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115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
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A. Function which best describes your activity in Pollution Control (check only one):

A ❑ Corporate responsibility for Pollution Control
B ❑ Manage all Pollution Control Operations at this location
C ❑ Supervise sub-group in Pollution Control Operations
D ❑ Provide professional consulting service on Pollution Control
E ❑ Provide staff environmental service on Pollution Control
Z ❑ Other_____

rs121a

B. Type of Business (check only one):

A ❑ 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
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❑ (35) Mach., except Elect.
❑ (36) Elect. & Electron Mach
❑ (37) Trans. Equip.
❑ (38) Instr./meas./analyze/controlling
❑ (39) Miscellaneous Mfg.

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

Type of Govt:
G ❑ City
H ❑ County
I ❑ State
J ❑ Federal

K ❑ Transportation
N ❑ Labs
O ❑ Training
P ❑ Real Estate
Z ❑ Misc. Services _____

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

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

D. In your job function do you recommend, specify or purchase? (check all that apply)

A ❑ Pollution Control Equipment
B ❑ Instrumentation
C ❑ Chemicals
D ❑ Parts & equipment for maintenance operation and control
E ❑ Services/Consulting
F ❑ None of the above_____

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

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

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

A ❑ Pollution Engineering
B ❑ Environment Today
C ❑ Environmental Solutions
D ❑ Pollution Equipment News
E ❑ The National Environmental Journal
F ❑ Water Environment & Technology
G ❑ None of the above_____

G. Which of the following SLUDGE DRYING AND DISPOSAL PRODUCT(S)/SERVICE(S) do you plan to purchase in the next 12 months? (Select all that apply)

A ❑ Belt Filter
B ❑ Vacuum Filter
C ❑ Filter Press
D ❑ Screw Press
E ❑ Centrifuge
F ❑ Sludge Incinerator
G ❑ Wet Air Oxidation System
H ❑ Fluid Bed Incinerator
I ❑ Bulk Bags
J ❑ Odor Control
K ❑ Sludge Level Meter
L ❑ Sludge Dryer
M ❑ Biosolids Treatment System
N ❑ Flocculant
O ❑ Land Application Vehicles

H. What is your reason for purchasing the selected products/services? (Select one)

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I. What is your projected budget for the selected products/services? (Select one)

A ❑ Over $200,000
B ❑ $100,001-$200,000
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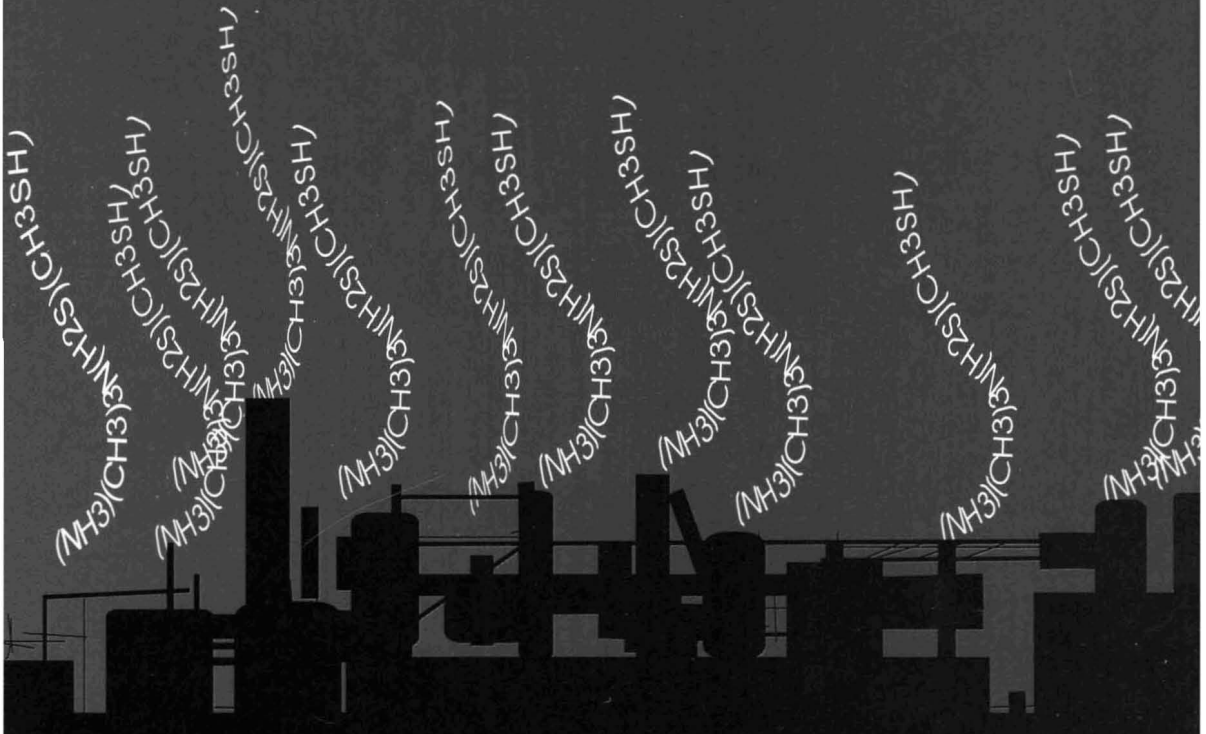

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Cover:
America faces the mounting problem of managing huge quantities of garbage. *EP* looks at how modern landfills are handling the solid waste surge in a cost-effective and environmentally responsible manner.

Photo courtesy of TNRCC.

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FEATURES

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The Scoop On Landfills

No longer the world's largest city, New York, N.Y,. is still at the top of the heap in terms of landfills. Fresh Kills Landfill on Staten Island, N.Y., is the world's largest dump. It covers 3,000 acres and currently accepts about 3.9 million tons of refuse a year. When Fresh Kills Landfill is filled in the year 2010, it is projected to be about 440 feet tall, making it the highest peak on the East Coast.

This mountain of trash looms as a reminder of the tremendous amount of solid waste generated by our society. Tons of discarded diapers, scrapped pizza cartons and other junked items are buried daily throughout the United States. By the year 2000, Americans will throw away more than 220 million tons of garbage annually and about 70 percent of it will end up in landfills.

The problem with landfills is that nobody wants to live near them. Yet, alternative methods of solid waste disposal, such as recycling, combustion with energy recovery, and composting, can only handle a small percentage of the load. Consequently, landfills will continue to be the primary means of handling solid waste until other treatment and disposal methods are improved.

Given that landfills are a fact of life, it's encouraging that today's modern landfills do not resemble old dumps, which all too often become Superfund sites. A major change in the laws governing landfills is responsible for the progress. In 1976, the Resource Conservation and Recovery Act set out rules for constructing and operating solid waste landfills to get rid of open dumps and decrease pollution.

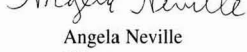
Now modern landfills have liners, leachate collection systems, extensive groundwater monitoring systems and gas collection systems. In addition, today's landfills don't accept hazardous waste or bulk liquids.

Modern landfills are also better located than their predecessors. Factors considered in selecting a landfill site include soil characteristics, hydrology, air circulation patterns, transportation access and adjacent land uses. Planners for landfill sites also must examine potential effects on nearby flora and fauna.

In her article highlighting recent advances in landfill design, Karen Meinders describes how the municipal landfill in Logan, Iowa, was converted from a substandard dump to a state-of-the-art landfill in a two-year, $2.2 million project (see page 30).

As the design and operation of modern landfills are being transformed, so are the uses of closed landfills. Because closed landfills are generally unsafe for housing construction since they tend to settle, they become guaranteed open space. As a result, the trend is to convert closed urban landfills into golf courses, baseball fields and even habitat for wildlife.

Faced with thousands of acres unsuitable for development, New York City has plans to transform Fresh Kills Landfill into the largest contiguous natural area in the Big Apple. Clearly, Fresh Kills is proof that landfills are gaining ground in protecting the environment.



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NEWS UPDATE

Lab Backlog Prompts Indiana To Seek Outside Contractors

A growing backlog of untested laboratory samples is forcing Indiana's environmental agencies to turn to outside contractors for help—a costly proposition.

The Indiana Department of Environmental Management has only four staff people to test samples from health agencies, local governments and individuals across the state.

A staffing shortage has created an ever-growing workload that's slowing the state's ability to tell whether air pollutants are causing problems.

Its first priority is identifying asbestos, with about 300 samples tested annually for the fiber-like building material. Another 1,000 air filters from state monitoring stations are tested each year for metals, and an additional 2,600 are tested for other unknown air pollutants.

But the IDEM is swamped with requests and has a backlog of 102 samples. For example, seven samples received by the state in 1994 are not yet analyzed.

The Indianapolis Air Pollution Control Section, which usually has its lab tests done by the state, has budgeted an extra $10,000 this year to farm out work to ITT Research Institute in Chicago, Ill. And the IDEM has requested $13,000 from the state to hire an outside lab or contractor.

Some local governments, such as the Air Pollution Control District of Jefferson County, Ky., rely strictly on outside labs because they can't afford to keep a chemist on staff.

Recycling Program to Divert Computers from Landfills

Rhode Island may become the first state in the nation to establish a center where unwanted computers can be reused rather than dumped in a landfill.

Some say the effort is doomed because manufacturers aren't required to use recycled materials and find it cheaper to buy new materials. Another problem is identifying and sorting out the many materials that go into a computer.

Currently, two computers become obsolete for every three purchased, according to Carnegie-Mellon University in Pittsburgh, Pa. By 2001, about 150 million personal computers will have been buried in landfills. And discarded computers can pose environmental threats because of the lead, mercury and other materials used in the components.

Although federal law prohibits businesses from dumping computers, it doesn't govern individuals.

The U.S. Environmental Protection Agency's Jobs Through Recycling Program awarded Rhode Island's Department of Environmental Management a $236,000 grant to develop a plan other states could copy.

DEM plans to create a computer program that will log the value of the components and raw materials in every computer type sold in the country.

When a computer is brought in for recycling, the program will determine the most profitable course of action.

California's Underground Fuel Tanks Not as Leaky as Thought

Leaks from California underground fuel tanks may be less widespread than originally thought, and natural microbes may be breaking down any leak that occurs, according to a recent report. Conducted by the Lawrence Livermore Laboratory in Livermore, Calif., the study analyzed data on the state's roughly 200,000 tanks. About 28,000 tanks have leaked or are still leaking, contaminating just six of more

than 12,150 public water supply wells in the state.

Leaks also spread less than imagined, and in most cases, no more than 250 feet, according to the study. Allowing natural microbes in the soil to break down the fuel may work just as well as using expensive cleanup equipment. And the cost of vacuuming soil vapors and stripping groundwater of gasoline is often inappropriately compared to the threat to drinking water wells.

The Environmental Resource Council, a 3-year-old group of property owners concerned with cleanup costs and hassles, is scrutinizing the state's underground tank program. The study was commissioned by the state Water Resources Control Board.

Reduced Polymer Use in Biosolids Yields Big Savings

Annual savings of up to $26 million nationwide and improved biosolids quality are among the potential benefits of new polymer research, according to the Water Environment Research Foundation.

The findings on polymers—synthetic organic compounds used in treatment plants to stabilize and dewater solid material—were released in a report, *Polymer Characterization and Control in Biosolids Management.*

The report indicated that effective dosage control can reduce polymer consumption by 17 percent to 20 percent in the United States, resulting in a potential savings of $22 million to $26 million for municipal water agencies. Polymer reduction in wastewater solids content would also increase the options for solids disposal.

The report looks at biosolids conditioner applications, control technologies and polymer fate in biosolids processing.

It includes general guidance on reducing polymer use in biosolids management, specific approaches to take in selecting an appropriate conditioning product and an assessment of polymer dosage control systems.

Medical-Waste Management Market Poised for Growth

Proposed regulations, decreasing landfill space, rising costs and new treatment technologies may force hospitals out of the incineration business and create a boon for commercial waste-management services, according to a recent report.

The United States annually generates about 3.2 million tons of medical waste, which encompasses everything from paper towels and dressing gowns to chemotherapy agents, human tissue, scalpels, needles and radioactive material.

Most of the waste is incinerated, but that is about to change, according to the report by FIND/SVP, a New York, N.Y., research firm. The medical waste-management market is expected to grow at a compound annual rate of 7.2 percent through 1999, when it will reach $1.3 billion.

Driving the growth are proposed Environmental Protection Agency regulations to reduce incinerator emissions of nine pollutants by 95 percent, declining landfill capacity that will increase disposal costs and tougher environmental rules. Paving the way for growth is the availability of new technologies that are more environmentally acceptable and cost-effective than current disposal methods. They include microwave technology, electron beam irradiation and plasma technology, according to the report.

NEWS UPDATE

U.S. Hits 25-Percent Recycling; Progress Expected to Slow

Although the nation reached a 25-percent recycling goal last year, additional dramatic increases are unlikely any time soon, according to a report from the Virginia-based Waste Policy Center. If the prognosis proves true, state recycling programs with goals of 40 percent or more will fail, said the report's author, J. Winston Porter.

More than 26 states, including New York, New Jersey, Michigan, Colorado and California, have set lofty goals.

Porter, who was then–Environmental Protection Agency assistant-administrator, established the 25-percent recycling goal in 1988. At the time, U.S. residents were recycling about 10 percent of their wastes.

The U.S. recycling model is unique among industrialized nations because it relies on market forces and national, state and industry goals. In sharp contrast, Europe has legally mandated recycling rates for specific materials.

Of the 55 million tons of trash recycled annually in the United States, more than half is paper products. But Porter said the upper limit for recycling will be about 30 percent because about one-fourth of trash is nonrecyclable, including items such as dirt, kitty litter, food scraps and broken toys.

Many materials are becoming lighter, yielding overall environmental benefits but reducing their recycling value. Only a few of the 50-plus items in garbage are present at significant levels, and most are already recycled at high levels.

Group Favors Keeping Pollution-Control Rules

In a rare bipartisan consensus, a presidential panel said existing pollution-control rules could be improved but they shouldn't be weakened. The recommendations, which were forwarded to President Clinton, come despite Republicans last fall demanding that pollution rules be rolled back.

The President's Council on Sustainable Development, comprised of an unlikely mix of industry and environmental groups, also called for a thorough review of taxes and corporate subsidies. The goal is to raise taxes on pollution and consumption in exchange for cutting income taxes.

Recycling Market Rode 1995 Pricing Roller Coaster

Supply and demand volatility wracked national paper and plastic recycling markets in 1995, forcing price changes as great as 200 percent, according to the Environmental Industry Association. Some commodities—newspaper and corrugated cardboard, in particular—showed big gains the first half the year, only to post even bigger losses the second half.

The average price paid by end users for old newspaper climbed from $87.21 a ton in December 1994 to $202.86 a ton in June 1995, but dropped nearly 82 percent to $36.93 a ton by the year's end.

The average end-user price for PET plastic—the typed used in soft drink bottles—shot up 200 percent from 8.86 cents a pound in December 1994 to 26.64 cents a pound in August 1995. It ended the year at 22.64 cents a pound, up more than 150 percent.

Not all prices fell as dramatically, however. Prices for glass and metals remained fairly stable. Clear glass, the most valuable color, fell about 5 percent from December 1994 to December 1995. Brown glass, on the other hand, rose about 4 percent, and

green glass rose slightly less than 4 percent.

Aluminum prices dropped 10 percent during the 12 months, while steel prices remained stable.

Group Claims Cutting Subsidies Will Help Protect Environment

Using economic arguments to try to protect the environment, a coalition of environmental groups is demanding the government cut costs by eliminating programs that help big industries.

Cutting federal subsidies to the timber, aluminum, farming, mining and nuclear industries would save Northwest taxpayers $2.3 billion over the next five years, the groups said. Among the groups are the Sierra Club, the Inland Empire Public Lands Council, Friends of the Earth, Taxpayers for Common Sense and the Save Our Wild Salmon Coalition.

Critics, however, say the claims are inaccurate. The environmental groups, for example, say eight aluminum smelters in the Northwest will receive $1.07 billion worth of reduced rates from the Bonneville Power Administration in the next five years.

BPA's Peter Gruber, however, said the aluminum industry's lower rates are not subsidies but are because of high usage. The aluminum industry also can have the electricity shut off at a moment's notice when BPA needs it to maintain residential power.

Environmental Movement Focusing More Regionally

The environmental movement is shifting gears, focusing more on local communities and state governments and less on Washington, D.C.

"It's a major transition time," National Audubon Society President John Flicker said recently in Oregon. "We went through an era when we thought all solutions came from Washington, D.C. The election of November 1994 came as a blunt wake-up call to all of us."

Flicker was referring to the new Republican-dominated Congress, which quickly advocated dismantling environmental protection laws and selling public land. But he said the freewheeling anti-environmental attitude did an abrupt about-face when voters chose Democrat Ron Wyden over Republican Gordon Smith in Oregon's recent special U.S. Senate election.

Since Wyden's election, Flicker said the Republican anti-environmental effort has stalled, and House Speaker Newt Gingrich has admitted he misread public sentiment on environmental issues.

Oil Filters Join Growing List Of Recycled Items

More than one of every four oil filters sold in the United States is currently being recycled, and an industry group expects the number to continue to grow. Only four years ago, no filters were recycled.

According to a study conducted by the Filter Manufacturers Council (FMC), about 56 million filters were recycled in 1994. In the first six months of 1995, more than 44 million had already been processed, and FMC said about a total of 88 million would be processed by year's end. The number does not count the filters that went directly for recycling at waste-to-energy recovery plants.

Filters must be processed by some form of crushing or shredding to be accepted by endusers, such as steel mills and foundries.

FMC credits the jump in recycling to an educational program and used filter hotline, which provided information about state regulations and companies providing recycling services.

About 420 million oil filters are sold in the United States annually.

Debate Clouds Colorado Plan to Raise Speed Limit

An Environmental Protection Agency study shows higher speed limits will mean more pollution. But a Colorado legislator sponsoring a bill to raise the state's speed limit is one of the study's naysayers.

"They came up with the conclusion they wanted this study to come out with," said Sen. Ray Powers, R-Colorado Springs. The state House passed the bill, which would raise speeds to 75 miles per hour on rural interstates and increase top limits elsewhere after studies of road conditions.

Results of the preliminary EPA study show that cars emit more nitrogen oxide at speeds of more than 48 miles per hour. Up to 48 mph, higher speeds increase engine efficiency and reduce emissions.

Nitrogen oxide, which is a part of Denver's brown cloud, could increase in the air by 6.6 percent if speeds on all the state's rural highways were raised to 65 mph. The increase would be 28 percent if speeds were raised to 65 mph on urban roads.

Powers, however, contends that cars emit less pollution as they go faster.

Nitrates in Drinking Water Subject of Study, Debate

Several thousand communities, especially in agricultural areas, frequently have unhealthy nitrate levels in drinking water, posing a special risk to infants, says an environmental group. The study by the Environmental Working Group examined 200,000 water sampling records back to 1985.

The group found 2,016 water systems that exceeded Environmental Protection Agency nitrate standards at least once. In many cases, the violations occurred only one or two times during the 10-year period.

The study found that in 10 states, more than 10 percent of all private drinking water wells were contaminated with high nitrate levels.

The states were Delaware, Kansas, Iowa, California, New York, Nebraska, Arizona, Illinois, Colorado and Wisconsin. The EPA considers nitrate levels of more than 10 parts per million as dangerous.

High nitrogen levels in drinking water—if it is used to mix baby formula—can deprive infants of oxygen and result in the potentially fatal "blue-baby syndrome."

The largest city to report violations was Columbus, Ohio, a system that serves nearly 270,000 people. The violations occurred in five of 10 years.

The Association of Metropolitan Water Agencies and the American Water Works Association, however, said EWG exaggerated the dangers and did not take into consideration recent improvements. AWWA also cited a 1995 report from the National Research Council stating that exposure to nitrates found in U.S. drinking water is unlikely to contribute to human cancer risk.

The report also said that EPA's current nitrate standard is adequate to protect human health.

EWG is proposing to change the standard to 5 ppm, which according to AWWA has no apparent scientific basis.

Utah City Considers Treated Effluent for Lawns, Gardens

City officials in northern Utah admit they will have a tough time selling homeowners on using treated sewage effluent to irrigate yards and gardens.

Though the plan is still in its infancy, growth along the Wasatch Range may eventually make it a reality.

Because it won't happen overnight, the public will have time to warm to the idea, said Ivan Anderson, a North Davis Sewer District board member.

Sewer engineers currently are looking at the feasibility of having treated effluent pumped and distributed throughout Davis County. About 13 million gallons of wastewater are processed by the Syracuse, Utah,

treatment plant north of Salt Lake City before being dumped into the Great Salt Lake.

