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- 812  Legal Services
- 813  Insurance, Environmental Liability
- 814  Pollution Prevention Consulting Services

- 817  \$50,001-\$100,000
- 818  \$10,001-\$50,000
- 819  \$5,000-\$10,000
- 820  Under \$5,000

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- 822  7-9 months
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- 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 \_\_\_\_\_

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- A  Manufacturing. If manufacturing, please check the appropriate SIC (check only one):
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  - (21) Tobacco  (32) Stone/Clay/Glass
  - (22) Textile  (33) Primary Metal
  - (23) Apparel  (34) Fab. Metal
  - (24) Lumber & Wood  (35) Mach., except Elect.
  - (25) Furniture  (36) Elect & Electron
  - (26) Paper  (37) Trans. Equip.
  - (27) Print/Publish  (38) Instr./meas./
  - (28) Chemicals  (38) Instr./meas./
  - (29) Petrol. & Coal  (39) analyze/controlling
  - (30) Rubber/Plastic  (39) Miscellaneous Mfg.

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E  Utilities, public, private & cooperative

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G  City H  County I  State J  Federal

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O  Training P  Real Estate

Z  Misc. Services \_\_\_\_\_

C. Number employed at this location:

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)

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B  Instrumentation

C  Chemicals

D  Parts & equipment for maintenance operation & control

E  Services/Consulting

F  None of the above

G  Other (please specify) \_\_\_\_\_

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

I  Recycling

J  Other (please specify) \_\_\_\_\_

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  Pollution Equipment News

D  The National Environmental Journal

E  Water Environment & Technology

F  None of the above

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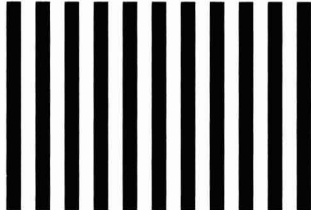
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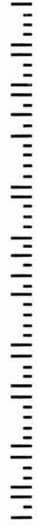
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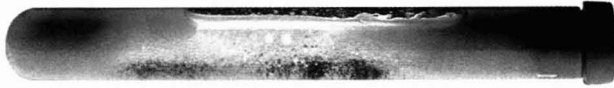
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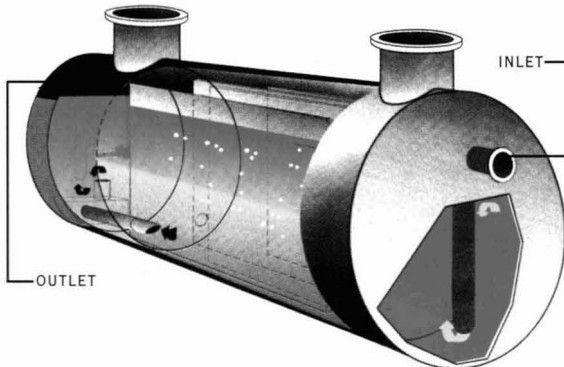
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## ABOUT THE COVER

Abitibi Consolidated's pulp and paper mill has won several environmental awards for its innovative water reuse program, in which it uses all of its treated effluent to irrigate more than 60 species of trees and crops on nearby land. Beginning on page 20, we profile this mill and four other facilities that have shown exemplary commitment to the environment.

PHOTO BY DAVID WIDMAIER

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# Pollution: The poor's burden?

BMW's and biosolids don't usually mix. Typically, U.S. wastewater treatment plants, industrial plants and landfills are located far from country club environs. Such facilities often abut against low-income neighborhoods with depressed real estate values. As a result, many residents of poor areas located close to industrial plants are expressing concern that their health is being adversely impacted by exposure to air contaminants and hazardous chemical spills from nearby facilities.

In response to such complaints, President Clinton and the U.S. Environmental Protection Agency (EPA) have promoted an initiative known as environmental justice. EPA's Office of Environmental Justice defines environmental justice as follows: "Fair treatment means no group of people, including racial, ethnic or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal or commercial operations or the execution of federal, state, local and tribal programs and policies."

In 1994 President Clinton showed his support for environmental justice by issuing an executive order. As a result, EPA's environmental justice program is being enforced pursuant to Title VI of the Civil Rights Act of 1964, which bans states and localities that receive federal money from taking actions that result in discrimination based on race, color or national origin. The agency released an interim policy in February that allows citizens to file complaints with EPA if they believe state or local agencies have taken actions, such as issuing pollution control permits, that ultimately have a disproportionately adverse environmental effect on minority communities. (For more information about the interim guidelines and EPA's environmental justice program, visit EPA's Web site at <http://es.epa.gov/oeca/oejbut.html>.)

The interim guidelines have spawned strong criticism in the business community. Thomas J. Donohue, president of the U.S. Chamber of Commerce, has accused EPA of trying to become a "national zoning board" and attempting to overturn state and local development through its environmental justice initiative. Additionally, Harry Alford, president of the National Black Chamber of Commerce, has stated his group's members "fully support the U.S. Chamber's effort to repeal EPA's misguided policy." Many business groups are concerned that the guidelines will undermine urban development and job growth policies such as enterprise zones.

In his controversial new book *The Promise and Peril of Environmental Justice*, Christopher Foreman Jr. asserts that environmental justice activists lack specific data to back up their claims that polluted sites are disproportionately located in minority neighborhoods. Foreman, a Brookings Institution Fellow, maintains that even though many environmental justice complaints are not based on valid health concerns, they can still hold up the government's permitting decisions on companies' projects for months.

The discussion concerning this issue promises to become even more intense. Yet, government and industry need to move beyond the heated debate and work together to ensure that our nation's economic progress does not come at the expense of low-income and minority citizens.



*Angela Neville*

Angela Neville, JD, REM  
Editor-in-Chief

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By Ingrid Truemper

## Bioprotein suitable for human consumption

More feedstock, anyone? In the future, bioproteins derived from natural gas may become part of our daily diets, as a recent development from Norway highlights.

Two European companies have created alternative uses for natural gas leftover from the oil extraction process. A bioprotein plant based on natural gas feedstock began production in October at Tjeldbergodden in mid-Norway by Statoil, the state-owned Norwegian oil company, and UK-Norwegian pharmaceutical group Nycomed Amersham.

The new facility, the first of its kind in the world, uses natural gas from the Heidrun field in the Norwegian Sea as feedstock. The plant has an annual capacity of approximately 10,000 metric tons.

The production utilizes natural microorganisms that derive energy and nutrition from methane. Oxygen, ammonia, water and minerals are also added to the process in a sealed reactor. The finished product takes the form of brown granules that contain 70 percent protein, 12 percent carbohydrates, 10 percent fat and 8 percent minerals.

Work on developing a commercial bioprotein technology was initiated in 1985 by Denmark's Dansk Bioprotein. An extensive research and development program has been pursued through Dansk Bioprotein and Norferm, a joint venture firm created by Statoil and Nycomed that now owns 98 percent of the Danish firm.

An application to the European Union (EU) for product approval as an animal and fish feed additive was approved by the Danish Ministry of Agriculture in 1993 and by Brussels in the summer of 1995. EU countries consume roughly a million metric tons of protein for animal and fish feeds annually.

Seventy percent of the plant's present annual output has been sold to farm supplies cooperative Felleskjøpet Rogaland Agder as animal feed. The bioprotein has

been EU-approved for feed for salmon, calves, pigs and chicks and for use in pet food, mainly for cats.

Product development has also established that the bioprotein is suitable for human consumption—as taste additives in processed food and snacks, for instance. Norferm is collaborating with Nestle and Toro to develop taste additives, or protein hydrolysates, from the feedstock. Two different processes are being used to create different flavors, one with enzymes and another that utilizes hydrochloric acid. Sales of hydrolysates in the EU total about 100,000 metric tons per year.

Norferm expects to receive approval from Brussels for this application by the end of 1999 at the earliest, according to Kurt Strand, plant manager at Tjeldbergodden. EU countries use roughly 600,000 metric tons of proteins in foods annually, derived primarily from soybeans and milk.



**The new facility, the first of its kind in the world, uses natural gas from the Heidrun field in the Norwegian Sea as feedstock. The plant has an annual capacity of approximately 10,000 metric tons.**

Bioproteins also represent a suitable raw material for various industrial products. Casein, a milk product, is used in paper adhesives, lightweight concrete and fillers. The EU uses about 10,000 tons of casein per year, with paper adhesives accounting for 70 to 80 percent of this volume. Additionally, the National Starch & Chemical Co., a U.S. company that produces technical adhesives, will be using the bioprotein in glue production for books.

**For more information, contact Gunnar Kleppe at Norferm via e-mail at [gunnar.kleppe@norferm.no](mailto:gunnar.kleppe@norferm.no).**

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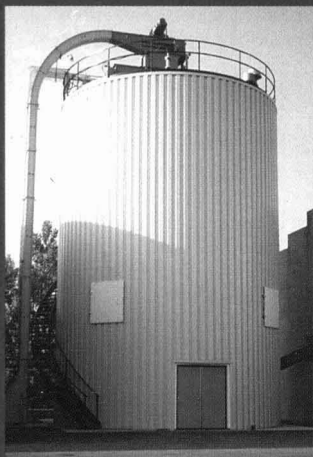
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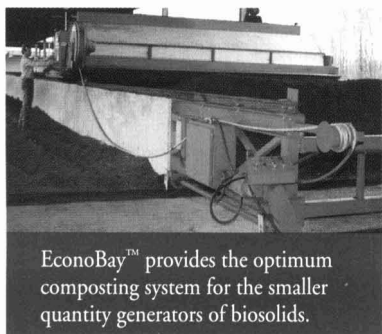
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# News at a glance

Compiled by Kristie L. Guillotte

**Big demand to monitor the air**  
NORTHBROOK, ILL.—The world market for monitoring air pollution is expected to grow from \$1.9 billion per year in 1998 to over \$2.2 billion per year in 2000, according to the McIlvaine report "Air Pollution Monitoring and Sampling World Markets 1997-2001."

The market is presently equally divided between intermittent source testing and continuous emissions monitoring. The largest regional segment is Europe/Africa with over 40 percent of the total market. The large size of this market is due to strict standards in western European countries and the influence of the European Union not only on members, but on prospective members.

Europe is ahead of the United States in requiring continuous weight measurement of particulate emissions. Only opacity measurement is required in the United States. However, major recent developments in particulate measurement tech-

niques will lead to new systems. This is a technology forcing situation and will result in substantial sales increases. The market for continuously measuring specific hazardous particulates is growing much faster than the general market. The development of continuous monitors for mercury will lead to the requirement for their use on waste incinerators.

The U.S. regulations that will eventually

cover hundreds of hazardous air pollutants are leading to substantial increases in source testing activities. Whereas a stack test could be accomplished for a few thousand dollars when only particulates were to be measured, now tests may cost hundreds of thousands of dollars and may require measurement of as many as 10 pollutants. The complexity of measuring certain toxic compounds such as dioxins also substantially increases the cost.

## Aiding rainforests

**WASHINGTON, D.C.**—Two Australians played a key role in a plan to protect 62 million acres of Brazilian rainforest.

Don Henry, lead negotiator for the World Wildlife Fund, and James Wolfensohn, president of the World Bank, formed an alliance to set aside an ecologically representative network of forests around the world. The alliance aims to help countries set aside 125 million acres of forest in new protected areas, and bring 500 million acres of the world's forests under ecologically sustainable management by the year 2005. Already 22 countries have pledged to include at least 10 percent of their forests in protected areas by the year 2000.

"The decision by Brazil's President Cardoso to protect 25 million hectares is truly a remarkable one, both for its size and for its content," said Wolfensohn. "This decision will help preserve the abundant biodiversity in this remarkable tropical region. It is a true gift to the Brazilian people and, indeed, to the world."



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# Corrections

## Calling all math majors

In *From the editor* in our November 1998 issue, we stated that Environmental Business International Inc. (EBI) projects that Latin America "will increase its environmental market from \$8.8 billion to \$13.8 billion—a 12 percent increase—during the period of 1996 to 2000" and "EBI estimates the growth for the United States in this sector will increase from \$171.8 billion to \$184.5 billion from 1996 through the end of the decade, which is a 1.8 percent increase." We failed to clarify that the percentages mentioned are the compound annual growth rates.

## Clarifying waste classification

In the article, *Shortcut to Success*, which appeared on pages 14-20 in the September 1998 issue of *Environmental Protection*, author Sultan I. Amer, PhD, stated wastewater treated with the new AQUASIL® water treatment system meets Resource Conservation and Recovery Act (RCRA) requirements to be classified as nonhazardous waste and

passes the Toxicity Characteristics Leaching Procedure (TCLP) test. The author also wrote that treated wastewater could be land-filled as nonhazardous waste. These statements require further clarification.

Under the authority of RCRA, hazardous wastes are designated as either unlisted or listed. Unlisted wastes are solid wastes that exhibit certain characteristics (see 40 CFR Part 261, Subpart C), including ignitability, corrosivity, reactivity and toxicity. Such wastes remain hazardous until treated and no longer exhibit these characteristics.

