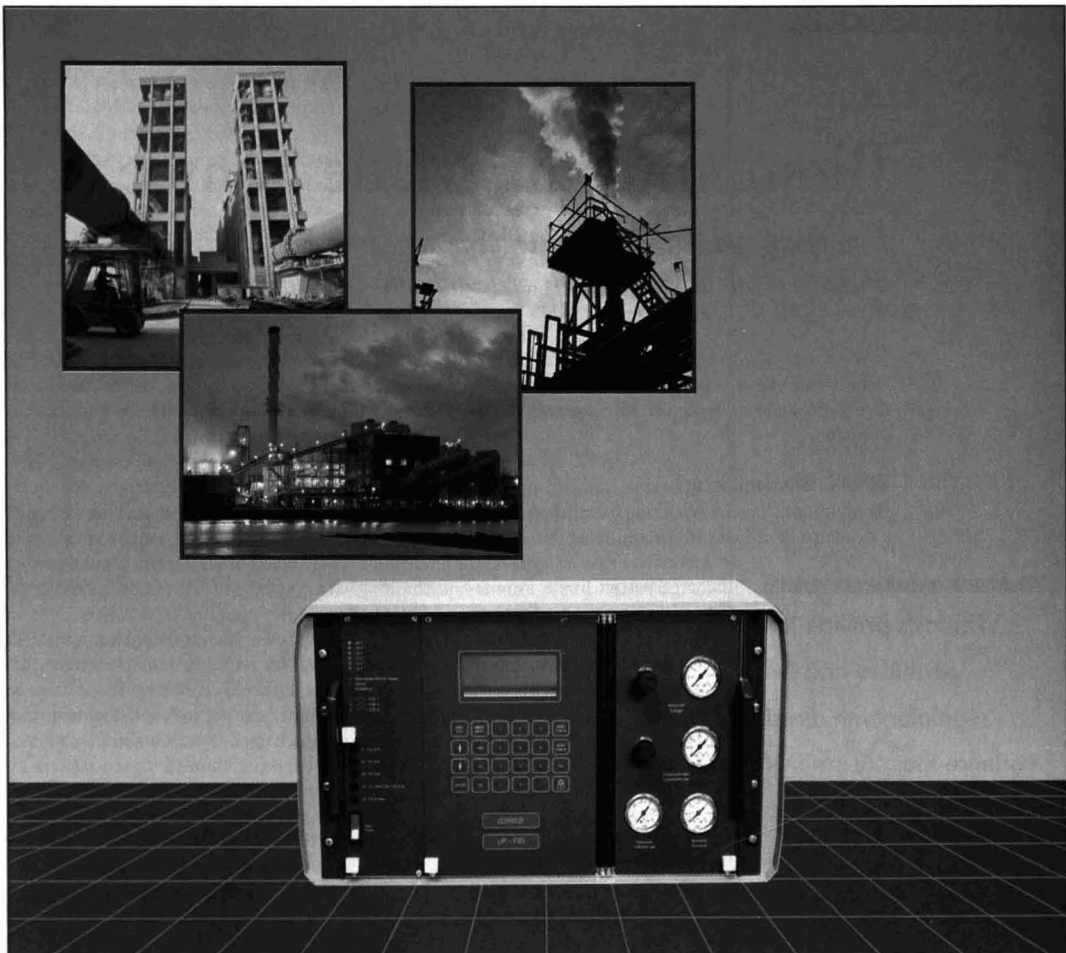
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Biomonitoring Made Simple

By exposing indicator species to effluent, regulators and dischargers can determine both acute and long-term toxicity.

Editor's note: With this issue, Environmental Protection welcomes a new column in which experts in their fields answer some of the most commonly asked questions.

What is Biomonitoring?

Biomonitoring involves exposing living organisms to a discharge or effluent to determine its toxicity and acceptability based on applicable discharge permit limits. Any facility with a permit to discharge effluent into U.S. waters is probably required to conduct biomonitoring tests, usually on a quarterly basis.

Biomonitoring tests, commonly known as whole effluent toxicity or WET tests, are simple laboratory procedures, although experienced biologists must conduct them following rigorous U.S. Environmental Protection Agency or state guidelines. A routine WET test costs between \$250 and \$750, depending on the test species and the experimental design required by the discharge permit. WET tests provide the permittee and the regulator with direct evidence that the effluent is not hazardous to aquatic life. A WET test failure can be considered a discharge permit violation and can lead to treatment modifications to reduce the toxicity or to substantial fines.

Why is Biomonitoring Required?

The Clean Water Act, which prohibits toxic releases into U.S. waters, requires U.S. dischargers to conduct WET tests. For many years, dischargers were required only to monitor effluents for specific chemical concentrations. Problems with this approach surfaced more than 10 years ago because of the number of individual chemicals in complex wastewaters.

Even if a discharger could analyze the effluent for each chemical, it would be impossible to implement control measures for each one. In addition, the chemical-specific approach does not account for matrix effects, where the chemical toxicity often depends on other effluent components. For example,

shifts in water hardness, pH and organic material may affect the toxicity of many metals. Moreover, the chemical-specific approach does not address interactions among toxicants.

Given this reasoning, why not conduct WET tests alone and eliminate the requirement for chemical-specific monitoring? Most regulatory agencies have adopted an approach that requires both types of monitoring, because WET tests cannot predict the long-term effects of chemicals on receiving water bodies.

For example, some chemicals bioaccumulate in organisms over time, resulting in adverse effects that may not appear during WET testing. Based on these considerations, the best way to ensure that toxic materials are not discharged in toxic amounts is to conduct chemical-specific monitoring coupled with WET testing.

What Types of Toxicity Tests Are Used?

There are two major types of effluent toxicity tests: acute and chronic. Acute tests are short duration, usually 24 to 96 hours, and the measured endpoints are severe effects — mortality or species immobilization. Chronic tests last normally six to seven days, and the endpoints are more subtle, usually including evaluation of growth or reproduction in addition to survival.

Although testing requirements vary among states and EPA regions, toxicity tests are typically conducted with several effluent concentrations. To prepare the test concentrations, the effluent sample is diluted with water from the receiving water body or with matching laboratory water.

A typical dilution series might include effluent concentrations of 100 percent, 50 percent, 25 percent, 12.5 percent and 6.25 percent. Plain water would be the control. Definitive tests include several dilutions. Many states may require only screening tests with 100 percent effluent and a concurrent control; no mixtures of effluent and dilution water are required.

What Organisms Are Used and Why?

For freshwater testing, the most common biomonitoring organisms are water fleas (*Ceriodaphnia dubia*) and fathead minnows (*Pimephales promelas*). Less common freshwater biomonitoring species

WET tests provide the permittee and the regulator with direct evidence that the effluent is not hazardous to aquatic life.



Jeffrey M. Giddings, Ph.D., is technical director of environmental toxicology services for ENSR, Acton, Mass.

include other water fleas species, rainbow trout, scud and green algae. The organisms are common and can be cultured easily in the laboratory. *Ceriodaphnia dubia* are becoming the invertebrate species of choice because they reproduce quickly; a single newborn will produce about 30 offspring in seven days. An adult *Ceriodaphnia dubia* is about the size of a pinhead; newborn are about five times smaller.

For marine and estuarine testing, common biomonitoring organisms include opossum shrimp (*Mysidopsis bahia*), sheepshead minnows (*Cyprinodon variegatus*) and inland silversides (*Menidia beryllina*). Other saltwater test species include sea urchins and red algae.

What Are the Test Endpoints?

Test organisms are placed into effluent dilutions at the start of a test and monitored at regular intervals. The most commonly estimated endpoint for a definitive acute test is the LC50. This is the concentration of effluent estimated to kill 50 percent of the test organisms during a specified time period. If more than 50 percent survive in all the effluent dilutions, the LC50 is greater than the highest effluent concentration tested, and the effluent is not considered acutely toxic.

Different statistical endpoints are commonly required for chronic tests. Toxicity is evaluated by determining whether organism survival, reproduction or growth in a specific effluent dilution is significantly less than in the control. Using these methods, the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) are determined. Although the NOEC and LOEC are the most widely used endpoints for chronic tests, it is becoming more common to use a point estimate, such as the IC25. The inhibition concentration (IC) is the concentration estimated to cause a 25-percent reduction in organism performance compared with the control.

In screening tests, an LC50, LOEC, NOEC or IC25 cannot be calculated. Data from screening tests are typically evaluated using hypothesis testing. For example, if organism survival in 100 percent effluent is significantly less than in the control, the effluent sample is considered acutely toxic.

In all cases, control organism performance is evaluated using specific criteria

to determine the test validity. Acute tests are normally considered unacceptable if less than 90 percent of the control organisms survive.

For chronic testing with *Ceriodaphnia dubia*, control organism survival must be at least 80 percent, and control organisms must produce an average of at least 15 offspring per female. If any of these criteria is not met, the test is invalid and must be repeated.

What Does TIE/TRE Stand For?

If a toxicity pattern occurs during WET tests, many states and regions require a Toxicity Reduction Evaluation (TRE) for the discharge.

According to the EPA, a TRE is "an investigation conducted within a plant or municipal system to isolate sources of toxicity, specific causative toxicants if possible, and to determine the effectiveness of pollution control options in reducing the effluent toxicity."

A TRE can be comprised of many studies, including chemical screening, housekeeping audits, process reviews, evaluation of plant performance and treatment simulation studies. The most important element of a TRE is a Toxicity Identification Evaluation (TIE). In the TIE, chemical/physical manipulations, followed by toxicity tests, identify the cause of toxicity.

When the causative toxicant is identified, compliance options, such as source control or focused treatment, can be evaluated. A systematic TIE/TRE can result in significant savings for the discharger.

What Are the Long-Term Benefits?

The WET tests provide the permittee and the regulator with direct evidence that the effluent is not hazardous to aquatic life. The test and subsequent facility discharge evaluations (TRE and TIE) help facility managers evaluate the most cost-effective permit compliance options available. **EP**

Questions or comments? E-mail us at webmaster@eponline.com.

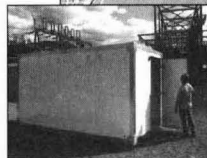
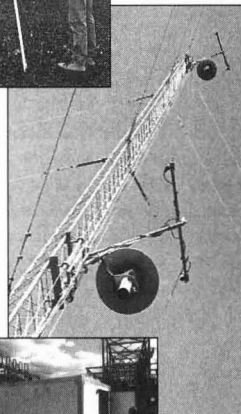
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From Headache to Lifesaver

Environmental auditing is no longer just an afterthought but an integral part of many companies.

WHEN THE ENVIRONMENTAL PROTECTION AGENCY'S Office of Criminal Enforcement stepped up enforcement in the early '90s and began criminal prosecutions for corporate noncompliance, environmental audits were increasingly required as part of settlements and other forms of judicial relief. U.S. corporations began to audit in earnest, pressing the EPA and state legislators to help protect their audits.

Corporations wanted the information that was uncovered during an audit protected from disclosure to enforcement officials. They justifiably did not want to be penalized for discovering unexpected violations and taking steps to correct them. An environmental audit served to inform management about whether operations complied with regulations.

A number of states responded to corporate demands and have passed, or have pending, audit privileges to encourage and protect environmental audits. The laws provide immunity from regulations if the company voluntarily discloses its findings and takes steps to correct the problems.

EPA Drafts New Auditing Policy

The EPA, as part of a regulatory reform initiative, finally responded with a new environmental auditing policy, updating and enhancing the 1986 policy. The new policy provides significant incentives to conduct voluntary self-audits but will only reduce, not eliminate, penalties for violations that are voluntarily disclosed. The EPA wants to make sure it recovers the value of any economic benefit from avoiding environmental requirements.

Audit Legislation Under Consideration

Under additional pressure from powerful lobbying groups, legislators have introduced audit privileges

into the U.S. House and Senate. "The federal government should encourage responsible actions with incentives and flexibility rather than through threats and penalties," said Sen. Mark Hatfield, R-Ore., who introduced the bill. Oregon was one of the first states to enact similar legislation. More than a dozen states so far have passed audit privilege legislation.

Auditing Study

To assess the current state of environmental auditing, Price Waterhouse conducted a survey that showed three out of four industrial companies had environmental auditing programs in place. The study clearly showed that companies think the benefits of audits outweigh the risks. Environmental auditing is no longer an afterthought; it is an essential element in any comprehensive approach to environmental management.

Auditing Organizations Flourish

The growth of environmental auditing has stimulated the creation of professional organizations devoted to furthering the practice of environmental, health and safety (EHS) auditing. Membership in the Environmental Auditing Roundtable (EAR) has grown. Today, EAR's clout may earn it the role of acting as U.S. accreditor or registrar for qualifying organizations registering for the ISO 14000 International Environmental Management System standard.

Software Programs Simplify Auditing

As corporate auditors come under increasing pressure to get audit programs up and running and to train staff to perform objective, quality jobs, they seek software systems to help. They look for EHS auditing software that automatically generates workable, intelligent checklists and references applicable regulations. Software has become the tool of choice because it provides consistency for audits performed across many facilities, and it clears the way for objective communication between corporate and facility staff. Using a comprehensive auditing software system assures auditors and environmental managers that audit reports are factual without speculation. And staying up to date with changing regulations is almost unmanageable without a software tool. A comprehensive audit software program actually can



Software such as Dakota Auditor™ is loaded on a portable Fujitsu pen-based computer. Digital images of objects or sites captured by the Connectix camera are incorporated into a draft audit report.