Richard Harvey, director of Davis County Environmental Health Department, said using effluent is not as simple as just obtaining water rights and pumping it. The district's plan would require intense oversight from his department to ensure it does not pose a health threat.

In parts of California, treated effluent is pumped back into aquifers and reused for drinking water.

Enviro Industry Saw Ups And Downs in 1995

The fourth-quarter performance for the architectural, engineering, planning and environmental consulting industry dropped to its lowest level in a year after showing back-to-back growth for the first three quarters of 1995. Zweig White and Associates of San Francisco, Calif., announced the findings after examining the net revenues of more than 100 firms that participate in its confidential poll.

The net revenue index fluctuated wildly, beginning at 109 in January, reaching an all-time high of 136 in August and ending at 104, the lowest since July 1994. The effective labor multiplier saw similar swings, hitting a two-year high of 2.99 in June 1995 and finishing at 1.83, the lowest since October 1994.

The late decline in economic performance had a predictable effect on optimism. In December, short-term optimism was at 3.67, 8 percent lower than in December 1994. The long-term level finished higher at 3.82, showing participants believe economic performance will improve in 1996.

Not all the news was negative, however. The median staff level index increased to 107 at the end of 1995 after starting at 103.

State Lottery Nixes Tickets Printed on Recycled Stock

The Massachusetts state government's biggest paper user, the lottery, has stopped using recycled paper for its instant game tickets. And environmentalists are at a loss, because the move didn't save money. It also contradicted the governor's "Clean State Initiative."

The lottery sells about 1 billion instant game tickets a year.

Lottery executive director Sam DePhillippo told the Legislature the reason for the change was that scratch tickets printed on recycled paper didn't work well with vending machines and scanning equipment.

A spokesman for the company that sells the paper to the lottery, Scientific Games Inc., said he knew of no similar complaints from other states.

Cape Avengers Fight For Clean Water

It's a bird. It's a plane. No, it's Captain Sewer, taking to the road to educate youth about water quality, conservation and pollution prevention. Clad in tights and a cape, Rick Barger, of the Little Rock (Ark.) Wastewater Utility takes time away from his schedule to visit classrooms and extol the virtues of clean water.

But Barger isn't the only plunger-wielding caped crusader. Bruce Daniels, a full-time industrial waste inspector for the city of Sunnyvale, Calif., also doubles as Captain Sewer. In 1994, the Santa Clara Valley Water District passed a resolution expressing appreciation to Sunnyvale and Daniels for their innovative programs.

Giardia Detected in Many Canadian Water Systems

Drinking water in many Canadian communities may contain *Giardia,* which

causes an illness marked by severe diarrhea and vomiting, according to a recent survey of drinking water systems.

A national survey of 72 municipalities found 18 percent of the samples contained the *Giardia* cyst.

Only about 3 percent of the parasites in the drinking water were alive. But even the low concentrations can be dangerous, said health department scientist William Robertson.

The parasites, which produce embryos or cysts, are extremely contagious and highly resistant to disinfection, such as large doses of chlorine. The only way to effectively remove them from water is filtration.

Commonly known as beaver's revenge, beaver fever or the Aspen two step, the disease can be spread by beaver, muskrat, dogs, elk and humans.

TSD Facilities May Have Hit Plateau in U.S.

The U.S. hazardous-waste management industry may have reached a turning point in 1995, according to an annual survey of treatment, storage and disposal (TSD) facilities by Elsevier Science Inc. of New York, N.Y. The firm noted no new proposals for TSD facilities and an actual net loss of facilities for the first time since 1991.

Despite the U.S. downturn, the number of Canadian facilities is nearly twice as many as in 1994, and Mexico remains poised for growth, according to the survey.

In the United States, four new facilities or expansions began accepting hazardous waste during 1995, while more than 20 projects were delayed or canceled due to public opposition or stringent restrictions. Ten facilities were closed.

Large industry players, such as Philip Environmental, Rollins and Safety-Kleen, continue the trend toward consolidation by buying existing facilities from smaller companies. However, the new owners have chosen to close or downgrade some of the facilities because of overcapacity.

Of the 14 projects making progress in 1995 toward obtaining Part B permits, four are for new landfills or expansions to existing capacity. Although one cement kiln is awaiting approval of a permit to begin burning hazardous waste-derived fuel, no applications for new hazardous-waste incinerators are immediately pending, according to the survey.

Converted Spy Plane Now Spies on Hazmat Sites

A plane originally designed to spy on Cold War enemies is now spying on hazardous wastes from mine sites near Leadville, Colo. Researchers from the U.S. Geological Survey have developed maps using images collected by a modified U-2 spy plane.

The jet is outfitted with a spectrometer that detects pollution by analyzing the way rocks, dirt, minerals and other material absorb and reflect light. USGS researchers in Lakewood, Colo., analyze the jumble of data collected by the jet—as many as 7,000 measurements per second—with a computer program that assigns colors to the contaminants.

Maps generated by the USGS have been used by the Environmental Protection Agency and other agencies to identify sources of contamination over a 20-square-mile area.

Use of the remote-sending technology has trimmed as much as a year and $500,000 from cleanup work that began in 1983 around Leadville. The contamination stems from 130 years of snow runoff and rain that have carried lead and other heavy metals from hundreds of tailings piles into the Arkansas River.

Agencies Beefing up Effort Against Haz-Mat Smuggling

The U.S. Environmental Protection Agency and the U.S. Custom Service are teaming together to beef up border security when it comes to smuggling hazardous waste and dangerous pollutants into the United States. Last year, the Customs Service seized more than 1 million pounds of chloroflourocarbons, second in quantity only to illegal narcotics.

During the past 18 months, the EPA, working closely with customs, has conducted 16 investigations of CFC smuggling, resulting in 11 indictments and nine convictions so far.

EPA Honors Anaheim, Calif., For Pollution Prevention

Anaheim, Calif., may be the home of Mousetown, but it also is the first Project XL Community because of its innovative approach to controlling air pollution at a lower cost. The savings will be used to make new advances to protect groundwater.

The award, presented by the U.S. Environmental Protection Agency, stands for "excellence in leadership" and calls for communities across the nation to find new ways to meet environmental goals.

The city plans to expand three of its voluntary environmental programs—a chlorinated solvent reduction program to protect groundwater against hazardous chemical pollution, a well identification program tied into groundwater protection and an electrotechnologies program to help businesses reduce air emissions.

In exchange for the efforts, the EPA will grant Anaheim flexibility in monitoring air emissions from the city's gas-fired power plant. The flexibility, which will have no impact upon the level of air emissions from the plant, will save the city more than $250,000.

Plutonium Cleanup Could Start by 2010

Plutonium removal at Rocky Flats, Colo., could begin as early as 2010 and end by 2015, under a new agreement between the state of Colorado, the U.S. Environmental Protection Agency and the U.S. Department of Energy. City and county governments also would be involved in any steps taken to protect water supplies from contamination.

Rocky Flats manufactured plutonium triggers for nuclear weapons until 1989, when production was suspended because of safety problems. The Cold War ended before production could resume.

A draft cleanup agreement is expected in June. The draft would speed cleanup and closure but still seek compliance with state and federal laws. Agency representatives said plans call for cleaning the buildings and either converting them to other uses or demolishing them if they no longer are needed.

Agency officials did not mention in the Associated Press article where they were going to deposit the tons of plutonium-contaminated soil that will be removed from Rocky Flats.

New Texas Air Permits Give Plants Flexibility

A new permitting system in Texas is providing more flexibility to plant operators by allowing them to choose their own pollution-control devices while still reducing pollutants. The Texas Natural Resource Conservation Commission has received 11 binding commitments from plants during the past year that will result in the permanent reduction of 116 million pounds of pollution by the turn of the century.

The TNRCC couldn't have required such a reduction by law, because the state's authority to control emissions is limited by grandfathered permits and plants that were operating before the state's 1971 clean air

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law. If companies have old permits, they have relatively inefficient pollution-control methods, but the state doesn't have a way to cause them to update the equipment unless there is clear evidence of problems at the facility.

Traditional permits prescribe specific pieces of air pollution-control equipment. A company couldn't alter its environmental plant without a full state review.

But the new permits allow plant operators to determine their own pollution-control devices as long as they keep emissions below set caps.

Though the new permit process has drawn praise from industry, environmentalists are wary and say they would like to see the standards tightened, especially in urban areas.

EPA Region 5 Fetes Top Wastewater Districts

The U.S. Environmental Protection Agency's Region 5 recently honored several municipal wastewater districts for their pretreatment programs. Pretreatment is essential to prevent contaminants that are discharged to sewage treatment plants from interfering with their operation or polluting waterways.

This year's winners were:

- Muncie, Ind., Sanitary District for establishing a good relationship with local industry that led to dramatic reductions in discharges of toxic pollutants to the White River.
- Metropolitan Council Wastewater Services, Minneapolis and St. Paul, Minn., for carrying out an effective enforcement program resulting in a high rate of compliance from industrial dischargers.
- City of New Philadelphia, Ohio, for finding creative ways to effectively treat unusual wastewaters and developing partnerships with industrial dischargers, the state and city administration.
- Fox River Water Pollution Control Center, Brookfield, Wisc., for its enforcement and inspection program that resulted in perfect compliance from dischargers during the latter half of 1994.
- Green Bay, Wisc., Metropolitan Sewerage District for operating a program that resulted in perfect compliance from dischargers for the past three years. The district emphasizes pollution prevention and has conducted a pollution-prevention workshop for discharges and other municipalities.

Republicans Try to Shed Anti-Environmental Image

The Republicans have taken several steps recently designed to blunt criticism that the GOP is anti-environmental.

House Republicans have become divided and stung by opinion polls saying they destroy the environment. Led by a class of fiery freshmen, they have cited environmental programs as examples of out-of-control federal bureaucracy that needs to be reeled in.

House Speaker Newt Gingrich said he's heartened by work being led by Reps. Richard Pombo (R-Calif.) and James Saxton (R-N.J.) to design a swap between landowners on the fringes of the Everglades in south Florida and land owned by the federal Department of Housing and Urban Development elsewhere in the state.

Gingrich also said that $7 million has been included in the Interior Department's appropriations bill to buy more land for recreation areas along the Chattahoochee River near Atlanta, Ga. EP

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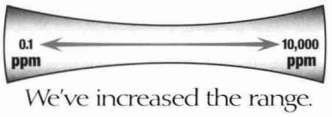

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THE GRAPEVINE

William J. McDonnell, a member of the American Society of Engineers (ASCE) and a principal with **Camp Dresser & McKee,** Cambridge, Mass., was elevated to the membership level of "Fellow" within the society....**Intermagnetics General Corp.,** Latham, N.Y., and its wholly owned subsidiary, InterCool Energy Corp., signed an agreement with Ausimont S.p.A. of Milan, Italy, under which Ausimont becomes a European distributor of FRIGC™ FR-12™ refrigerant....Scott J. Blumeyer joined **Unicom,** Chicago, Ill., as senior project manager....**GMD Environmental Systems,** Fort Worth, Texas, received a contract to design, manufacture and install the air pollution control equipment for EBAA Iron's new foundry.

ENSR, an Acton, Mass., environmental services company, named Don Faul president of the firm's consulting and engineering division and Anthony Horncastle executive vice president and chief financial officer of ENSR Corp....**Burns & McDonnell Engineers-Architects-Consultants** added Mark I. Saito, an air pollution control specialist, to the firm's Kansas City, Mo., staff.

Koyoshi Hoshino joined **MKS Instruments Inc.,** Andover, Mass., as president and representative director of MKS Japan Inc., a Japanese subsidiary of MKS headquartered in Tokyo, Japan....**Shaw, Weiss & De Naples Corp.,** a multidiscipline civil and environmental engineering firm based in Dayton, Ohio, appointed Kimberly A. Izenson as marketing communications coordinator....Jeff Polnau was appointed national sales representative of **Permatron Corp.,** Franklin Park, Ill.

Barry L. Phillips, president of **The Grandall Co.** was elected chairman of the Equipment Manufacturers Institute, a Chicago, Ill.-based trade association for manufacturers of agricultural, construction, forestry, materials handling and utility equipment....**Bechtel Group Inc.,** a San Francisco, Calif.-based global engineering and construction organization, elected Frederick W. Cluck vice chairman, Adrian Zaccaria president and chief operating officer, and Riley P. Bechtel as chairman and chief executive officer.

WMX Technologies Inc., Oak Brook, Ill., declared a quarterly cash dividend of 15 cents per share payable Jan. 4 to stockholders of record on Dec. 20, 1995....**Dewberry & Davis,** Fairfax, Va., has been selected to develop the Roanoke Valley Regional Stormwater Management Plan, a multi-jurisdictional effort coordinated by the Fifth Planning District Commission in Roanoke, Va....**Action Instruments,** San Diego, Calif., can now be found at http://www.actionio.com/actionsales on the World Wide Web.

Charles Mondello was appointed manager of remote sensing and geographic systems at **Eastman Kodak Company's Aerial Systems,** Rochester, N.Y....**Montgomery Watson**, Pasadena, Calif., was awarded a contract to study industrial water pollution in the metropolitan region of Belo Horizonte, Brazil....**Roy F. Weston Inc.,** a West Chester, Pa.-based environmental consulting firm, has a new home page on the World Wide Web—http://www.rfweston.com.

Kenneth Olden, director of the National Institute of Environmental Health Sciences and the National Toxicology Program, received the first distinguished service award in toxicology from the **American College of Toxicology**....James L. Stipe joined **R.E. Wright Environmental Inc.,** Middletown, Pa., as general manager, landfill services/solid waste consulting....Steven J. Eckard, president of **Anthalpy Analytical Inc.,** Raleigh, N.C., assumed responsibility for daily operations of the company.

Internet users can now find **The International Society for Measurement and Control** at http://www.isa.org/isa....The National Council for Public-Private Partnerships honored a state-of-the-art materials recovery facility operated by **Waste Management of Michigan Inc.** in Southfield, Mich....**Dow Environmental Inc,** a wholly owned Rockville, Md., subsidiary of The Dow Chemical Company, was awarded a $2.5 million Army Corps of Engineer contract for structural removal and/or upgrade at various locations.

Kenneth Y. Millian is the new executive director of the **Global Environmental Management Initiative,** a Washington, D.C., group of 26 corporations dedicated to achieving environmental excellence in the global business community....The International Cooperative for Ozone Layer Protection, a Washington, D.C., non-profit partnership dedicated to promoting innovative environmental solutions through technology exchange, changed its name to the **International Cooperative for Environmental Leadership.**

Douglas R. Rogers, a registered professional engineer, was elected to the board of directors of **Omega Environmental,** which has 52 locations in North America....The U.S. Air Force awarded the West Chester, Pa., firm of **Roy F. Weston Inc.** a $15 million contract for cleanup, regulatory compliance, remedial design and pollution prevention at Kelly Air Force Base in San Antonio, Texas.

The Institute of Gas Technology, Des Plaines, Ill., signed a memorandum of understanding with Atlanta, Ga.-based **Golder Associates Inc.** for promoting, marketing and executing projects related to environmental, remediation and process technology....The board of directors of **Anderson Columbia Environmental Inc.,** Lake City, Fla., elected John R. Folkerson president....**Advanced Technology Materials Inc.,** Danbury, Conn., announced the signing of a letter of intent to purchase the Guardian Systems business of MG Industries for about $6 million.

Pace Analytical Services Inc., Minneapolis, Minn., announced the formation of a new company comprised of seven environmental laboratories and multiple service centers across the country....**GTS Duratek,** Columbia, Md., announced it has acquired 80 percent of the San Leon, Texas-based Bird Environmental Gulf Coast hazardous waste recycling center....**The American Industrial Hygiene Association,** Fairfax, Va., has a new address on the Internet—http://www.aiha.org.

Jerry McGurkin is the new vice president and general manager of **Willson Respiratory**, Reading, Pa....**Zimpro Environmental Inc**., Rothschild, Wis., received a contract to provide a wet-air oxidation system for treatment of spent caustic at Exxon's new grassroots ethylene facility in Baytown, Texas.

Battelle, a Columbus, Ohio, technology development firm, won a $10 million contract with the U.S. Environmental Protection Agency to develop and demonstrate technologies for the National Risk Management Research Laboratory....Dr. Charles Lancelot is the new vice president of technology at **Ansell Protective Products,** Atlanta, Ga....**ENSR**, based in Acton, Mass., named Jim Bowlby the new senior project manager at the firm's

Denver, Colo., office.

Robert Bartels was appointed senior associate for water and environmental resources at **Consoer Townsend Envirodyne Engineers,** Chicago, Ill....**Wahlco Environmental Systems** announced that its subsidiary, Wahlco Inc., formed a strategic alliance to provide air-pollution control engineering and equipment to Cinergy Corp., a large Midwestern electric utility....The Lisbon, Portugal, municipal area waste treatment agency selected the joint-venture team of **Foster Wheeler Conception Etudes Entretien** and **Foster Wheeler Power Systems Inc.** to design, build and supply the mass-burn, municipal solid-waste-to-energy plant in Loures, Portugal.

WGM Safety Corp., Reading Pa., named Roger Gehring president....**Chester Environmental,** Township, Pa., received the 1995 Governor's Export Excellence Award in the service sector, medium category....**Foster Wheeler Environmental Corp.,** Clinton, N.J., received a Technology Management Support contract with Battelle Memorial Institute's Pacific Northwest Laboratories in Richland, Wash.

Temple City, Calif., about 10 miles northeast of Los Angeles, awarded **Berryman & Henigar**, a San Diego, Calif., the contract to provide ongoing engineering services for a variety of public works projects....The environmental laboratory of **The Mead Corp.**, Dayton, Ohio, recently received ISO 9001 registration in recognition of its efficient processes and high quality standards....**A.O. Smith Corp.** acquired the Peabody TecTank Division, which has headquarters in Parsons, Kan., from the Pullman Co.

Robert Gregg joined **Action Instruments,** San Diego, Calif., as European sales manager....**CDM Engineers & Con_structors Inc.,** Cambridge, Mass., were selected to dismantle a sewage sludge recycling facility in New York state, and manage construction of a light rail system and manage environmental rehabilitation of a bus garage, both in Pennsylvania....Sherry E. Peske was appointed vice president of **Foster Wheeler International Corp.** and manager of FWIC's Washington, D.C., government affairs office....**URS Corp.**, San Francisco, Calif., and **Greiner Engineering Inc.** announced they had signed a letter of intent for URS to acquire all of the outstanding shares of Greiner's common stock.

Scott Carter was named exclusive sales representative for Alaska, Idaho, Montana, Utah and Wyoming for **Geotronics of North America,** a Westmont, Ill., global positioning systems firm....**Eder Associates,** an environmental engineering firm headquartered in Locust Valley, N.Y., formed a forensic engineering unit to provide law firms with environmental litigation support and expert testimony....**Industrial Compliance,** a national engineering, consulting and remediation company in Lakewood, Colo., hired Philip Gagnard as senior scientist.

Richard Whiteside was named product manager for multi-gas analyzers at **Land Combustion,** Bristol, Pa....Kenneth Y. Millian was elected executive director of **Global Environmental Management Initiative,** a Washington, D.C.-based group of 26 corporations. EP

The Votes Have Been Counted, and the Winner Is...

pH meters and water test kits were two of the top vote getters, according to a poll of buyers' intentions conducted by Environmental Protection.

THE POLLSTERS HAVE BEEN BUSY with the presidential primaries, asking the nation's voters what candidates they favor.

Environmental Protection has also been busy seeking opinions. But in our case, it involves purchases of water quality instrumentation products and/or services that readers plan to purchase during the next 12 months.

The poll was conducted in the January *EP*, and those voting circled the appropriate categories on the magazine's outside wrapper. Unlike the presidential race, where you can only vote for one candidate, people going to the polls in our election could circle several of the instrumentation candidates they intended to purchase.

And much like some of the party races, there appears to be a few front runners, with pH meters leading the pack. Of the readers responding, nearly 62 percent said they planned to purchase one in the next year.

Test kits also ranked high in the polls, garnering nearly 55 percent of the votes.

In the middle of the pack were groundwater samplers, with 33 percent; flow controllers and monitors, with 30 percent; and wastewater samplers, with 37 percent.

We also asked our readers how much they had budgeted for water quality instrumentation and services this year.