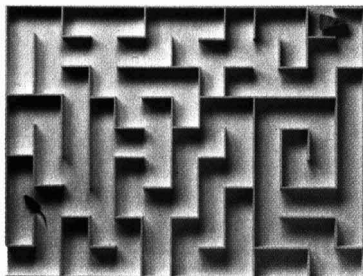
Nonlisted wastes generated by Dr. Amer's new treatment are already stabilized and pass the TCLP test. These wastes are considered nonhazardous according to 40 CFR Part 261, Subpart C.

Listed wastes are solid wastes that are specifically listed, for various reasons, as hazardous (40 CFR Part 261, Subpart D).

Although a listed waste generated by Dr. Amer's new treatment at a particular facility may not be hazardous in nature, it is classi-

fied as hazardous until a petition has been submitted to the U.S. Environmental Protection Agency (EPA) for its exclusion or delisting. Only after an exclusion has been granted, and the waste delisted, can the waste be managed as a nonhazardous solid waste (under Subtitle D).

Delisting is a lengthy process which requires the documentation over an extended period of time of analytical data providing clear indications of the nonhazardous nature of the waste, and that the waste no longer meets the requirements for which it was originally listed. Such data must be submitted to EPA for the exclusion and delisting of the waste. Until a petition has been granted and a delisting decision made to grant an exclusion, the waste remains a listed waste, i.e., hazardous, and subject to regulation (40 CFR Parts 260 through 268 and permitting standards 40 CFR Part 270). For more information, consult EPA Region 6 RCRA Delisting Program's "Guidance Manual for the Petitioner," March 21, 1996, obtainable from EPA, 1445 Ross Ave., Dallas, TX 75202.



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Biological risk assessment as applied to indoor air quality issues evaluates the risk biological organisms pose to indoor environments. Until recently, scientists did not have dynamic methods to test for airborne biological risk. Essentially, they relied upon transfer of sampled material and swabs to laboratory sites for culturing. In some cases, they were able to obtain air samples using filter cassettes, or impingement onto agar plates using a static—non-mobile once sampling was proceeding—air-sampling tower.

Although all of these methods are still used, scientists now have a new tool—a fixed volume biological air sampler developed to meet the needs of clean rooms and immune suppressed patient treatment medical facilities. This sampling device allows insertion of an instrument the size of a hand-held vacuum into formerly inaccessible locations. Samples can be obtained with a designated air flow of 50 liters to 1000 liters (1000 liters being equivalent to a cubic meter). These samples can often be taken quickly with less drying of the agar plates.

contamination in the form of molds, fungi and bacteria. Relative counts may show whether an amplification (over-growth) site is present within a heating ventilation air conditioning (HVAC) system, plenum (space where air was transferred without the benefit of duct work through spaces between wall and floors), or other structural layers. With this information, consultants conducting the

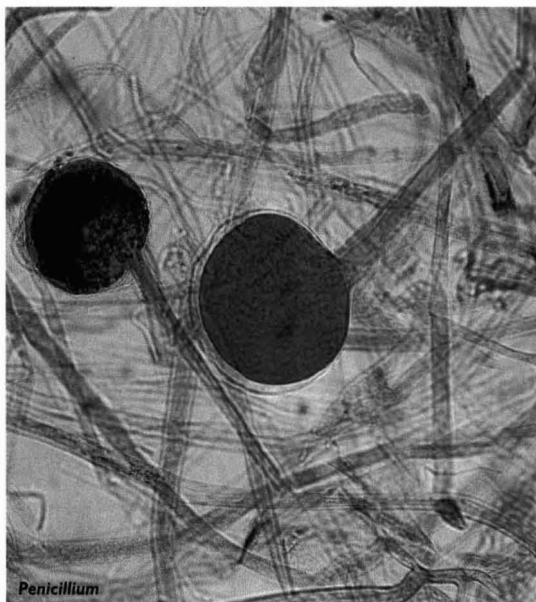
have the potential to reproduce. Sampling must be completed as consistently and quickly as possible, taking precautions not to become endangered by these contaminants during the sampling process.

### Mold myths

The term “wet” is a relative one. Some molds do not need wet environments in the traditional sense to flourish—any condensation may be sufficient for growth, even that caused by very slight temperature differences.

The common belief that fiberglass will not grow biologicals is also incorrect. The fiberglass itself may not be a good food source; however, the fiberglass forms a nice nest and traps other food sources. Fiberglass filters, lined fiberglass ducts and fiberglass panels inserted for insulation all become less densely packed with age and use. Particulates, especially those associated with any greasy vapor-laden air stream, stick to the fiberglass and provide a nutrient bed for biological contamination.

Because of the problems with grease or oil in air streams and biological amplification, care



*New methods of biological risk assessment help address indoor air quality concerns*

# The HOT zone

By Martha J. Boss, CIH, Dennis W. Day, CIH, and David A. Henney, PE

Transfer to biological safety cabinets at laboratory sites is accomplished under chain of custody documents. At no time are these or the air sampling media plates left unattended prior to transfer to the laboratory. After a pre-defined growth period, microbiologists can provide both quantitative and qualitative evaluations of these samples.

Also used are direct contact agar plates that can be applied to surfaces or dipped in liquids. The combination of all these methods allows assessment for biological

investigation can alert building owners and residents to potential indoor air quality (IAQ) problems—and in many cases find the real cause for IAQ problems that were formerly left unsolved.

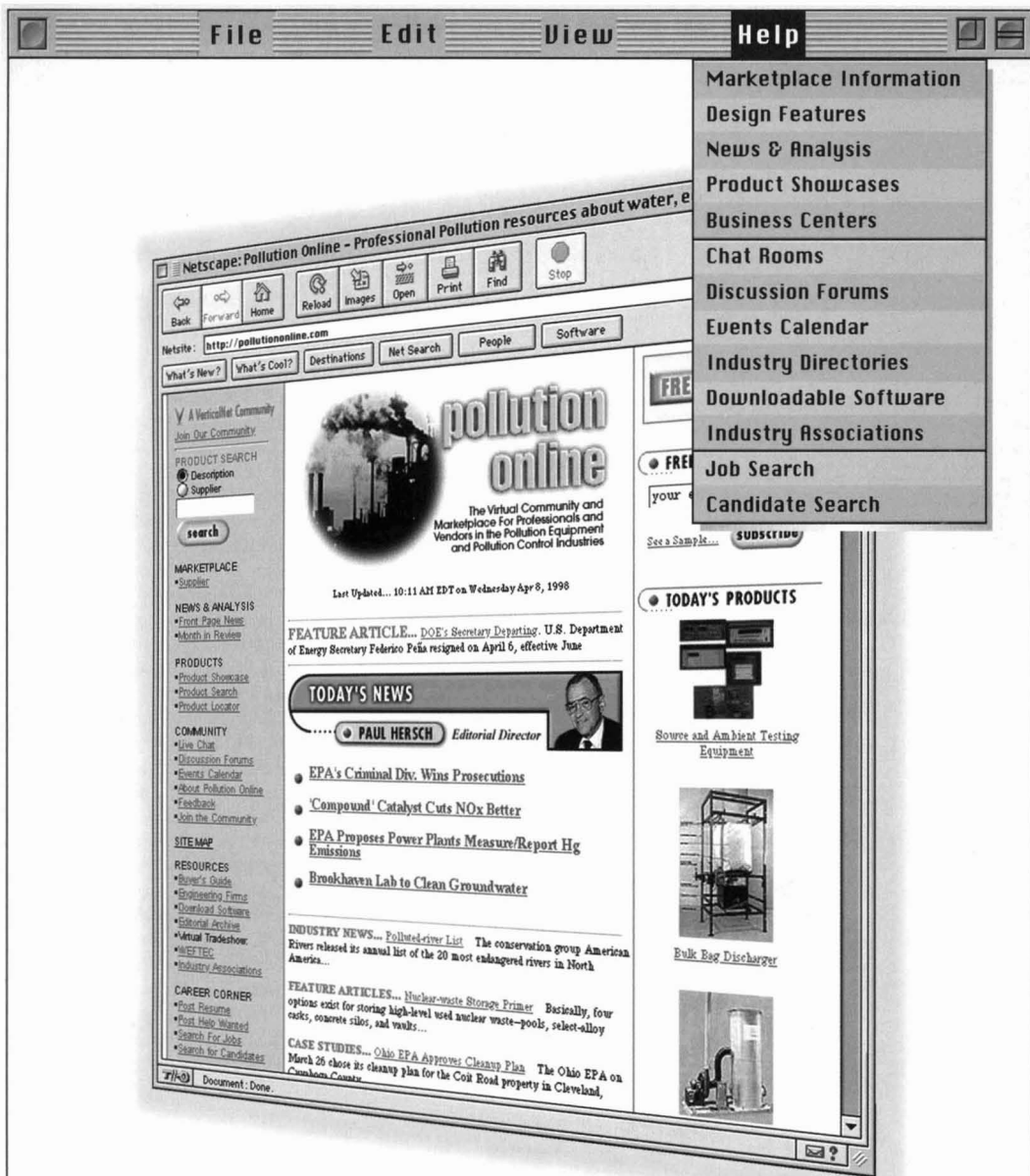
All sampling for biologicals must account for surrounding environmental factors and building usage. A complete history of building usage and in some cases additional sampling for other contaminants may be required. Samplers must be aware that biologicals, unlike chemical contaminants,

must be taken in using these chemicals. Whenever refrigerant lines bearing mineral oil and Freon are serviced, any breakage should be viewed as potentially providing oil-based nutrient for biological contaminants.

### Aesthetics and health

When molds are amplified to the extent that the building is increasingly hospitable to further mold growth, pathogenic, or disease-causing, colonies may take hold in a building's interior. Great concern must





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prevail when confronted with possible *Stachybotrys atra* (Stachy). Air stream movement does not readily spread Stachy, as the spores become less viable in dry air stream environments. However, in moisture-laden air streams or within homes with other amplified mold colonies, Stachy may begin to flourish. Stachy can cause lethal hemorrhage within the lungs, especially when exposed individuals are immune-compromised.

In areas where bird, bat and rodent droppings are prevalent, *Histoplasmosis* (Histo) may be lurking. The lungs are the main sites of Histo infection, but dissemination to the liver, heart and central nervous system can also occur. Pulmonary infection can

resemble symptoms seen in tuberculosis.

How much is bad? That question is answered in part by aesthetic concerns and in part by health concerns associated with

certainly unacceptable and over time may even result in structural damage. *Aspergillus* can thrive on cellulose, paint and drywall, leaving unpleasant-looking stains as the

## For sensitized individuals, the elderly or very young, and immune-compromised people, even very sparse mold colonies may cause health problems.

the particular biological contaminants. If you do not want visible mold growth, even small colonies may be too much. Larger colonies, even if no health effects are forthcoming, are

colonies die back.

Questions of health have many answers, depending in part on how sampling is accomplished. With current sampling protocols, it is a cause for concern if any part of a building is showing amplified mold growth. Investigative consultants often compare sampling results to exterior background levels, or to levels in a part of the building shown to be relatively free of mold contamination. These biological contaminants may be changing in number as conditions change, so there is no such thing as a static background level. The lack of hard numbers is another reason that the sampling team and microbiologist oversight must be comprised of senior level scientists.

For sensitized individuals, the elderly or very young, and immune-compromised people, even very sparse mold colonies may cause health problems. For individuals without these types of concerns, non-pathogenic mold counts should be as low as practicable over established background levels. Higher levels may be acceptable for certain mixes of mold species, and lower levels may be required for single species and pathogenic contaminants. A combination of contact and air sampling information is required to assess most buildings, and these acceptable numbers vary given different biological contaminant mixes and building usage. For example, in a hospital setting, 20 colony forming units per sampling strip area would be too much in the operating room; however, the same result would be perfectly acceptable in the visitor's waiting room.

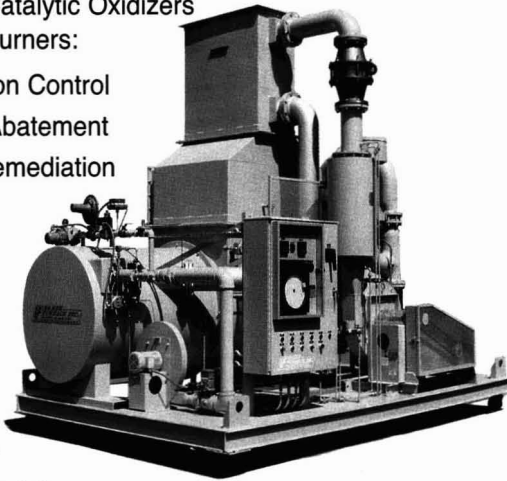
### Decontamination

Once the level of contamination is assessed, scientists can begin to decide how to remedy most negative situations. Steam cleaning without the use of biocides is sometimes the wrong thing to do. Steam will ultimately cool down, and cool to warm water is just what most molds need to increase their amplification rate. Steam cleaning can be beneficial with adequate drying cycles, though, and, in some instances, the concurrent use of biocides.