Arlene Davidson is manager of public relations at Dakota Software Corp. in Rochester, N.Y.

make an expert out of any new auditor.

As time goes on, the EPA will continue to feud with states over the audit privilege, international standards will establish auditing requirements, and the mini-industry that has grown around environmental, health and safety auditing will continue to flourish. **EP**

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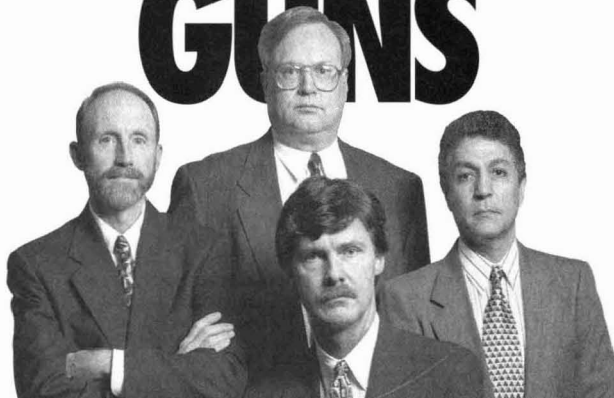
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Protection from Copycats

Patent laws can be applied to environmental technology and processes, such as bioremediation organisms, air strippers and remediation processes.

THE NUMBER OF ISSUED U.S. PATENTS directed to environmental technologies has grown substantially in recent years. A large part of this growth can be attributed to increased awareness about patents among companies that deal in environmental technology. The companies have come to realize that the advantages provided by patents in the form of protecting research and development investment in new technologies and defending against patents held by competitors often outweigh patent costs.

A patent is a government-granted right allowing the patent holder or owner to exclude others from making, using or selling the patented invention. The right does not extend indefinitely but lasts only for the term of the patent. Once the patent has expired, the public is free to use the patented invention as long as it doesn't infringe on another unexpired patent. In most instances, patents are published and publicly available.

In the United States, a patent term has traditionally been 17 years from the date it is published by the U.S. Patent and Trademark Office. However, the U.S. patent laws have been recently modified to comply with the General Agreement on Tariffs and Trade (GATT) provisions so that the term of any patent filed in the United States after June 8, 1995, is 20 years from the date of filing.

The typical time between the date of filing and the date the patent is published is about two to three years. An additional GATT-related modification provides that the patents in force as of June 8, 1995, (i.e., pending patent applications filed before that date or issued patents that had not expired by that date) be given a term that is the longer of 17 years from the date of publication or 20 years from the date of filing.

Patents do not confer an absolute right to make, use or sell the patented invention but only the right to exclude others from doing so. This is because an invention claimed in a patent may be subordinate to a previous invention claimed in another patent. For example, one could invent and patent tubeless tires.

Subsequently, a second person could invent and claim tubeless radial tires. The second invention, tubeless radial tires, is arguably subordinate to the first invention, tubeless tires, since the second patent holder cannot make, use or sell the second invention without infringing the patent for the first invention. In industries where the patent positions are competitive, no one can make, use or sell the final product without some type of cross license where the participants exchange patent rights.

Types of Patents

There are two different types of inventions that can be patented: devices and processes. A patent for a device can be directed to a machine, an article of manufacture or a chemical composition. Patents are typically not available for newly discovered laws of nature or naturally occurring substances. However, the U.S. Supreme Court has held that man-made, genetically engineered organisms are patentable.

A patented process is usually a patent for the steps performed in connection with the process. For example, U.S. Patent No. 5,276,253, titled "In-Situ Remediation and Vitrification of Contaminated Soils, Deposits and Buried Materials," is directed to a method in which a plasma arc torch is used to vitrify and remediate a site containing contaminated soils. The claimed process includes steps where contaminated earthy material or subterranean deposit is pyrolyzed, melted or solidified by the plasma torch. The material is then gradually raised to the surface.

Patents are available for many areas and new developments in the environmental technology. For example, improvements in devices used to monitor and/or control pollutants, such as air strippers and filters, are patentable. Similarly, man-made organisms used in remediation to consume pollutants can be patented.

Processes used to monitor and assess the environment, control hazardous emissions, and remediate and restore the environment are also patentable. In fact, there are so many patents directed to environmental technology that the U.S. Patent and Trademark Office has created a separate classification, Class 588, for hazardous waste-related products and processes.

In order to be patentable, an invention must be novel. Under U.S. patent law, this means that the in-

The U.S. Patent and Trademark Office has created a separate classification, Class 588, for hazardous waste-related products and processes.

Donald Muirhead is an associate with the law firm of Foley, Hoag & Eliot in Boston, Mass.

vention cannot have been released to the public or used in connection with any services or products provided to the public for more than one year prior to the date of filing the patent application. Most foreign patent laws are even more restrictive and require that the invention not have been disclosed to the public at any time prior to filing. Therefore, a company that wants patent protection for a product about to be publicly released should carefully consider its patent position before releasing it.

Patent Enforcement

In most instances, patents can only be enforced in the country in which they are obtained. For example, a U.S. patent usually cannot be enforced outside the territory of the United States. However, a U.S. company can obtain and enforce patent rights in most other countries just as foreign companies often apply for and obtain patent rights in the United States. Approximately half of the U.S. patents issued in 1995 were owned by foreign companies or individuals.

Patents can be used to protect investment in research and development. Often, it is not cost-effective to invest in research and development without some assurance that the investment can be protected, since the cost of developing a new technology could far exceed the cost of implementing it.

If there were no means for protecting the technology from copying, then competitors without development expenses to recoup could provide the technology to customers at a much lower cost. Copying is prevented when a developer of new technology patents it and enforces the rights provided by the patent to exclude competitors from practicing the patented invention.

Enforcement of patents is usually with a civil suit by the patent holder (plaintiff) against one or more alleged infringers of the patent (defendants). The result of a successful patent infringement suit could be damages paid by the defendant to the plaintiff and/or an injunction ordering the defendant to stop practicing the patented invention.

Damages can be calculated in a variety of ways, such as by determining the plaintiff's lost profits or calculating a reasonable royalty rate that the defendant would have paid the plaintiff had they negotiated a license. If the defendant is found to have "willfully in-

fringed" the patent—knew about the patent but chose to infringe anyway—the amount the defendant ultimately pays to the plaintiff can be increased up to three times the actual damages. In some instances, threatening a civil suit is enough to stop a potential defendant from infringing.

Independent development is not a defense to patent infringement. It is not enough to simply ensure that the technology has been developed independently. Often it is also advisable to patent that technology. For example, if

one company develops a waste-treatment system and patents it, it can in many instances enforce that patent against a second company that independently develops the same waste-treatment system but does not patent it. The first company, having the patent, would be in a superior competitive position to the second company.

Patents in the Environmental Field

Technological innovation in the environmental area can involve devices or *continued on page 36*

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Division of Resource Consultants

PROBLEM SOLVER



Photo courtesy of Zimpro Environmental Inc.

A wet-air oxidation system treats refinery spent caustic liquors.

Small System Does Big Job Pretreating

By using a wet-air oxidation treatment unit at a refinery, expensive off-site disposal is eliminated.

A skid-mounted wet-air oxidation unit has been started up at Refinaria de Petroleos de Manguinhos S.A., a Rio de Janeiro, Brazil, producer of liquid petroleum gas, gasoline, fuel oil and solvents. The unit is being used to treat refinery spent caustic liquors before further treatment in an on-site biological system. Expensive off-site disposal is eliminated.

Spent caustic liquors are commonly produced by sulfide removal processes in the refining and petrochemical industries. The wastewaters typically contain sodium hydroxide with high concentrations of reduced sulfur, including extremely odorous mercaptans.

The wet-air oxidation process, designed and installed at the Manguinhos refinery by Zimpro Environmental Inc. is a liquid-phase reaction between organic material in water and air. The oxidation occurs at moderate temperatures (400 to 500 degrees Fahrenheit), and at pressures from 1,000 pounds per square inch to 1,200 psi. In treating spent caustic disulfide oils, mercaptans, sulfides and phenols are either destroyed or con-

verted to biodegradable forms. Zimpro has also provided wet-air oxidation units for spent caustic treatment in North America, the Far East and Europe.

The Manguinhos system is the smallest commercial-scale wet-air oxidation unit ever designed and built by the firm and is designed for a flow of two gallons a minute.

All equipment, including the control room, is mounted on a single shop-fabricated skid. A skid-mounted air compressor, reactor vessel and heat exchanger make up the rest of the system. **EP**

For more information on the Zimpro skid-mounted wet-air oxidation unit, circle 207 on card.

Questions or comments? E-mail us at webmaster@eponline.com.

What Do You Think?

Please indicate your level of interest in this article by circling the appropriate number on the Reader Service Card.

High 208 Medium 209 Low 210

legal watch

continued from page 35

methods that aid compliance with environmental statutes or regulations at a reduced cost. The holder of a patent for a lowest-cost device or method used for complying with an environmental statute or regulation could legally use the patent to maintain a substantial advantage over the competition by enjoining competitors from using the technology. Such an injunction would force competitors to revert to older, presumably less cost-effective, technology.

There are exceptions to how a patent holder can enjoin an infringer from practicing a patented invention. For example, Section 7608 of the Clean Air Act provides for compulsory licensing, rather than injunction, where the patented technology is necessary to enable compliance with the emission limitations. An applicant for a compulsory license would obtain certification from the attorney general to a U.S. district court indicating there is a need for a license.

The court would then, if it agreed, issue an order requiring the patentee to license the invention on the terms set by the court. However, the applicant would be paying a royalty to the patentee and would have a higher cost for compliance compared to the patent holder.

Patents can be used defensively to guard against becoming a defendant in a patent infringement suit. Often a company having a business interest related to a particular area of technology will obtain as many patents as possible in order to discourage patent infringement suits by competitors. Assuming that most competitors are active in the same areas of technology, a competitor is less likely to file a patent infringement suit against the company if that company has a relatively large portfolio of patents.

Providers of environmental technology that choose not to obtain patents could find themselves at a competitive disadvantage. As more patents directed to environmental technology are issued, those without patents will be forced to pay increasing licensing fees to patent holders or excluded from operating in some areas altogether. **EP**

What Do You Think?

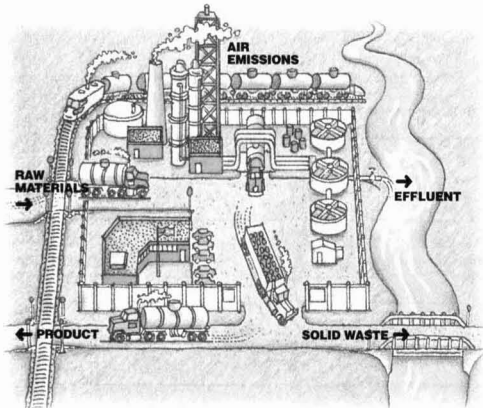
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High 211 Medium 212 Low 213

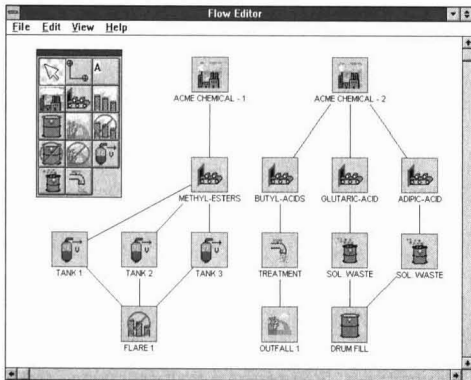
PlantWare®

COMPREHENSIVE TRACKING SOFTWARE FOR AIR, WATER & SOLID WASTE EMISSIONS

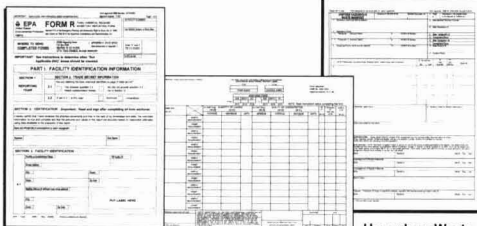
Start With . . .



Use This . . .



To Get These...



SARA 313
Form R

Discharge Monitoring Reports

Hazardous Waste
Manifests

See us at AWMA - Booth #424. Circle 131 on card.

PlantWare® is a multi-media emissions tracking system that allows users to model all air, water or solid waste emissions that leave a facility. PlantWare utilizes a unique process flow approach to emissions tracking, allowing users to depict sources, control devices and emission points as objects in a flow diagram. PlantWare's air, water and solid waste modules can be purchased separately or as a comprehensive, integrated system. Since PlantWare is designed to support multiple facilities, entire corporations can be stored in one comprehensive database.