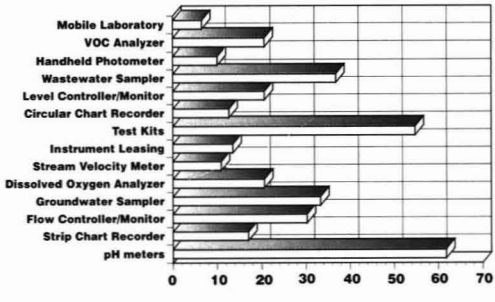
Of those responding, 10 percent said they would spend more than $200,000 for those products and/or services. About 4 percent said they would spend between $100,001 and $200,000 during this year, whereas another 10 percent said they would spend between $50,001 and $100,000.

Rounding out expenditures, 26 percent said they would spend between $10,001 and $50,000; 15 percent said they'd spend between $5,000 and $10,000; and 35 percent said they'd spend less than $5,000.

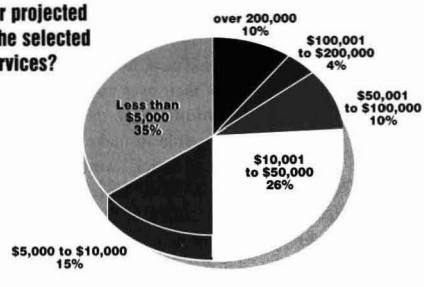
EP also asked our readers how immediate their needs were for the selected products and/or services. The majority—79 percent—said they'd be needing them within the next year. Only 21 percent said they would be needing them outside of the year.

If you would like to participate in the April buying intentions survey, simply answer the appropriate questions on the reader service card and mail it to *Environmental Protection*. And watch for the results in future issues. EP

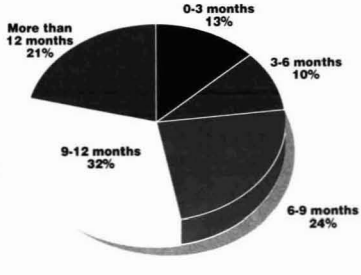
Which of the following Water Quality Instrumentation product(s)/services(s) do you plan to purchase in the next 12 months?



What is your projected budget for the selected products/services?



How immediate is your need for the selected products/services?



Game Plan for Successful Training

YOUR COMPANY'S DIRECTOR OF TRAINING is planning to conduct an eight-hour hazardous waste operations refresher course for a group of employees. He or she has led the Occupational Health and Safety Administration-mandated training before, but is frustrated. Many of the employees seem to forget what they've "learned" a week earlier.

It's a pattern often repeated, not only with HAZWOPER training but with all kinds of environmental health and safety training. When you pull your employees into an EHS training session, what happens? Someone pops a videotape into a VCR and the group watches a dry lecture on a small television screen. A few people in the back of the room close their eyes and tip back their chairs.

Unfortunately, this scenario is not uncommon. But it is possible to make environmental, health and safety training "stick" while making it interesting and enjoyable as well. More importantly, participants can approach learning in a new way that allows them to apply what they've learned in actual safety situations.

"Regulatory training tends to be dry," said Karen Shipman, regulatory training consultant for B.P. Exploration & Oil Inc. "You have to go over things many times. I've worked very hard to find a different approach."

Shipman and many other industrial in-house trainers have found what they were looking for in EHS Excellence Quest, an award-winning interactive game that covers a broad variety of topics, from identifying potential safety hazards to handling hazardous chemical spills. Rather than trying to teach employees to memorize safety procedures, it provides an overview of important EHS topics, and teaches them how to use reference materials to find information about the topics. The game includes a copy of an easy-to-use EHS resource guide.

The board game teaches participants how to use the EHS reference guide. Players take turns trying to answer questions, which are printed on the game cards. They have 30 seconds to get the correct answer using the guide.

Once you purchase the game, you don't have to hire a consultant to lead the training sessions. The cards can be customized for your particular industry or even your factory.

B.P.'s Shipman is responsible for leading HAZWOPER and Resource Conservation and Recovery Act (RCRA) refresher training for a variety of employees, from petroleum storage terminal managers to pipeline technicians.

"I go through the cards and pick out the ones that are appropriate for each group," she said. "I tailor it to the needs of the group I'm training by simply selecting the appropriate cards."

Shipman said the game has been particularly effective as the starting point for a two-day refresher training course.

Though the game alone won't meet your entire compliance requirements, it will reinforce what is being taught and greatly increase your employees' ability to use and remember what they've learned.

"Training where you involve people tends to have more retention," said Shipman. "People are not just hearing the information but reading, looking, listening to others try to answer."

The game is played in a manner similar to Trivial Pursuit. Correct answers allow players to roll dice and move around the board; while too many incorrect answers land players in "prison." They remain there until they answer a question correctly.

The questions are designed to make learning fun. For example—"From your hazard communication program, you learned that common hazardous chemicals are contained in which of the following: a. Forklift batteries; b. Copy machine ink; c. Most items on the menu at a fast food restaurant; d. Both a and b above." (The correct answer is d.)

The game also includes "Chance" cards that reward or punish safety decisions. For example, one reads, "Your hands are burned when handling some chemicals while

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Circle 117 on card.

not wearing the proper protective equipment. Lose 20 points. Wear the rubber gloves for the next two turns."

Here's another: "You conduct a safety self-audit and find that one of your shop processes is equipped with the wrong type of fire extinguisher. Collect 20 points. Receive a pat-on-the-back from the person to your left."

Although it sounds like fun and games, trainers who have used it have found it to be very effective. Because it requires trainees to respond to a wide variety of real-life situations, it keeps their attention and boosts their comprehension.

"I like the fact that the information is not specific to OSHA only," Shipman said. "It has things on environmental regs, too."

B.P. Oil has been using the game as part of its training for several months, and although it's too soon to measure its effectiveness quantitatively, Shipman says it has been very well received on every level.

"The employee reaction has been very positive," she said. "It helped set the direction of the training, so that we would go over things that people needed."

Rather than trying to teach employees to memorize safety procedures, it provides an overview of important EHS topics and teaches them how to use reference materials to find information about those topics.

Consumer's Power Co., a major electric and gas utility in Michigan, is currently using the game to train all of its field supervisors. The company introduced the game early in 1995 by having its field managers play it. "They were very enthused," said Tom Griffiths, environmental coordinator for Consumer's gas business unit.

Griffiths said Consumer's is customizing the game. "Some of the questions in the original version of the game deal with things like a railroad tanker car turning over, where our employees might never encounter that. They need to know what to do with a 30- or 40- or 50-gallon spill."

Griffiths said he thinks games like this one represent a trend in health and safety training. "Governing bodies, like OSHA, or the Department of Natural Resources, are looking for interactive training. They realize that with most traditional training, employees aren't learning anything."

Arizona Public Service Co., which provides residential and commercial electric service throughout Arizona, has pilot-tested the games and is in the process of identifying all the ways they will use it.

"We are developing, as a company, programs on specific EHS topics, such as spill prevention and counter measures," said Darlene Taylor, EHS training and development program leader for the utility company. "We piloted Excellence Quest with various people in the company and asked for their feedback. It was all positive. They liked the interactive format of the game, the ease of use of the quick reference guide."

"It has great possibilities for new employee training; or it could be used in safety committee meetings, either to address specific topics or in a general sense," said Darlene Taylor, EHS training and development program leader for the utility company.

Taylor said that playing a generic version is not going to meet all the regulatory compliance requirements for a specific industry, but it is a valuable training tool.

"It lends itself well where you want to teach people to learn a procedure," she said. "Participants are learning to look up answers, rather than memorize answers. There's so much (EHS) information out there, it's not realistic to expect people to know all the answers." EP

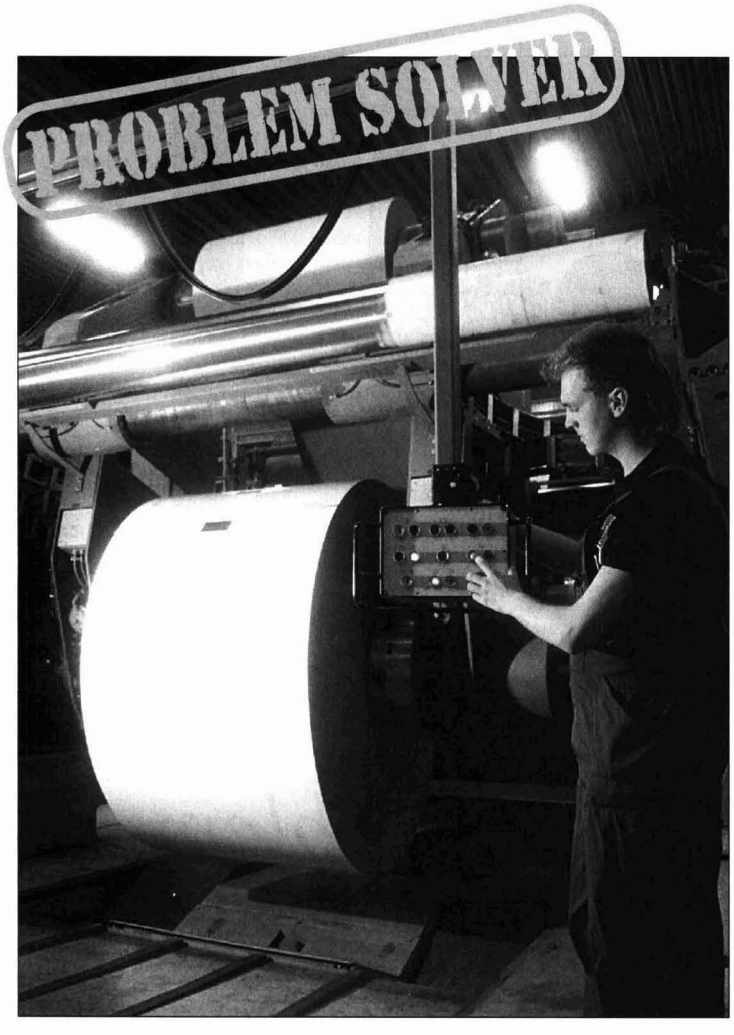
Blair Stock is vice president of marketing and development for Performance EFX Inc. in St. Joseph, Mich.

For more information on the EHS Excellence Quest game, circle 265 on card.

What Do You Think?

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

High 266 Medium 267 Low 268



Recipe for Recycling

A Maryland paper mill combines reclaimed water with a dash of wastepaper to cook up a market-ready pulp.

Construction continues on a unique water reclamation system for a greenfield wastepaper recycling mill in Hagerstown, Md. The project is 1st Urban Fiber—a new facility which, when completed, will produce 150,000 bone dry short tons per year of deinked, market-grade pulp from 100 percent post-consumer mixed office wastepaper.

Expected to cost about $200 million, 1st Urban Fiber is the largest capital project in Hagerstown's history.

Raw water used in the mill and wastepaper produced by the recycling processes will be treated on site in a state-of-the-art water reclamation system designed to have no impact on the receiving stream. The system includes a combination of treatment processes, including the Hydro-Clear® pulsed bed sand filter and the powdered activated carbon treatment (PACT®) system, which enhances biological treatment of wastewater with the addition of powdered activated carbon.

Raw water will be drawn from Antietam Creek, which flows along the property's edge, at an average rate of 2 million gallons per day. The water will pass through a clarifier and filtration system to remove suspended solid particles and reduce turbidity. The filter uses a shallow, 10-inch bed of fine grain sand and a unique compartmentalized underdrain.

From the filters, the clean water will flow to the mill. Wastewater discharged from the recycling process will be treated in a series of steps to restore its purity. Processes will include additional clarifiers and sand filters as well as a biological system that can be upgraded to a PACT system as effluent requirements dictate. In the PACT system, biological microorganisms break down the biodegradable contaminants, while the non-biodegradable—toxics in particular—are adsorbed by the carbon.

After treatment, the wastewater passes to a clarifier, where solids settle to the bottom, and the clear, treated water is drawn off the top. The solids, containing spent carbon and biomass, will be dewatered and disposed.

In addition to effluent purity, heat exchangers will control the temperature throughout the process to ensure that discharged water will have no thermal impact on the receiving stream, which is a trout habitat. The effluent will also be closely monitored for chemical oxygen demand, biological oxygen demand, suspended solids, turbidity and color, under terms of a wastewater discharge permit regulated by the Maryland Department of the Environment.

However, the actual volume of water returned to the stream will be minimized. About 65 percent of the treated wastewater will be reused by the mill.

Ground was broken for the project in the fall of 1994. Startup of the mill and the water recycling system is anticipated for the spring of 1996. EP

For more information on the Zimpro system, circle 296 on card.

What Do You Think?

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

High 297 Medium 298 Low 299

Photo courtesy of American Sigma

Flow meters were installed to "get the heartbeat" of the collection system.

Flooded with Problems

Lawton, Okla., begins a comprehensive sanitary sewer evaluation survey under order from the EPA.

Under an Environmental Protection Agency administrative order that identified a number of sanitary sewer overflows in its system, the city of Lawton, Okla., began a comprehensive sanitary sewer system evaluation survey (SSES).

"The initial findings will indicate that we do have an excessive amount of infiltration and inflow (I&I) in the system," said Jerry Ihler, city engineer for Lawton, Okla. "I attribute that to the age of our system and deterioration of our concrete pipes over the years."

Long-range plans for Lawton include a treatment plant expansion. The current plant is rated at 20 million gallons per day and the city expects to double that capacity. Recognizing that the collection system affects the treatment facility, Lawton has undertaken a dynamic evaluation of the two systems together as part of the SSES.

"Based on the difference between those two, we can get a quantitative impression about how rainwater is affecting the collection system."

Byrd/Forbes Associates Inc. of Dallas, Texas, is the technical field services consultant, with CH2M Hill acting as the overall project coordinator.

The first leg of the survey, which has been completed, involved the flow monitoring of 38 key locations. For this phase, Byrd/Forbes installed 38 American Sigma 950AV area velocity flow meters.

The meters were used to monitor depth, velocity and flow to obtain quantifiable numbers for what Byrd/Forbes director of engineering Jim Forbes called "getting the heartbeat of the collection system. We want quantified dry weather and wet weather flows in the collection system.

"Based on the difference between those two, we can get a quantitative impression about how rainwater is affecting the collection system. We're probably going to find there are some portions of the collection system that have a bigger problem with rainwater getting

in, implying more defects in that portion of the collection system that will help us prioritize the follow-up activities."

Data collected during a 45-day period, which included five or six significant rainstorms, confirmed what Forbes had expected.

Lawton has three major drainage basins and the entire project will require about 500,000 feet of physical inspection and SSES work. The next stages include smoke testing the sewer lines, physical inspections of the 6,000 manholes in the system, an inventory of the specific types of material in the system and internal televised inspections of line segments identified as having obvious defects. Dyed-water flooding and other tests will also be performed.

As a result of the complete test procedures and subsequent reports, Lawton will identify defects in the system and set its capital expenditure priorities to improve or rehabilitate necessary sections.

The city will then eliminate sanitary sewer overflows and act in compliance with the EPA administrative order. EP

For more information, circle 269 on card.

What Do You Think?

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

High 270 **Medium 271** **Low 272**

Coming in May

You're invited to take a test drive on *EP*'s new home page.

Buckle your seatbelts and start your engines.

Cruise the information superhighway with us as *Environmental Protection* unveils its new home page on the Internet.

Drive down such main thoroughfares as "Editorial," "Advertisers" or "Day Timer."

Take a diversion down roads such as "EP Feedback" or "In the Lab."

Our May issue of *Environmental Protection* will not only give you directions and a road map on how to find us, but it will also give you directions about how to find related environmental home pages.

TECHNOLOGY PROFILE

Flow Meters

Measuring and monitoring liquid flow—whether in rivers, sewers or sludges— is vital. This profile highlights flow meters currently on the market.

Sigma 950 Ultrasonic Flow Meter

The Sigma 950 Ultrasonic Flow Meter is the only meter that also measures key water quality parameters. It has the ability to simultaneously monitor pH and dissolved oxygen and will consolidate equipment needs at treatment facilities. Offered with a 40 kHz sensor for general-purpose applications or a 75 kHz sensor for narrow beam applications, the multi-channel logging capability allows the option for monitoring parameters such as pH, temperature, dissolved oxygen, conductivity and rainfall. All the features of the Sigma 950 are easily upgraded, allowing operators to add additional monitoring capabilities as their requirements grow. **American Sigma.**
Circle 311 on card.

Electronic Flow Meter/Accumulator

Cole Parmer's new electronic flowmeter/accumulator features integral display with accumulation. A rotating turbine detector generates an electronic signal that is transformed into a six-digit readout. Compact and easy to operate, these meters are available in four different housing materials to accommodate even the most corrosive fluids. Meters are battery operated, have a 2,000-hour average life and are replaceable. Also available are optional nozzles, hose assemblies and calibration containers. **Cole Parmer.**
Circle 312 on card.

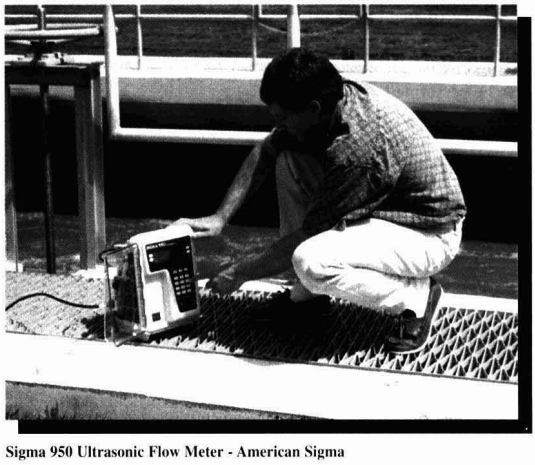
Flex-Valve 6000 Series

The versatile Flex-Valve 6000 series enclosed-type pinch valves from Flexible Valve Corp. handle a variety of environmental applications requiring flow control or shut-off of abrasive slurries, corrosive fluids, sludge and other flow media. The inert, elastomer sleeve spans the entire length of the valve and is the only part of the valve exposed to the corrosive line process. Suitable for adaption to virtually every type of actuator for on/off modulating service, the valves are available in standard and heavy-duty configurations for closing against high pressure lines. **Flexible Valve Corp.**
Circle 313 on card.

New Series 7000 Smartvalve

Chlorinators' new Series 7000 Smartvalve is a highly sophisti-

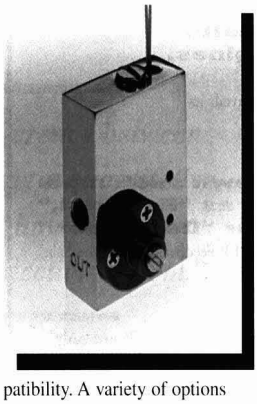
cated flow proportional control valve for use wherever chlorine or sulfur dioxide is needed to treat varying water flow rates. It can be factory-configured to operate in either flow-proportional or step-rate control mode. Features a unique "linearization" program in microcontroller to compensate for tolerance differences in valve plugs, rotameters and component parts. It can be operated in the field four ways: fully automatic, electric/manual and two methods of manual. **Chlorinators Inc.**
Circle 314 on card.



Sigma 950 Ultrasonic Flow Meter - American Sigma

Gases and Liquids Flow Meter

CTE's most versatile flow meter, the 125-BP, comes in various materials to improve media com-



patibility. A variety of options makes the unit functional in extreme situations, including higher pressures, higher temperatures and lower flows. It features a broad range of adjustability, compact size, high resolution, close on/off differential, and the ability to monitor both gases and liquids. The uni comes in brass, 316ss and Teflon. Maximum pressure is 3,000 PSIG for stainless and the port is 1/8-inch FNPT. Other uses include: nuclear waste facility gas-flow assurance, cooling water-flow detection, industrial gas lines flow sensing and biomedical media-flow verification. **CTE.**
Circle 315 on card.

Portable Digital Doppler Flow Meter

The new, lightweight, handheld digital Doppler flow meter is designed for temporary flow measurement applications such as flow surveys, leak or rupture detection, efficiency studies and check metering. Weighing only 26 ounces, the compact instrument features true digital signal processing (DSP) and a high-resolution, graphic display that provides excellent viewing visibility even in poorly lit conditions. **Polysonics.**
Circle 316 on card.