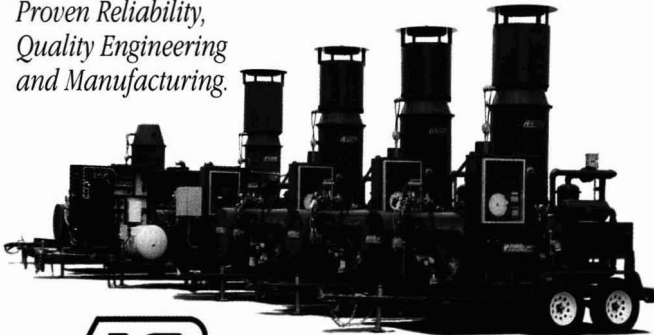
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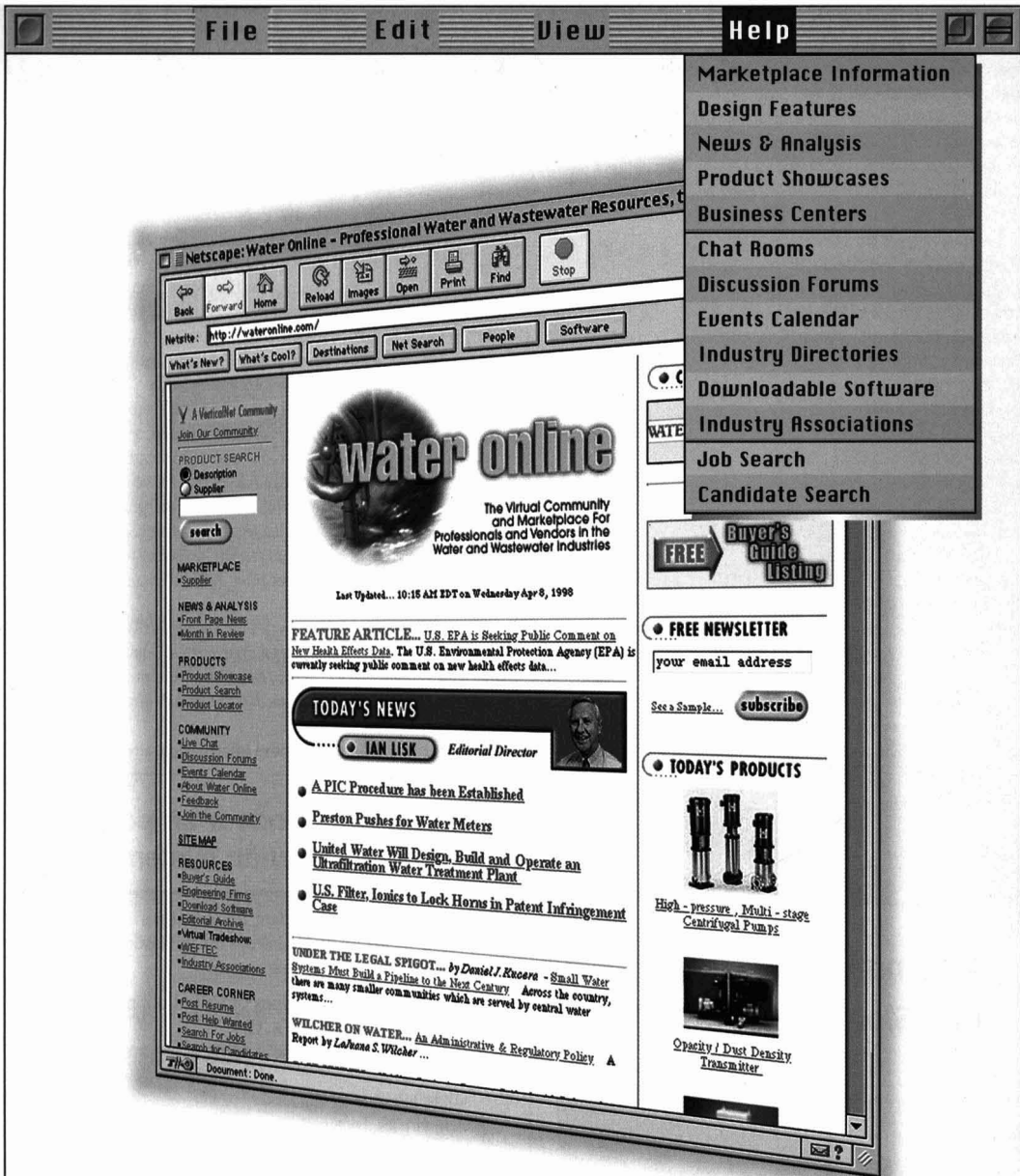


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Biocide—chlorine, phenol and ozone—usage can also be problematic. Chemicals that work in the laboratory may cause aesthetic and even health problems in the real world. Often biocides have limited residual time and may not even be tested against the particular biological contaminant mix of concern.

Residual time for any chemical mix has many unresolved questions; sometimes the chemicals' residual time in a particular circumstance is not even known. In other cases, residual time may make the chemical unattractive, in that the toxic properties of the chemical remain and can cause contamination problems in and of themselves. The basic cellular structure of some unicellular and fungal biological contaminants is similar to the human cellular structure, so chemicals that harm these contaminants may also harm humans.

Recently, biocides that have U.S. Department of Agriculture (USDA) and U.S. Environmental Protection Agency (EPA) approval have been developed and can be used in areas where biocides were formerly unacceptable. The decision as to the appropriate biocide that will not harm humans or animal occupants, or damage structural materials, can be a difficult one.

Decontamination and rehabilitation methodologies must be part of a coordinated abatement design effort.

#### Why now?

A common response to this information is—why now? The answer is twofold. First, humans probably always had these concerns

## Throughout growth and as they die back, molds and fungi give off metabolic gases that contain volatile organic compounds (VOC) emissions.

after living for any length of time indoors. Second, we have increasingly closed our buildings and relied on forced air ventilation systems. Both of these answers are also applicable to closed cab modes of transportation—airplanes, cars, rail cars and ships.

In the past it was thought that endpoint filtration of air streams was sufficient to render delivered air relatively pure. Scientists have now learned that filtration only works for a time, and excessive biological amplification can be transmitted through most current HVAC systems, once established in ductwork or plenums.

Molds and fungi give off metabolic gases throughout growth and as they die back, that contain volatile organic compounds (VOC) emissions. Many of these emitted chemicals are identical to those originating from solvent-based building materials and cleaning supplies, including hexane, methylene chloride, benzene and acetone. If you suspect biological contamination, see visible mold growth, have personnel with repetitive mycosial infections or have IAQ problems that have remained undiagnosed, you need to consult a team of professionals to find answers to these problems in the biological risk hot zone. **EP**

*Martha J. Boss and Dennis W. Day are certified industrial hygienists for Dames & Moore, Omaha, Neb. David A. Henney is a professional engineer for Dames & Moore.*

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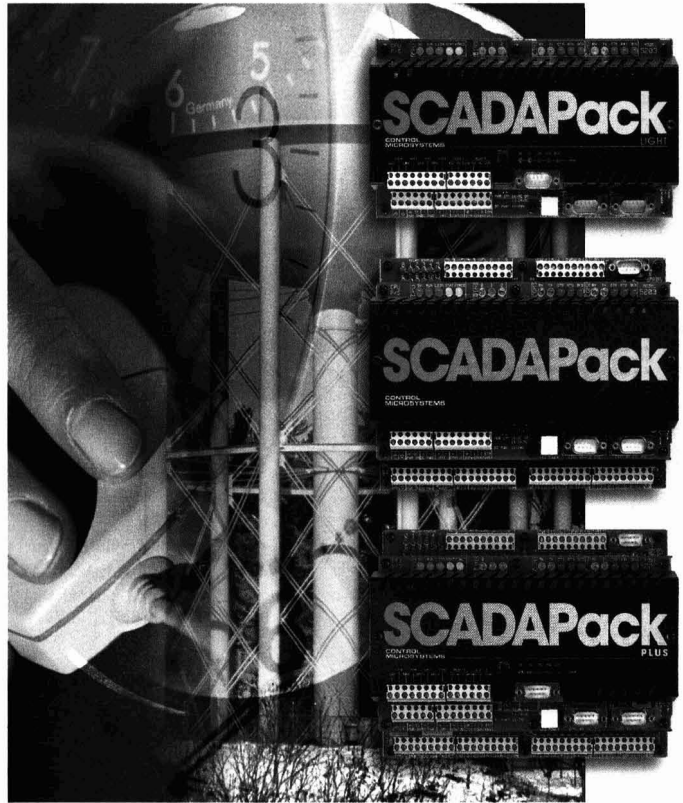
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### **Abitibi Consolidated Pulp and Paper Mill, Snowflake, Ariz.**

Abitibi Consolidated pulp and paper mill, formerly owned by Stone Container Corp. in Snowflake, Ariz., manufactures newsprint and was one of the earliest de-inking facilities for newsprint in the United States.

The mill personnel recognized that water

Under the current program, Abitibi is using all its treated wastewater to irrigate over 60 species of plants on 3,100 acres. Plants species include alfalfa, corn, wheat and sordan (a cross between sorghum and sudan); tree species include cottonwood, black locust and Russian olive. Seasonal crops such as sordan and alfalfa are harvested and sold to local farmers. In addition, a permanent impoundment used to balance the lower winter demands for irrigation will serve as a wetlands habitat for wildlife.

Due to the unique nature of the project and the lack of data for paper mill effluent for irrigation under the existing conditions at the mill, Northern Arizona University School of Forestry was awarded a \$1.4 million study grant to optimize tree growth and the use of various species. The school is currently assisting Abitibi in monitoring the project.

Recently, the Arizona Farm Bureau Federation awarded Stone the 1998 Environmental Enhancement Award. In addition,

had been unusable until relatively recently because of its low BTU value and high sulfur content. Due to a new circulating fluidized bed (CFB) steam generator technology designed by Foster Wheeler Corp., the plant can now readily use the abundant waste coal as fuel. The CFB technology allows the plant to exclusively use waste coal as its fuel, and yet fall below the most stringent air emission standards. Sulfur dioxides and oxides of nitrogen, precursors of acid rain, are almost entirely captured in the process and chemically converted into inert materials. These inert materials are entrained in the fly and bottom ash that is not landfilled. Instead, the alkaline ash is used beneficially to reclaim abandoned waste coal piles near the plant.

The process is unique in that waste coal is removed from the adjacent old mine properties and alkaline ash is returned to these sites for neutralization purposes. Reclamation of the 150 acre Colver refuse site is expected to be complete within 15

# Facilities of the

reuse in Arizona is strongly encouraged by the Arizona Department of Water Resources and the Arizona Department of Environmental Quality. According to the mill's environmental manager Arthur "Skip" Hellerud, in order to turn the pulp and paper mill's effluent discharge from an environmental liability into an environmental benefit, Stone developed a project calling for the total reuse of the mill's treated wastewater to grow biomass such as trees and crops on site.

Presently, the mill generates about 14,000,000 gallons per day of effluent. In the past, this effluent, which contains dissolved salts such as sodium chloride and sodium sulfate, as well as suspended solids such as wood fiber, sizing clays and inks, was placed in two large impoundments and allowed to evaporate. Because these evaporation ponds were located next to a state highway, several citizens complained about the odors from these ponds.

this year the mill received a letter of recognition for its environmental achievements from the American Farm Bureau Federation. Last year, it was presented the Arizona Clean & Beautiful Governor's Pride Award for environmental technology.

### **Colver Power Project, Western Pennsylvania**

Benefits from the Colver Power Plant in western Pennsylvania include electricity, the creation of jobs and improvements to the environment. The power plant is a waste coal-fired electric generating station that creates enough electricity for 120,000 typical residents. The project was constructed during 1993 to 1995 under the most stringent environmental guidelines, resulting in actual air emissions that are well below state and federal guidelines.

The project uses waste coal from nearby abandoned mining sites as its fuel, which

years. This should result in the elimination of a large source of acid-mine drainage into the nearby watershed.

In addition, the plant has implemented a stringent water conservation plan in which water is recycled up to 150 times before it must be discharged. Even at discharge, the water must meet extremely strict National Pollution Discharge Elimination System (NPDES) permit requirements. The plant is very close to becoming a zero-discharge facility.