■ POWERFUL ENGINEERING TOOLS FOR CALCULATING EMISSIONS

PlantWare is based on the concept that all facility emissions can be represented mathematically – even if the expression is as simple as an emission factor. With PlantWare, you can configure simple and/or complex expressions for defining air, water, and solid waste emissions using our intuitive spreadsheet interface. Even complex chemical engineering calculations are possible through the use of our extensive physical property dataset.

■ PROCESS FLOW DIAGRAMS

PlantWare is designed around a process flow diagram of a facility. PlantWare's Flow Editor allows users to graphically establish the links between sources, control equipment and emission points. Once the facility model is defined, process parameters can be brought in and the model immediately reflects any changes in emissions.

■ FLEXIBLE BATCH PROCESS FEATURES

Modeling emissions from a batch facility can be a daunting task. PlantWare provides an easy to use interface for fast, accurate batch emission calculations.

■ TITLE V PERMITTING TOOL

PlantWare is built to streamline the process of generating a Title V permit. PlantWare allows the user to conduct what if scenarios that help establish the maximum potential to emit. Once permit conditions are established, PlantWare will track compliance by comparing calculated emissions to permitted allowables.

■ TRACK APPLICABLE REQUIREMENTS

Title V requires that a facility assess all applicable federal regulations and emission limits. The permit you propose will be based on these requirements. PlantWare allows a facility to not only list all applicable requirements, but also to document compliance by tracking parameters and providing accurate reporting and recordkeeping.

■ REAL-TIME DATA ACQUISITION

To automatically access data from remote SQL databases and process historians, EnviroMetrics developed the DataPump™. Using the DataPump, a facility can create automated sessions which log into remote databases, extract the necessary data, and place the data into the appropriate PlantWare table. Since DataPump is server resident, it runs around the clock, ensuring continuous, reliable data acquisition that can be scheduled for extraction at frequencies ranging from seconds to years. The data can be used to calculate emissions, determine regulatory compliance, or provide alarms to the appropriate environmental contact.

■ CLIENT/SERVER ARCHITECTURE

PlantWare is designed to work with Oracle, Sybase System 10, Microsoft SQLServer, SQLBase and many other SQL database engines. The reliability of PlantWare has been proven in a number of environments, from single PC installations to deployment across an entire corporation via a Wide Area Network.

Call to learn more about PlantWare or any other EnviroMetrics Software products.



ENVIROMETRICS
SOFTWARE, INC.

92 Read's Way • New Castle, DE 19720

Phone (302) 324-9136 • Fax (302) 324-9138 • Internet: sales@enviro.com

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COMPANY	SOFTWARE	DESCRIPTION																							
			HAZMAT TRACKING	PERMIT TRACKING	MANIFEST TRACKING	MONITORING	MODELING	PARAMETERS/THRESHOLD	REPORTING	3D VISUALIZATION	ANALYSIS	AUDITING	LABELING	REGULATION	TRAINING	DEMO	CD-ROM	COST \$100-\$500	COST \$500-\$1,000	COST >\$1,000					
ACRI 1931 Stradella Road Bel Air, CA 90077 310-471-3023 Circle 233 on card.	ANSWER	Comprehensive mathematical model for simulation of laminar or turbulent fluid flow, heat and mass transfer with or without swirl, chemical reactions and combustion.																	▲	▲					
	PORFLOW	Simulates transient or steady-state fluid flow, heat, salinity and mass transport in multi-phase, variably saturated, porous or fractured media with dynamic phase change.																		▲	▲				
A V Systems Inc. 4657 Platt Road Ann Arbor, MI 48108 313-973-3000 Circle 234 on card.	Material Inventory Report System	Comprehensive environmental/safety data management and compliance.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					▲					
	MIRS Environmental	Environmental data management and compliance with hazmat, inventory, MSDS management and more.	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					▲					
	MIRS Corporate	Large-facility or corporate-wide environmental data management and compliance.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					▲					
Achieve! Technology Inc. P.O. Box 668 Amherst, NH 03031-0668 603-595-1414 Circle 235 on card.	Fast Regs	Computerized regulatory compliance.																	▲	▲	▲	▲	▲	▲	
BEE-Line Software P.O. Box 7348 Asheville, NC 28802 704-258-1895 Circle 236 on card.	BEEST for Windows	ISCST3 modeling environment for Windows. Contains complete interface, including data entry, graphics and more.							▲											▲			▲		
	BEE-Line Menu Modeling	DOS-based modeling system. Models such as ISCST3, ISCLT3, SCREEN3, SLAB, and more.							▲												▲	▲	▲	▲	
Canadian Centre for OH&S 250 Main St. E. Hamilton, Ontario, Canada L8N 1H6 905-572-2981 Circle 237 on card.	Canadian Legislation Plus Standards	OSH and environmental legislation and referenced standards.																			▲			▲	
	MSDS	MSDS and chemical information.																				▲	▲		
	CHEM Source	Collection of databases on health, safety and regulations.																				▲	▲		
CHEMTOX®, a div. of Resource Consultants P.O. Box 1848 Brentwood, TN 37024 615-373-5040 Circle 238 on card.	SARA 313 (Form R) Reporting	Streamlines complex tasks involved in reporting Form R chemical releases.	▲		▲		▲	▲		▲										▲			▲		
	Waste Management	"Cradle to grave" management of hazardous waste.	▲	▲	▲		▲						▲		▲								▲		
	Air Management	Flags regulated (HAPs, criterion pollutants, etc.) chemicals, calculates emissions from product usage.	▲	▲	▲		▲														▲			▲	
Citation Publishing Inc. (CPI) 1435 Hayden Scottsdale, AZ 85257 1-800-808-3372 Circle 239 on card.	FESA	Comprehensive regulatory compliance software covering all EH&S and state regs. Has full text Federal Register, multiple CFRs, state coverages and regulatory compliance manuals, all on one CD.																			▲	▲	▲	▲	▲

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COMPANY	SOFTWARE	DESCRIPTION	FEATURES														COST		
			HAZMAT TRACKING	PERMIT TRACKING	MANIFEST TRACKING	MONITORING	MODELING	PARAMETERS/THRESHOLD	REPORTING	VISUALIZATION	3D VISUALIZATION	ANALYSIS	AUDITING	LABELING	REGULATION TRAINING	DEMO	CD-ROM	COST \$100-\$500	COST \$500-\$1,000
F-Soft Inc. 6060 McDonough Dr. Ste. L Norcross, GA 30093 770-840-1108	Transporter for Windows™	Includes all features of Facility Associate, excluding TSDF inventory tracking and lab-packing.	▲	▲			▲	▲	▲	▲	▲	▲	▲	▲	▲				▲
	Manifest Associate for Windows™	Includes all features of Facility Associate, excluding inventory tracking. Multiple-site generators.	▲	▲			▲	▲	▲	▲	▲	▲	▲	▲	▲				▲
ES&T 2608 Sheffield Drive Blacksburg, VA 24060 540-552-0685 Circle 249 on card.	ARMOS	Groundwater flow and free phase hydrocarbon migration and recovery model.				▲		▲		▲				▲				▲	
	BIOTRANS	A multispecies dissolved transport with oxygen-limited biodecay in fractured or porous aquifers model.				▲		▲		▲				▲				▲	
	SPILLCAD	A hydrocarbon spill assessment and remedial design model.				▲		▲		▲				▲				▲	
Eagle Point Software 4131 Westmark Drive Dubuque, IA 52002 319-556-8392 Circle 250 on card.	Profiles	Provides vertical alignment design of a project.				▲		▲	▲		▲		▲		▲	▲	▲	▲	
	RoadCalc	Interactive tool gives you the flexibility to evaluate multiple design alternatives and create reports and plots.				▲		▲	▲		▲		▲		▲	▲	▲	▲	
	Site Design	Provides advanced features for developing general site grading plans.				▲		▲	▲		▲		▲		▲	▲	▲	▲	
Earth Soft 166 E. Gobbi St. Ukiah, CA 95482 1-800-932-1030 Circle 251 on card.		Stand-alone and integrated packages, semi-customized to client needs. Developer/distributor data management products and services.	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲				▲	
EnviroMetrics Software Inc. 92 Read's Way New Castle, DE 19720 302-324-9136 Circle 252 on card.	F.E.M.S.®	Fugitive Emissions Management System is designed to streamline collecting, administering and reporting fugitive emission monitoring data.		▲	▲			▲		▲				▲				▲	
	PlantWare®/Audit	Automates the process of defining applicable requirements for regulated sources.						▲		▲	▲			▲	▲			▲	
	PlantWare®/Waste Tracking	Tracks waste from "cradle-to-grave." Calculates cost info and interfaces with accounting systems.	▲	▲	▲			▲	▲		▲	▲	▲	▲	▲			▲	
Eagle Technology Inc. 1050 N. Port Washington Rd. Mequon, WI 53092 1-800-388-3268 Circle 253 on card.	Expert MSDS System	Organizes and maintains MSDSes.	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲				▲	
EcoAnalysis 221 E. Matilija St. Ojai, CA 93023 Circle 254 on card.	EcoDB	Fully integrated, Windows-based relational data management and GIS system.			▲			▲	▲	▲	▲							▲	
	LabTRAQ	Laboratory information management system (LIMS) specifically designed for environmental analysis and data.		▲			▲	▲		▲	▲	▲						▲	



THERE'S A
CHANGE IN
THE AIR

The sign of change in the world of process emission control

Focused clean-air solutions for industry



The world over, legislation is tightening on atmospheric emissions from industrial processes. The issue is urgent. The consequences of non-compliance could be critical to your business. But the challenge of compliance can be complex, and no two manufacturing processes present quite the same set of problems.

The time is right for a new kind of emission systems supplier. One with an in-depth understanding of your process. One with not just one family of solutions, but a complete spectrum. One with the skills, the experience and the global infrastructure to support your compliance strategy worldwide.

Introducing **ENGELHARD PROCESS EMISSION SYSTEMS**. An emission systems and solutions partner for today, but with a track record spanning many years.

Engelhard Process Emission Systems, formerly Salem Engelhard, offers the

widest range of stationary source emission abatement options available anywhere. It supplies technologies, based on both catalytic and thermal oxidation principles, to treat volatile organic compounds, nitrogen oxides and ozone.

What's more, our engineering teams possess the experience and process knowledge to ensure that your solution represents a simple, cost-effective and low-maintenance route to long-term compliance.

Make contact with your new partner in process emission control. Call us now to arrange an initial consultation without obligation.

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Iselin, New Jersey, USA 08830-0770
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ENGELHARD

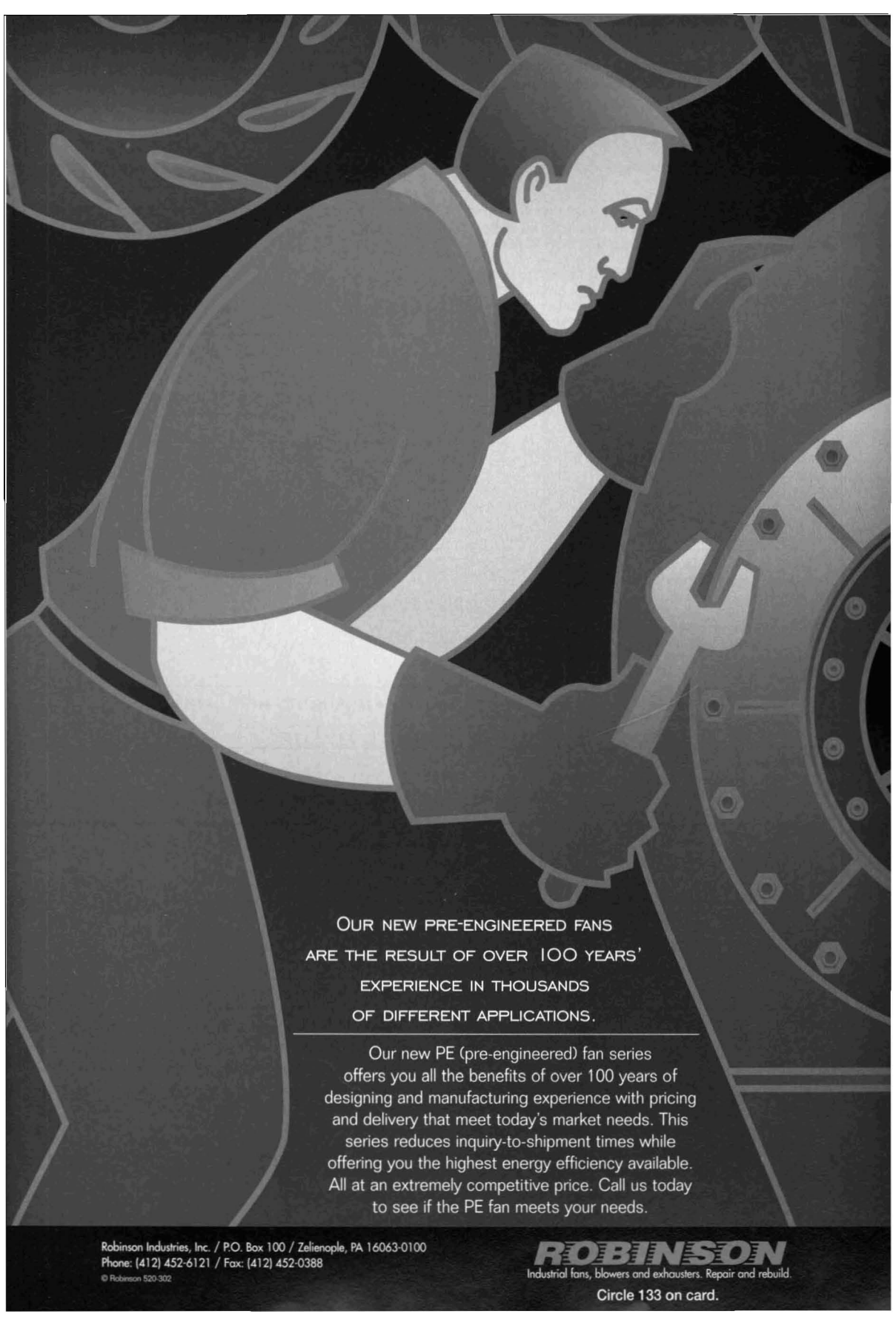
PROCESS EMISSION SYSTEMS

Circle 132 on card.