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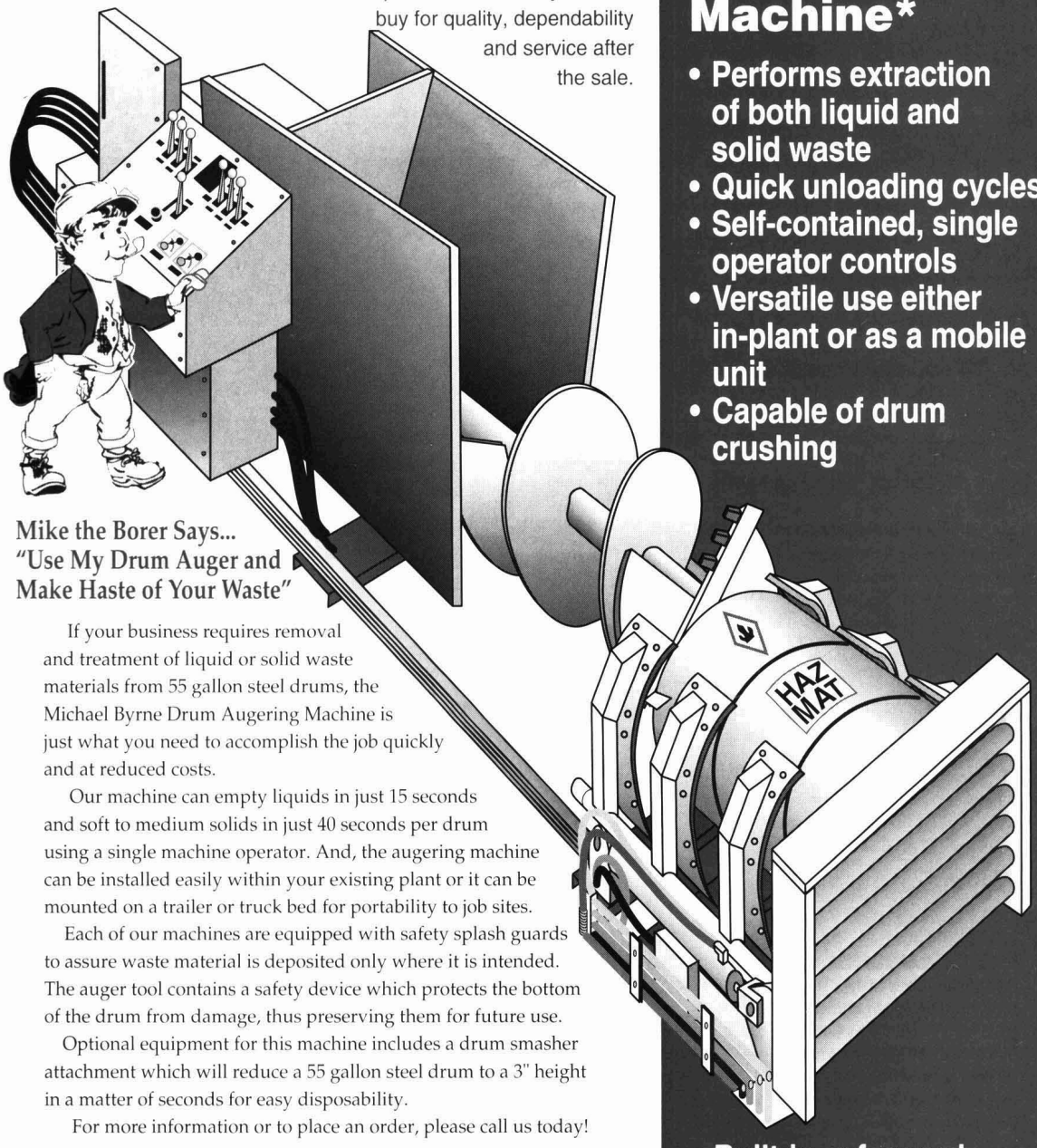

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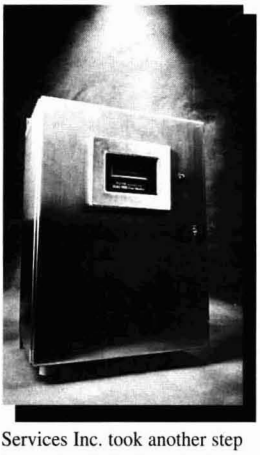
TECHNOLOGY PROFILE

Ultrasonic Compound Flow meter

The Badger Meter Series 5000 ultrasonic compound flow meter is the latest in flow measurement technology for partially filled pipes. The Series 5000 offers true chordal velocity measurements and couples this with ultrasonic depth of flow measurement, ensuring the most accurate open channel flow measurement system available. **Badger Meter Inc.**
Circle 317 on card.

Model 5600 Flow Monitor

Flow monitoring technology from ADS Environmental



Services Inc. took another step forward with the introduction of its Model 5600 Flow Monitor. The Model 5600 is being touted for both its accuracy and configuration ease. The product is designed to meet the requirements of standard- and custom-flow monitoring process. **ADS Environmental Services Inc.**
Circle 318 on card.

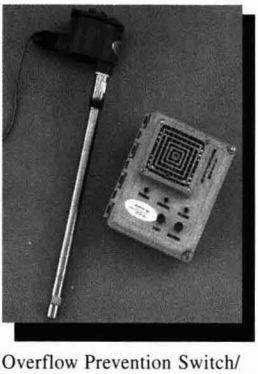
Dual-Range Micro Flow Sensor

The new SIGNET® 2000 Micro Flow Sensor is a precision flow transducer capable of measuring extremely low flow

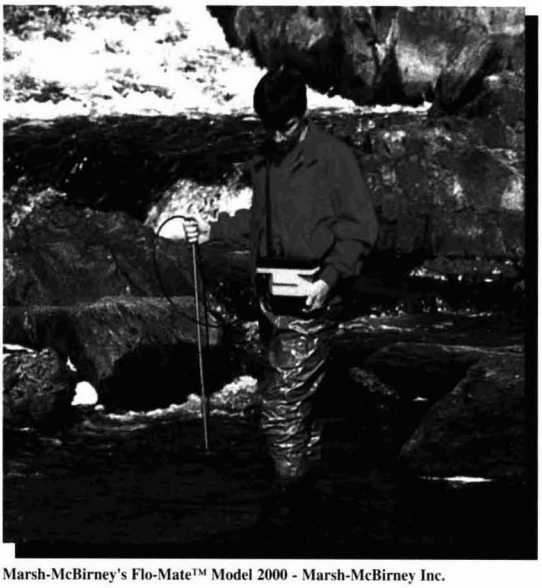
rates in industrial, commercial and laboratory applications. It supports measurements in both gpm and lpm with a linearity of 1.2 percent of full range and repeatability of ±0.5 percent of full range. **George Fischer Inc.**
Circle 319 on card.

Preventing Tank Fluid Overflow

New literature from Bernhard Inc. describes its Model 712



Overflow Prevention Switch/Alarm that monitors tank fluid levels and automatically shuts off flow in overfill situations. The 712 mounts on top of the tank and measures liquid levels with an ultrasonic probe. The device can be wired to instantly shut off flow when a high level condition is reached. At the same time, a loud horn sounds and a red indicator light shines. **Bernhard Inc.**
Circle 320 on card.



Marsh-McBirney's Flo-Mate™ Model 2000 - Marsh-McBirney Inc.

Teflon® Flo-Sensor

The Series 105 Teflon Flo-Sensor is designed for the measurement of low flow rates of low viscosity, aggressive chemical solutions and features dual output signals, 0-5 VDC and buffered 7.5 VDC pulse output signal linearly proportional to flow rate. Optional rate/totalizer panel meters are available. **McMillan Co.**
Circle 321 on card.

Portable, Open Channel Flow Meter

Marsh-McBirney's Flo-Mate™ Model 2000 flowmeter instantly provides accurate and dependable flow velocity measurements in rivers, streams, sewers and other open channel applications. It uses a solid-state electromagnetic sensor with no moving parts, so it is unaffected by chemicals and debris. The Model 2000 is capable of accurately registering velocity down to zero, and it offers a choice of data averaging capabilities, making it easy to meter turbulent or noisy flows. Several sensor styles are available for full-pipe and open-channel applications. **Marsh-McBirney Inc.**
Circle 322 on card.

Have Skimmer, Will Travel

An Ohio consulting firm found a portable belt skimmer to be an integral tool in cleaning up groundwater contaminated with hydrocarbons.

By Mark Steiner

Underground tank leaks and above-ground spills call for quick action once they are identified.

Often, a recovery well is a good interim tool to remove hydrocarbons from groundwater before full-blown remediation or a monitoring well is installed to assess the environmental impact of past events.

Regardless, skimming is an effective way to remove many hydrocarbons. Selecting the right skimming equipment configuration will help maximize product removal while minimizing problems, capital outlay and operating costs.

Chemviron Midwest, Inc., an environmental consulting and remediation firm in Wooster, Ohio, frequently needs to recover hydrocarbon products from groundwater. Typical situations include remedial studies, soil contamination, groundwater studies, environmental compliance, permitting applications and environmental site assessments during property transfers.

Because of the variety of situations encountered, the firm wanted a highly flexible recovery tool, preferably portable.

Chemviron Midwest Inc.

An Abanaki PetroXtractor and mounting stand being used for oil recovery at an Ohio service station site.

Skimmer Selection Criteria

The major selection criteria for skimmers that can be easily deployed include:

- Product removal rate
- Water table fluctuations
- Amount of water in skimmed product
- Environmental factors
- Power required for operation
- Portability
- Installation requirements
- Operating characteristics
- Convenience/flexibility features and options
- Reliability and maintenance

Passive methods: In earlier projects, Chemviron used manual bailing to recover hydrocarbon product. While the method was flexible and portable, it only recovered 25 percent to 50 percent of the product. Other types of passive skimmers use a fixed or floating intake with outlets connected to a sump for collecting the skimmed product.

With the proper design, skimmers have good recovery rates but usually recover less than a gallon a day of product. The major advantages, however, are they require no power and can be left unattended for days with adequate sump capacity.

Active pump systems: Several active systems are available with various types of electric and pneumatic pumps. The main attraction is relatively high removal rates and automatic controls for unattended operation. But damage can occur if they run dry or happen to ingest solid debris.

When the firm's consultants used skimming pumps, they typically found excessive water in the skimmed product, which required extra time and cost for disposal. Usually, recycling companies charge more

continued on page 32

Transforming an Ugly Duckling into a Handsome Swan

Harrison County, Iowa, took control of waste and turned an existing 'dump' into a state-of-the-art landfill.

By Karen Meinders

Today, $2.2 million will pay for 15 special edition Mercedes-Benz S600 coupes, 250,000 shares of IBM stock or 88 Iowa toxic cleanup days. Or, it will pay for the new Harrison County Landfill in Logan, Iowa. The two-year, $2.2 million project has changed the Harrison County Landfill from a substandard "dump" to a state-of-the-art landfill in a short time, according to Bruce Jones, solid waste manager for the landfill. Harrison County is located on the western border of Iowa. Logan is located 30 miles northeast of Council Bluffs and 20 miles east of the Missouri River.

The project included the closure of the existing landfill, construction of a small vehicle-transfer station and installation of a 12-foot-by-70-foot truck scale and scale house.

"Historically, the Harrison County Landfill has not been great on keeping up with regulations. Things just didn't get done when they should have. But now we are on the road to responsible waste management," said Jones.

Alternatives Examined

In the early 1990s, the Harrison County Landfill Commission (HCLC) recognized that the existing landfill facility was running out of space. The commission is comprised of representatives from each of the county's individual communities and from the Harrison County Board of Supervisors.

Coupled with the expectation of future regulations, the HCLC began to weigh the options. Before deciding to construct the new facility, several alternatives were considered, including combusting solid waste, upgrading the existing facility and transferring solid waste to a facility outside the county. With careful examination and advice from design engineers from Olsson & Associates of Lincoln, Neb., the HCLC voted to build a new landfill next to the old landfill on the existing property. It viewed a new landfill that exceeded current state regulations investment in the future, said Jones

Before deciding to construct the new facility, several alternatives were considered, including combusting solid waste, upgrading the existing facility and transferring solid waste to a facility outside the county.

Existing Landfill Closure

Before closing the old Harrison County Landfill, it was necessary to determine the limits of previously closed areas. Previous closure work was undocumented, and the limits for the closure area had not been clearly defined. To determine closure limits, a 100-foot square grid pattern was set up over the entire site. At each node of the grid, hand auger excavations were taken to a depth of 2 feet. If refuse was encountered above to the 2-foot depth, closure had not occurred.

The initial design of the closure cap was based on the Iowa Department of Natural Resources' (IDNR) standard: 2 feet of compacted clay with a permeability of no greater than $1x10^{-7}$ cubic meters per second and a 2-foot layer of vegetative cover. In addition, a geosynthetic clay liner was laid between the subbase and vegetative cover to ensure desired permeability.

Once the old facility was properly closed, opening the new facility began. The new facility site was located adjacent to the old landfill and had been previously used for quarrying operations. Building on the existing property allowed the permitting process to go quickly.

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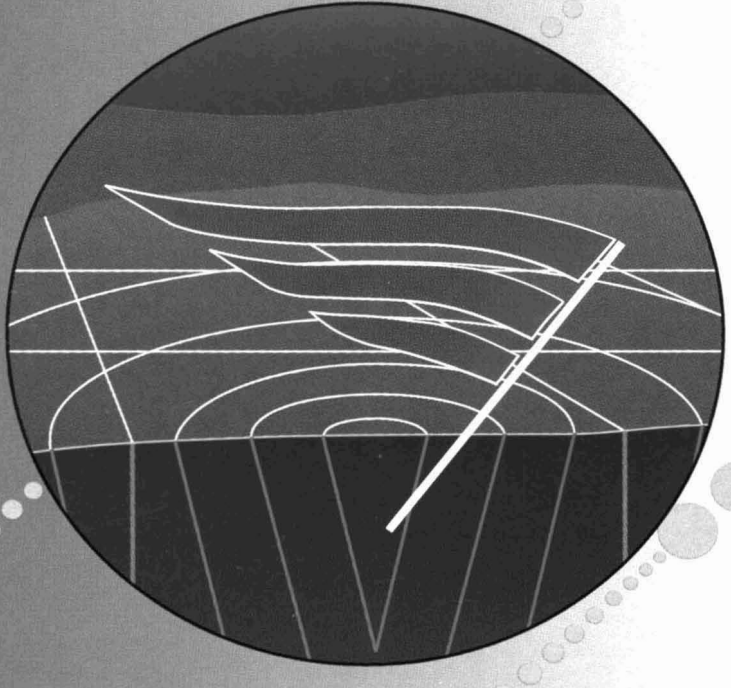

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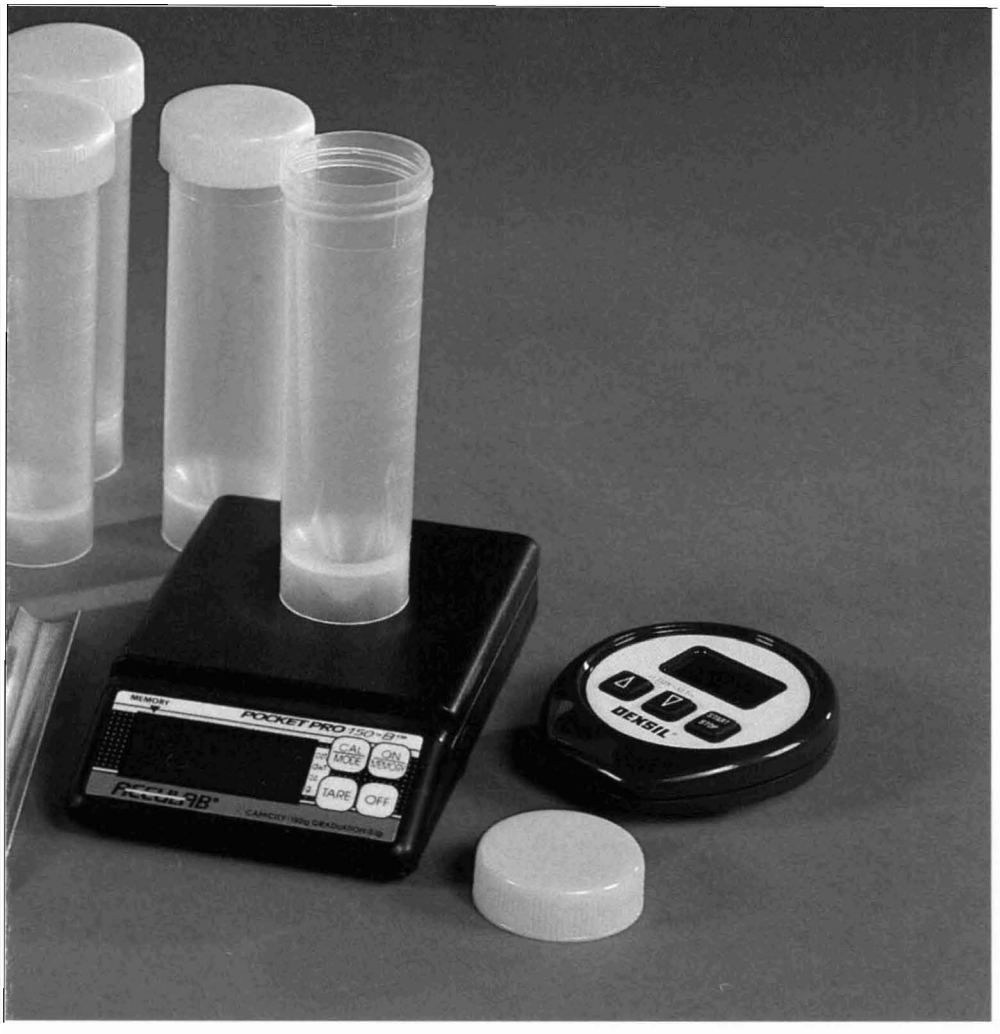

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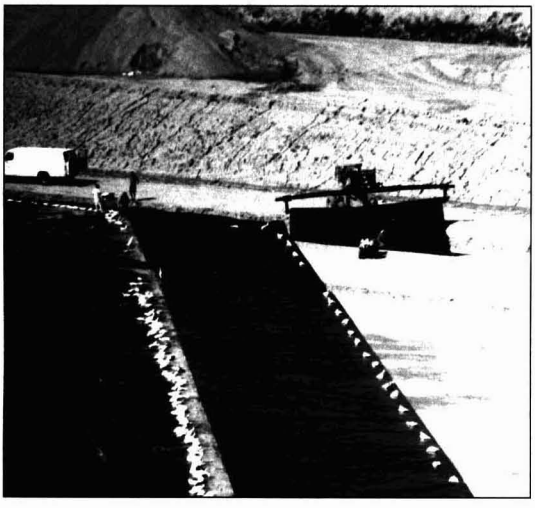

Bruce Jones, Harrison County Landfill

Above: *The new 60 mil HDPE liner is put down and then covered with soil.* **Right:** *Ground is prepared for the new landfill.*

"We were in a good situation financially and logistically because the property was already there. The IDNR was cooperative once we showed we wanted to get back on track. The permitting process went very smooth after we established our intentions," said Jones.

Liner Exceeded Regulations

A composite liner consisting of a 2-foot thick compacted soil subbase overlain with a 60-mil high-density polyethylene membrane was used in the new landfill's design. Above the membrane was a leachate system constructed of 12 inches of sand followed by geotextile filter fabric and a 9-inch-thick protective cover layer.

Leachate is removed from the sand drainage layer through two pipes that run the entire bottom of the facility in a north-south direction. In addition to exceeding current IDNR permeability specifications, the use of a composite liner was cost-effective, according to Jones.

Many landfills opt for a 4-foot compacted clay liner constructed from existing landfill materials. At the Harrison County Landfill, this design would have required adding costly bentonite to the soil to meet compaction standards.

Using the composite liner in place of a clay liner offered several advantages, said Jones. A computer model showed the composite liner allowed less leakage from the bottom of the landfill and occupied less space, allowing an additional 2 feet of refuse across the entire site. The landfill has an estimated life of more than 90 years.

Scale Facility and Transfer Station

At the new Harrison County Landfill, the scale facility serves as the central point in the control of the waste stream where the scale operator documents the incoming waste tonnage. As vehicles enter the site, the scale operator directs them to one of two locations, depending on the type of vehicle. Commercial vehicles are sent into the landfill for direct disposal. Small or other nonconventional vehicles are sent to the transfer station for disposal into a 40-cubic-yard roll-off box.

Leachate is removed from the sand drainage layer through two pipes that run the entire bottom of the facility in a north-south direction.

The watertight roll-off boxes hold all liquids and sludges so they can be examined for regulated or hazardous wastes. Although random load inspections are not a state requirement, future regulations may require them.

Primary features of the transfer station include a disposal bay, which can accommodate two 40-cubic-yard roll-off boxes or a single 100-cubic-yard transfer trailer. Approximately 14 feet of grade separation exists between the dumping level and transfer station floor.

Two trench drains collect runoff. The leachate flows to a 8,000-gallon concrete vault common to the landfill and transfer station.