Recognized by numerous organizations for its accomplishments, the power plant has received the 1998 Waste Watchers Recycling Award from the Pennsylvania

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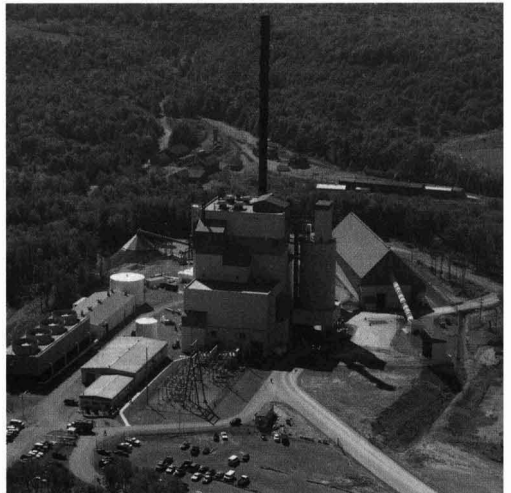
**Opposite page, clockwise from top left, Abitibi Consolidated, William S. Warner Water Treatment Plant, Anchorage Regional Landfill, Colver Power Plant and Circuits Engineering Inc.**



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# YEAR

*By Angela Neville, JD, REM*



Department of Environmental Protection, the 1997 Governor's Award for Environmental Excellence, the 1997 Three Rivers Environmental Award and the 1996 Power Plant Award by *Power Magazine*.

**Circuits Engineering Inc., Bothell, Wash.**

Circuits Engineering Inc. (CEI), a printed circuit board manufacturer in Bothell, Wash., has gone to great lengths to promote its partnership with the environment, regulatory agencies, its customers and its employees.

Through its in-house Environmental Awareness Team and Waste Prevention Challenge Program, CEI has made big strides. During the period of 1996 to 1998, CEI decreased its annual hazardous waste generation by over 45 percent and decreased its average daily generation of industrial water by more than 11 percent. In addition, CEI currently recycles more than 70 percent of its total solid waste stream.

CEI intends to continually improve its environmental performance. "By the end of this year, Circuits Engineering will make a

purchasing decision on an ion exchange waste treatment system for the purpose of recycling over 90 percent of our total industrial waste stream," Chad Renando, CEI's compliance officer, said. "This will replace our current chemical precipitant system that discharges wastewater directly to the local publicly owned treatment work (POTW) after treatment."

Moreover, CEI intends to reduce the total chemicals it stores on site by 90 percent. The company plans to accomplish this by changing from a current process that uses copper, formaldehyde and cyanide to an alternate process that uses carbon as a main constituent.

In light of the manufacturer's accomplishments, Washington State Department of Ecology honored CEI in 1997 as having the best small business recycling program in Washington. This year, CEI received the EnviroVation Award from King County, Wash., for its efforts in pollution prevention. Additionally, the Puget Sound Waste Information Network recently recognized CEI with its Environmental Achievement Award for "minimizing hazardous materials, developing less hazardous products and fostering an ethic of personal responsibility among employees, peers and the public." The company is an active partner in the U.S. Environmental Protection Agency's WasteWise Program and the Energy Star Small Business Program.

**William S. Warner Water Treatment Plant, Fairfield, Conn.**

The William S. Warner plant in Fairfield, Conn., began operations in 1997 and is designed to treat up to 50 million gallons of drinking water per day from the adjacent Hemlocks Reservoir. The plant is the largest operating plant in the United States to treat drinking water using dissolved air flotation (DAF)

David Nickols, PE., is the vice-president of Hazen and Sawyer, the New York City-based engineering firm that designed the plant. According to Nickols, the Warner Plant represents an important milestone in making DAF a more widely accepted treatment process in this country. DAF is a cost- and space-efficient technology that is used widely overseas, but has only recently been proven domestically. In the DAF process, flocculated particles are floated to the top of a tank, unlike the traditional settling processes, in which particles settle to the bottom. More than twice as much water can be treated by DAF than by high-rate settling in the same tank area—producing better water quality, in addition. It requires only half the area of high-rate set-

*Continued on page 51*

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Raising Industry Standards

Companies could face an environmental liability crisis in 2000

# The millennium bug: Will it bite you?

By Dixie Lee Laswell, JD



**I**t is Friday night, December 31, 1999, and midnight is fast approaching. Have you found and exterminated all the bugs in the embedded systems yet, or, like Cinderella's coach at the stroke of midnight, will your pollution control equipment turn into a pollution pumpkin?

The pest in question is the so-called millennium bug, and is the cause of the Year 2000 (Y2K) problem. The basic problem is in the date. To save precious memory space, many date-sensitive software programs and embedded processors were programmed to use only two digits to store the year. This means the "00" of January 1, 2000, may be interpreted by computers as January 1, 1900. To make matters worse, 2000 is a leap year, which could throw off the calendar days even further. Automated billing, shipping and purchasing systems could begin to make errors, or the bug simply may cause all systems to crash.

Little attention has been paid, though, to what this may mean to the environment. Y2K poses special problems for both pollution control specialists and for the regulators attempting to enforce environmental laws.

### **Environmental protection infrastructure**

Many pollution control systems rely on computers for their operation. These include, among others, emission monitoring systems, water treatment systems, pollution control equipment and valve control units. In addition, systems not specifically related to the environment that may be affected include information management systems, electronic data delivery systems, security systems and even heating, ventilation and air conditioning systems. Even instrument software and hardware could be affected.

Just identifying the systems that could be impacted is a massive job in itself, because embedded processors are hidden in many non-computer control systems. Embedded processors control a wide variety of systems, including complex industrial processes. While not all of these embedded processors will have Y2K failure problems, identifying the affected systems and finding and fixing the problems are critical. Stopped manufacturing lines could result in explosions. Security systems could admit anyone with a credit card. An in-plant power substation could fail, along with a municipal water treatment plant.

Many companies, however, have not addressed these problems. One reason is these companies have been focusing on the

more immediate, tangible Y2K concerns affecting their day-to-day business. Y2K can seem to be little more than just another doomsday prophecy. But the potential cost of pollution control system failure is huge, and the manufacturers of pollution control equipment are not offering any easy solutions.

On August 7, 1998, the U.S. Department of Transportation's Research and Special Programs Administration (RSPA) issued an advisory bulletin to owners and operators of hazardous liquid and natural gas pipelines.

"These (erroneous) date calculations may be embedded in controllers that operate pipeline equipment. There is the possibility that a Y2K problem could cause this equipment to malfunction. In most cases, operators must evaluate their system-by-system operations to determine if there is a Y2K

especially the larger ones, are heavily automated and could be at risk of failure if not prepared for the four digit year," it stated.

The Y2K problem is widespread, even within the confines of individual companies. International Paper states in its most recent 10-Q report that its 46 pulp and paper mills' control systems have 1,000 to 2, 000 components per mill to monitor and regulate power, emissions and production operations. "Failure to identify, correct and test Year 2000 sensitive systems at any one of these facilities could result in manufacturing interruptions, possible environmental contamination, or safety hazards," it reads.

### **Potential repercussions**

Not having the advantage of a crystal ball, it is difficult to predict what really will happen

## **Y2K on the Internet**

North American Electric Reliability Council . . . . . <http://www.nerc.com>  
An overview of Y2K and  
other links . . . . . <http://www.abanet.org/lpm/magazine/tu984.html#tag0>  
Year 2000 Information Center . . . . . <http://www.year2000.com>  
Information Technology Association of America . . . . . <http://www.ita.org/year2000.htm>  
Microsoft Year 2000 Resource Center . . . . . <http://www.microsoft.com/year2000>  
Y2K Cinderella Home Page . . . . . <http://parsifal.membrane.com/y2k/index.html>  
CIO's Year 2000 Research Center . . . . . <http://www.cio.com/forum/y2k/index.html>  
Y2KExperts.com . . . . . <http://www.y2kexperts.com>  
Dr. Ed Yardeni's Center for Cybereconomics . . . . . <http://www.yardeni.com/cyber.html>  
2000is.com . . . . . <http://www.2000is.com>  
The Year 2000 Law Center . . . . . <http://www.Year2000.com/y2klawcenter.html>  
U.S. Government  
Year 2000 Gateway . . . . . <http://www.itpolicy.gsa.gov/mks/yr2000/y2khome.htm>  
President's Council on Year 2000 Conversion . . . . . <http://www.y2k.gov>  
U.S. Government Best  
Practices Guidelines. . . . . <http://www.itpolicy.gsa.gov/library/yr2000/y207best.htm>  
Environmental Protection Agency Year 2000 . . . . . <http://www.epa.gov>  
Law Journal EXTRA!'s  
"Year 2000 Dilemma" . . . . . [http://www.ljextra.com/practice/computer/ct\\_y2k.html](http://www.ljextra.com/practice/computer/ct_y2k.html)  
XPS Bulletin Board . . . . . <http://www.xpsoft.com/board.html>  
Year 2000 Resource . . . . . [http://www.ttuhs.edu/pages/year2000/y2k\\_bib.htm](http://www.ttuhs.edu/pages/year2000/y2k_bib.htm)

problem in their hardware or software," it stated (63 *Federal Register* 42478).

If a system fails, shut-off valves could remain open or chemicals could become trapped in the pipeline, which could result in hardening or corroding, or even worse, leaks or explosions.

A U.S. Environmental Protection Agency (EPA) report issued in May 1998 to senior EPA officials disclosed that some of the most significant Y2K effects could be on water treatment systems.

"The nation's drinking water treatment plants and clean water treatment plants,

on January 1, 2000. Companies that do nothing may have system failures resulting in explosions, massive emissions to the air, discharges of toxins to the water or publicly owned treatment works. Failure of pollution control equipment could mean permit violations due to faulty monitoring devices, or even wholesale shutdown of operations. A valve malfunction alone could result in an environmental disaster of historic magnitude.

System failures also may occur as a result of the loss of electric power. Through no fault of their own, companies may find themselves literally in the dark. Contingency

plans should incorporate the very real potential for environmental non-compliance.

Violations of state and local pollution laws could abound, as could workplace health and safety violations. There are, in addition, potential violations of consent agreements or consent decrees. While many of these documents contain *force majeure* provisions, the coming millennium is foreseeable and not unanticipated. These violations probably will not be covered by *force majeure*.

Corporate directors and officers with the responsibility to assure Y2K compliance may find themselves in trouble under both federal securities laws and state tort laws. Even

worse, the potential for criminal environmental liability exists, because the majority of federal environmental crimes only require evidence of "knowing," or intentional, conduct and may not require evidence that the defendants were aware they were violating a particular law or regulation, as the U.S. Supreme Court ruled this year in *Bryan v. United States*. All of these result in the potential for significant liability.

### How to fight the bug

Industries on the cutting edge of these issues are already working out their bugs. "Many utilities are developing contingency

plans for possible, computer-related shutdowns of monitoring systems," said Edison Electric Institute spokeswoman Linda Schoumacher in the July issue of the *BNA Daily Environment Reporter*.

A company must develop a plan to assess and to deal with any technical and legal Y2K problems. The complete Y2K environmental assessment plan should:

1. Create a Y2K team including senior management, system users, information systems professionals, environmental engineers and consultants, and lawyers. Select a team leader.
2. Inventory technology, including embed-

## Protect yourself—a warranty option for Y2K compliance

A Fortune 500, publicly traded distribution company shared with the author three Year 2000 warranty forms, which can be used with a common definition of Y2K compliance, depending on the type of agreement.

### 1. Consulting Only

All Services rendered by Consultant in connection with this Statement of Work shall be provided in accordance with the highest applicable professional standards and in accordance with Customer's specifications, including Year 2000 Compliance requirements. Any and all deliverables shall be Year 2000 Compliant, as defined below. Customer reserves the right to reject any Services or Deliverables that are not performed or delivered as set forth above.

### 2. Consultant/Product Provider

All Services by Consultant in connection with this Statement of Work shall be provided in accordance with the highest applicable professional standards and in accordance with Customer's specifications, including Year 2000 Compliance requirements. Customer reserves the right to reject any Service not performed in accordance with Customer's specifications. Consultant represents and warrants that any and all deliveries shall be Year 2000 Compliant, as defined below. In the event of a non-conformity with this warranty, Consultant shall repair or replace any non-conforming product, at no cost to Customer.

### 3. Y2K Solution Provider

Consultant represents and warrants that all Services rendered by Consultant in connection with this Statement of Work shall be provided in accordance with the highest applicable professional standards and in accordance with Customer's specification in general and, in particular, shall further Customer in its Year 2000 transition. Customer reserves the right to reject any Services not performed in accordance with such specifications. Consultant further represents and warrants that its internal systems and all hardware, software and any other deliverable provided pursuant to the performance of the Services shall be Year 2000 Compliant, as defined below.

For the purposes of this Request for Proposal (RFP), Y2K Compliant shall mean that the Products (including any and all products and/or services, however provided) shall be able to process date data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, including leap year calculations.