See us at AWMA - Booth #377.

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			HAZMAT TRACKING	PERMIT TRACKING	MANIFEST TRACKING	MONITORING	MODELING	PARAMETERS/THRESHOLD REPORTING	VISUALIZATION	3D VISUALIZATION	ANALYSIS	AUDITING	LABELING	REGULATION TRAINING	DEMO	CD-ROM	COST \$100-\$500	COST \$500-\$1,000	COST >\$1,000
Envirogenics 3812B Quakerbridge Road Ste. 208 Mercerville, NJ 08619 609-586-0700 Circle 255 on card.	CHEM Master®	Full-featured chemical information and inventory tracking for OSHA hazcom and SARA Title III compliance.	▲		▲		▲	▲		▲		▲		▲				▲	
	MSDS Generator™	MSDS generation using standard phrases, MSDS templates, ANSI format and customer tracking.	▲					▲				▲		▲				▲	
	WASTE db™	Hazardous waste manifesting, tracking, labeling, annual reporting and cost analysis.	▲		▲				▲			▲		▲				▲	
Environmental Data Services a div. of Petroleum Information Corp. P.O. Box 2612 Denver, CO 80201 1-800-727-4496 Circle 256 on card.	HazSearch® Database	Comprehensive database of info on transported hazardous waste, based on shipment records filed with state agencies and the EPA.	▲					▲										▲	
	HazProfile™ Marketing System	More than 150,000 detailed company profiles on CD-ROM.																▲	
	CD Site Guide from HazProfile	Instant access of individual sites' environmental backgrounds.																▲	
EnviroWin Software Inc. 2032 W. Cullum Ste. 1 Chicago, IL 60618 Circle 257 on card.	Generator Associate	Manages hazardous and non-hazardous wastes.	▲	▲	▲	▲		▲	▲		▲		▲					▲	
	Manifest Associate	Manages hazardous and non-hazardous wastes. (Unlimited generator)	▲	▲	▲	▲		▲	▲		▲		▲					▲	
	Transporter Associate	Manages hazardous and non-hazardous wastes.	▲	▲	▲	▲		▲	▲		▲		▲					▲	
General Research Corp. 1900 Gallows Road Vienna, VA 22182 1-800-934-5917 Circle 258 on card.	Flow Gemini™	Comprehensive EH&S software.	▲	▲	▲	▲		▲	▲		▲	▲	▲					▲	
GeoTrans Inc. 46050 Manekin Plaza #100 Sterling, VA 20166 703-444-7000 Circle 259 on card.	Site GIS	Environmental data management.						▲	▲	▲	▲		▲					▲	
Haestad Methods 37 Brookside Road Waterbury, CT 06708 203-755-1666 Circle 260 on card.	WaterCAD	Water distribution modeling for Windows.						▲									▲	▲	▲
	StormCAD	Storm sewer design and analysis.											▲					▲	▲
	CulvertMaster	Culvert design and analysis.											▲					▲	
HazMat Control Systems Inc. 5199 E. Pacific Coast Hwy. #500 Long Beach, CA 90804 310-597-7994 Circle 261 on card.	MSDSFile™	Windows-based application designed for handling MSDSes and reporting requirements under Worker and Community RTK. MSDSes can be scanned, indexed, printed, retrieved or converted.	▲					▲	▲								▲	▲	▲
HOMANN Assoc. Inc. 39831 San Moreno Court Fremont, CA 94539 510-490-6379 Circle 262 on card.	EPLcode 5.0®	Air dispersion model and library for toxic substances.						▲	▲			▲					▲	▲	▲



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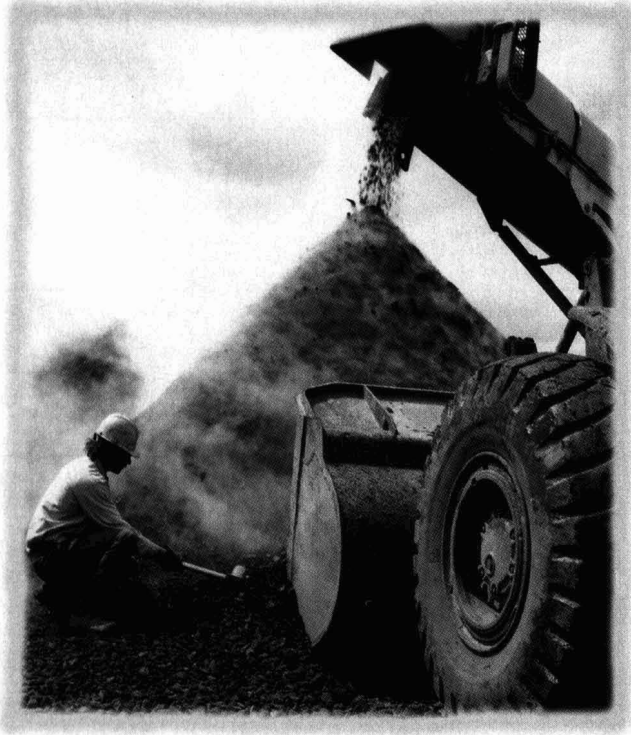
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IHS Environmental Information Inc. 912 Springdale Drive Exton, PA 19341 610-594-4400 Circle 263 on card.	ENFLEX Federal and State Regulations	Covers regs from OSHA, EPA, DOT, U.S. Coast Guard and other agencies, equivalent titles for all 50 states, the EHS portion of the Federal Register, OSHA and NIOSH Guidance Publications, and federal and state statutes.			▲						▲	▲	▲	▲	▲				▲
	ENFLEX Register Tracking	Contains summaries of EH&S regulatory activity from the Federal Register and 33 state registers.			▲						▲	▲	▲	▲	▲				▲
	EarthLaw International	Full-text English translations of EH&S and transportation laws and regs.			▲							▲	▲	▲	▲	▲			
ImageWave Corp. P.O. Box 4504 Lago Vista, TX 78645 512-267-9705 Circle 264 on card.	MSDSFinder™ MSDS Management and Chemical Tracking Software	Scans MSDSes and imports from a variety of sources. Tracks over 100 MSDS fields in MS Access database including components, percentage, location, properties, NFPA and more.	▲				▲	▲				▲		▲					▲
Intec Controls 55 West St. Walpole, MA 02081 508-660-1221 Circle 265 on card.	Paragon TNT Software	Process monitoring and control software.			▲	▲	▲			▲				▲					▲
	Paragon 550 Software	Industrial automation software for process monitoring and control for air and water pollution control, wastewater and hazardous materials.			▲	▲	▲			▲				▲					▲
	Paragon 500 Software	Instrumentation control software for process monitoring and control and information management.			▲	▲	▲			▲				▲					▲
J. J. Keller & Assoc. 3003 W. Breezewood Lane Neenah, WI 54957 414-727-7304 Circle 266 on card.	Keller-Soft™ Compliance Information Manager	Instant access to EPA, OSHA and DOT regs, compliance explanations, agency documents and more.									▲			▲	▲	▲			▲
	Keller-Soft™ DOT Hazmat Compliance	Easy access to compliance info, including 49 CFR parts 100-180 and 397, pre and post HM-215A material, and reference.									▲			▲	▲	▲	▲		
John A. Keane & Assoc. Inc. 575 Ewing St. Princeton, NJ 08540 609-924-7904 Circle 267 on card.	GMS Programs®	ISO Compliance Software			▲		▲			▲	▲	▲	▲	▲	▲				▲
	CIM Quality™	ISO Training Software				▲		▲							▲				▲
Jordan Systems 119 3rd St. NE Ste. 307 Cedar Rapids, IA 52401 319-364-0036 Circle 268 on card.	Hazardous Material Manager™	Comprehensive hazmat management system that includes bar code serialized container life cycle tracking.	▲	▲			▲	▲					▲						▲
Knorr Associates 10 Park Place Butler, NJ 07405 201-492-8500 Circle 269 on card.	DataPipe	Comprehensive, modular, multi-user Windows-based program for collecting and managing EH&S info.	▲	▲	▲	▲	▲	▲	▲			▲	▲	▲	▲				▲



Today, you need environmental insurance to be in an environmental business.

Environmental companies operate in a world filled with risk created by complex business problems and a web of ever-changing regulations. Faced with financial and liability uncertainties, failure to obtain proper environmental insurance protection could ultimately lead to business failure.

Fortunately, ECS Underwriting and Reliance National have an unequaled understanding of the insurance needs of the environmental industry. At the forefront of environmental insurance since 1979, no one else provides a stronger array of environmental insurance products. That means transporters, generators, consultants, contractors, treatment facilities and many others can properly address environmental liability exposures. When you do, you benefit from a level of experience and service, unsurpassed in the insurance industry... and available only through ECS Underwriting.

If your business is environmental, you have an environmental exposure, and your current insurance may not provide the environmental coverage you need. Don't find out the hard way. Call 800-ECS-1414 and talk to the experts at ECS Underwriting today.



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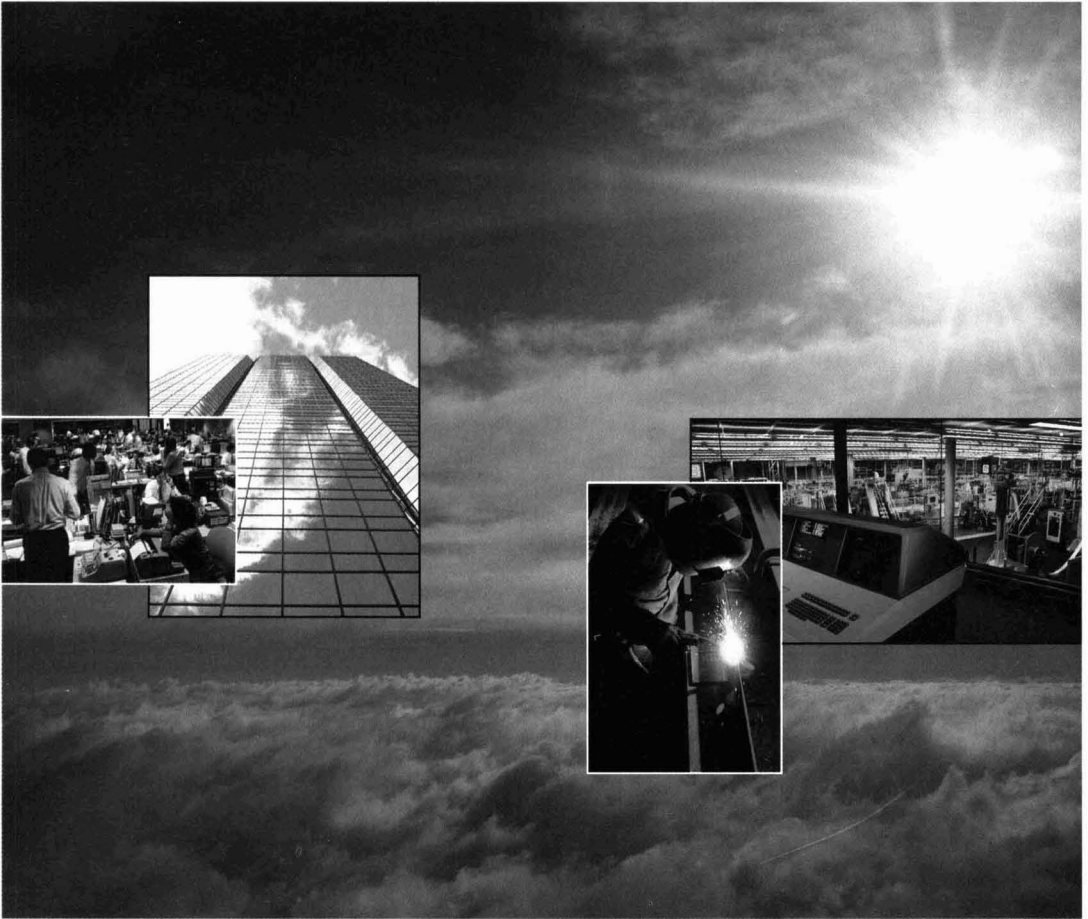
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See us at HazMat Int'l. - Booth #729. Circle 134 on card.