"This landfill secures the solid-waste disposal needs of Harrison County for many years to come. This proves that even in a small rural county of 15,000, it can be done," said Jones. EP

Karen Meinders is an information specialist with the Iowa Department of Natural Resources' Waste Management Assistance Division, Des Moines, Iowa.

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Have Skimmer, Will Travel

continued from page 29

to dispose of product with high water content because they have to take extra steps to process the mixture.

Another drawback to suction skimmers is sediment or bacterial growth can clog intake filters or screens. Compared to passive systems and active belt skimmers, pumping systems are more difficult to install, and certain electrical codes or site permit requirements usually have to be met. The larger suction-type systems may require a well casing as large as 24 inches.

Active Belt Skimmers: The main advantages of belt skimmers are simplicity—in both installation and operation—reliability and relatively low phase-separated water ingestion. Depending on conditions, a belt skimmer can reduce hydrocarbons to no more than a sheen and lift skimmed material up to 100 feet or more without the a pump.

Selecting the right skimming equipment configuration will help maximize product removal while minimizing problems, capital outlay and operating costs.

Some units are light enough to be portable, and most can run unattended for prolonged periods. With the right belt material, motor and options, they can be used for almost any application. The electric or pneumatic motor belt-drive may require permitting and adherence to codes, depending on use.

With the skimmer's speed fixed at the appropriate rate, the belt width dictates the rate of product removal. In turn, the well casing diameter limits the belt width.

For example, a typical unit designed for a 6-inch diameter casing can remove about 12 gallons of SAE 30W oil per hour. Since most wells produce less than one gallon of product per hour, removal rate usually isn't an issue.

For Chemviron's use, a belt skimmer offered the best combination of features and performance. In April 1995, the company acquired a PetroXtractor™ active belt skimmer from Abanaki Corp. and has successfully used it at six different retail service station locations. Oil skimming has proven to be a cost-effective, easy-to-use technology applicable to a broad spectrum of hydrocarbon liquids in groundwater.

The firm is currently using the belt skimmer at a retail service station in the Cleveland, Ohio, area as an interim corrective action required by the State Fire Marshal's Office. In Ohio, the fire marshal oversees U.S. Environmental Protection Agency-mandated cleanup programs.

The station has a 1,000-gallon underground holding tank for used motor oil, and it isn't clear if it is leaking or nearby residents have dumped spent oil on the ground. Regardless, oil leaked into the backfill and soil surrounding the tank and is now showing up in the groundwater.

The firm used the belt skimmer to recover the oil, installing it in a 4-inch-diameter well casing also fitted with an integral screen to exclude larger-sized solid debris. About one to two gallons of oil per daily visit is being recovered.

The firm plans to use the belt skimmer to recover oil-based hydraulic fluids. The fluids, used in service station automotive lifts, have also been found in groundwater at some garage sites. The firm may use oil skimmers as a preemptive strategy to remove oil, grease, fuel and solvents from wastewater in the wash bay sumps of many automotive service shops.

With adequate hydrocarbon removal, the sump fluid may be allowed to drain into a municipal sanitary sewer system. Otherwise, skimming may be a crucial step in recycling the fluid. The latter option would eliminate the cost and liability of fluid disposal. EP

Mark Steiner is an environmental consultant with Chemviron Midwest Inc., Wooster, Ohio.

For information on the PetroXtractor™, circle 273 on card.

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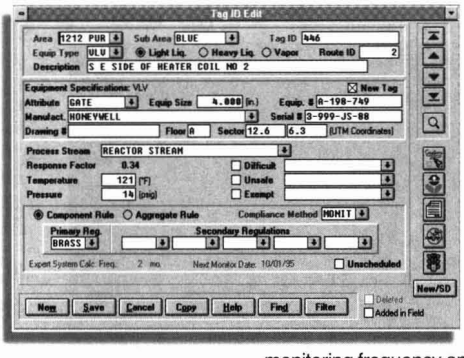

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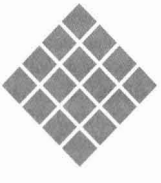

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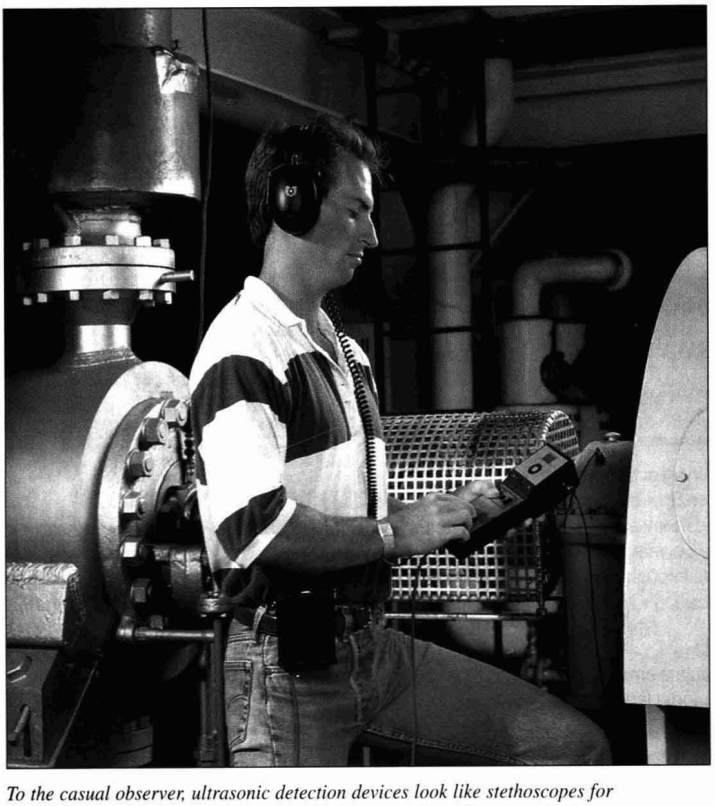

Photo Coutesy of SDT USA

To the casual observer, ultrasonic detection devices look like stethoscopes for heavy equipment, which allow the user to hear not a heartbeat but a leak.

An ultrasonic-detection device can locate air or liquid leaks frequently missed by the human eye and ear.

By Howard Malm and Fernando Halpern

Imagine a pinpoint leak allowing gallons of gasoline to leak unnoticed from an underground storage tank. Ultrasonic detection, which relies on ultrasonic waves from a variety of mechanical and electrical processes, can locate the problem before it becomes larger.

Ultrasonic detection relies on ultrasonic waves of more than 20 kilohertz and far too high pitched to be heard by humans. Ultrasonic-detection devices "hear" the waves and translate the vibrations into sound that can be heard through loudspeakers or headphones.

To the casual observer, the devices look like stethoscopes for heavy equipment that allow the user to hear leaks.

The standard "listening" package consists of a hand-held detection instrument, high-impedance headphones, a localization sound probe, ultrasound transmitter and precision contact probe.

An electronic circuit within the system converts the ultrasonic vibrations into the audible frequency heard through the headphones. Some ultrasonic-detection devices also provide a digital readout for quantifying the results.

How Ultrasonic Technology Works

When gas flows from high pressure to low pressure through a small hole, it generates turbulence and creates sound in the ultrasonic region, where the background from machinery noise is often small. Generally, the higher the decibel reading, the larger the leak. In the airborne detection mode, ultrasonic-detection units can detect gases with a pressure of 200 millibars or higher.

However, the relation between the leak size and ultrasonic intensity is nonlinear. That is because the detector response depends on several factors, including the distance from the leak, the gas volume of the leak, the gas velocity and the direction of the leak.

Even though the dependence is nonlinear, a simple calibration for typical measurement conditions can allow a user to estimate the size of the leak.

The ultrasonic response increases with pressure. The amount of ultrasonics measured also depends on distance—the noise gets larger the closer you are to the object being measured.

The ultrasonic intensity also may be smaller when the detector is in line with the leak compared to when the detector is 30 to 60 degrees off axis. Sometimes the variation can be more than 50 percent.

There is also a nonlinear relation between decibel reading and leak size. As

the size of the leaking hole becomes larger, the ultrasonic intensity also increases but in a nonlinear manner. To understand the measurement results, operators need to know the inherent nonlinearity of ultrasonic measurement. A simple calibration that considers use conditions can help estimate the leak size.

Ultrasonic Technology Use Grows

Though available for several years, ultrasonic technology use is becoming more widespread. With increased use and the availability of different sensors for different conditions, new applications are being discovered, including detecting hydrocarbon leaks from underground storage tanks.

In the past, quantified ultrasonic readings were recorded and charted by hand. But the cumbersome process is being replaced by devices that interface ultrasonic-detection units with computers for systematic data collection and trend analysis.

Many users initially purchased an ultrasonic-detection device for locating compressed air leaks, only to find it had other applications.

Ultrasonic technology is typically used to detect hazardous leaks in liquid or gaseous form, including hydrocarbons, such as gasoline, fuel oil, diesel oil and methane. The same sensors are used to detect both forms of leaks.

The technology has also proven successful in detecting industrial gas leaks, such as hydrogen and Freon.

Ultrasonic technology is employed worldwide by most major oil companies and firms involved in drilling, refining, transporting and storing hydrocarbons.

Tracking Down UST Leaks

Ultrasonic technology has proven to be an efficient and economical way to test single-wall underground storage tanks that hold hydrocarbons or other hazardous substances. The detection process involves several steps.

First, the product level and water level are measured in the tank, and the levels are marked. All outlets of the tank, such as vent pipes, pipes to the burner, flow meters and pumps, are closed and sealed. The filling pipe inlet remains open.

Using an adapter screwed on the filling pipe, one ultrasonic sensor is placed in the liquid and a second sensor is placed above the liquid. An extension piece may be required, depending on the depth of the manhole.

The vacuum pump on the tank is started and runs until a vacuum of 50 to 100 mbar is created before shutting it off.

With the hand-held ultrasonic detection unit on maximum amplification, the flexible sensor and headphone are connected to the unit. The sensor above the liquid is then connected to the hand-held unit. An ultrasonic signal indicates a leak above the liquid level.

When no signal is detected, the pump is started again and remains operating

Stalking Fugitive Emissions

Nowadays, facility managers are paying more attention to a problem that used to sneak past them—fugitive emissions. The leaks are small amounts of process gases or fluids, typically organic, that escape into the atmosphere through a number of mechanical routes.

Examples of fugitive emissions include chemical releases from pipes, valves, pumps, flanges, couplings, gaskets, hose connections and compressors. In addition, fugitive emissions can involve vapor emissions from loading and unloading storage tanks and cleaning and purging process tanks and containers. Another type of fugitive emission is fine particulate matter released from granular solid-material transfer points and storage piles.

Through regular leak inspections, plant management can reduce fugitive emissions and the loss of raw materials. Successfully detecting fugitive sources involves locating potential sources, collecting data and quantifying the emissions.

Another important reason why facilities should monitor fugitive emissions is to comply with environmental regulations. The U.S. Environmental Protection Agency requires certain types of industrial facilities to include fugitive emissions when they calculate total facility emissions. If an industrial facility's total hazardous air pollutant emissions exceed 10 tons per year for an individual HAP or 25 tons per year for more than one HAP, the facility is classified as a "major source" and is subject to facility-wide permitting requirements under the Clean Air Act.

A new approach to monitoring fugitive emissions is an integrated, leak detection, recording and reporting system, the Leak Tracker® System, developed by the Leaktracker Alliance. The system combines data collection, bar code and radio frequency tag identification, and gas detection.

The system is comprised of lightweight hardware that fits comfortably in a vest worn by a field technician. The technician uses the system's hand-held computer and lightweight, detachable reader/sniffer probe connected to the computer to take readings.

The technician scans the machine-readable bar codes or radio frequency identification tags that have been placed at potential fugitive emission sites. When the technician pulls the computer's trigger, it begins the tag location/equipment identification reading and generates an automatic recording of the time, date and location of each reading.

Basically, the reader/sniffer "sniffs" for emissions while the computer records data from the component.

When the technician finishes the day's readings, he or she electronically uploads the collected data to an end-user's mainframe or personal computer. The computer generates the reports automatically and no manual input is necessary, ensuring the integrity of the final reports.

The system is designed to interface with fugitive emissions data management software programs, such as Fugitive Emission Management Systems (F.E.M.S.) created by EnviroMetrics® Software Inc. The software program can calculate emissions for selected chemicals over a desired time period, set up automated scheduling for each component in a plant, and generate reports for submittal to state and federal agencies.

— Angela Neville

until a vacuum is created that is greater than the hydrostatic pressure of the liquid. The sensor that was placed in the liquid is connected to the hand-held unit. An ultrasonic signal indicates a leak at liquid level.

In testing storage tanks, different types of sounds are heard, such as bubbles, whistling, waterfall or the falling of ground. Through experience, each sound can be recognized to indicate the leak location in the tank.

Ultrasonic Advantages

Ultrasonic technology provides several advantages when testing underground storage tanks, including:

- The method ensures that fuel is not leaked into the ground during testing.
- The ultrasonic detection unit is not influenced by temperature, humidity or tank tilting.
- Testing is reliable on both empty and filled tanks, and minimal training is required to achieve reliable readings.
- Readings are not affected by ambient plant noise and the plant does not need to be shut down to take the measurements.
- Ultrasonic detectors are reliable in environments with more than 80 decibels of external noise.

There are other less tangible but equally valuable cost savings associated with ultrasonic detection because the devices are available with several types of sensors and signal transmitters.

Howard Malm is president of Carma Systems, Santa Rosa, Calif. Fernando Halpern is president of SDT USA, Port Moody, British Columbia, Canada. EP

For more information on Leak/Tracker, circle 280 on card.

For more information on F.E.M.S., circle 281 on card.

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Photo courtesy of Dames & Moore

Chipped tires comprised the underlying drainage layer of the cap.

Remediation in the Fast Lane

By Leonard Sarapas

Chipped tires and low-permeability silt helped put a Vermont landfill remediation project on the Superfund fast track.

With time of the essence, a group of New England consultants began remediating a contaminated Vermont landfill even before they'd received the go-ahead from state and federal regulators. The result was an exemplary project using innovative technology, such as recycled tires for a landfill cap, that became part of an Environmental Protection Agency Superfund fast-track program.

Disposal Specialists Inc., a Browning-Ferris affiliate, owned and operated a 17-acre site near Rockingham, Vt., from 1968 to 1991. During that time, the subsurface became contaminated with organic compounds and metals. Out of concern for contaminant migration toward the neighboring Connecticut River, the EPA placed the landfill on its National Priorities List in 1989. The move subjected the landfill to the provisions of the Comprehensive Environmental Response, Compensation and Liability Act—commonly known as Superfund—and the National Contingency Plan. Because Browning-Ferris had already begun closure with the Vermont Department of Environmental Conservation, the state retained jurisdiction.

Consultants from Dames & Moore were retained to assist with the cleanup. At the beginning, however, key federal and state

regulatory agencies said it would be at least two years before they would be able to review and approve remedial plans. Browning-Ferris could have delayed its response until the government provided the necessary approval and the project could have spanned 10 to 15 years, like many Superfund projects.

Instead, Browning-Ferris' Derrick Vallance decided to move forward and the firms successfully completed remediation in six years.

Fast Forward

Without an official mandate from regulators, Browning-Ferris assumed some risk by proceeding with remedial investigations and feasibility studies. Dames & Moore helped minimize the risk by ensuring each of the project phases met state and federal requirements and could ultimately become part of an approved plan. In October 1992, a consent order was issued so that representatives from the EPA and the state could become involved. By then, remedial investigations and feasibility studies were nearing completion.

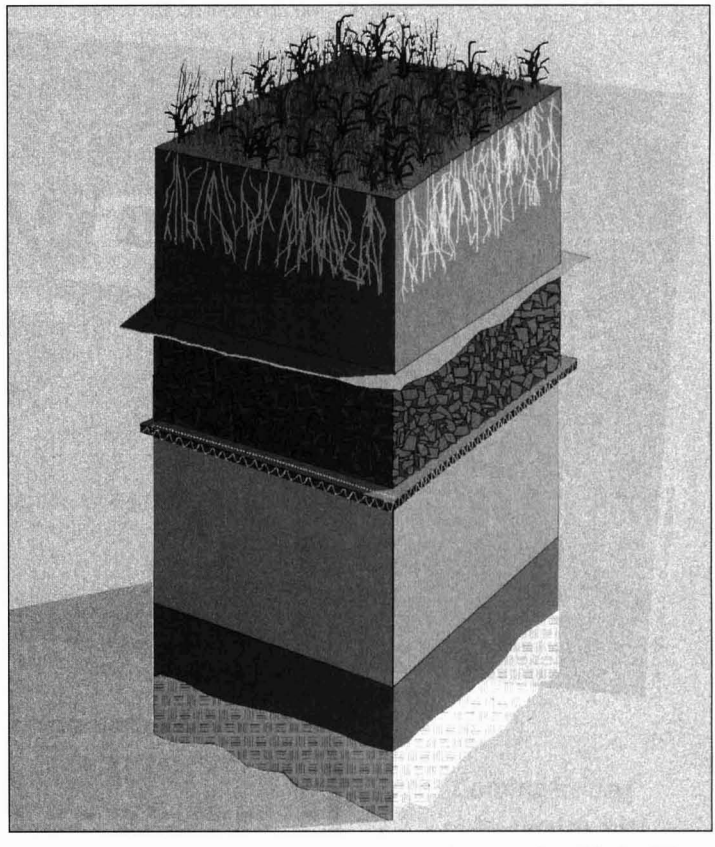
In response to progress made at the DSI site, the EPA selected Browning-Ferris for inclusion in its Superfund Accelerated Cleanup Method program. The ensuing work focused on intercepting contaminated groundwater and designing an effective landfill cap.

A 350-foot-long-by-30-foot-deep trench, designed and built in six months, captured contaminated groundwater and transported it to a treatment facility until contaminant levels were sufficiently reduced. The speedy completion of the trench addressed earlier concerns earlier and at a far lower cost than most Superfund programs.

Unconventional Cap Materials

Representatives from the two firms met with regulators to finalize the landfill-cap design, even though remedial investigations and feasibility studies were still underway. To meet federal requirements, they agreed the cap would include a surface vegetation layer, an underlying drainage layer, and a barrier layer consisting of a flexible-membrane liner and low-permeability soil.

For the drainage layer, they looked at the usual material—sand—as well as other alternatives. They discovered that used, chipped tires, due to local availability, could provide drainage and be installed at a lower cost than sand. To gain approval from regulators, the project team presented extensive documentation comparing the two drainage methods. Ultimately, the regulators agreed that chipped tires would comprise the drainage layer on an eight-acre portion of the cap, while sand would be used on the remaining nine acres.



A cross section of the landfill cap.

Two years of monitoring indicate that both materials are performing as expected. An innovative material was also used for the barrier layer. The conventional medium, clay, is rare in the Northeast, and subsurface freezing and thawing limits its effectiveness. But low-permeability silt was locally available.

To test the performance of a silt barrier, studies to assess freeze-thaw effects were conducted at a U.S. Army cold regions research and engineering laboratory. Based on the test results, the team received approval to use silt.

The landfill cap was designed and approved by the EPA in only 10 months. Construction began in June 1994 and finished in August 1995. Based on the operation of the drainage trench, completion of the cap and review of a groundwater contaminant attenuation model developed for the site, regulators selected natural attenuation and monitoring as the preferred future remedy. This solution eliminated the need for costly groundwater extraction and treatment.

By moving forward with the project and using innovative technology, BFI was able to save at least 15 percent of the costs normally required for reporting, dealing with agencies and retaining legal counsel. EP

Leonard Sarapas, project lead consultant, is with Dames & Moore's Salem, N.H., office.

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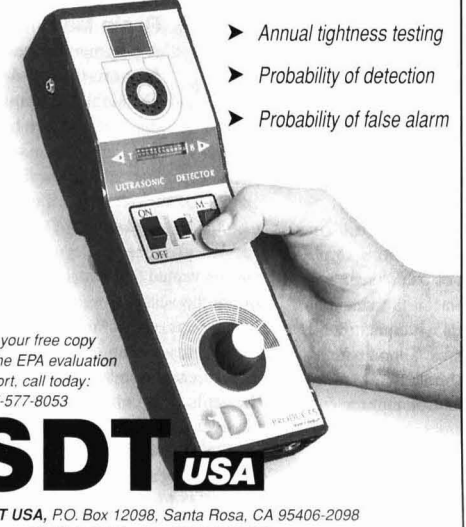

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A Happy Ending in the Fight Against HAPs

A manufacturer complies with MACT standards by choosing an innovative approach to controlling hazardous air pollutants.