Further, the Product's respective systems: (i) will not abnormally end or provide invalid or incorrect results when used with valid date data, specifically including, but not limited to, date data that represents or references different centuries or more than one century and date data formerly used to indicate unknown or "filler" dates (e.g., 1/1/99 or 9/9/99); (ii) will ensure Year 2000 compatibility including, but not limited to, date data century recognition, calculations that accommodate same century and multi-century formulas and date values, and date data interface values that reflect the century; (iii) will correctly interpret and exchange date data with other software and equipment with which it interfaces, interacts, inter-operates, or exchanges data; and (iv) includes "Year 2000 capabilities." For purposes of this RFP, "Year 2000 capabilities" means the Product's respective systems will: (i) manage and manipulate data involving dates, including single century formulas and multi-century formulas, and will not cause an abnormally ending scenario within the application or generate incorrect values or invalid results involving such dates; (ii) provide that all date-related user interface functionality and data fields include the indication of century; and (iii) provide that all date-related data interface functionality include the indication of century.

### For more information, please see the following Web sites:

GSA Year 2000 Contract Language Presented to the Year 2000 Interagency Committee  
[www.itpolicy.gsa.gov/mks/yr2000/y2kfnl.htm](http://www.itpolicy.gsa.gov/mks/yr2000/y2kfnl.htm)  
Year 2000 Warranty  
[www.year2000.com/archive/warranty/html](http://www.year2000.com/archive/warranty/html)  
National Institute of Standards and Technology, Department of Commerce: FIPS PUB 4-1, "Representation for Calendar Date and Ordinal Date for Information Interchange" and related Change Notice  
[www.nist.gov/itl/div879/yr2000.htm](http://www.nist.gov/itl/div879/yr2000.htm)  
GTE Year 2000 Compliance Definition, "GTE 2000 Proposed Criteria for 'Century Compliance'"  
[www.mitre.org:80/research/cots/GTE\\_CRITERIA.html](http://www.mitre.org:80/research/cots/GTE_CRITERIA.html)  
British Standards Institute, DISC PD200-1, : A Definition of Year 2000 Conformity Requirements:  
[www.bsi.org.uk/bsi/disc/year2000/2000.html](http://www.bsi.org.uk/bsi/disc/year2000/2000.html)  
Central computing and Telecommunications Agency, United Kingdom, "Tackling the Year 2000"  
[www.open.gov.uk/ccta/mill/cct\\_guid.htm](http://www.open.gov.uk/ccta/mill/cct_guid.htm)  
Performance Standard Language  
[www.mitre.org:80/research/cots/Y2K\\_QUESTIONS.html](http://www.mitre.org:80/research/cots/Y2K_QUESTIONS.html)



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ded systems. Identify critical systems relating to health, safety and the environment. Teams should contact system manufacturers to determine whether or not the embedded systems are Y2K compliant, and if not, ask for assistance. Check warranties, contracts and transaction agreements for possible liability.

3. Fix the identified Y2K problems and test

pliant." (See "A federal definition...") Be careful that liability is not limited and that warranties do not expire too soon.

4. Conduct emergency contingency planning for environmental noncompliance. This could include obtaining and testing backup generators in case of electrical failure and contacting all utilities (power, water, telephone) and local emergency

readiness, companies have had to re-compute the dollar cost of fixing the problem, and disclose Y2K risks and contingency plans. As a result, Y2K cost projections have increased substantially. For example, Citicorp increased its estimated costs to \$650 million, up \$50 million; Lillian Vernon Corp. increased its estimated costs to \$1.2 million, up more than \$200,000.

## A federal definition of Y2K compliant

"Year 2000 Compliant ... means that the information technology accurately processes date/time data (including, but not limited to, calculating, comparing and sequencing) from, into and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other information technology, used in combination with the information technology being acquired, properly exchanges date/time data with it." (48 Code of Federal Regulations Section 39.002)

the systems. Testing, however, could take more time than left available. Computer experts say accurate testing procedures could take several years. Some systems may have to be replaced entirely, in lieu of testing. Make sure that any purchase or license contains a warranty that it is Y2K compliant. (See "Protect yourself...") One starting point is the Federal Acquisition Regulation definition of "Year 2000 Com-

pliant." Get their responses in writing, ensuring they are aware of, and are dealing with, possible outages.

5. Check on insurance coverage and determine whether to purchase special coverage.

6. Develop a strategy for external communications.

Y2K is expected to take a bite out of company budgets. Under new Securities and Exchange Commission guidelines for Y2K

## The government has problems of its own

The President's Council on Year 2000 Conversion, established on February 4, 1998 by Executive Order 13073, is responsible for coordinating the federal government's efforts to address the Y2K problem. The council also has a special focus on assessing Y2K preparations in the key infrastructure areas of energy, telecommunications, finance and transportation.

EPA has been addressing its own internal problems with the four digit date issue. In a January 1997 report to Congress, EPA's Office of Inspector General found "the potential effect of the problem within EPA is tremendous."

So is the estimated cost. EPA expects to spend \$26 million addressing the Y2K problem between 1996 and 2000.

There is also still a big question whether the government will ever know about violations of permits or environmental laws created by the millennium bug. If the government's systems fail as well, date sensitive computer cross-checks of required monitoring reports may not be possible. By the time all of this is sorted out, applicable statutes of limitations may have run.

## Act now—don't wait to be bitten

It is essential to conduct both a technical and legal Y2K environmental assessment as soon as possible in order to avoid a huge corporate headache in the next year. Awareness and prevention now will help minimize the risk of environmental disaster at the stroke of midnight, Friday, December 31, 1999. **EPA**

**For more information, circle 116 on card.**

**Author's note:** This article is intended solely to raise the level of Y2K awareness of the reader and is not intended to provide legal advice with respect to specific transactions or matters. Readers of this article are cautioned to consult with their own legal counsel prior to undertaking any action with respect to specific legal matters or issues. This article was written in October 1998 and does not reflect any information or events after October 1998.

Dixie Lee Laswell, JD, is a partner at the law firm of Seyfarth, Shaw, Fairweather and Geraldson in Chicago.

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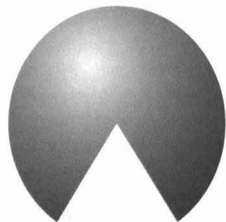
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# The new age of reason

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models, brings  
sound science to the  
remediation process*

*By Larry Brannaka, PhD, PE,  
Tony Giunta  
and James Hewitt, PE*

## PART 1

*In this month's issue, the theory and history of contaminant transport modeling in soil are presented. Part II, in our January issue, will discuss how New Hampshire established its soil cleanup standards.*

At hazardous waste sites where contaminated soils pose a threat to groundwater quality, site remediation activities usually consist of removing contaminated soil to a treatment or disposal facility, or remediating soil on-site with an active on-site contaminant removal process such as soil vapor extraction. Environmental regulations typically require contaminated soils be treated or removed to the extent the remaining *in situ* soil can no longer produce leachate—water from precipitation that becomes contaminated by percolating through soil—at concentrations that would degrade groundwater quality. This extent is defined as the “allowable contaminant concentration” in soil, or its soil cleanup standard.

In the early days following the enactment of the Comprehensive Environmental Compensation and Liability Act (known as Superfund) in 1980, very little information existed regarding fate and transport of chemicals in soil and the effect these contaminants had on the environment. Because of this lack of knowledge, most state and federal environmental regulators assumed the conservative position that if contamination could be detected in soil, it must be removed or remediated to natural background levels. As laboratory quantitative detection limits improved from parts per million (ppm) to parts per billion (ppb), the volume of soil with detectable levels of hazardous chemicals, and thus the volume of soil requiring remediation, increased dramatically. The “cleanup to non-detect” or “cleanup to pristine conditions” approach, while certainly protecting groundwater quality, caused millions, possibly billions, of public and private dollars to be spent on soil remediation activities that were not necessarily needed to protect groundwater quality.

There has recently been a shift by some reg-

ulators away from the simplistic, though politically expedient, “cleanup to background” ideology to a more reasoned “risk-based” approach. This is often referred to as risk-based corrective action (RBCA), sometimes called “Rebecca.” This approach uses state-of-the-art science to determine contaminant specific concentrations in soil that are protective of human health and the environment. These allowable levels are based on the predicted amount of contaminant that would reach the water table, and the risk the subsequent migration of contaminants in the aquifer poses to human health and the environment.

Quantifying the allowable concentration for the hundreds of chemicals commonly found in soil at hazardous waste sites has perplexed government regulators for years. Now, with new and powerful computer models developed to predict the fate and transport of chemicals as they migrate through soil above the water table in the vadose zone, modelers are able to predict aquifer contamination levels using specific site and chemical characteristics. Regulators in some states have recently begun to use these computer models to establish risk-based rather than rule-based cleanup standards.

### **Method development of risk-based soil cleanup standards**

The State of Oregon Department of Environmental Quality was an early visionary in developing methodologies for employing computer models in a risk-based approach to setting cleanup standards. From the numerous computer models available for both the vadose zone and the saturated water-table aquifer, two public domain computer models, Seasonal Soil Compartment Model (SESOIL) and Analytical Model of Transport 1-, 2- and 3-Dimensional Waste Transport (AT123D), were selected. SESOIL was used to model chemical specific leachate flow in the unsaturated zone and AT123D was used for contaminant transport through the aquifer.

The computer simulations were used to establish the threshold levels of soil contamination that would not adversely affect groundwater quality. This original work prompted other states to pursue risk-based cleanup methodologies. In April 1995, Wisconsin's Department of Natural Resources codified in its *Soil Cleanup Standards* risk-based chemical specific soil cleanup standards based on modeling.

The New Hampshire Department of Environmental Services (NHDES) followed states

# Waste Management News

REGULATORY UPDATES, ENFORCEMENT POLICY AND COMPLIANCE STRATEGIES FOR TREATMENT AND DISPOSAL



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### Waste Cleanup

## Ashland Agrees to Pay \$30 Million in Civil Penalties, Environmental Projects

Ashland Inc. has agreed to spend about \$32.7 million to settle allegations of illegal discharges of pollutants and reporting violations at its petroleum refineries in Kentucky, Minnesota and Ohio.

The corporation agreed to pay more than \$5.8 million in civil penalties, to spend \$12 million to correct its violations and to spend \$14.9 million to per-

form supplemental environmental projects, such as a project that will restore 274 acres of rare prairie grass in Minnesota.

The agreement, announced by EPA and the Department of Justice, resolves charges that Ashland violated RCRA, the Clean Air Act, the Clean Water Act,

■ See *Ashland Agreement*, Page 2

### Waste Cleanup

## Washington, DOE Have Agreement Over Cleanup Of Hanford's Critical Problems

The state of Washington and the Energy Department have negotiated a new agreement for cleaning up critical problems at the Hanford nuclear reservation, averting a lawsuit threatened by the state.

The agreement, announced Oct. 14

by Energy Secretary Bill Richardson, comes just four months after Gov. Gary Locke called leaking radioactive waste storage tanks at Hanford an "underground Chernobyl waiting to happen."

■ See *Hanford Agreement*, Page 2

### Hazardous Waste

## FMC Corp. Receives Largest RCRA Civil Penalty, Agrees To Spend \$170 Million

FMC Corp. Inc. has agreed to spend about \$170 million — including the largest civil penalty ever obtained under RCRA of more than \$11.8 million — to settle charges that it repeatedly violated the hazardous waste law at its phosphorus production facility in Pocatello, Idaho.

The government's claims against FMC include several RCRA violations, the most serious of which involve mismanagement of ignitable and reactive phosphorus wastes in ponds. According to EPA, the sediments in these ponds burn

■ See *Waste Ponds*, Page 2



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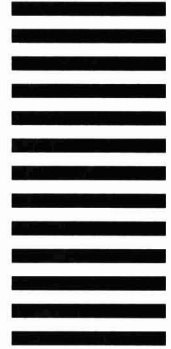
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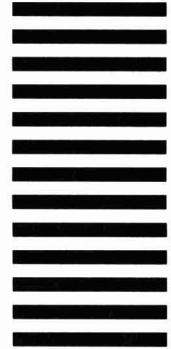
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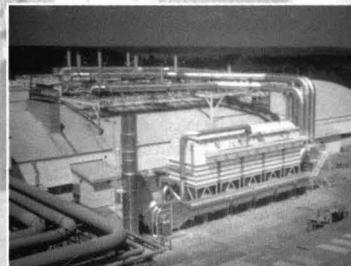
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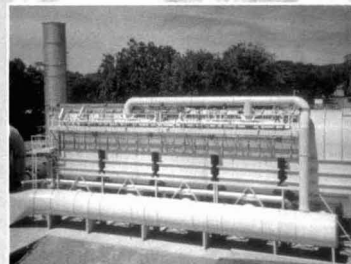
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like Oregon and Wisconsin, and after reviewing the scientific basis and performance records of the new methodologies, adopted the *Interim Policy for the Management of Soils Contaminated From Spills/Releases of Virgin Petroleum Products* in September 1991. The policy was optimistically received and quickly won support from the regulated community. It was the first policy in New Hampshire that addressed individual petroleum compounds, allowed scientific evaluation and, based on individual compound risk analyses, allowed for closure of sites even though detectable levels of petroleum constituents remained within site soils. The program was such a success that business and industry quickly requested the program be expanded from petroleum compounds to all compounds regarded as hazardous wastes under the Resource Conservation and Recovery Act.