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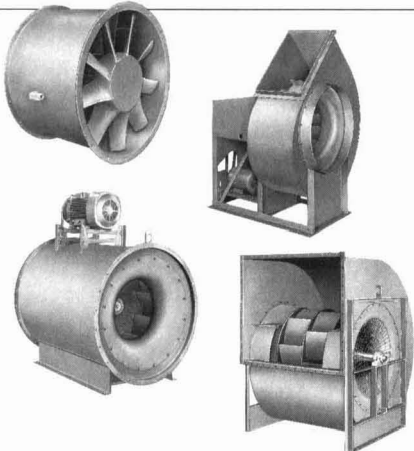
COMPANY	SOFTWARE	DESCRIPTION	HAZMAT TRACKING	PERMIT TRACKING	MANIFEST TRACKING	MONITORING	MODELING	PARAMETERS/THRESHOLD	REPORTING	VISUALIZATION	3D VISUALIZATION	ANALYSIS	AUDITING	LABELING	REGULATION TRAINING	DEMO	CD-ROM	COST \$100-\$500	COST \$500-\$1,000	COST >\$1,000
Lewis & Zimmerman Assoc. Inc. 6110 Executive Blvd. Ste. 512 Rockville, MD 20852 301-984-9590 Circle 270 on card.	Wastewater Training Program (WWTP)	Comprehensive interactive computer-based training program incorporating subvisory, monitoring animation, simulation and "make your own treatment plant" features.				▲			▲	▲	▲	▲			▲	▲	▲			▲
Logical Technology Inc. 13 N. Executive Drive Peoria, IL 61614 1-800-COMPLY Circle 271 on card.	HAZMIN®	Combines comprehensive environmental tracking and hazardous materials management.	▲	▲	▲	▲	▲	▲		▲	▲	▲	▲	▲	▲					▲
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North American Software Inc. P.O. Box 1197 Lake Forest, CA 92630 Circle 275 on card.	HAZARD Waste Management System	A total disposal management system that prints labels and manifests. Tracks waste from receipt to disposal.	▲	▲	▲			▲						▲	▲					▲
PACS Inc. 409 Meade Drive Corapolis, PA 15108 412-457-6576 Circle 276 on card.	VOC Carbon Adsorption	Converts air concentrations to activated carbon loading.				▲	▲	▲	▲			▲	▲	▲						▲
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Pacific Environmental Services Inc. P.O. Box 12077 Research Triangle Park, NJ 27709 919-941-0333 Circle 277 on card.	i-STEPS	Environmental data management, for air water and waste. SARA 313 reporting, discharge monitoring report, EPA AIRS compatible, EDI between agency and industry versions.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲					▲

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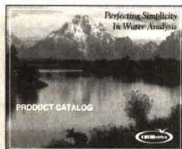
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New Guidelines Promote Environmental Responsibility

ASTM and ISO 14000 principles encourage high standards of conduct.

THE STRUGGLE TO DEFINE ENVIRONMENTAL due diligence from a legal perspective continues unabated in our nation's courts. Due diligence is defined by ASTM's Standard Practice for Environmental Site Assessments: Phase 1 Environmental Site Assessment Process as whether one has conducted "all appropriate inquiry into the previous ownership and uses of the property consistent with good commercial or customary practice."

It is not defined well enough to apply in a standardized way to a real estate transaction because there are many factors to consider in determining whether one has adequately conducted all appropriate inquiries.

The struggle is motivated by an interest to use the "innocent landowner defense" under federal law. The standard can only be met if "all appropriate inquiry" has been conducted, and the intent is to relieve a party of environmental liability, providing a safe harbor from liability under the Comprehensive Environ-

mental Response, Compensation and Liability Act (CERCLA). Anecdotal cases have emerged but are so fact-specific that it is difficult to discern any broad or uniform rule. Meanwhile, environmental due diligence is emerging as a way to ascertain and limit economic risk without regard to the nebulous legal safe harbor from cleanup liability.

At the same time, corporations are focusing greater attention on environmental responsibility. Traditionally, the driving force has been regulatory enforcement. However, today the "surrogate" regulators—financial institutions, insurance companies, investors and shareholders—are demanding greater environmental responsibility. Moreover, the public wants to purchase environmentally friendly products from environmentally responsible companies. Two new standards in the environmental industry advance the development of responsible corporate environmental records and environmental diligence to minimize liability.

Beginning in the late 1980s, the American Society for Testing and Materials (ASTM) spearheaded ef-

forts to establish uniform due diligence standards for real estate transactions. The first was the ASTM 1527 Phase I and ASTM 1528 Transaction Screen standards, which are the most widely recognized standards for conducting environmental due diligence in the United States. The latest effort focuses on the qualifications of those conducting the due diligence.

Another organization, the International Organization for Standardization (ISO), has recently developed standards for corporate environmental behavior. The ISO 14001 Environmental Management Systems Standard will be finalized later this year. The impact of the ASTM and ISO standards on environmental professionals and corporations is significant and should not be underestimated.

ASTM's Role

ASTM's most recent contribution to this debate comes from the recently released draft standard, "New Standard Practice for Accreditation Criteria to Assess Certification Programs for Environmental Professionals." ASTM's intent is to develop accreditation criteria to evaluate the credentials of certifying organizations. The criteria will eventually become the ground rules for organizations seeking to certify "environmental professionals."

As stated in Section 1.1.2 of the standard, "The standard will enable a user of environmental services to distinguish between quality professional certifications of high integrity and lower quality certification programs." The document warns the standard "does not propose to address any specific certification program" and that it is the responsibility of the user to determine whether a specific certification program meets the criteria. Nonetheless, the new standard may be controversial. The mere reference to "high integrity" and "lower quality" is certain to spark a debate among professionals whose ability to gain certification could have a significant impact on their livelihood.

The standard provides two options for certification program accreditation. The first involves independent accreditation through a professional accreditation body, such as the Council of Engineering and Scientific Specialty Boards (CESB), and suggests that such certification brings the "highest level of credibility." The second, and by implication, less credible means of accrediting a certifi-

Today the "surrogate" regulators—financial institutions, insurance companies, investors and shareholders—are demanding greater environmental responsibility.

Mark J. Bennett is president and Anthony J. Buonicor is chief executive officer of Environmental Data Resources Inc., (EDR), Southport, Conn. Buonicor also chairs the ASTM E-50.02 Phase I Task Group and heads ASTM's efforts to establish accreditation standards.

cation program, is through "self-declaration." The self-declaration option requires conformity with an appended list of 34 components in six categories. Among the requirements in ASTM's accreditation criteria are:

- Development and publication by the certification organization of the detailed "body of knowledge" required by a practitioner,
- Establishment of minimum educational and experience requirements,
- Documentation supporting a candidate's experience,
- Adherence to a professional code of ethics,
- Examination of a candidate's knowledge and
- The necessity for recertification.

The ASTM 1527 Phase I Standard requires the Phase I work be performed by an environmental professional. Unfortunately, the standard does little to define such a professional.

The new ASTM Accreditation Criteria Standard should be able to fill the gap. If

an "environmental professional" certification by a certifying body conforms to the ASTM accreditation criteria, a user can have confidence that the practitioner meets at least minimum professional requirements.

ISO's Role

Though the ASTM standard focuses on the individual environmental professional without reference to corporate affiliation, the ISO 14001 standard focuses on the overall environmental governance of a corporate entity.

The ISO 14001 Environmental Management Systems (EMS) Standard, now a draft international standard, is expected to become an international standard later this year.

ISO 14001 is the standard against which a company's environmental management systems would have to be certified. According to the standard, a company must maintain five core elements of an environmental management system (EMS): commitment and policy, planning, implementation and opera-

tion, measurement and evaluation, and review and improvement.

There are four reasons a corporation might want to seek certification: decreased costs, market opportunities, pressure from the financial community and the public, and corporate image and community goodwill.


In addition to the four "market-driven" motivations, there may be other incentives. Voluntary initiatives, such as those contemplated by the Environmental Protection Agency's Audit Policy and Environmental Leadership Program, the U.S. Department of Justice's sentencing guidelines, and the U.S. Department of Energy's defense contractor procurement orders, provide incentives and possible legal benefits for environmental self-auditing. **EP**

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Meeting MACT Head On

An \$8 million air cleanup system at Borden's Columbus Coated Fabrics slashed VOCs by 93 percent and already meets 1999 MACT standards.

By Lynn Anderson

For years, Columbus Coated Fabrics of Columbus, Ohio, had the highest air emissions in Franklin County on the Toxic Release Inventory (TRI), an annual compilation of pollution information released by the Ohio Environmental Protection Agency.

CCF's ongoing commitment to be a good neighbor led to a search for a way to decrease emissions. Initially aiming to meet

EPA requirements, the CCF team decided to even further and control as many emission sources as possible. The three-year search for a pollution-control system ended with the May 1995 installation of an \$8 million air cleanup system from DURR Industries, Plymouth, Mich, that slashed CCF's emissions by 93 percent.

Columbus Coated Fabrics, owned by Borden Inc., produces wallcoverings for residential and commercial applications; decorated vinyl films that are laminated by customers to the surface of wallboard; wood and metal substrates for use in building panels, furniture, appliances and automotive items; and specialty vinyls for medical packaging and other uses. The volatile organic compounds (VOCs) generated in manufacturing mainly methyl ethyl ketone (MEK) and small amounts of other solvents.

The Search for Alternatives

In searching for a system to reduce its emissions, senior project engineer Rich Tetrick, manager of project engineering Glenn Myres and health, safety and environment manager Grover Thomas evaluated a number of alternatives.

Due to space restrictions at the facility, a small storage building had to be removed to install the control equipment. All ducts had to be run over the roofs of several buildings and in between open spaces, requiring major structural modifications to the existing buildings. Since the only available site for system installation is visible to the public and close to public areas, noise abatement was included in fan and motor housings design.

The system chosen by the CCF team exceeded the current abatement requirements of both the federal Clean Air Act and Ohio's air-quality goals. The system, in fact, met federal Maximum Achievable Control Technology (MACT) standards that aren't effective until 1999.

MACT standards will require a minimum destruction and removal efficiency (DRE) of at least 95 percent for all hazardous air pollutants (HAPs) used in gravure printing and associated operations or the use of compliance inks with HAP contents of 0.2 kilogram of HAPs per kg. of solids applied. The new capture and control system installed by CCF will allow the company to operate its gravure printing operations with its current high-performance solvent-based inks.

The Four-Step System

The four-step system, featuring DURR's "concentrator/thermal oxidizer" abatement technology, was chosen because it offered the best combination of cleanup efficiency, capital and operating costs, energy utilization and operational flexibility. It also allows CCF to continue manufacturing its current range of products without trying to switch to other processes.

In the first step, newly installed permanent total enclosures (PTEs) around the CCF print department and coating equipment capture airborne solvents. Within these PTEs, solvent-based inks and coatings are used to print decorative patterns and apply top coats on vinyl wallcoverings and other products.

In the second step, air withdrawn from the PTEs enters four rotary concentrators (zeolite carousels), which entrap the solvent on adsorption material, and the purified air exhausts to the atmosphere. In the third step, the carousel of adsorption material rotates through a desorption zone, in which a hot air stream desorbs solvent from the material. This produces a continuous exit air stream with high solvent concentrations but only 10 percent as large as the original flow from the PTEs.

In the final step, the solvent-concentrated air flows into the system's regenerative thermal oxidizer (RTO). The solvent is destroyed at about 1,525 degrees Fahrenheit in less than a second and is converted to harmless carbon dioxide and water. After heat recovery, the clean and cooled stream exhausts to the atmosphere.

Actual figures to date substantiate a 93-percent reduction of TRI-emitted VOCs. The system is expected to reduce the former 1.1 million pounds of VOCs annually (an amount permitted by current regulations) to 74,000 pounds.

The system has performed smoothly during its first year of operation, and is expected to knock CCF out of its position as Franklin County's top source of air emissions—a title it gladly relinquishes. **EP**

Lynn Anderson is manager of corporate communications with Borden Inc., in Columbus, Ohio.

For more information, circle 217 on card.

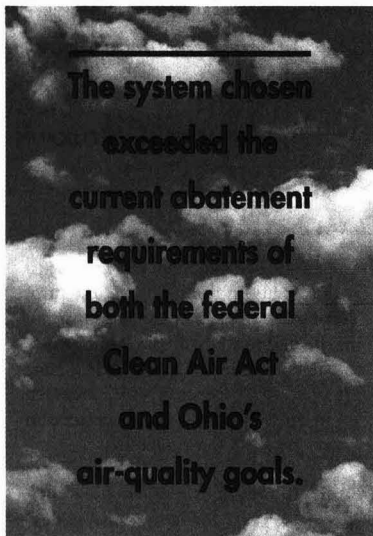
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Vacuumping for VOCs

The soil-vapor extraction system, which draws VOC-laden vapors from the subsurface, has become a popular remediation tool.

By Alok Das and Charles R. Mazowiecki, P.E.

The soil-vapor extraction (SVE) system, also known as “venting,” has proven to be a popular and cost-effective choice to remediate sites contaminated with volatile organic compounds (VOCs) in the vadose zone. The SVE system includes airflow in the subsurface by applying a vacuum through extraction wells.