By John J. Sudnick

Many factors are changing the way America and the world do business. The transformation to a global market place, the increased struggle for market share, and the need to do it better, cheaper and faster have all taken their toll on industry's "standard operating procedure."

The way companies manage environmental issues has not been immune to changes, either. Reactive compliance to violations or regulatory deadlines is becoming a thing of the past.

This is not to say that protecting the environment is no longer a concern. On the contrary, companies have begun incorporating environmental management into their long-range planning for growth and profitability.

Opportunities to combine environmental compliance requirements with optimizing a manufacturing process exist in every plant. In fact, the need to comply with an environmental regulation can provide the impetus to improve the process and its profitability through waste reduction, energy and raw materials recycling, and eliminating or reducing end-of-the-pipe controls.

The Clean Air Act

One goal of the Clean Air Act Amendments of 1990 is to reduce hazardous air pollutant (HAP) emissions into the atmosphere. The 1970 national emission standards for hazardous air pollutants (NESHAPs) program failed primarily because there was no definitive limit on HAP emissions. The NESHAPs program defined emission limits as those amounts that provided an ample margin of safety to protect public health.

The decision on what option to use would be determined based on economic considerations as well as compatibility with the plant's operating philosophy and the ease or difficulty in permitting the equipment.

The 1990 CAAA replaced the nebulous 1970 risk-based standards with quantifiable technology-based standards. The maximum achievable control technology (MACT) standards set emission-control requirements for HAPs emitted from a source, thereby giving industry a clear target.

Title III has targeted 174 industrial categories, which produce and emit HAPs from manufacturing processes. The Environmental Protection Agency is currently developing MACT standards and 14 are in place, with the remainder scheduled to be rolled out over the next six to seven years. MACT standards not only specify emission limits, but they also recommend control methods.

The methods typically involve using a control, such as a water scrubber or thermal oxidizer. The basic requirement of the regulation, however, requires the standard be met, providing industry with flexibility in how it complies.

Polymer and Resin Manufacturer

A polymer and resins manufacturer uses and produces chemical compounds that make it subject to Title III and compliance with MACT standards. One stage of manufacturing occurs in pressurized reactor vessels. The reaction produces gases and vapors that must be vented to maintain a constant pressure in the vessel.

The vents, consisting primarily of water vapor, are contaminated with volatile organic compounds (VOCs) and HAPs. The vents were condensed and collected in a condensate tank. A portion of the condensate was fed back into the reactor, with the remainder going to wastewater treatment. (**See Figure 1.**)

A substantial amount of VOCs and

HAPs were volatilized in the wastewater treatment tanks. Emission control was required to comply with applicable regulations. The MACT standard recommends thermal or catalytic oxidation to control the emission. The company initially investigated thermal oxidation equipment to destroy the aqueous stream which was discharged to the wastewater treatment plant.

But the results were not encouraging. The costs of the equipment and operation were extremely high. The liquid also could potentially be considered a hazardous waste, which would require that the disposal system be permitted as a hazardous-waste incinerator.

Alternatives

As a first step, the plant organized a team comprised of the area project engineer, equipment operators, environmental manager and production manager to define and evaluate the problem.

In addition to technical and operational issues, the team considered the cost of equipment, installation, operations and maintenance.

The result was a list of ideas from which the following were deemed the best:

1. Provide an enclosure for the wastewater tanks and other sources of fugitive emissions in the wastewater system. Operate the enclosure at a negative pressure and treat the exhaust from the enclosure to remove or destroy the contaminants.

2. Install a distillation column and thermal oxidizer to remove the VOCs and HAPs from the wastewater discharge and oxidize them.

3. Pipe the vents from the reactors, prior to condensation, to existing utility combustion equipment at the facility.

The first option did not involve any process changes. It used capture-and-control equipment to comply with the standard. The second option added a process—distillation—in conjunction with control equipment. The third option modified the process and used existing facility equipment as a control device.

All three options would satisfy the MACT requirement. The decision on what option to use was based on economics as well as compatibility with the plant's operating philosophy and the ease of permitting the equipment. Economically, option three was the winner. Option three also had other benefits (See **Figure 2**), including requiring no new equipment, reducing the load on the wastewater treatment plant and a simplified permitting process.

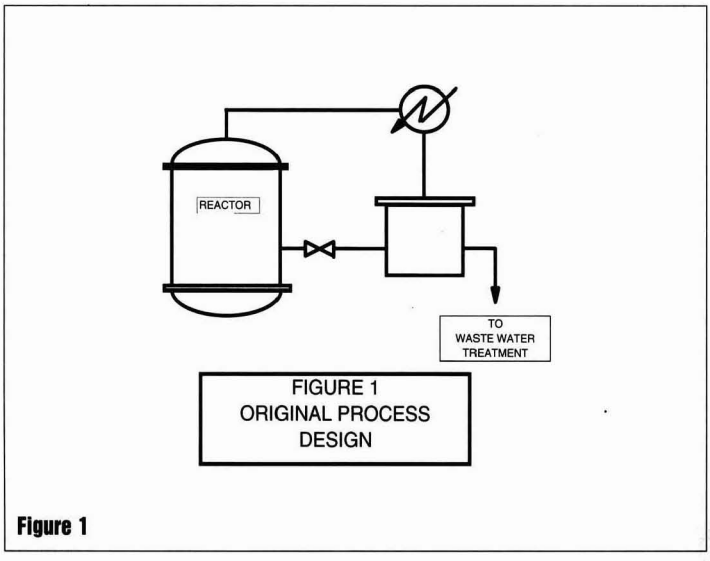

Figure 1

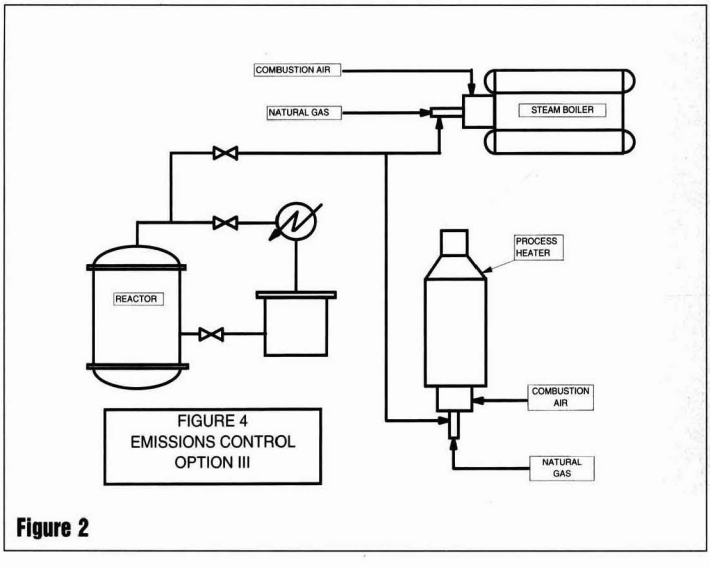

Figure 2

The burner also anticipated a reduction in nitrogen oxide generation with the introduction of water vapor into the burners. Tests would be conducted before and after the installation of the vapor injection system to determine the reduction. The facility could then credit the reductions for future combustion equipment permits.

The company could have chosen the most obvious and immediate solution to the problem—thermal oxidation of the liquid effluent. Instead, it pursued a course of investigation, innovation and change. The final outcome satisfied not only the regulatory obligation but also provided economic and operational benefits to the company. EP

John J. Sudnick is director of the Air Quality Management Division at Ekenfelder Inc., Greenville, S.C.

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High 290 Medium 291 Low 292

Covering All the Bases

A new technology cleans up a 50-year-old "soup" of volatile organic compounds at McClellan Air Force Base in Sacramento, Calif.

By Richard F. Reimers and Micheal P. Gross

Photo courtesy of ENV America Inc.

Interior view of SDP system trailer showing two plasma reactors and computer monitoring and control systems.

Under its Innovative Remediation Technology Program, the U. S. Air Force has been testing and evaluating new technologies that may assist base cleanup around the country. Silent discharge plasma technology (SDPT), developed by Los Alamos National Laboratory and licensed to High Mesa Technologies, LLC., has been successful in treating volatile organic compounds (VOCs) during a two-month test at McClellan Air Force Base.

But SDPT applications don't stop there. The process is ideally suited for the petroleum, chemical, electronics, water and wastewater treatment, and air pollution-control industries. In the first-stage configuration used at McClellan, SDPT was used to treat off gases from air strippers, vapor-extraction systems and incinerators. Treatment of hydrocarbon vapors from tank degassing at petroleum terminals is another application.

By adding a packed-bed reactor to the first stage system, SDPT can treat organic liquids, such as water-based sludges laden with VOCs. The packed-bed reactor atomizes the liquid into a gas that is treated by the SDP system. Industrial smoke-stack emissions also can be treated in a turnkey installation adapting existing manufacturing processes for industries, ranging from painting and textiles to munitions and dry cleaning.

Historical Air Force operations at McClellan Air Force Base near Sacremento, Calif., have significantly impacted soil and groundwater beneath the base. "The McClellan test site soup is one of the nastiest you'll ever find," said Dr. Louis Rosocha, principal investigator for Los Alamos National Laboratory. "We were really challenged by this test, because up to now, our tests on SDPT have been mostly conducted in a laboratory under carefully controlled conditions or at other DOE (Department of Energy) test sites under much lower flow rates and concentrations."

The "soup" consists of spent solvents and waste fuel deposited in a landfill from 1940 until about 1981. About 41,000 cubic yards of soil are contaminated with trichloroethene; 1,1,1-trichloroethane; tetrachloroethene; benzene; toluene; ethylbenzene; xylenes; Freon; methylene chloride and acetone, among others. Total influent VOC concentrations from the test site are currently 1,000 parts per million by volume (ppmv).

continued on page 52

EP Exclusive

Corbus Introduces a Cutting-Edge MSDS Software Package

Corbus, a leader in safety and environmental compliance software—including all SARA Title III reports and highlighting Spill Reports, Tier II and Form R—announces a cutting-edge, electronic way to accommodate material safety data sheets (MSDSs) right at your computer, reducing time, cost and paperwork involved in MSDS management. Using Corbus' MSDS BASIC software, an electronic receipt of the MSDS is accomplished using databases including the Chemical Manufacturer's Association, the Internet and Corbus' MSDS Network. The databases act as a nationwide clearinghouse for the electronic transmission, distribution and reception of MSDSs between chemical suppliers and end users. This new way of handling MSDSs not only eliminates the manual entry of the original MSDS and update, but automatically organizes and updates each of the MSDS databases. Secured access allows only authorized personnel to receive the MSDSs. MSDS BASIC software saves time, postage and allows fast access in an emergency. **Corbus.**

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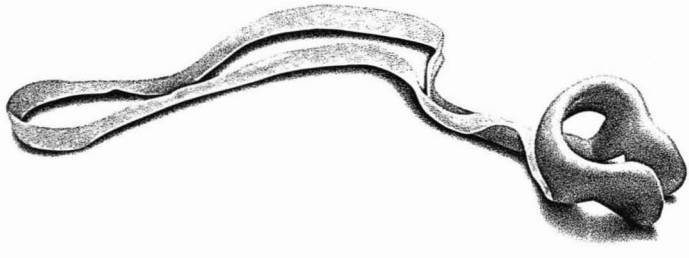

Odor control this simple and inexpensive. But much more effective.

In the past people may have plugged their noses to the problem of odor control. But today Odor Management, Inc. offers a solution proven effective in neutralizing both organic and inorganic odors — without complex technologies or expensive price tags.

ECOSORB® Natural Organic Odor Neutralizer is a combination of natural, non-toxic essential oils that does more than merely mask unpleasant odors. ECOSORB has been proven to actually break down and eliminate hydrogen sulfide, a potentially toxic gas which is one of the most common causes of malodor.

ECOSORB is so effective it can replace scrubbers and other more elaborate odor control equipment. Where scrubbers are necessary, ECOSORB can be used as a safe, effective odor control substitute for potentially hazardous sodium hypochlorite, caustic or blended solutions.

Simple, easy-to-install ECOSORB dispersal systems integrate easily with existing plant equipment and require little of the capital outlay and maintenance of other odor control systems. Because ECOSORB is very highly concentrated, it can be water-diluted to a greater degree than any other odor neutralizer. This uses less product — and saves additionally on reorder costs.

ECOSORB is a broad spectrum odor neutralizer which can be used in a variety of settings including wastewater treatment plants, processing plants, landfills, dumps, and industrial plants of all kinds. For more information on how ECOSORB can work to eliminate your odor problems, call or write Odor Management, Inc. for a free brochure.

odor management inc.

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Golden Valley, MN 55422
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1-800-998-ODOR

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PRODUCTS & SERVICES

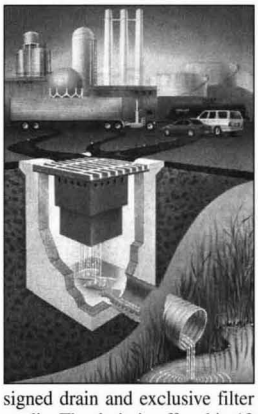
Air Modeling Dispersion Software

Scientists, engineers and consultants using PC-based air dispersion modeling software may need to allow more time to run the EPA's recently updated ISC models. Changes in area source algorithms between the ISCST3 and ISCST2 programs have contributed to increased processing times. Memory requirements have also increased in ISCST3. It takes more free RAM to make the same runs as in ISCST2. The BEE-Line ISCST3 version has special routines that reduce the amount of memory required. **BEE-Line Software.**

Circle 146 on card.

Storm Drain Filter

The Hydro-Kleen storm drain filter is a simple and sound method of eliminating the most toxic substances from storm and industrial wastewater. It is a combination of a specially de-



signed drain and exclusive filter media. The drain is offered in 12 standard sizes and can also be custom designed. It can also solve site-specific contamination problems. **Bamcon Engineering Inc.**

Circle 147 on card.

Soil Remediation

Brown Bear Corp. provides a variety of equipment for soil aer-

ation and remediation. The unique hydrostatic aerator is well-suited for performing bioremedition in either excavated or in-situ operations. The aerator moves material from the bottom up, which provides excellent homogenous mixing and distribution of organisms throughout the material. A liquid spray system is available for application of nutrients, innoculents, odor-control medium and others. **Brown Bear Corp.**

Circle 148 on card.

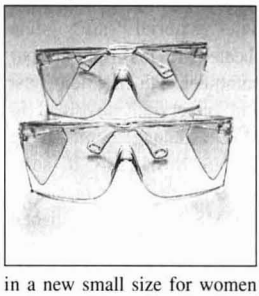
Carbon Detection

The new GD-444 personal pocket-size carbon dioxide analyzer uses the latest miniature non-dispersive infrared technology to pack precision analysis into an instrument that fits in the palm of your hand. Weighing only 15 ounces, the GD-444 includes a built-in datalogger, internal sample pump, adjustable audible alarm, belt clip and recorder and computer outputs. **CEA Instruments.**

Circle 149 on card.

Safety Eyewear

AOSafety Tour-Guard III protective eyewear is now available



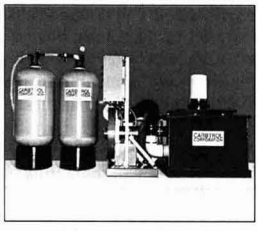
in a new small size for women and men with smaller faces. The new size also fits over smaller,

more contemporary protection glasses. The lightweight, wrap-around spectacle is made from high-impact, optical-grade polycarbonate, and absorbs 99 percent of ultraviolet radiation. **Cabot Safety Corp.**

Circle 150 on card.

Water Treatment

CARBTROL Corp. announces its new Water Treatment Division



to provide systems for the treatment and recycle of industrial process wastewater. Oils, solids, heavy metals and organics are removed and the treated water is suitable for reuse in the manufacturing process. Each treatment module is pre-piped and wired for easy installation. **CARBTROL Corp.**

Circle 151 on card.

New Brochure Describes Safety

The REGAL direct-mounted, all-vacuum chlorinator manu-

factured by Chlorinators Inc. is one of the safest, most reliable and most economical on the market. The new revised version of Bulletin 901 explains why. The brochure details how safety is designed and built into the REGAL, starting with the heavy-duty mounting yoke and extending throughout the entire system. **Chlorinators Inc.**

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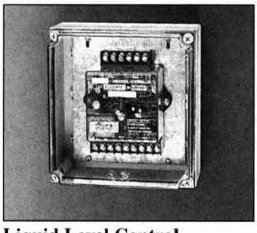


Liquid Level Control

The new Optical-Electronic Level Control System (43200 series) optically measures and controls liquid level and is ideal for leak detection in secondary containment systems. The adjustable 1 to 60 second time delay compensates for tank turbulence and prevents rapid load cycling. Fail-safe mode protects valuable equipment from damage. **Cole Parmer.**

Circle 153 on card.

Audit Software

Dakota Auditor for Windows™ allows companies to efficiently determine regulatory applicability, audit for compliance with environmental, health and safety regulations, and do regulatory research and management training. Dakota Auditor is available in 13 modules covering EPA, OSHA and DOT regulations. **Dakota Software Corp.**

Circle 154 on card.

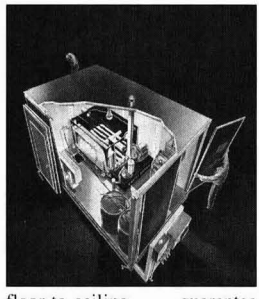
Inertial Filter

Sampling gaseous mixtures from stacks and sources containing high levels of particulate matter is possible with the new Model IF/OOS sampler. The sampler consists of the EPM Out of Stack dilution probe with an inertial filter mounted in a NEMA 4 heated enclosure. **EPM Environmental.**

Circle 155 on card.

Engineered for UPTIME

Ejector Systems does it your way. With a broad line of ESI-designed and built process equipment available for your groundwater remediation needs, you can be equally at ease buying components or packages. Elimination of the middleman allows ESI to furnish the package option for no more than the additional cost of enclosure, piping and wiring. The result is a

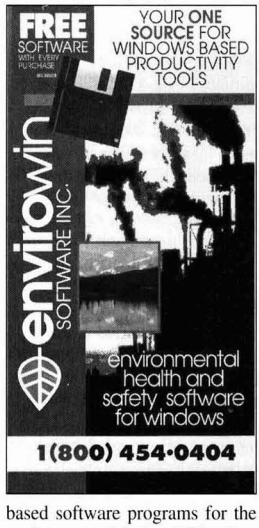


floor-to-ceiling guarantee whether its vent/sparge, pump-and-treat or some other choice from more than 300 combinations waiting to be custom-designed for your specific need. **Ejector Systems Inc.**

Circle 156 on card.

Software Catalog

Now there is one source for more than 230 quality Windows-



based software programs for the environmental, industrial hygiene and safety markets. The latest EnviroWin Software Catalog features the best in software productivity tools designed for environmental, health and safety professionals to meet the specific needs of their fields. The catalog is free to qualified subscribers and includes an offer for free software with every purchase. **EnviroWin Software Inc.**

Circle 157 on card.

Foot Valves

The new Enviro-Check® series is designed to comply with the most stringent of the

proposed EPA guidelines for reduced lead content. The new patented material formulation greatly reduces lead content without comprising the strength of the valve. The unleaded foot valve series 302E features NSF-approved epoxy-coated cast iron body with Enviro-Check poppet. **Flomatic.**

Circle 158 on card.

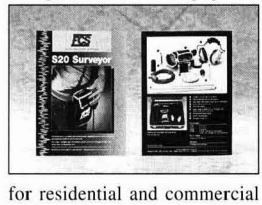
Refrigerant Tracking Software

The newest Version 2.0 of Refrigerant Compliance Monitor™ allows control of inventories and service practices to ensure an adequate supply of refrigerant for the life of the appliance. The new version includes several new features for tracking and controlling inventories as well as meeting EPA's record-keeping requirements. **Environmental Support Solutions.**

Circle 159 on card.

Leak Detection Brochure

A new full-color brochure featuring leak detection equipment



for residential and commercial applications is now available. The literature outlines features and benefits of the portable S20 Surveyor unit and tells how to accurately pinpoint leaks and avoid "dry holes." **Fluid Conservation Systems Inc.**

Circle 160 on card.

Fugitive Emissions

The TVA-1000 FE (Toxic Vapor Analyzer) is the latest member of the LeakTracker family of products and makes the monitoring of fugitive emis-

sions easier and more efficeint. It meets EPA monitoring specifications and includes gas detection, on-board datalogging and integral bar-code scanning capabilities. The TVA-1000FE can be used with any standard tagging system, including bar-codes, with the scanner accessory. **The Foxboro Company.**

Circle 161 on card.