Because the computer simulations were indifferent to the type of chemical modeled, expanding the risk-based analyses to hazardous wastes was the logical next step in the process. Work progressed on the groundwater leaching analyses using computer models and the establishment of generic soil cleanup standards. The result led to the adoption of the Risk Characterization and Management Policy (RCMP) in

September 1996. To establish the criteria set out in this document, leachate migration through the vadose zone and throughout the aquifer was simulated for 147 chemicals commonly found at New Hampshire waste sites. Other states modeled only a dozen or so chemicals and extrapolated these results to establish cleanup levels for their state's hundred or so targeted compounds. Even though New Hampshire was not the first state to establish soil cleanup guidelines using computer modeling, New Hampshire was and remains the only state to individualize model each of its 147 target contaminants.

#### Description of the computer models

The modeling tool selected by the NHDES was the combination of two coupled models, SESOIL and AT123D. The selection of these models was based, in part, on the success other states had using the same models, in particular the states of Oregon, Wisconsin and Massachusetts. SESOIL is a one-dimensional compartmental model for vertical water flow and contaminant transport in the vadose zone. It breaks the vadose zone into compartments of soil (adsorption), soil moisture (dissolved chemical species) and soil vapor (volatilized chemical species).

Water flow is based on Eagleson's unsaturated zone water balance model.

The model incorporates the processes of precipitation (P), infiltration (I), surface runoff (SRO), evapotranspiration (ET), capillary rise from the water table (CR), soil moisture retention ( $\Delta S$ ), and groundwater recharge (U). Moisture flow within SESOIL is based on the following water balance equation:

$$P + CR - ET - \Delta S = SRO + U \quad (1)$$

and

$$I = P - SRO \quad (2)$$

For moisture flow the model assumes a homogenous, isotropic soil column with uniform effective porosity and unsaturated hydraulic conductivity. It follows that the soil moisture content is also assumed to be uniform along the length of the column before each storm event. The model utilizes a national climatic database to assign hydrologic input parameters. The water flow is driven by a series of statistically derived storm events, using the climatic data input.

The model computes the pollutant transport using the average monthly hydrologic cycle results. Pollutant transport is comput-

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The report is over 140 pages in length, with 36 tables. The cost is \$395 (\$195 for non-profit institutions).

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ed on a daily basis by computing a pollutant mass balance for each compartment, and assuming equilibrium partitioning between the different phases (dissolved, sorbed, vapor and pure). The mass balance equation is:

$$O_{(t-1)} + I_{(t)} = T_{(t)} + R_{(t)} + M_{(t)} \quad (3)$$

where

- $O_{(t-1)}$  = Original species mass in compartment;
- $I_{(t)}$  = Species mass input;
- $T_{(t)}$  = Species mass transformed;
- $R_{(t)}$  = Remaining species mass; and
- $M_{(t)}$  = Mass lost to other compartments.

The pollution cycle of SESOIL accounts for the residual pure phase as well as the fate processes of advection, adsorption, volatilization, vapor phase diffusion, and first-order transformations such as biodegradation, hydrolysis and complexation. Input parameters include site dimensions, extent of contamination, soil characteristics, climate data and chemical properties. The climatic data required is generally gathered from the region in which the site is located. In the United States, climatic data has been compiled in a large data base from available weather stations across the country.

#### AT123D

SESOIL is typically run in conjunction with AT123D, which is an analytical transport model for the saturated water table aquifer. SESOIL provides the data for the vertical mass transfer of the specific contaminant to the groundwater table. The migration of the contaminant with the ambient groundwater flow is simulated by AT123D. The name can be misleading. This model is essentially a one-dimensional groundwater flow model. The second and third dimensions refer to the model's computation of dispersion/diffusion effects, in which the contaminant plume may spread out in the vertical and transverse directions from the advective flow.

It is an analytical model, and assumes a homogeneous aquifer in which groundwater flow velocities ( $v$ ) are computed for steady-state horizontal flow under a small gradient. Effects of anisotropy, the condition in which properties vary according to the direction in which they are measured, are handled by varying the dispersivity tensor ( $D$ ). The model accounts for advective and dispersive transport of the contaminant species, and includes retardation ( $R$ ), and first-order transformation (decay) processes ( $\lambda$ ). Transport is computed using

the standard advection-dispersion equation (ADE):

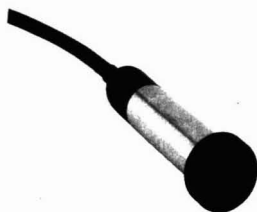
$$\frac{\partial C}{\partial t} = \nabla \cdot \left[ \frac{D}{R} \cdot \nabla C \right] - \nabla \cdot \frac{v}{R} C + \frac{M}{\Phi R} \quad (4)$$

The ADE includes a term for mass loading ( $M$ ). The effective porosity is represented by  $\Phi$ . The user must specify the points down-gradient for which the time-series concentration values are desired. The maximum concentration of contaminant in the groundwater predicted by AT123D is used to establish the soil cleanup standard. **ED**

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# A new weapon in the battle for cleaner water

By John Vardeman

*A breakthrough chemical process based on the creation of a new molecule shows promise for wastewater treatment*

**T**he cleaning of truck tanks often involves dealing with hazardous materials such as benzenes, polychlorinated biphenyls (PCBs) and phenolics that can come together to form potentially dangerous chemical cocktails. To date, the options available for this task have been limited to traditional treatment practices—physical, chemical and biological. Today's activated carbon drums may work a little better than they did several years ago; the process of polymer flocculation and wash-out basins may be even more efficient, but the fact remains that in the last 100 years, technology and application principles have changed little.

Recently, however, an independent test at Chemical Leaman Tank Lines' Savannah, Ga., terminal introduced a new method of industrial wastewater treatment. The process, called MYCELX™, is based on the creation of a new molecule by Mother Environmental Systems Inc., an environmental research group based in Gainesville, Ga.

In the Chemical Leaman field test (see **Figure 1**), conducted by Savannah Laboratories & Environmental Services Inc. in April and reported in May, a wastewater sample containing approximately one half-gram per liter of phenolics was reduced to 78 millionths of a gram—a magnitude reduction of nearly one million times. Consequently, biochemical oxygen demand (BOD) was reduced significantly in the same sample from 405.1 milligrams per liter (mg/l) to 230 mg/l. Detectable levels of zinc were brought down by a third, while other metals were all below detectable limits. All tests were conducted with a single pass.

## The new chemistry's beginnings

Oddly enough, the new process got its start in a bar. Hal Alper, a former research director for a large electrochemistry company, was drinking beer and watching television at a New York pub in March 1989 when news broke of the Exxon Valdez oil spill in Prince William Sound, Alaska.

A longtime environmentalist, Alper was horrified by the accident but, at the same time, inspired to develop a solution to the enormous challenges of spill removal. Relying on his chemistry background in emulsification, Alper retreated to a tiny lab in his basement and threw himself into the project.

After days of boiling linseed oil together with different polymers,

FIGURE 1

## Chemical Leaman field test

	Wastewater sample (before)	Wastewater sample (after single filter pass)
Oil and grease	1,664 mg/liter	14 mg/liter
Phenolics, total recoverable	420.2 mg/liter	0.078 mg/liter
Cyanide	335.2 mg/liter	<0.010 mg/liter (BDL)
Cadmium	200.7 mg/liter	<0.0050 mg/liter (BDL)
Chromium	200.7 mg/liter	<0.012 mg/liter (BDL)
Copper	200.7 mg/liter	<0.025 mg/liter (BDL)
Lead	200.7 mg/liter	<0.0050 mg/liter (BDL)
Nickel	200.7 mg/liter	<0.040 mg/liter (BDL)
Zinc	200.7 mg/liter	<0.19 mg/liter (BDL)
Arsenic	200.7 mg/liter	<0.010 mg/liter (BDL)
Silver	200.7 mg/liter	<0.010 mg/liter (BDL)
Mercury	245.1 mg/liter	<0.00020 mg/liter (BDL)

BDL = Below detectable limits

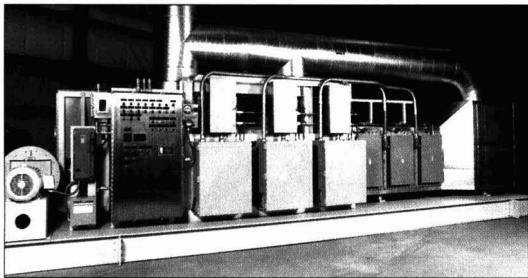
TESTING CONDUCTED AND VERIFIED BY SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES INC.

Alper discovered that one of his concoctions did a surprisingly good job of clumping together non-detergent motor oil in a water-filled beaker. Still unsure of the magnitude of his discovery, he sought the advice of a friend who was among the many consultants in the Valdez crisis. After viewing the experiment, his friend advised him to get a patent.

Nearly a decade and numerous refinements later, the chemistry has been implemented in a number of oil-remediation applications. Infused into substrate materials ranging from wood chips to buoyant pads, the chemistry is sold and marketed under a number of different product names. Recently, the technology has been adapted to the wastewater treatment industry.

According to Stu Putman, applications engineer at Mother Environmental, industrial wastewater treatment is often a slow, expensive process. "Meeting all the regulations for hazardous waste cleanup and removal is obviously very expensive," he said. "The process can be very slow and tedious when you're working with activated carbons and basins. Chemical Leaman, for example, often gets so backed up with the task that they resort to shipping out the [hazardous waste] in drums for treatment and disposal elsewhere, which is even more expensive for them."

Putman said, "[The new process] represents chemistry that is nearly 100 percent effective with only a single pass, no matter if it's



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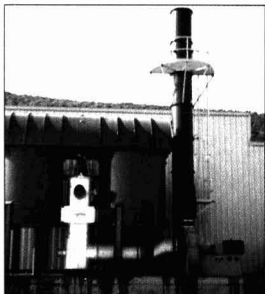
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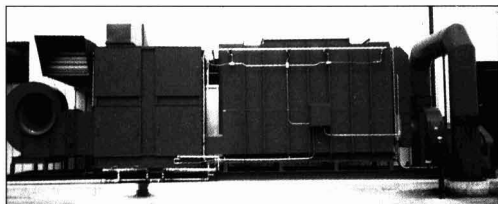


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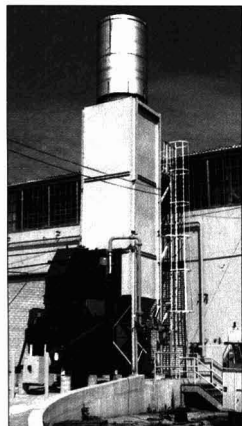
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### Overview of how it works

The new chemistry, according to its technical definition, is the product of a reaction between a natural drying oil and a synthetic polymer. In its natural state, MYCELX is a clear, non-toxic solid chemical, but can be transformed into a liquid with various thicknesses, depending upon how it will be used. The new material has been listed with the Chemical Abstracts Services under the registration numbers 173967-80-1 and 173967-81-2. First patented in 1995, the chemistry currently has four full patents and a fifth patent pending.

The chemistry is in the same class of materials known as surfactants, which includes emulsifiers such as soap. However, within the realm of surfactants, it is classified as a viscoelastic rheology modifier. The new material forms a complex network of molecules that, among other things, causes organic molecules to form structures called micelles, which are extremely hydrophobic.

This property is key in the chemistry's ability to attract and remove all organic compounds from waste streams. Included in this range are aromatic hydrocarbons, such as benzene, toluene, ethyl benzene and xylene (BTEX); PCBs; and chelated and non-chelated metals.

Whether water-soluble or insoluble, materials coated with the chemistry bond organic compounds to their surfaces and prevent them from separating and emulsifying. "[The chemistry] allows water to flow through the filtration process with virtually no restrictions," Putman said. "The mesh on filters [coated with the chemistry] actually increases water flow."

The new material features extreme differential affinity for removing specific waste materials from effluent streams. Filters infused with the chemistry will remove virtually 100 percent of kerosene from water, and can also remove nearly 100 percent of oil from kerosene. This is a rare property in chemistry.

### The new process vs. existing technologies

One of the more popular chemical technologies today for industrial wastewater treatment involves ionic exchange through polymer flocculation. Under this slow process, a polymer is added to water and through the resulting generation of positive and negative charges, the polymer attaches to a hazardous chemical. This leads

## Field trials demonstrated that filters coated with the new chemical process are successful in removing contaminants after a few seconds of exposure to industrial wastewater.