The vacuum is applied to the extraction wells with a compressional pump, commonly referred to as a “vacuum pump.” The introduction of fresh, non-contaminated air into the impacted zone accelerates the volatilization of the contaminants. Once removed from the subsurface, the VOC-laden vapor is drawn through the vacuum pump and treated by carbon adsorbers, thermal oxidizers or other methods.

The clean air can either be released into the atmosphere or injected into the subsurface. Injecting the treated air into the vadose zone increases the rate of volatilization as the extracted air is heated by the compressional forces applied in the vacuum pump.

Investigation

The remediation involved an approximately 50,000-square-foot Los Angeles, Calif.-area railroad facility contaminated primarily with tetrachloroethene; 1,1,1-trichloroethane; 1,1 dichloroethane; and benzene, toluene, ethylbenzene and xylene.

A soil vapor survey and subsequent

drilling and soil sampling were conducted at the facility to determine the extent of lateral and vertical contamination within the soil and to study the site geology.

The data collected in the vadose zone indicated the presence of VOCs between 5 and 33 feet below ground surface and at site-specific clean-up levels.

Pilot Testing

As part of the pilot testing, soil-gas extraction tests were conducted to estimate the soil permeability and the extent of vacuum pressures in discrete lithologic zones. In addition, the permeability and the predicted radius of influence in the vadose zone sediments at various locations and depths were calculated. The pilot test results were used to determine full-scale system design parameters.

System Design

The key factors evaluated during design were:

- Site geology,
- Lateral and vertical extent of soil contamination,
- Type and concentration of the contaminants,
- Depth of groundwater,
- Radius of influence and
- Soil cleanup levels.

A full-scale design of an SVE system was made based on data obtained during the soil-vapor survey, soil sampling and the SVE system testing process. The system design consisted of:

- Four 4-inch extraction wells screened from 5 feet to 33 feet below the ground surface;
- Eight 2-inch injection wells screened from 10 feet to 33 feet below the ground surface;
- One positive displacement blower with a maximum air flow rate of 225 cubic feet per minute at a pressure differential of 60 inches of water column;
- One moisture separator;
- One 2,000-pound bituminous carbon adsorber; and
- Two 2,000-pound coconut carbon adsorbers.

The California Environmental Protection Agency approved the SVE system design, and the South Coast Air Quality Management District issued a permit to allow the installation and operation of the SVE system at the site.

Figure 1 shows the vapor flow path through different stages. The system was designed with the flexibility to operate each individual well or to operate the wells simultaneously. The bituminous carbon was used in the first adsorber as a pre-filter, and the coconut carbon in the second and final carbon adsorbers to enhance VOC adsorption.

Performance Monitoring

The SVE system was monitored regularly for temperature, relative humidity, photo-ionization detector (PID) readings, air flow rate and pressure measure-

ments at different sampling points. During operation, PID readings over time were evaluated to determine remediation progress.

Within the soil, the equilibrium pressure of a compound decreases as it is removed.

To increase efficiency, blower operation was changed from continuous to cyclic operation, or "pulsing." When the blower was shut off, the compounds diffused into the soil pore space. Once the system was restarted, the concentrations of compounds increased at the start of the operating cycle, a phenomenon commonly referred to as "rebounding."

The system was operated continuously until concentrations reached an asymptotic level. The pulsing operation was used until there was no significant observable rebound.

Two operational problems occurred during operation and performance monitoring. During initial start-up, the blower outlet temperature exceeded the recommended operating temperature for the activated carbon, causing contami-

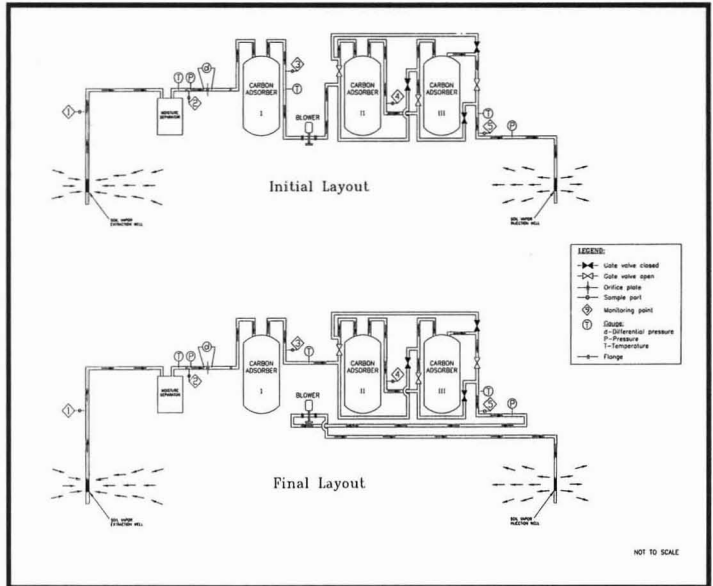
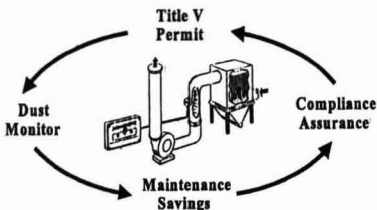


Figure 1 shows the vapor flow path through different stages.

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nant concentrations after the final carbon adsorber to exceed the 2 ppm permit limit. The high temperatures were reducing the carbon adsorption capacity, leading to premature breakthrough of the contaminants. The system was immediately shut down.

Without removing the blower or the carbon adsorbers, the piping was reconfigured to place the blower downstream of all treatment equipment (See Figure 1). Any head from the vapor compression was not introduced until after the vapors had passed all of the carbon adsorbers.

Heavy precipitation during the 1995 spring caused water percolation through the subsurface and increased soil water content. A clay layer 30 feet below the surface prevented deeper percolation.

After the rainy season, most of the vapor extraction wells contained water. But nearby groundwater monitoring wells screened about 10 feet beneath the lower extent of the vapor extraction wells didn't have significant increases in groundwater levels.

The extracted air became saturated,

and water droplets were carried over into the manifold, damaging the vacuum blower. The system was again shut down.

After several months, the perched water dissipated, the vacuum blower was repaired and the system was restarted.

A Successful Ending

The SVE system has been effective at successfully remediating the railroad facility. Based on experiences at the railroad site, some key aspects should be considered when designing and operating similar SVE systems:

1. An SVE system should be designed to assure that the extraction wells' influence encompasses the entire area of soil contamination.

2. The extraction header should slope toward the extraction wells to reduce free moisture being carried upstream.

3. Knowledge of the contaminants' physical and chemical properties, such as partitioning coefficient (Koc), solubility in water, octanol water coefficient (Kow), and Henry's Law Constant allows for a better understanding of the

fate and transport in the soil.

4. In areas suspected of having widely fluctuating groundwater levels or the existence of ephemeral water, care should be used in system design and operation to prevent introduction of free moisture.

5. Hydrocarbon concentrations in the incoming vapors should be monitored. The rate of decline can be an indication of system operating efficiency. **EP**

Alok Das is a project engineer and Charles R. Mazowiecki, P.E., is an environmental engineer and project manager with Terranext, Cypress, Calif.

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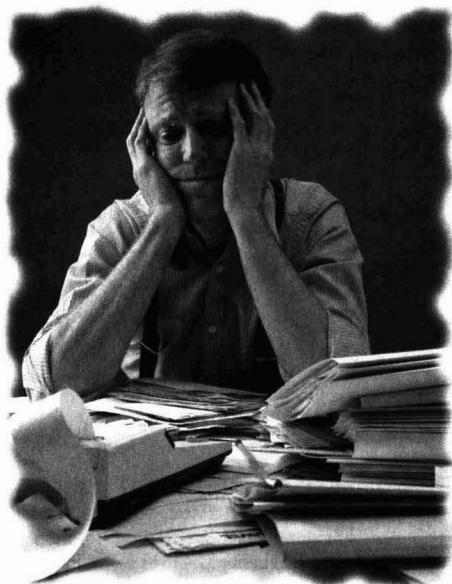
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Winning an Uphill Battle

Despite having to pump treated effluent 27 miles, a California treatment plant cut electricity costs while maintaining an impeccable treatment record.

By Vicky Boyd

The Lake Tahoe Public Utility District's wastewater treatment plant has done an about face, shedding its troubled past of the 1980s to become an award winner of the '90s.

Since 1992, the California treatment plant has reduced annual chemical expenses by \$300,000 and annual electrical expenses by \$100,000 while maintaining an almost blemish-free record. The energy savings came in spite of the district exporting treated sewage effluent 27 miles over a 7,700-foot mountain pass to neighboring Alpine County.

Because of its accomplishments, the utility received the U.S. Environmental Protection Agency's top award for wastewater treatment plants in 1994. The plant also garnered honors from the California Water Pollution Control Association and the California Energy Commission.

But the facility has not always been as stellar. During the 1980s, the plant was plagued by up to 300 violations annually, mostly for chemical oxygen demand, fecal coliforms and pH.

The Turnaround Program

Ross Johnson, utility district wastewater treatment operations manager, attributed the plant's turnaround to a program he helped develop in 1991 establishing specific targets for areas such as chlorine

residual and pH. Before the program, operators ran the plant within a range for most controls.

Johnson's program also involved the employees, who were encouraged to develop ways to save chemicals and energy and become more efficient. At times, however, the program was not an easy sell.

"It can be tough because operators are used to doing things a certain way and feel we would have a violation if we tried something else," Johnson said.

Eventually, the operators lost their apprehension. "The interesting thing is the program took on a life of its own,"

Johnson said. "It is generating a lot of new ideas and experimentation. The plant runs a lot better, and it's probably easier to run once we had all of these new techniques."

Since the program was implemented, the plant has had only one COD violation, and Johnson said it was due to illegal dumping of a phenol compound and not operator error.

The utility operates an advanced secondary treatment facility using primary sedimentation, biological secondary treatment and multimedia filtering. With a capacity of 7.7 million gallons per day, it serves 16,000 customers.

Lake Tahoe, however, is a tourist destination, and the population can balloon to more than 150,000 people on a peak holiday, such as New Year's or July Fourth.

The Uphill Trek

Three 400-horsepower pumps transport effluent from the plant 10.4 miles to about 6,400 feet elevation at the base of Luther Pass. Two 700-hp and two 1,000-hp pumps, working alone or in combinations, at Luther Pass create the 600-psi head needed to lift the effluent the 4.3 miles and 1,240 vertical feet over the summit. Once over the pass, the effluent flows by gravity another 10.7 miles to Harvey Place Reservoir, where it is stored until farmers need it to irrigate alfalfa and pastureland.

"The interesting thing is the program took on a life of its own. It is generating a lot of new ideas and experimentation."

—Ross Johnson

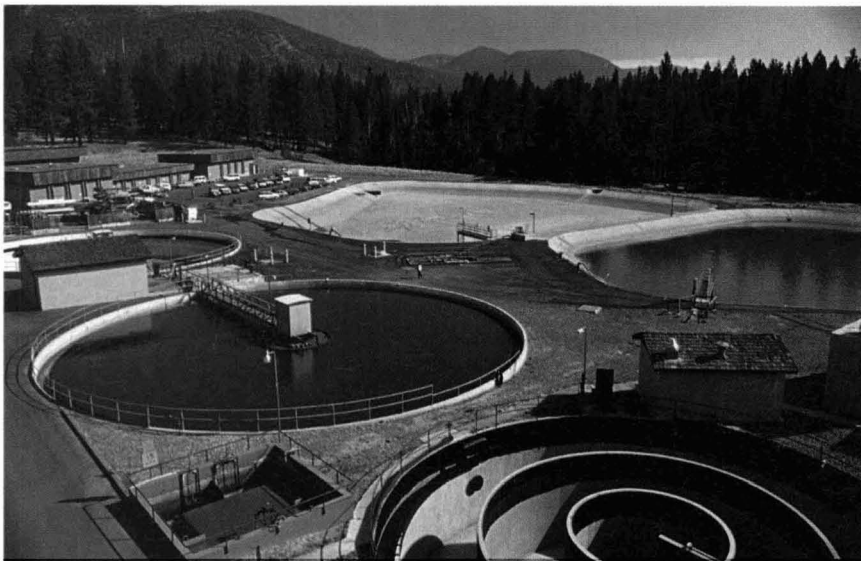


Photo courtesy of South Tahoe Public Utility District

The wastewater treatment plant in South Lake Tahoe, Calif., reduced chemical costs while improving operations.

The reservoir, constructed in 1988, can store up to 3,800 acre-feet of reclaimed wastewater. About 4,583 acre-feet of reclaimed water is released annually for agricultural use in the eastern Sierra Nevada.

The pipeline was the result of California's Porter-Cologne Act, wide-ranging water quality control legislation enacted in 1972. The act makes septic systems illegal in the Lake Tahoe Basin and requires all wastes go to a collection and treatment system for eventual export out of the basin.

The unique regulations are designed to minimize nutrient loading, which can cause algal blooms and reduce Lake Tahoe's clarity, said Scott Ferguson, associate water resources control engineer with the Lahontan Regional Water Quality Control Board in South Lake Tahoe, Calif. The Tahoe Basin is the only basin of its size in California and probably the United States with the strict export requirements.