The Dimminutor

The Dimminutor™ reduces oversized solids in wastewater

streams to enhance downstream processes and improve pumping. Three rotary and stationary cutters intermesh closely, cutting and shearing solids to a size small enough to pass through the slots of a special semi-circular screen. By rotating 360 degrees this unit cuts round objects as well as rags and plastics. **Franklin Miller.**

Circle 162 on card.

Brand Name Products

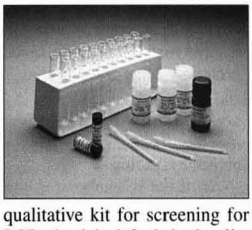
TEAMWORX™ outfits your work team in high fashion while

letting you avoid many of the hassles and expenses of in-house development. The line features brand name products decorated to add identity and reward to your initiatives and programs, including ISO 14000. Products can be customized and personalized for an additional charge. **Futrell & Assoc.**

Circle 163 on card.

PCB in Oil Test Kit

The new EnviroGard PCB in Oil Test Kit is a qualitative/semi-



qualitative kit for screening for PCBs in deisel fuel, hydraulic, transformer, waste and other petroleum-based oils in only 20 minutes. The kit indicates the presence of PCBs at 5 ppm and 50 pm levels. Antibody-coated tubes make the enzyme immunoassay fast and simple to run without special training. **Millipore.**

Circle 164 on card.

Multi-port Valve

The HA162 series is a line of soft-seated multi-valve manifolds that are used for the distribution of plant air, instrument air and purge gases. The HA162 incorporates up to 12 shutoff valves into one integral valve assembly to provide a gas/air source for up to 12 work stations. For varying service conditions, a selection of packing and seat materials are offered. **Hex Valve Division of Richards Industries.**

Circle 165 on card.

Containment Feed Systems

Containment Feed Systems allow the feeding of chemicals from a poly tank while providing an added degree of security for containing any leaks or spills. Spilled chemical can be reclaimed and housekeeping is improved. The systems are complete packages including all necessary suction tubing, valves,

strainers and optional foot valve. **Neptune Chemical Pump Co.**

Circle 166 on card.

HazMat Shipper

Using a mouse and a personal computer, distribution managers and shippers can now immediately verify DOT requirements for the transportation of hazardous materials right on the shipping dock. The HazMat Shipper allows subscribers to verify shipping names, labels and special provisions just minutes before the material is shipped. **IHS Regulatory Products.**

Circle 167 on card.

Leak Detection

The PAL-AT Leak Detection and Location System pinpoints and monitors water and/or hydrocarbon leaks in computer rooms, jet fuel systems, tank farms, clean rooms and other sensitive work areas. It can monitor up to eight sensing zones, each having up to 5,000 feet of sensor cable. The TankWatch unit can sense organic liquids and water within seconds of contact and monitors sumps, storage tanks and groundwater. The FluidWatch unit monitors small areas for water leaks. Typical applications for FluidWatch include unmanned equipment rooms, small raised floor areas and small tanks. **PermAlert.**

Circle 168 on card.

HazMat Management Solutions

A new 16-page guide to the management of hazardous materials is filled with market-driven product solutions for the safe management of both flammable and non-flammable hazardous materials. Included are product specifications and examples of how this equipment can be used

to comply with regulations and provide a safe operating environment for your business. **Justrite Manufacturing Co.**

Circle 169 on card.

Dry Filter Cakes

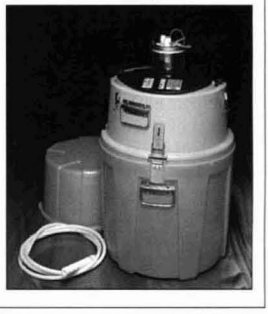
Larox pressure technology produces up to 94 percent dry filter cakes in some applications without the need for additional

drying and processing. The filters are used worldwide to dewater a variety of process and effluent slurries. Cake discharge is 100 percent and optional cake washing is 99 percent efficient. **Larox Inc.**

Circle 170 on card.

Vacuum Pump Samplers

A line of portable and stationary samplers is available that features high performance



vacuum pumps to draw measured samplers. The pumps allow for higher sample transport velocity, which provides a more representative sample. **Manning Samplers.**

Circle 171 on card.

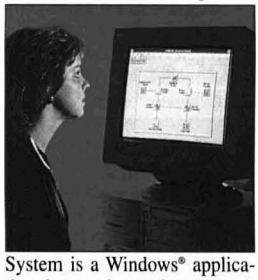
Compressed Air Vacuums

The new 705 Series Air Vacuums use compressed air and the venturi principle to create a vacuum of high flow and high static lift. The vacuums are capable of lifting or moving an extensive variety of solid or liquid material. Most Air Vacs offer a selection of models and sizes for specific applications. **Minuteman.**

Circle 172 on card.

Management Software

Version 3.0 of Linden™ Environmental Management



System is a Windows® application that can be used on a stand-alone PC or on a client/server network. Version 3.0 includes all previous hazardous materials, MSDS, emissions and waste management features, while adding expanded reporting capabilities and new MSDS image viewing capabilities. **Modern Technologies.**

Circle 173 on card.

Half-Mask Respirator

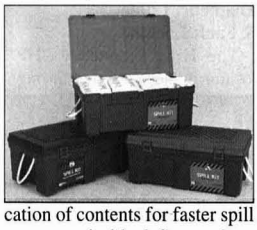
The 8800 Series HEPA Disks use a new technology to reduce

the weight of HEPA filters for industrial respirators. The result is a half mask respirator that weighs less for higher user acceptance. The disks can be stand-alone or piggybacked with gas/vapor cartridges. Its low profile provides a larger field of vision than other half masks and makes safety eye wear more comfortable. **Moldex.**

Circle 174 on card.

Color-Coded Spill Kits

Color-coded spill kits, specifically designed for easy identifi-

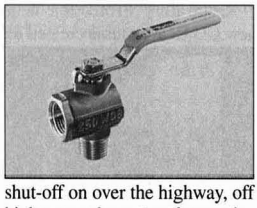


cation of contents for faster spill response, is ideal for workers who must respond quickly in emergency response situations. The kits come with lids and spill kit labels color-coded to match the absorbents inside. Each kit carries enough absorbents to respond to spills of up to 19 gallons. **New Pig.**

Circle 175 on card.

Brass Ball Valve

The Parker 90 degree ball valve is for quarter-turn fuel line

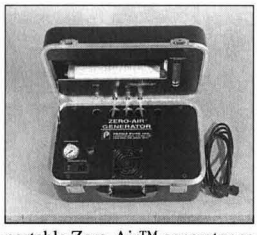


shut-off on over the highway, off highway and construction equipment vehicles, as well as water and air service lines on capital equipment. It features a forged brass body for extended life service and resistance to failure caused by severe temperature applications. **Parker Hannifin Corp.**

Circle 176 on card.

Portable Generator

Bring "zero" air to the point of use without handling bulky and hazardous compressed gas cylinders. Perma Pure® now offers a

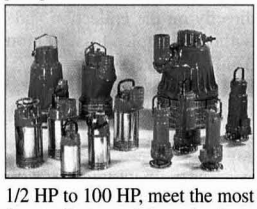


portable Zero-Air™ generator as an inexpensive supply of instrument-quality air for field applications. The unit supplies up to 20 liters per minute of purified air with just the flip of a switch. **Perma Pure Inc.**

Circle 177 on card.

Drainage Pumps

Portable Pumpex submersible pumps, available in sizes from



1/2 HP to 100 HP, meet the most demanding conditions for handling 24 hours a day in dewatering applications. The stainless steel casings provide great durability and strength, with anti-corrosion protection. The pumps convert easily between normal-, high- and low-head versions as operating conditions change. **Pumpex Inc.**

Circle 178 on card.

UL Listing

RGF O^3 Systems Inc., a member of RGF Environmental Group is pround to announce that all models of the TURBO-HYDROZONE® line of ozone generators have passed stringent testing and evaluation by Underwriter Laboratories and are now UL listed. The TUR-

BOHYDROZONE line consists of ozone generators for water that reduce or eliminate bacteria, algae, chemical oxygen demand and color among other waterborne substances. **RGF.**

Circle 179 on card.

Vial Crusher

The VYLEATER Vial Crusher is used in the safe disposal of

off-spec, expired or rejected products. Originally designed to crush small cylindrically shaped glass or plastic research containers, it is also suited for the destruction of pharmaceutical, industrial and chemical bottled products no longer suitable for use. **S&G Enterprises.**

Circle 180 on card.

Chlorine Gas Detection

Sensidyne Inc. introduces a new chlorine gas detection

system designed specifically for general purpose applications. The new transmitter provides a measuring range of 1-10 ppm for use within chemical plants, pulp and paper plants, research and development labs, refineries and other applications. **Sensidyne Inc.**

Circle 181 on card.

PRODUCTS & SERVICES

Tank Mounted Compressed Air System

A new compressed air system by Saylor-Beall is offered in a complete tank-mounted and piped package that saves floor space. The two-stage reciprocating air compressor is cast iron, a key element in building rugged systems for high-efficiency and easy service. Models are available from 1.5 HP to 30HP with tank capacities of 80 gallons to 240 gallons. **Saylor-Beall Manufacturing Co.**

Circle 182 on card.

Standpipe Piezometers

The Solinst Standpipe Piezometer is the least expensive of

the Direct Push Equipment line, and is designed to be placed within an open hole. The pointed PVC tip is suitable for pushing into very loose sands at the base of a borehole. The Model 601 is suited for water level monitoring, permeability measurement, construction control, de-watering and drainage operations, and slope stability investigations. **Solinst.**

Circle 183 on card.

Microbio Controller

The Strantrol® 890 microprocessor-based controller is for industrial water applications, but is equally suitable for dechlorination and disinfection applications. The controller is fully customizable, with standard features such as datalogging, remote control and remote reporting. It is ideal for any type of industrial process control application using chlorine, bromine or ozone in a one-through or batch system. **Stranco Inc.**

Circle 184 on card.

Air Sampler

Complete air integrity is maintained as the Air-O-Cell Air Sampler is sealed prior to collection and resealed after collection during transport. The collector slit accelerates particles for impaction onto an adhesive collection surface that is optically clear and smooth for easy-on-the-eye microscopic analysis. The adhesive surface provides the capability of staining the collected particles directly on the collection slide without sample loss. **Zefon Analytical Accessories.**

Circle 185 on card.

Training Video

Train your employees with Summit's new "Excavations,

Trenches and Shoring" safety training program and educate them to respect potential hazards. Using live action footage and high-quality graphics, this program teaches workers how to plan an excavation and how to protect against potential hazards. **Summit Training Source.**

Circle 186 on card.

Portable Vacuum Gauge

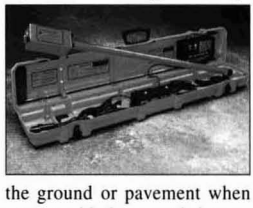
The Model ATV 4/6 is a new compact, hand-held, dual-range portable vacuum gauge designed primarily for industries using vacuum-jacketed insulation

piping, tanks or transportation vehicles. The ATV 4/6 is small and has a long battery life. **Hastings Instruments.**

Circle 187 on card.

Magnetic, Cable & Fault Locator

The High Frequency "HF" locator induces a signal through

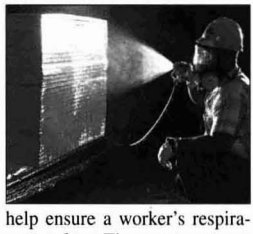


the ground or pavement when contact with the target is impossible and can be switched to a Low Frequency "LF" signal to prevent the signal from jumping to another continuous metal that is located near your original target. **Schonstedt Instrument Co.**

Circle 188 on card.

CD ROM Safety Course

Respiratory Protection is a new CD ROM course created to

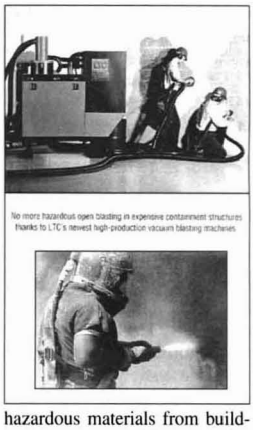


help ensure a worker's respiratory safety. The course covers critical areas of OSHA's respiratory protection standard and has state-of-the-art interactive technology to help users absorb the information easier. **Clarity Multimedia.**

Circle 189 on card.

Dust-Free Cleaning

A line of multiple Blasthead recycling vacuum blasting machines removes lead and other

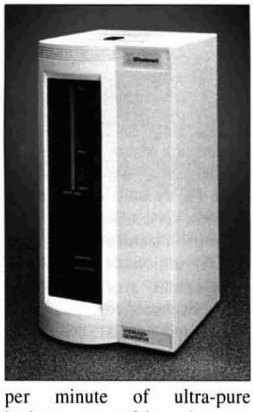


hazardous materials from building structures without raising clouds of toxic dust. Used at the Hanford site in Richmond, VA, the machines cleaned 40,000 sq. ft. of concrete basins contaminated to an 0.25-inch depth. **LTC Americas Inc.**

Circle 190 on card.

Hydrogen Gas Generator

The model 75-36 Hydrogen Gas Generator produces 600 cc



per minute of ultra-pure hydrogen gas safely and conveniently at regulated pressures from 0 to 60 psig, eliminating the need to interrupt analysis to change tanks. The state-of-the-art technology uses deionized water and electricity to operate. **Whatman.**

Circle 191 on card.

Air Stripping Technology

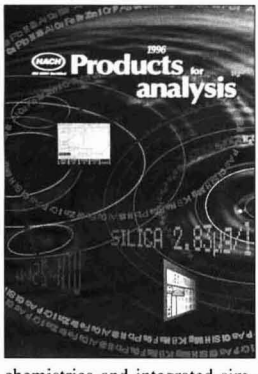
The TurboStripper™ is a 100% non-clogging air stripper that eliminates costs and downtime, is free-standing, removes VOCs, semi-volatiles, naphthalenes and ammonia, and is

easily adapted for off-gas treatment. Available individually or as a part of a complete turn-key remediation. **Diversified Remediation Controls.**

Circle 192 on card.

Water Quality Testing Catalog

Hach Co.'s new catalog covers an in-depth line of instruments,

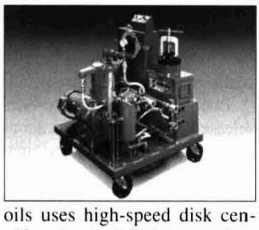


chemistries and integrated simplified procedures and accurate results. The 448-page catalog covers more than 200 field tests and is a valuable resource for areas such as analysis of drinking water and wastewater, chemical manufacturing, food and beverages, agriculture, and ecological studies. **Hach Co.**

Circle 193 on card.

Coolant Recovery System

An integrated on-site recovery system for coolants and cutting

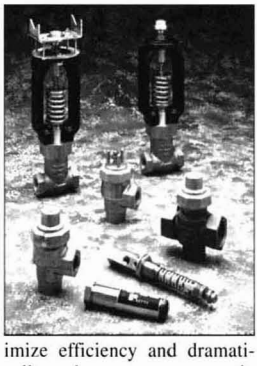


oils uses high-speed disk centrifugation and flash pasteurization. The units have been proven in hundreds of installations to end rancidity, coolant odor and dermatitis caused by coolant contact. **Sanborn Technologies.**

Circle 194 on card.

Control Valves and Steam Traps Bulletin

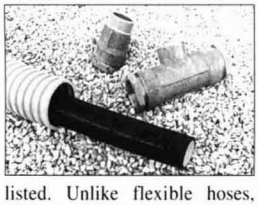
A new Ogontz bulletin features a full line of self-contained, temperature-actuated control valves and steam traps that maximize efficiency and dramatically reduce energy usage in stream and water systems. Also featured is the unique solid-liquid phase thermal actuator employed by all of the valves and traps. **Ogontz Corp.**



Circle 195 on card.

Flexible Piping

PERMA-FLEXX® flexible piping is now UL- and ULC-

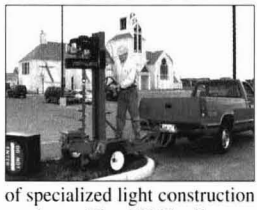


listed. Unlike flexible hoses, PERMA-FLEXX is a pipe, combining strength with flexibility. Rated at 100 psi, it is compatible with petroleum products, alcohol, alcohol-gasoline blends and chemicals. **Containment Technologies Corp.**

Circle 196 on card.

DIG-R-MOBILE

The M660 DIG-R-MOBILE has been added to General's line



of specialized light construction products. The M660 allows a single machine operator to drill holes up to a 16-inch diameter in a wide variety of unconsolidated and semi-consolidated soil classifications. **General Equipment Co.**

Circle 197 on card.

Automated Pugmill Plant

New from Pugmill Systems Inc., is a 750-ton per hour totally

automated pugmill plant for soil bentonite mixing, waste stabilization, encapsulation and agglomentation, and other mixing projects. The 750LS plant has automatic proportioning and feed control for aggregate, cement and water. **Pugmill Systems Inc.**

Circle 198 on card.

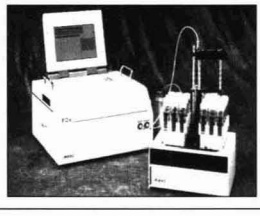
5.5 HP Pump

Pump-to-Go is a new compact, low-cost pump for maintenance, hazmat control, batch sampling, construction and other uses that is gasoline engine-powered and self-priming to 25 feet. It will move up to 170 gallons of liquid per minute and is compatible with abrasives, mild acids and viscous materials. **MP Pumps.**

Circle 199 on card.

Fuel Analyzer

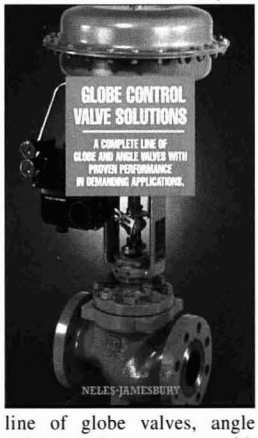
The new, upgraded Fox FTIR Fuel Analyzer is the petroleum industry's leading instrument for comprehensive analysis of motor and aviation fuels. Applications include oxygenates, benzene, aromatics, olefins, octane, distillation, cetane number and cetane index. Now available with customized Windows software package and autosampler, Fox meets the demands of fuel testing in a highly regulated environment. **MIDAC Corp.**



Circle 200 on card.

Globe Valve Brochure

A new, 8-page, color brochure describes a complete



line of globe valves, angle valves and actuators with proven performance in demanding applications. The brochure also reviews the company's special expertise in cryogenic, high-temperature and high-pressure, and applications where emissions containment is critical. **Neles-Jamesbury.**

Circle 201 on card.

Liquid/Solid Interface Control

The Bindicator Pulse Point™, with a stainless steel liquid/solid

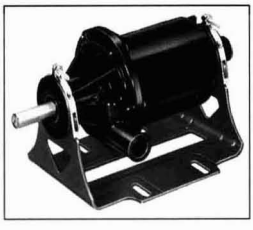
PRODUCTS & SERVICES

interface fork and stainless steel enclosre, controls the level of nylon pellets submerged in a liquid cleaning solution. The installed level switch controls the pneumatic feed system and eliminates the possibility of tank overflow due to an overabundance of nylon pellets. Other liquid/solid interface applications include carbon/water interface and sand/water interface. **Bindicator Co.**

Circle 202 on card.

Pump Series

A new Moyno® 500 Series 301 Pumps provide process ver-



satility in corrosive chemical dosing and transfer applications. The series feature a reverse-covered seal design between the rotor and shaft, eliminating metal exposure to fluids. Hose connections, resilient cushions and cradle mounting provide easy installation, maintenance and replacement. **Moyno Industrial Products.**

Circle 203 on card.

Change-Over Regulator System

The Change-Over System combines a pressure reducing

regulator with an ideal outlet valve and high-pressure purge valves to create a compact design for continuous gas applications. The system directs the flow of gas from two separate sources to the user's application. **Scott Specialty Gases.**

Circle 204 on card.

Spill Containment Manhole

The POMECO 211AST Spill Containment Manhole protects the environment and your site from spills that occur during the filling of aboveground storage tanks. It features a standard, high-capacity, pull-to-drain internal valve for added operator convenience and a hinged, lockable cover to prevent unauthorized entry into the AST. **OPW Fueling Components.**

Circle 205 on card.

Solvent Recovery

A new system using microwave energy to increase the amount of solvent recovery has

been introduced, helping plant managers save costs and reduce waste. In the new "Magnum" solvent drying process, a dual chamber design maximizes the solvent recovery to produce a solid, dried residual cake. **Progressive Recovery Inc.**

Circle 206 on card.