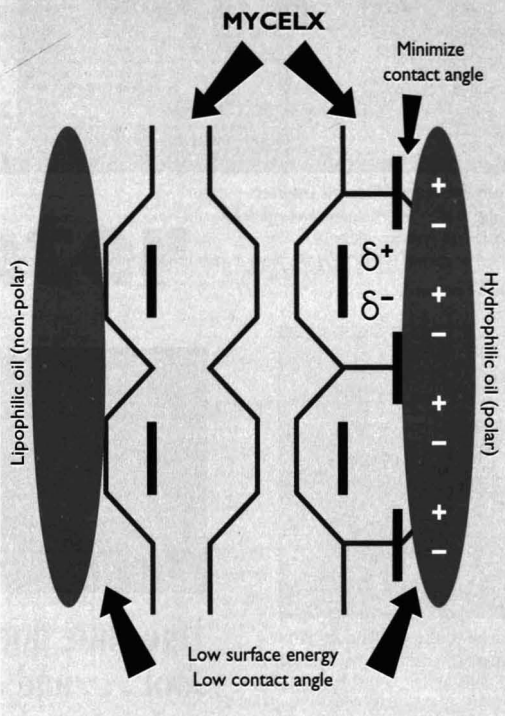
to coagulation, and the resulting material rises to the surface for removal. The process usually takes a number of days.

MYCELX takes far less time. Field trials demonstrated that filters coated with the new material are successful in removing contaminants after a few seconds of exposure to industrial wastewater.

Activated carbon-adsorption technology currently represents the most common process in industrial wastewater treatment. However, activated carbon is effective only with specific contaminants, depending on their molecular size and water solubility. It is least effective with water-soluble organic compounds, which constitute the majority of natural and industrial-generated chemical wastes.

FIGURE 2

## How the removal of hydrocarbons from water works



A supplemental technology used along with activated carbon is air stripping, which is most effective with organic contaminants that are volatile in nature. Consequently, air stripping fails to remove organic contaminants with very low vapor pressures.

Unlike activated carbon, the new chemistry actually solubilizes both water soluble and insoluble organic compounds, bonds them to its surface and keeps them from separating and emulsifying. The chemistry can remove mixed emulsions, both oil/water and water/oil along with lipophilic compounds, which are substances that have a strong attraction for fats, and hydrophilic compounds, which are substances having a strong tendency to bind or absorb water (see Figure 2). The chemistry is also able to remove many chelated and nonchelated metals from the process streams.

As proven in field tests, filters infused with their new chemistry can reduce 200 parts per billion (ppb) BTEX chemicals in water to below detectable limits (BDL) in a single two-second pass. A 10-ounce cartridge filter can bring 37,000 gallons of 10 ppb benzene in water to BDL in a single two-second pass.

According to Mike Morgan of Chemical Leaman's Southeast division, the new technology is still undergoing the preliminary testing process. Initial field tests were conducted with Mother Environmental's filters; Chemical Leaman is now adapting its own filter equipment for a third round of field trials. In the future, Mother Environmental plans additional testing in conjunction with other companies. **EP**

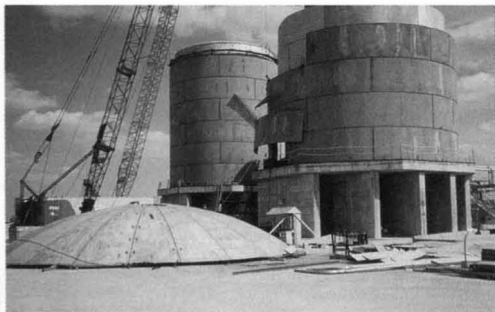
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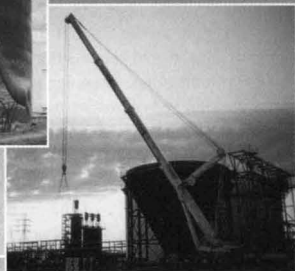
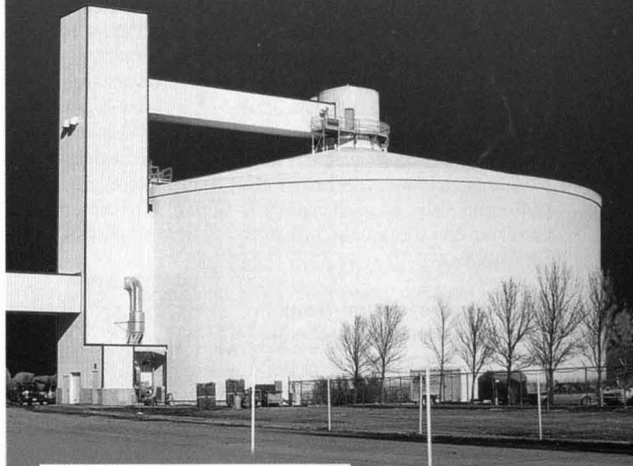
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# The trickle-down effect

*How EPA's new Phase II stormwater rules will impact you*

By James L. Koewler Jr., Attorney-at-Law

The U.S. Environmental Protection Agency (EPA) has adopted the Phase II stormwater rules governing municipal separate storm sewers for small municipalities. In addition, the new rules reach construction sites of 1 acre or more. EPA published the rules at 63 *Federal Register* 1536 on January 9, 1998, and hopes to have them take effect by March 1, 1999. While the Phase II rules do not place any new requirements directly on industrial stormwater dischargers, the requirements placed on small municipalities will certainly trickle down to individual companies.

## Maximum prevention from minimum requirements?

The new rules require municipalities to reduce contaminant levels and stormwater runoff to "the maximum extent possible" (MEP). To achieve MEP, EPA expects municipalities to adopt narrative effluent limitations that require dischargers to use best management practices (BMPs). Of course, the concept of stormwater BMPs started with the Phase I rules.

In addition, the Phase II rules require municipalities to adopt certain minimum control measures. These include public education and outreach on stormwater impacts, public involvement and participation, detection and elimination of illicit stormwater discharges, regulation of stormwater flows from construction sites of 1 acre (down from 5 acres) or larger, continued management of real estate development or redevelopment after the construction phase and pollution prevention for municipal operations.

Municipalities negotiated these minimum requirements into the proposed rules to avoid numerical discharge reduction targets. The National League of Cities argued that strict numerical limits would unreasonably increase costs to municipalities. Further, the League argued that numerical limits would prevent cities from developing creative, bold and assertive programs. Instead, the minimum requirements are designed to give cities maximum flexibility in regulating stormwater discharges.

Most of these minimum control measures are similar or even identical to requirements created in the Phase I rules. The new empha-

sis on public education and public involvement, however, may increase environmental activist groups' scrutiny of dischargers. The increased public awareness may even result in "repackaging" of stormwater information for public distribution similar to the Environmental Defense Fund's Scorecard Web site (<http://www.scorecard.org>.)

Even with the possibility of environmental activist group involvement, it is not clear how EPA expects maximum prevention from these minimum requirements. The minimum requirements can certainly give significant improvement in contaminant control, but their ability to achieve maximum pre-

vention, it does not need a permit.

To qualify for the no exposure exemption, a property owner or operator must carry out all industrial activities and handle and store all industrial materials in ways that prevent exposure to precipitation or stormwater runoff. The rules require the owner or operator to protect all industrial materials and all industrial activities with storm resistant shelters.

To demonstrate its eligibility for the no exposure exemption, a stormwater discharger must notify the permitting authority (generally the state environmental agency) prior to commencing discharges, or at the



vention is doubtful. As a result, EPA or local governments may find additional measures necessary. As discussed below, the onset of total maximum daily loads may hasten these additional measures even more.

## "No exposure" exemption

While the new rules set out minimum control measures and require implementation of MEP, they also give stormwater dischargers an opportunity to avoid the permit requirement. The new rules set out the elements of a "no exposure" demonstration. If a discharger can successfully demonstrate that its stormwater has no exposure to potential

beginning of what would have been, without the exemption, its permit term and each renewal. The exemption claimant must also allow the permitting authority and the manager of the local storm sewer system to inspect the facility and make its inspection reports publicly available. Of course, if operations change in a way that nullifies the no exposure exemption, the facility must obtain a stormwater discharge permit.

## Impact of new TMDL requirements

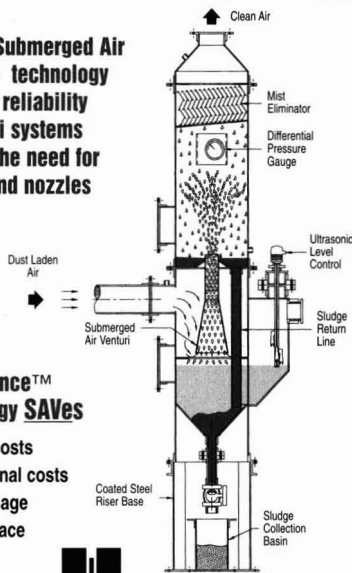
The current proposed Phase II rules could drastically change as a result of EPA's new

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Circle 34 on card.

initiative on total maximum daily loads (TMDLs). A TMDL for any particular stream is the amount of any one contaminant that, according to government calculations, the stream can assimilate or absorb in a day without adverse environmental impact.

As EPA and the various states develop TMDLs pursuant to EPA's recent rule, the flexible minimum stormwater requirements could quickly become hard numerical limits. As governments set TMDLs for each chemical in each receiving stream—which no doubt will be a lengthy process—and as those TMDLs are allocated amongst the various discharges to a receiving stream, long-regulated wastewater dischargers may be hard pressed to find any allocable share for recently regulated stormwater discharges. Because most wastewater dischargers expect TMDLs and waste load allocations to squeeze their allowable discharges, each discharger will probably fight to increase its allocation as much as possible.

Through their long history of regulation, industrial dischargers will certainly have advantages in knowledge, experience and regulatory contacts over the newly-regulated stormwater dischargers. As a result, stormwater dischargers may find that they get very little of the waste load when compared to non-stormwater dischargers.

So far, EPA's newly proposed rules provide only hints of the eventual impact on stormwater dischargers. Because local governments and local storm sewer systems will control the regulations directly imposed on dischargers, wide variations in requirements may result among dischargers.

Nonetheless, industries and trade groups should examine the proposed rules and, if beneficial, seek changes in the final version. Dischargers may have opportunities to influence the content of local regulations, but they should not pass up an opportunity to influence the federal rules that will create the outline for local rules. **EP**

James L. Koewler Jr., an attorney at law, practices environmental and OSHA law with Kahn, Kleinman, Yanowitz & Arnsion Co., L.P.A., Cleveland.

For more information circle 68 on card.

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**(734) 973-3000**

**Product name:** Material Inventory Report System (MIRS)

**Features:** HazMat tracking, permit tracking, manifest tracking, monitoring, parameter/threshold, reporting, analysis, labeling, regulation training, product demonstration, CD-ROM

**Cost:** Varies

**Description:** MIRS is an environmental and

reporting, visualization, analysis, product demonstration, CD-ROM

**Cost:** \$199.95

**Description:** PCSWMM '98 is a decision support system for the USEPA Stormwater Management Model, providing a large array of file management, datafile creation, output interpretation, model calibration, collaboration and reference tools.

**Product name:** PCSWMM GIS '98

**Features:** Modeling, parameter/threshold, reporting, visualization, analysis, product

**Features:** Monitoring, reporting, regulation training, product demonstration, CD-ROM

**Cost:** \$995 to \$16,000+

**Description:** Proteus CMMS is a management application for asset and facility maintenance scheduling.

**EcoLogic Systems**  
**7977 Capwell Drive**  
**Oakland, CA 94621**  
**(510) 635-7400**

**Product name:** ADAM Asbestos and Lead Paint Management Software

**Features:** HazMat tracking, manifest tracking, monitoring, reporting, 3D visualization, regulation training, product demonstration, CD-ROM

**Cost:** Varies

**Description:** ADAM is a Windows-based asbestos and lead information management system. Also able to track regulatory compliance and prepare documents, it generates survey reports and notifications and can provide access to material locations, abatement information and OSHA records. ADAM is network compatible and can be used with an Intranet system.

# Environmental management software guide

Compiled by Monica A. Harvey

safety data management and compliance software package. It includes modules for air, water, waste, inventory, MSDS management, hazardous materials and OSHA HazCom.

**BEE-Line Software**  
**P.O. Box 7348**  
**Asheville, NC 28802**  
**(828) 258-1895**

**Product name:** 112(r) Suite for Windows

**Features:** Modeling

**Cost:** \$1,750

**Description:** The 112(r) Suite includes four tools for 112(r) impact zone analysis from toxic releases: SLAB, INPUFFZ, SCREEN3 and a special implementation of EPA's source data calculations tool. It also features on-screen graphics and a Windows interface.

**Product name:** BEEST for Windows

**Features:** Modeling

**Cost:** \$2,450

**Description:** BEEST for Windows is an ISCST3 modeling manager for air dispersion modeling. It includes enhanced versions of ISCST3 and BPIP and allows unlimited sources, receptors and source groups. It features on-screen graphics and a Windows interface.

**Computational Hydraulics Int.**  
**36 Stuart St.**  
**Guelph, ON Canada N1E 4S5**  
**(519) 767-0197**

**Product name:** PCSWMM '98

**Features:** Modeling, parameter/threshold,

demonstration, CD-ROM

**Cost:** \$199.95

**Description:** PCSWMM GIS '98 links GIS and the USEPA Stormwater Management Model, but also acts as a stand-alone graphic model development environment. It is able to integrate with the PCSWMM '98 suite of modeling tools.