Faced with the unusual operating conditions, Johnson said he and operators looked at every aspect of the plant. As part of the cost-saving program, Johnson said they eliminated the dissolved air flotation thickener used on waste-activated sludge (WAS). Instead, the plant co-thickens WAS in the primary clarifiers, and a single sludge stream is withdrawn from the primary clarifiers. "We

found out flotation thickeners are a pretty big energy waster," Johnson said.

Cost-Cutting Measures

Another area operators focused on was the activated sludge process. Before the cost-cutting plan, caustic soda was one of the biggest expenses. By fine tuning the activated sludge process and avoiding nitrification, which depresses pH, Johnson said plant operators were able to eliminate the use of caustic soda.

They also reduced the use of chlorine by 55 percent to 60 percent. "If it's well run, you need less chlorine," Johnson said. Altogether, chemical expenses dropped 60 percent in 1992 from previous years.

Whittling Electrical Costs

But chemical savings were just part of the plan. The utility reduced its annual electrical bill by about \$100,000 by pumping at night during off-peak hours when power was cheaper. Johnson said operators also equalized flows in the treatment plant to keep the pumps running at an even pace. The equalization also meant less head loss in the lines.

The same theories were applied to the pumps leading from the plant to the pass and those carrying the effluent over the pass.

"We had three pumps at the plant and three at Luther Pass," Johnson said. "At

times we would run one, and at times, we would run three, which increased our demand charges. Now we run one to two pumps at a more constant rate."

Despite the electrical savings of 15 percent to 20 percent, the utility still spends about \$50,000 a month just for the energy to pump effluent over Luther Pass. It spends an additional \$40,000 to \$45,000 a month on electricity to power the wastewater treatment plant and to pump the effluent the 10 miles to the base of the pass.

The quest for savings hasn't stopped, although Johnson said they have already implemented most of the steps that will result in large reductions. "We've gone as far down as the lights, trying to make sure lights are off and installing motion sensors to turn the lights off when people aren't present," Johnson said. "We want those last few dollars." **EP**

Vicky Boyd is managing editor of Environmental Protection magazine.

Questions or comments? E-mail us at webmaster@eponline.com.

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Increased BOD5 loadings related directly to recent paper mill activity.

Putting On A Polished Act

By dosing lagoons with beneficial microbes, a kraft pulp and paper mill was able to keep BOD5 levels within permit requirements.

By Erik Rumbaugh and Bill Davis

A bleached kraft pulp and paper mill in Georgetown, S.C., used an aerated lagoon system with a primary clarifier, an aeration basin and two polishing facultative lagoons to treat wastewater flows. The aeration basin contained high-speed floating aeration units with about 3,925 horsepower. With a retention time between six and seven days, the mill had to maintain an average monthly BOD5 loading below 11,600 pounds a day. (BOD5 is the five-day biological oxygen demand.)

To remain within National Pollution Discharge Elimination System permit levels, daily loading had to stay below 17,000 pounds. Recently, maintenance of such low loadings proved difficult due to increased flows and influent BOD5 levels. Concerns included increased BOD5 loadings, high flow rates into the lagoon and elevated influent temperatures.

In July 1995, BOD5 levels reached a maximum of 205,000 pounds per day at the influent. During a six-day period in early July, loadings averaged 145,990

pounds per day. At the same time, influent temperatures ranged between 128 and 132 degrees Fahrenheit.

As a result of the high loadings, the water treatment system failed to maintain BOD5 levels at the effluent within NPDES permit levels. With effluent BOD5 increasing to 18,169 pounds per day, maximum loadings were exceeded, and the mill sought ways to avoid a monthly average violation.

While searching, the mill located several sources of increased loadings:

- Increased pulp production yield increased black liquor inventory/production,
- Limited liquor evaporation capacity at the plant forced discharge of liquor into the wastewater treatment system and
- Limited tank capacity for liquor storage increased wasting rates of liquor into the sewers.

The first reason for increased BOD5 loadings related directly to recent increased mill activity in the past few months. As mill activity increased, mill liquor handling capacity became inadequate for proper operations. The mill had to choose between limiting liquor use and production, or increasing wastewater treatment efficiency to keep effluent BOD5s at permissible levels.

Mill Concerns

Influent BOD5 loading increased to levels beyond the water treatment system's demonstrated capacity. Influent total organic carbon (TOC) levels reached a peak of 163,700 pounds per day in July. Influent temperatures remained elevated beyond the range of mesophilic bacteria.

Effluent BOD5 levels started to move above NPDES permitted levels for both daily and monthly loadings.

Increasing mill loadings exceeded capacity to store black liquor, resulting in discharges into the wastewater sewer system.

Objectives

Because of the sudden increase in BOD5 loadings to the water treatment system, efficiencies became unacceptable. Problems with the BOD5 levels exceeding the NPDES limits began to appear unavoidable unless the mill could increase the aeration lagoon's BOD5 removal efficiency. Facing the difficult loading problems, the mill requested Microbe Masters™ use microbiological inoculations to increase system

kinetic efficiency.

The firm's technicians looked at ways to establish an active biomass that would respond to the increased organic loadings and operate efficiently at the elevated system temperatures. The biomass efficiency also needed to deal with increasing hydraulic loadings into the system along with the above design BOD5 loadings.

The new biomass needed to have superior settling characteristics. Without such settling properties, the total dissolved solid (TDS) levels in the effluent would have increased proportionally along with increased flows.

By having a stable, efficient biomass adapted to the lagoon's environment, adequate removal of suspended solids could occur in the polishing lagoons before discharge.

The Prescription

In response to the need for improved lagoon efficiency, the mill increased applications of Micro Pro® "DP-HT," a commercial microbial inoculum from International Biochemicals of Baton Rouge, La.

In addition to the commercial cultures, the mill also examined the aeration conditions within the lagoon. After conducting necessary dissolved oxygen (DO) profiles, the mill undertook the least costly alternative to increase aeration.

The plan included repairing inoperative aerators and adding two new surface aeration units in areas experiencing the lowest DO residuals.

With increased aeration in place, the environmental staff began to stress the need for TOC reduction at the influent. By presenting relevant environmental information to the mill production workers, the environmental engineers worked to minimize the loss of black liquor into the sewer system from daily mill operations. Based on plant capabilities, the environmental manager set a maximum TOC level between 75,000 pounds and 90,000 pounds a day.

Having performed aeration and process changes, the mill began aggressively dosing the aeration lagoon with the microbial mix. Simultaneously, workers added several doses of Micro Pro® "AB," a facultative anaerobe product, to the facultative lagoon system.

Results

By using the two cultures along with the increased aeration, the mill successfully

increased the performance of the biological treatment system. The improved aeration basin efficiency brought effluent BOD5 to levels lower than pre-July averages. By having a lower effluent loading in spite of increased flow rates with higher influent BOD5 loading, the mill could continue at levels beyond the scope of initial system design by using the microbial cultures.

Initial BOD5 removal rates averaged about 92.5 percent before production increases. Efficiencies of 92.5 percent met plant needs until an increase in system stress began in June and peaked in early July. In addition to higher BOD5 and hydraulic loadings entering the system, the variance of these factors also increased during this period.

By July 6, BOD5 removal efficiencies fell to a low of 68 percent, placing effluent BOD5 loadings well above permissible limits. Starting in early July, the mill began aggressively dosing the aeration lagoon with the cultures, bringing the system to full recovery within two weeks. The use of commercial cultures, along with plant operation changes to reduce TOC loadings, contributed to current BOD5 removal efficiencies.

In June, the mill operated under high stress, but the system had enough buffering capacity to handle the shocks. With the consistently high loadings continuing more than a month, a system failure in July was imminent. The mill avoided even higher July loading by using heavy microbial doses, which increased BOD5 Kinetics more than would naturally occur in the lagoon biomass.

During the second half of July when the system recovered from the shock, the mill's hydraulic loadings increased by 50 percent. While flows through the plant increased, a concurrent reduction in BOD5 levels was achieved. **EP**

Erik Rumbaugh is a technical service environmental scientist with InterBio. Bill Davis is a technical service engineer with Interbio, Baton Rouge, La.

For more information on Micro Pro® "DP-HT" and "AB," circle 228 on card.

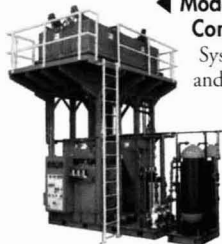
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The Model SRC will coalesce and remove oils and petroleum hydrocarbons from wastewater to produce an effluent with 10 mg/l or less of non-emulsified oil. It features a sloped sludge chamber directly under the oil coalescing media to collect settled solids and isolate them from the flow.



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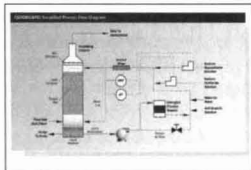
Five New Products

Graseby, the leader in the development of systems and accessories for air sample collection, introduces five new products at the 1996 AWMA show in Nashville, Tenn. They include: MST-Manual Sampling Train, AST-Automatic Sampling Train, Flow Totalizer, Flow Auditor and Beta Attenuation Monitor. Graseby Andersen.

Circle 296 on card.

Odorguard Process Eliminates Odors

Monsanto Enviro-Chem Systems Inc., a Monsanto Co., of St. Louis, Mo., is the exclusive U.S. licensee of Odorguard, an enhanced hypochlorite scrubbing process that eliminates odors and low-level VOCs in gas streams with a 99.9-percent guaranteed removal rate and 40 percent less

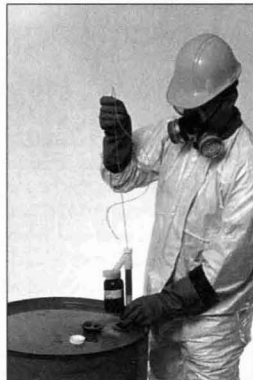


operating costs than traditional scrubbers. Odorguard is a fouling resistant, cost-efficient process that can be used in a wide variety of industries, including meat rendering, water and sewage, fine chemicals, food and spice processing and leather tanning. Monsanto Enviro-Chem.

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Liquid/Drum Sampler

Designed by field samplers, this device incorporates user ease in any level of PPE, as well as data quality. To collect a sample, lower the unit into the container, and at the desired depth or bottom, engage

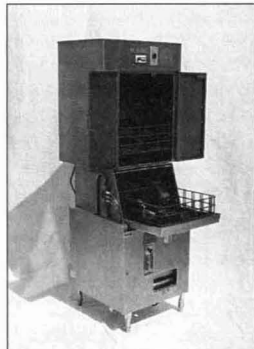


the plunger. Units are available in 250 mls and 1,000 mls. Advanced Concepts & Design Inc.

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Automatic Respirator Washer/Dryer

The Maskleen respirator washer/sanitizer/dryer unit has a high-volume capacity of up to 48 half-masks or 24 full-



face masks per hour. Wash time is adjustable from one to 10 minutes, allowing compensation for masks of varying dirtiness. Steele Inc.

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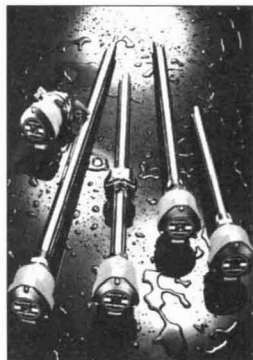
puter database that tracks and organizes environmental and occupational health and safety data. The Windowed record-keeping and documentation program helps manage your compliance challenges by in-

terrelating data about your facilities, hazards, personnel and projects. Open Range Software Co.

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Liquid Level Switch

The new Sona-Switch is a compact self-contained ultrasonic gap switch used in applications of liquid levels. Small and compact, the switch has all T316 SST wetted parts and



“two-wire” switching. The design is ideal for low-level, fail-safe applications and is available in a safe, extended length and explosion-proof version. Magne-Sonics.

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Personal Single Gas Monitors

The new GT-96 personal single gas monitor detects one



of the following gases: carbon monoxide, hydrogen sulfide or oxygen. The sensor and integral lithium battery are renewable annually. It provides a clear, unmistakable warning with visual and audible alarms whenever a hazardous atmospheric condition occurs. GasTech.

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Open Path Gas Detector

The new Precision Light Measurement System (PLMS)



line of Open Path IR Flammable Gas Detectors consists of three systems: The Model 4001 and 4002 are capable of line-of-sight gas detection up to 360 feet. The units are designed to protect chemical and petroleum plants from hazardous flammable gas leaks. The Model 4003 is designed for use in ventilation ducts and gas turbine units for immediate detection of gas vapors. **The Foxboro Co.**

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Electronic Oil/Water Interface Meter

GEOGUARD's Electronic Oil/Water Interface Meter is



used for the monitoring and remediation of groundwater contaminated by all oil products. The unit determines the thickness of floating product above the water table. **GEOGUARD.**

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TK Solver Release 3

TK Solver Release 3 has more features and more power to offer the perfect application development platform for

companies and independent software developers. TK easily handles equations, units, tables of data and graphs. **Universal Technical Systems Inc.**

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Vapor Guard™ is a structural fabric cover with large zip-



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This universal design features a unique variable pressure hydraulic ram system, which delivers from 20,000 pounds of force to compact wastes into cubic yard and cubic meter boxes without

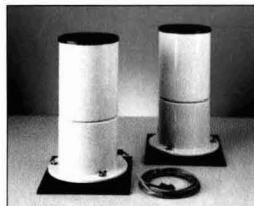


damaging the containers, to 60,000 pounds to compact wastes into drums and crush empty drums. With **VER-SAPAK**, you get four units in one, reducing equipment and operating costs, as well as floor space requirements. **RAM-FACTOR Inc.**

Circle 305 on card.