Drum Accountancy

The new TRU Piece Monitor has been designed to provide accurate TRU drum accountancy by monitoring contents on a piece-by-piece basis. By producing running totals for drum content, it is possible to ensure that each drum is optimally packed without exceeding nuclear safety limits. **BNFL Instruments.**

Circle 207 on card.

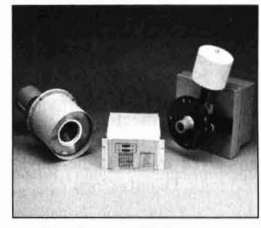
Collection Pumping Station

SERFILCO's versatile packaged systems maintain compliance for waste treatment and discharge. Collection of waste solutions, spills, drainages, chemical storage, neutralization and retrofit of old sumps are a few of its applications. **SERFILCO Ltd.**

Circle 208 on card.

CO Analyzer

The redesigned Model 5100A Carbon Monoxide Analyzer offers enhanced control of the fuel/air ratio for maximizing



combustion efficiency and reducing oxides of nitrogen emissions. It offers digital communications for fast, accurate CO measurements. **Rosemount Analytical Inc.**

Circle 209 on card.

Gas to Liquid Heat Exchanger

The new, improved Sidestream Economizer improves the current method of pre-heating liquid with heat from exhaust gases. The unit can be used with low pressure boiler feed systems, liquid storage tanks or liquid circulation loops. **General Resource Corp.**

Circle 210 on card.

New Filtration Media

The UltraFlo™ is a trilaminate composite that incorporates spunbonded outer layers sandwiching an inner layer of meltblown micro fibers. The outer layers provide strength while the inner layers provide filtering properties. It is excellent for liquid, air and gas filtration. **Reemay Inc.**

Circle 211 on card.

Oil/Water Separator

Acidic or caustic applications, such as oil contaminated with benzoic acid, are routinely handled by the new 361 Stainless Steel oil/water separator. Drastically altered pH solutions of emulsified oil in water being extracted by acid or caustic dosing may be separated before the neutralization process is performed. **National Fluid Separators Inc.**

Circle 212 on card.

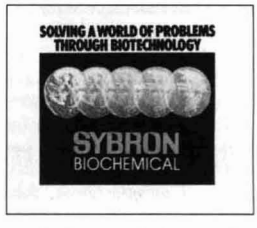
Dust Control Systems

The modular AirWall and AirMaster dust control systems are a cost effective solution to impending OSHA regulations. They not only exceed the air filtration requirements, but are less costly to install due to their modular configuration. **Stripping Technologies Inc.**

Circle 213 on card.

Bacterial Products

The BI-CHEM® 1010N series of liquid nitrifying bacterial products enhance nitrification efficiencies for wastewater



applications that require ammonia, or total-nitrogen removal. Used in aerobic biological treatment systems, it contains select strains of *Nitrosomonas* and/or *Nitrobacter.* **Sybron Chemicals Inc.**

Circle 214 on card.

National Pipelines Database

Two new databases have been released containing the locations of U. S. pipelines and key environmental, health and safety measures. Based on information provided by the American Petroleum Institute, NETDATA: Pipeline™ can be obtained for petroleum products and/or crude oil networks. **Abkowitz & Associates Inc.**

Circle 215 on card.

PRODUCT LITERATURE

Compliance Software With Air Emissions Data Management

MIRS is a comprehensive, integrated environmental software package with compliance modules for Clean Air Act Emissions Data Management, SARA Title III, EPA-approved Form R, MSDS management, OSHA Hazcom, Permit tracking, Water and Waste. MIRS comes in Windows and DOS versions for IBM PCs and networks. The MIRS AIR module manages air source and emissions data, both to support the permit application process, and to demonstrate compliance after permit issuance.

A V Systems Inc.
(313) 973-3000

Circle 216 on card.

Earthprobe 200

This self-contained all hydraulic rig meets the growing demand for direct push/probing technology for taking soil, water or vapor samples. The Earthprobe 200 is ruggedly built and can be mounted in any suitably sized pickup truck. Advanced hydraulics allow precise control over the feed and hammering functions. The mast lifts for angle probing. The optional rotary head provides limited auger drilling capability.

SIMCO
(800) 338-9925

Circle 217 on card.

AMS "Power Probe 9600-PLUS"

Setting new standards in Direct Push Technology, the new AMS POWER PROBE 9600 is the most versatile and efficient sampling system available. Designed for deep probing with the largest capacity ram available, the 9600 provides over 37,000 lbs. of pull up force for easy tool removal. Fully integrated, self-powered and compact, the AMS 9600 will perform sampling for site assessment of soils, soil gas and groundwater. The AMS 9600 speeds collection of 1.5 inch by 48 inch core samples now preferred by today's consultants, geologists, environmental engineers and regulators. Call for this free brochure and details.

Art's Manufacturing & Supply
(800) 635-7330

Circle 218 on card.

Reference Materials

Radian International LLC offers high quality analytical reference materials, including standards for EPA methods, Snap-N-Shoot™ callibration standards, drugs of abuse, aldehyde/ketone derivitives, explosives, pesticides, PAHS, and many others. Custom standards and organic synthesis are available. A Certificate of Analysis providing complete traceability is included free with each product.

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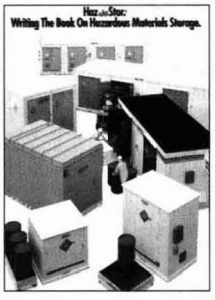

Haz-Mat Storage Solutions

"Writing the Book on Hazardous Materials Storage," a brand new catalog, presents descriptions of the FM-approved Haz-Vault™ Lockers, Mini-Lockers, Storage Platforms and Haz-Stor's Valu-Pak Option Packages. Also learn about Med-Stor®, a refrigerated structure, built for infectious medical waste, AG-Stor®, for agricultural chemicals, and Household Hazardous Waste Accumulation Centers, used by municipalities. Haz-Stor, Fire-Rated Buildings, the premier series in the product line, is classified by underwriters laboratories as complying with model building codes for Group H Hazardous Occupancies.

Stevens Associates
(417) 774-9991

Circle 220 on card.

Direct Push Equipment

Brochure details full range of Direct Push Equipment. Stainless Steel Drive-Point Piezometers: ideal for groundwater and soil gas sampling, water level monitoring, UST monitoring. Standpipe Piezometers: excellent for metals monitoring, permeability measurement. Drive-Point Profilers: multiple discrete zone sampling in a single drive (no cross contamination). The Sand Piper™: portable system designed to facilitate installation of drive-points with vibrating hand hammers.

Solinst Canada Ltd.
35 Todd Rd.
Georgetown, Ontario L7G 4R8
(800) 661-2023 Fax: (905) 873-1992

Circle 221 on card.

Fiberglass Pressure Vessels

Color brochure, details Structural's Composite Fiberglass Pressure Vessels and their excellent corrosion resistance in CPI and other harsh service. These lightweight vessels are made in over 100 sizes up to 63 inches in diameter. Standard ship within two weeks. Brochure includes Resistance Ratings for 48 elements and Vessel Design Guide Disk offer.

Structural North America
Industrial Parkway,
Chardon, OH 44024
(216) 286-8265 Fax: (800) 942-7659

Circle 222 on card.

Remediation, Efficient and Low Cost

Belt skimmer installs existing (2" ID and larger) recovery wells up to 100 feet deep and removes up to 12 gph of floating oil and fuel from groundwater. Recovers virtually all floating oil. Ask for our Chemviron and Chevron case histories.

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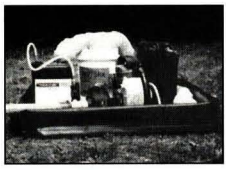
Chagrin Fallas, OH
(800) 358-SKIM

Circle 223 on card.

PRODUCT LITERATURE



Mini-Berm
The Mini-Berm is an ultra lightweight and convenient spill tray for cleanup operations and spill containment during fuel and chemical transfer. Mini-Berm trays are easily placed under valves and fittings, truck, and machinery. Reusable and compact, the Mini-Berm is appropriate for most liquid and chemical containment. It is designed to take standard size sorbent pads. Six sizes of Mini-Berm are available. Prices start at $55.
Exploration Products
800-448-7312
509-927-8101 FAX

Circle 310 on card.

Covering All the Bases

continued from page 42

How SDPT Works

SDPT eliminates aromatic, oxygenated and halogenated hydrocarbons and industrial emissions, such as nitrogen dioxide and sulfur dioxide, from gaseous waste streams in both the laboratory and rigorous field demonstrations. SDPT is an advanced oxidation and reduction process that uses plasma and free-radical chemistry to destroy VOCs. Nonequalibrium plasma is a gaseous state of matter in which a part or all of the atoms or molecules are dissociated to form ions, and is generally created by direct heating or by appyling an electrical field to gaseous media. Nonthermal plasmas, or those created only by high-voltage electricity, have only recently been used to treat VOCs from gaseous waste streams.

The plasma oxidizes and reduces VOCs entrained in the gaseous waste stream passing through each plasma cell. The gases passing through the cells are commonly at ambient temperature and pressure. The nonthermal reactions typically change toxic gases into carbon dioxide, water and nonhazardous compounds. In chlorinated VOCs, the reaction's byproducts are hydrochloric acid and other compounds. These compounds are easily removed from the effluent by wet scrubbing.

The Test at McClellan

In cooperation with the U.S. Environmental Protection Agency and the California Environmental Protection Agency and under overall supervision by CH2M Hill Inc., the Air Force recruited several subcontractors to test innovative cleanup technologies under industrial, real-life conditions. Testing parameters included continous operation over a two-month period and a minimum vapor flow of 10 standard cubic feet per minute (scfm) or more.

Once at McClellan, the SDP test was connected to an existing thermal/catalytic oxidation system. A portion of the vapor from the landfill was directed to the SDP system for treatment.

Key operating parameters of the SDP system are energy density applied to the plasma cells, flow rate, contaminant concentrations, inlet gas temperature and relative humidity, and the required destruction and removal efficiency (DRE). Energy density is determined by the power applied to the cells divided by the flow rate. Each contaminant, or mixture of contaminants, has its own characteristic energy density that will result in a fixed DRE. At increased flow rates through the system, the power must also be increased proportionately to maintain the same energy density necessary for the same DRE. If higher DREs are required, power must be increased or flow rate decreased to achieve a higher energy density. High vapor temperatures above 100 degrees Farenheit and with low relative humidity also tend to increase DRE at the same power output and flow rate.

Preliminary Test Results

During the two-month test, the SDP system operated more than 400 hours with a maximum continuous operation of four days. The SDP system treated VOCs from the McClellan site at flow rates up to 10.4 scfm and achieved DREs up to 99.4 percent. Higher DREs and more efficient and continuous operation were achieved by upgrading and fine tuning the SDP system during the test.

The program included extensive sampling and testing. VOCs, semi-volatile organic compounds, oxygen, carbon monoxide and carbon dioxide were analyzed in both influent and effluent vapor samples to evaluate DRE. In addition, the treated vapors and residues generated from the VOC destruction were analyzed for dioxin, hydrochloric acid, nitrogen dioxide, ozone and phosgene.

As a result of halogenated hydrocarbon oxidation, significant amounts of liquidhydrochloric acid were generated in the plasma cells and tanks. Hydrochloric acid can be treated in a wet scrubber attached to the SDP system.

"The McClellan test site soup is one of the nastiest you'll ever find," —Dr. Louis Rosocha

SDPT Advantages and Costs

SDPT has several advantages over other standard thermal-combustion technologies. In those systems, the entire waste stream is raised to temperatures up to 1,500 degrees Farenheit. This results in substantial fuel use and costs, and greater production of unwanted byproducts from incomplete combustion. In contrast, SDPT uses only "hot" electrons to generate plasma and treat VOCs at near-ambient temperature and pressure. No fuel is required and fewer combustion by prodcuts are generated.

The main benefits of SDPT include DREs of 95 percent to 99 percent for a broad range of VOCs, competetive operating costs compared to most thermal combustion technologies and on-site remediation in a portable system that is easy to operate and maintain. The equipment can be scaled to meet customer and site conditions by adding or subtracting power supplies and plasma cells. EP

Richard F. Reimers is director of business development at ENV America Inc., and project director of the silent discharge plasma technology field demonstration at McClellan Air Force Base, Sacramento, Calif. Michael P. Gross is cofounder and vice-president of High Mesa Technologies, LLC, and an attorney in Santa Fe, N.M.

What Do You Think?

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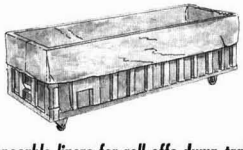

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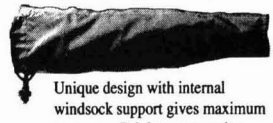

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102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391
103	120	137	154	171	188	205	222	239	256	273	290	307	324	341	358	375	392
104	121	138	155	172	189	206	223	240	257	274	291	308	325	342	359	376	393
105	122	139	156	173	190	207	224	241	258	275	292	309	326	343	360	377	394
106	123	140	157	174	191	208	225	242	259	276	293	310	327	344	361	378	395
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108	125	142	159	176	193	210	227	244	261	278	295	312	329	346	363	380	397
109	126	143	160	177	194	211	228	245	262	279	296	313	330	347	364	381	398
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

Interested because of: 95 ■ New Construction 96 ■ Adding Capacity 97 ■ Plant Upgrade 98 ■ Maintenance 99 ■ 1 for 1 Replacement

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A. Function which **best** describes your activity in Pollution Control (check only one):

A ❑ Corporate responsibility for Pollution Control
B ❑ Manage all Pollution Control Operations at this location
C ❑ Supervise sub-group in Pollution Control Operations
D ❑ Provide professional consulting service on Pollution Control
E ❑ Provide staff environmental service on Pollution Control
Z ❑ Other_____

rs121a

B. Type of Business (check only one):

A ❑ 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
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❑ (36) Elect. & Electron Mach
❑ (37) Trans. Equip.
❑ (38) Instr./meas./analyze/controlling
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B ❑ Mining
C ❑ Agriculture
D ❑ Engineering & Contracting
F ❑ Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
L ❑ Consulting
M ❑ Insurance
E ❑ Utilities, public, private & cooperative

Type of Govt:
G ❑ City
H ❑ County
I ❑ State
J ❑ Federal

K ❑ Transportation
N ❑ Labs
O ❑ Training
P ❑ Real Estate
Z ❑ Misc. Services _____

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

A ❑ 1-19
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D ❑ 100-249
E ❑ 250-499
F ❑ 500-999
G ❑ 1000-1499
H ❑ 1500-2499
I ❑ 2500 and up

D. In your job function do you recommend, specify or purchase? (check all that apply)

A ❑ Pollution Control Equipment
B ❑ Instrumentation
C ❑ Chemicals
D ❑ Parts & equipment for maintenance operation and control
E ❑ Services/Consulting
F ❑ None of the above_____

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

A ❑ Air
B ❑ Water
C ❑ Noise
D ❑ Solid Waste Disposal
E ❑ Industrial hygiene
F ❑ Toxic & hazardous material
G ❑ Energy control/ energy conservation
H ❑ None of the above _____

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

A ❑ Pollution Engineering
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C ❑ Environmental Solutions
D ❑ Pollution Equipment News
E ❑ The National Environmental Journal
F ❑ Water Environment & Technology
G ❑ None of the above_____

G. Which of the following SLUDGE DRYING AND DISPOSAL PRODUCT(S)/SERVICE(S) do you plan to purchase in the next 12 months? (Select all that apply)

A ❑ Belt Filter
B ❑ Vacuum Filter
C ❑ Filter Press
D ❑ Screw Press
E ❑ Centrifuge
F ❑ Sludge Incinerator
G ❑ Wet Air Oxidation System
H ❑ Fluid Bed Incinerator
I ❑ Bulk Bags
J ❑ Odor Control
K ❑ Sludge Level Meter
L ❑ Sludge Dryer
M ❑ Biosolids Treatment System
N ❑ Flocculant
O ❑ Land Application Vehicles

H. What is your reason for purchasing the selected products/services? (Select one)

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I. What is your projected budget for the selected products/services? (Select one)

A ❑ Over $200,000
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C ❑ $50,001-$100,000
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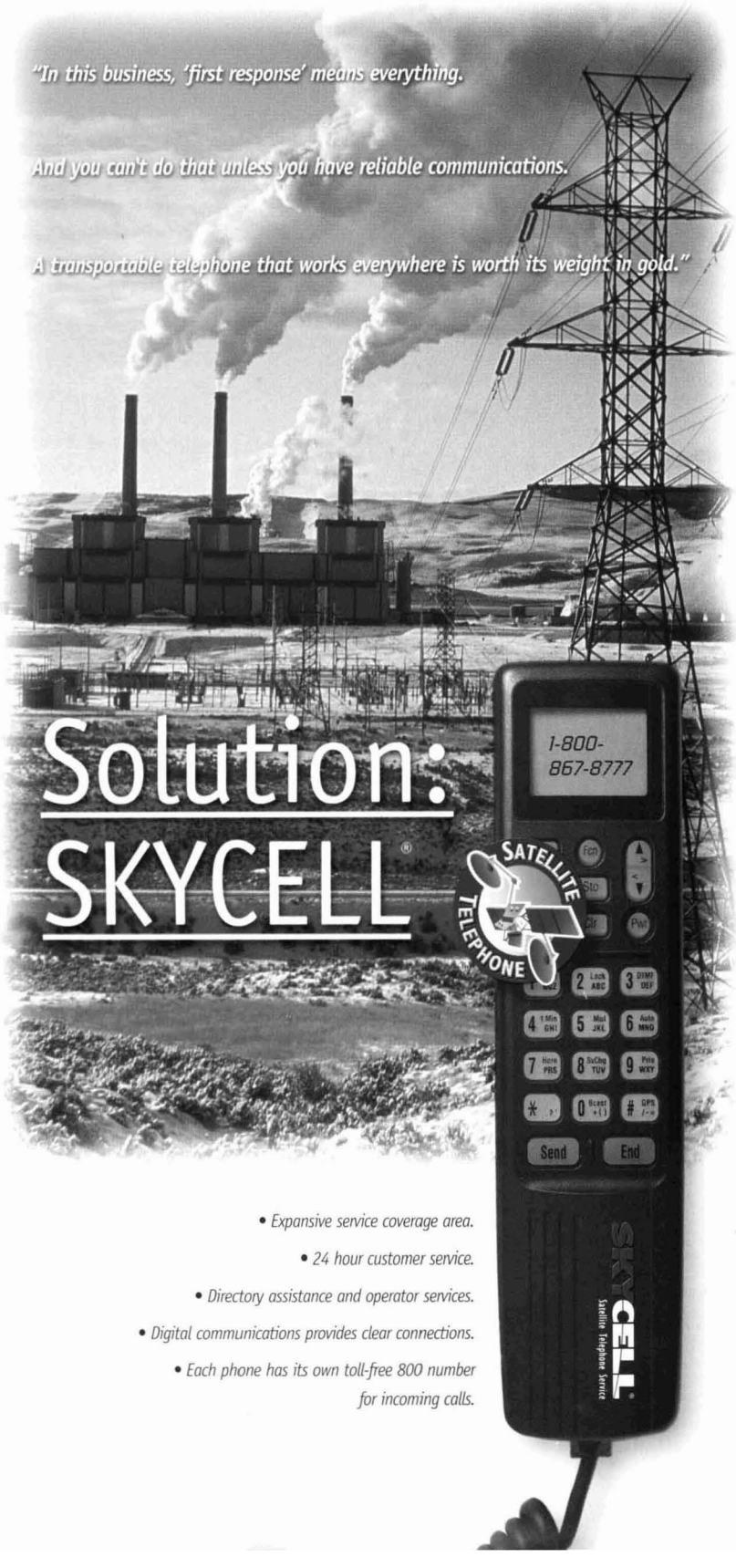

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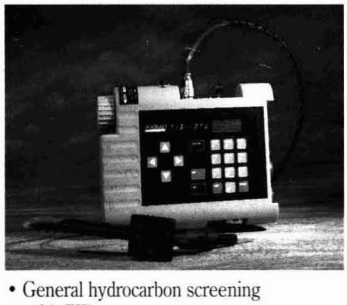

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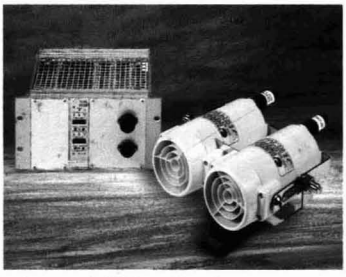

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