Datalogging Rain Gauge

The rugged design of the RainLogger makes it suitable



for long-term rainfall recording. Built to National Weather Service Standards, the gauge accurately measures rainfall in 0.01-inch increments. Measuring rainfall depth, intensity, duration and the time from the previous event, RainLogger will store weeks of data, operating on a replaceable 9 VDC alkaline battery. **American Sigma.**

Circle 310 on card.

Maintenance Management Software

Datastream Systems Inc. has released the client/server version MP2 for Windows, its flagship maintenance management software. The client/server configuration consists of

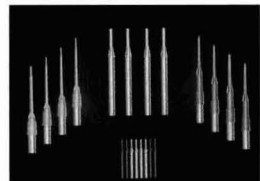


a powerful centralized SQL database server that supports one or more database applications existing on PC workstations, called clients. All database operations occur on a database server, and the results are sent from the server to the client workstation. **Datastream Systems Inc.**

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Robotic Liquid Handler

The VersaTip™ is a unique sampling tip that is used on



the Packard MultiPROBE® Automated Liquid Handling System. The MultiPROBE with VersaTip automatically changes from fixed, washable sampling tips to a variety of disposable tip sizes or types within the same protocol and without requiring any user intervention. **Packard.**

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EH&S Training Services

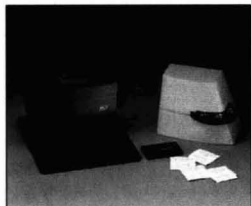
To assist companies with reducing costs and risks, Delta has developed a comprehensive environmental program to provide training to empower employees to manage a company's total environmental management process. Taking your current mission and situation, Delta develops a custom proposal to show you how training can benefit your company and improve performance. **Delta Environmental Consultants Inc.**

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Duel FT-IR Accessory

The Gemini combines the two most broadly applicable FT-IR sampling technologies—horizontal attenuated

new products



total reflectance (HATR) and diffuse reflectance—in one device. The Gemini allows the user to analyze the broadest range of sample types and consists of a unique cast aluminum optical base with two sampling heads. Spectra-Tech Inc.

Circle 314 on card.

High Head/Low Flow Wastewater Pump

A unique vortex impeller enables the new KL 85 and

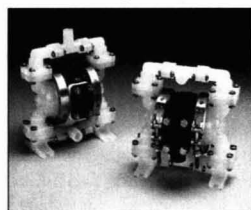


KL 86 submersible wastewater pumps to deliver an important cost-effective, low maintenance solution to pumping loads ranging from one to 300 gpm at total dynamic heads of 140 feet to 180 feet. At these levels, they achieve hydraulic efficiencies of almost 40 percent. Pumpex Inc.

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1/4-Inch Pump

The new 1/4-inch plastic Sandpiper offers an adjustable flow to four gallons per minute. Pumps are available



in polypropylene and PVDF, with Santoprene or Teflon-wetted parts. It is ideal for batching, pail transfer, machine fluid feed and OEM systems. Warren Rupp Inc.

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Dual Oven

The 8610 Dual Oven GC is a compact, small-footprint



portable GC system offering two independent programmable ambient-to-400 degrees Celsius column ovens, equipped with dual independent on-column injection ports for both packed and capillary columns. SRI Instruments.

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Oil Spill Response

Quali Tech Environmental has complete oil spill response packages, with everything from rugged shoreline booms and low-cost foam-filled models to high-strength offshore booms and complete systems. Quali Tech personnel have participated in virtually every major oil spill in the United States since 1980. Quali Tech Environmental.

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Ion Selective Electrodes

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Leak Investigation

The new TTDM Alarm and Locating Module enables



users to quickly detect leaks and monitor and record events following the leak. TraceTek leak detection systems are designed to detect and locate leaks in double-contained pipes and tanks and in piping trenches at industrial plants and facilities where fuel, hazardous chemicals or hazardous wastes are handled. Raychem.

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Customer Support Centers

Rosemount Analytical continues to enhance its customer support with the introduction of the Analytical Customer Support Centers. Customers can call the gas analysis hotline at 1-800-433-6076 or the liquid analysis hotline at 1-800-854-8257 anytime be-



tween 8 a.m. and 8 p.m. EST for immediate answers to analytical instrumentation questions. Rosemount Analytical.

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Diversified Sorbents

Slikwik® Sorbents has granular sorbents, containment products, spill readiness and response products, and provides maintenance, repair and operations. Products include spill kits, sweeps, soakers, drip pans, booms, mats and spill pallets. Slikwik.

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Spill Cleaning

Spill-Kleen can be used anywhere water-based spills occur that require fast and effective cleanup. It will hold 150 times its weight in water. One gallon will solidify 20 gallons of water or water-based materials. Exsorb Industries.

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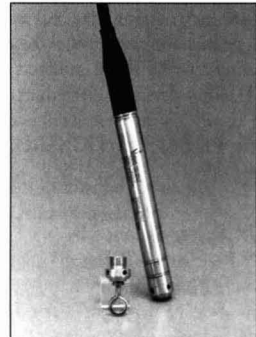
MSDS Software

The MIRS software offers a full range of modules to manage and disseminate MSDSes. MSDSes can be stored as a combination of text and/or scanned images for satisfying employee right-to-know and for authoring MSDSes. A V Systems.

Circle 324 on card.

Submersible Pressure Transmitter

The Model 516 submersible pressure transmitter



is designed as a general purpose unit. This pressure transmitter uses hydrostatic head pressure to measure liquid level and provides accurate measurements in varying depths. Viatran Corp.

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Tube Spill Kit

The Tube Spill Kit is contained in a 24-inch plastic



tube that can be mounted on a forklift or anywhere for immediate access. The kit contains Plug N Dike™ to stop the leak at the source, absorbent pads for fuels, oils, paints and solvents, and personal protective equipment. PND Corp.

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Grout Machine

The Geoprobe GS-1000 Series Grout Machine is the



first grouting system designed specifically for Direct Push Applications. It can deliver standard SSTM grout through standard 1-inch Geoprobe

probe rods or through 3/8-inch polyethylene tubing. Geoprobe Systems.

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Electromechanical Siren

The 2001 Siren Series is a unique innovation in high-power outdoor siren products. It is the first of a new generation—a rotating unidirectional, electromechanical siren—that operates on batteries. It can be controlled by telephone lines or radio and can produce up to three signals for various applications. Federal Signal Corp.

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Training Courses Schedule

Continuing its tradition of providing quality training programs in process safety and risk management, Primattech Training Institute announces

its 1996 course schedule. The institute offers courses for open enrollment, to provide participants with the capabilities to implement process safety and risk management programs. PrimaTech Training Institute.

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Storage Tank Emissions Calculator

Waid and Associates announces the release of STEC 2.7, a computer program that calculates storage tank vapor emissions. It calculates long- and short-term emissions, provides built-in meteorological and chemical databases, considers up to 50 chemical components per stored material, and provides various detailed and summary reports. Waid and Associates.

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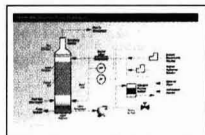


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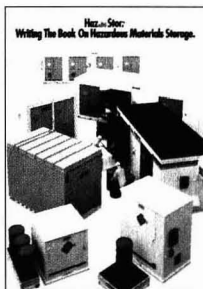
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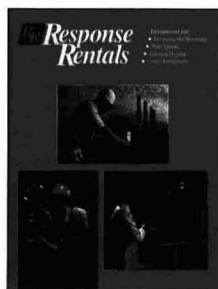


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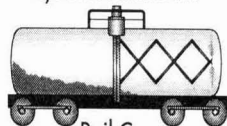


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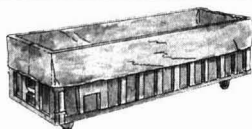
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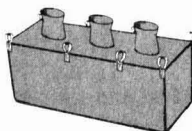
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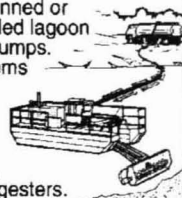
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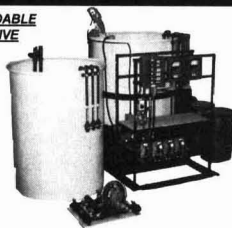
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107	124	141	158	175	192	209	226	243	260	277	294	311	328	345	362	379	396
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110	127	144	161	178	195	212	229	246	263	280	297	314	331	348	365	382	399
111	128	145	162	179	196	213	230	247	264	281	298	315	332	349	366	383	400
112	129	146	163	180	197	214	231	248	265	282	299	316	333	350	367	384	401
113	130	147	164	181	198	215	232	249	266	283	300	317	334	351	368	385	402
114	131	148	165	182	199	216	233	250	267	284	301	318	335	352	369	386	403
115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405

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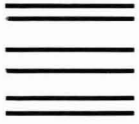
Zip+4 _____ Phone _____

Fax _____ E-Mail _____

- A.** Function which best describes your activity in Pollution Control (check only one):
- Corporate responsibility for Pollution Control
 - Manage all Pollution Control Operations at this location
 - Supervise sub-group in Pollution Control Operations
 - Provide professional consulting service on Pollution Control
 - Provide staff environmental service on Pollution Control
- B.** Type of Business (check only one):
- Manufacturing, if manufacturing, please check the appropriate SIC (check only one):
 - (20) Food
 - (21) Tobacco
 - (22) Textile
 - (23) Apparel
 - (24) Lumber & Wood
 - (25) Furniture
 - (26) Paper
 - (27) Print/Publish
 - (28) Chemicals
 - (29) Petrol & Coal
 - (30) Rubber/Plastic
 - (31) Leather
 - (32) Stone/Clay/Glass
 - (33) Primary Metal
 - (34) Fab. Metal
 - (35) Mach., except Elect.
 - (36) Elect. & Electron Mach.
 - (37) Trans. Equip.
 - (38) Instr./meas./analyze/controling
 - (39) Miscellaneous Mfg.
 - Mining
 - Agriculture
 - Engineering & Contracting
 - Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
 - Consulting
 - Insurance
 - Utilities, public, private & cooperative
 - Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
- C.** Which of the following AIR QUALITY INSTRUMENTATION PRODUCT(S) SERVICES do you plan to purchase in the next 12 months? (Select all that apply)
- Continuous Emission Monitor
 - Ambient Air Monitor
 - Test Kits
 - Gas Monitors
 - Gas Chromatograph
 - GC/MS Analyzer
 - Leak Detectors
 - Particulate Sampler
 - Tubing and Connectors
 - Windor Instrumentation
 - Ambient Air Monitor
 - Test Kits
 - Calibration Gas
 - Gas Monitors
 - Gas Chromatograph
 - GC/MS Analyzer
 - Leak Detectors
- D.** In your job function do you recommend, specify or purchase? (check all that apply)
- Pollution Control Equipment
 - Instrumentation
 - Chemicals
 - Parts & equipment for maintenance operation and control
 - Services/Consulting
 - None of the above
- E.** What types of Pollution Control are you responsible for? (check all that apply)
- Air
 - Water
 - Noise
 - Solid Waste
 - Energy conservation
 - None of the above
- F.** Which of the following publications do you receive personally addressed to you? (check all that apply)
- Pollution Engineering
 - Environmental Today
 - Environmental Solutions
 - Pollution Equipment News
 - The National Environmental Journal
 - Water Environment & Technology
 - None of the above
- G.** How immediate is your need for the selected products/services? (Select one)
- 0-3 months
 - 3-6 months
 - 6-9 months
 - 9-12 months
 - Over 12 months
- H.** What is your reason for purchasing the selected products/services? (Select one)
- New Construction
 - Plant Upgrade
 - Replacement/Maintenance
- I.** What is your projected budget for the selected products/services? (Select one)
- Over \$200,000
 - \$100,001-\$200,000
 - \$50,001-\$100,000
 - \$10,001-\$50,000
 - Under \$5,000

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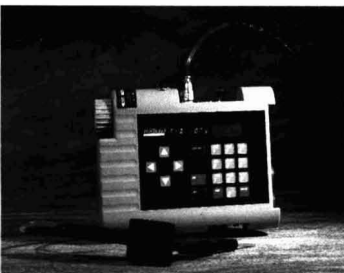
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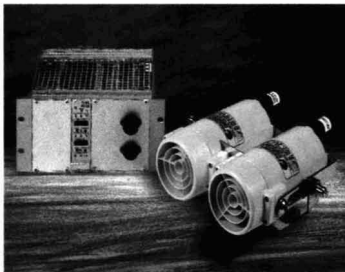
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- Simple to use
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- Intrinsically safe

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TVA 1000 FE — Fugitive Emissions Monitoring System



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