## Dakota

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**Dakota Software Corp.**  
**7 Tobey Village Office Park**  
**Pittsford, NY 14534**  
**(716) 381-8710**

**Product name:** Dakota Auditor

**Features:** Auditing, regulation training, product demonstration, CD-ROM

**Cost:** \$595 to \$5,995

**Description:** Dakota Auditor is an auditing tool that includes regularly updated information resources for federal and state requirements, Responsible Care Codes and ISO 14000. It allows users to build a regulatory profile of a facility and produce individualized checklists, as well as capture and track comments, findings and corrective actions.

**Eagle Technology Inc.**  
**10500 N. Port Washington Road**  
**Mequon, WI 53092**  
**(800) 388-3268**

**Product name:** Proteus CMMS

**Product name:** Safety Management and Regulatory Tracking (SMART)

**Features:** Permit tracking, monitoring, reporting, visualization, 3D visualization, auditing, regulation training, product demonstration, CD-ROM

**Cost:** Varies

**Description:** SMART is capable of tracking and maintaining OSHA employee records, health and safety qualifications and related information. It features applications for safety management, record-keeping and a reminder system.

**EnviroData Solutions Inc.**  
**15405 SE Stevenson Drive**  
**Vancouver, WA 98683**  
**(360) 254-1608**

**Product name:** Environmental Data Management System

**Features:** HazMat tracking, permit tracking, manifest tracking, monitoring, parameter/threshold, reporting, visualization, analysis, product demonstration

**Cost:** Varies

**Description:** Environmental data management systems are customized to each user's operations. The systems are Microsoft Access based and have automated reporting capability, as well as multiple graphing and mapping options. They are able to integrate with other off-the-shelf programs.

**EnviroWare**  
**85 Argonaut, Suite 190**  
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The screenshot shows the FacTS software interface. At the top, the title bar reads "Facility Tracking System [c:/facts7]: QCS". Below the title bar is a menu bar with "File", "Edit", "View", "Special", "Window", and "Help". A toolbar contains various icons for file operations and navigation. Below the toolbar is a section titled "Open Activity" with a grid of icons and labels: Emergency Response, Material Identification, Materials Tracking, Environmental, Medical, Safety, Industrial Hygiene, Waste Management, Training, and Sample Tracking. A "Blessure-Maladie:" window is open, displaying a data entry form with the following fields:

N° D' INSTALLATION:	002	002
ANNÉE DU RAPPORT:	1997	
N° DU CAS:	00001	
N° D' INCIDENT:	I9800001	Déversement
N° D' EMPLOYÉ:	3098	<input checked="" type="checkbox"/> Marais, Pierre
DÉPARTEMENT DE L'INCIDENT:	500	<input checked="" type="checkbox"/> Gestion
TRAVAIL EN EXÉCUTION:	8080	<input checked="" type="checkbox"/> Ingénieur
Contact- Indemnité Travail:	398	<input checked="" type="checkbox"/> Bourgnon, Jean

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**Product name:** EnviroWriter

**Features:** Reporting, product demonstration, CD-ROM

**Cost:** Varies, based on volume

**Description:** EnviroWriter helps write Phase I and other environmental reports, with over 700 standard answers provided, adding consistency to generated documents. It is Windows based and formattable.

**Product name:** Master

**Features:** Reporting, product demonstration, CD-ROM

**Cost:** Varies, based on volume

**Description:** Master automatically quotes, bids and prices all due diligence services. It can also write and fax contracts, track and assign job and quote numbers and schedule projects. It also prints contracts, sales letters, job sheets and schedules.

**Geotech Computer Systems Inc.**

**7346 S. Alton Way, Suite L**

**Englewood, CO 80112**

**(303) 740-1999**

**Product name:** Enviro-Space

**Features:** Monitoring, visualization, 3D visualization (cross sections), analysis, product demonstration

**Cost:** \$3,000

**Description:** Enviro-Space is a geographic information system for site environmental data. It features spatial queries, SQL-based data retrieval, graphical selection and editing, base maps, bubble maps, time-sequence graphs and more.

**Product name:** Geotech Environmental Data System

**Features:** Monitoring, visualization, analysis

**Cost:** \$995

**Description:** This program sorts and displays environmental site data. The software uses Microsoft Access as a front end user interface, and any ODBC-compliant database such as Access, SQL Server or Oracle as a back-end database server.



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Systems Inc.**

**145 King St. E., Suite 200**

**Toronto, ON, Canada M5C 2Y8**

**(416) 363-5577**

**Product name:** Environmental Performance Evaluation

**Features:** Monitoring, reporting, visualization, analysis, product demonstration, CD-ROM

**Description:** Environmental Performance Evaluation software is an integrated electronic system to record, monitor and report on environmental performance for internal and external purposes, including compliance. Financial performance information, including full cost accounting, can also be integrated.

**Product name:** ISO 14000 Assessment

**Features:** Reporting, visualization, analysis, product demonstration, CD-ROM

**Cost:** \$699 (Single user) to \$1,299 (Site, up to five users). Each additional user \$225. Discounts offered for combination software licenses.

**Description:** ISO 14000 Assessment software evaluates the status of an EMS for compliance with ISO 14001. It automatically generates a gap analysis report with comparative performance and cost allocation graphs, overall percentage of compliance, a detailed action plan and costs.

**Product name:** ISO 14000 Audit

**Features:** Reporting, visualization, analysis, auditing, product demonstration, CD-ROM

**Cost:** \$899 (Single user) to \$1,699 (Site, up to five users). Each additional user \$275. Discounts offered for combination software licenses.

**Description:** ISO 14000 Audit software is a tool for both internal and external audits of an EMS for registration to ISO 14001. It features a complete set of audit control procedures and tests, automatically-generated audit reports and working papers. It also includes audit planning and administration procedures.

**Product name:** ISO 14000 Implementation

**Features:** Monitoring, reporting, visualization, analysis, product demonstration, CD-ROM

**Cost:** \$1,199 (Single user) to \$2,099 (Site, up to five users). Each additional user \$325. Discounts offered for combination software licenses.

**Description:** ISO 14000 Implementation is a system for implementing, maintaining and improving EMS to meet ISO 14001 requirements. It features a series of linked and interactive worksheets that demonstrate and track conformance with automatic document verification and controls.

**Hydromantis Inc.**

**1685 Main St. W., Suite 302**

**Hamilton, ON, Canada L8S 1G5**

**(905) 522-0012**

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**Features:** Modeling, visualization, analysis, product demonstration, CD-ROM

**Cost:** \$2,900 entry level configuration

**Description:** GPS-X for Windows NT mod-



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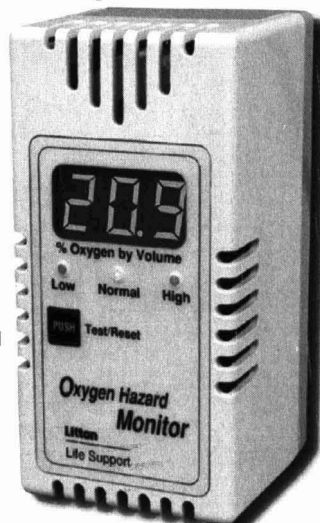


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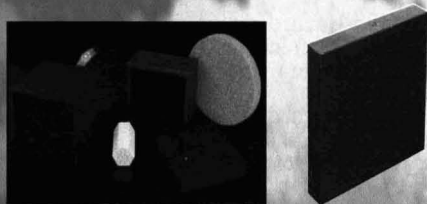
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#### IT Corp.

**2790 Mosside Blvd.  
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(412) 858-3902**

**Product name:** IT's Environmental Database Management System (ITEMS)

**Features:** Monitoring, parameter/threshold, reporting, visualization, 3D visualization, analysis, labeling

**Cost:** Client: \$2,500. Server: \$12,500. Volume and stand-alone license pricing available.

**Description:** ITEMS allows users to store, manage and report field and analytical data collected during site investigations and remediations.

#### International Technology Corp.

**5731 W. Las Positas Blvd.  
Pleasanton, CA 94588  
(925) 227-1100**

**Product name:** Manage IT

**Features:** HazMat tracking, manifest tracking, monitoring, parameter/threshold, reporting, analysis, auditing, labeling, product demonstration, CD-ROM

**Cost:** Starts at \$250

**Description:** Manage IT is a suite of products for hazardous waste management featuring a user-friendly format.

#### Lakes Environmental Software

**250 Keats Way-Unit 18  
Waterloo, ON, Canada N2L 6J5  
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**Product name:** ISC View™, IRAP-h View™, IRAP-c View™, BPIP View™, Screen View™, SLAB View™, SLAB 3D View™, RMP View™, WRPILOT View™

**Features:** Modeling, reporting, visualization, 3D visualization, regulation training, product demonstration, CD-ROM

**Cost:** Varies

**Description:** Lakes Environmental Software offers a variety of air dispersion and risk assessment software with both pre-processors and post-processors.

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**AllMax Professional Solutions Inc.  
12923 State Route 309 W.  
Kenton, Ohio 43326  
(800) 670-1867**

**Product name:** AllMax Task Manager

**Features:** Maintenance tracking and product demonstration

**Cost:** \$3,000

**Description:** AllMax stores equipment and parts/material lists as well as keeps track of inventory and preventive maintenance. Features allow users to define maintenance tasks, create and reschedule work orders, track maintenance costs, read multiple meters or gauges, run reports and build vendor and manufacturer databases.

**Product name:** BioSolids Data Management  
**Features:** Monitoring, permit tracking, parameter/threshold, reporting and product demonstration.

**Cost:** \$2,200

**Description:** This software allows users to monitor and report on biosolid land application and other disposal methods. Features include graphing, operator notes, an "address book," state and federal reports, unlimited site entry and application entry at specific sites. Users can also group and identify parameters.

**Product name:** Wastewater Data Management

**Features:** Monitoring, permit tracking, parameter/threshold, reporting and product demonstration.

**Cost:** \$2,950

**Description:** Wastewater Data Management is designed specifically for municipal and industrial wastewater treatment facilities. It allows users to report on the facility's laboratory analysis, and features graphing, operator notes and state and federal reports. It also includes defined and calculated process types.

**Product name:** Water Data Management

**Features:** Monitoring, permit tracking, parameter/threshold, reporting and product demonstration

**Cost:** \$2,200

**Description:** Water Data management is designed specifically for municipal and industrial water treatment facilities. It allows users to run reports on a facility's laboratory analysis. Features include graphing, operator notes, state reports and multiple defined and calculated process types.

**Quantum Compliance Systems, Inc.**  
**4251 Plymouth Road, Suite 1200**  
**Ann Arbor, MI 48105**  
**(734) 761-2175**

**Product name:** Facility Tracking System (FACTS™)

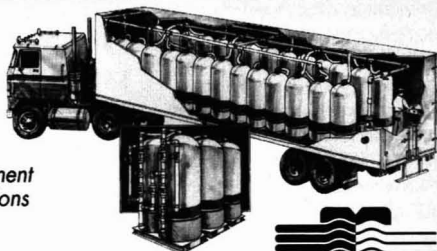
**Features:** HazMat tracking, permit tracking, manifest tracking, monitoring, modeling, parameter/threshold, reporting, analysis, auditing, labeling, regulation training, product demonstration, CD-ROM

**Cost:** Varies

**Description:** FACTS™ allows users to main-

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tain regulatory compliance by developing a description of hazardous materials and their use, storage, movement and disposal. It generates reports and allows inquiries for data evaluation, and can manage other information such as employee medical and training records, OSHA reporting, permits, costs, sample tracking, scheduling, waste approvals and emergency pre-planning. The system is developed in an integrated RDBMS and 4GL, offering power, speed and platform portability. It can also port databases without reformatting or restructuring the database and run on many different machine platforms and operating systems.

## Trinity Consultants

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(919) 549-0499

**Product name:** BREEZE® AERMOD SUITE  
**Features:** Modeling, visualization, 3D visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** AERMOD SUITE is an air

quality modeling system. It can assess the impact of air emissions from a variety of industrial sources.

**Product name:** BREEZE® CAL3QHC  
**Features:** Modeling, visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** CAL3QHC is a modeling application which allows users to predict carbon monoxide and other inert pollutant concentrations, from vehicles.

**Product name:** BREEZE® CALINE4  
**Features:** Modeling, visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** CALINE4 predicts carbon monoxide, nitrogen dioxide and particulate emissions from mobile sources. It also assesses air quality impact at grade, elevated or depressed highways and arterial streets.

**Product name:** BREEZE® DEGADIS+  
**Features:** Modeling, visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** DEGADIS+ is used for off-site consequence analysis and modeling dense gases.

**Product name:** BREEZE® HAZ DISPERSION

**Features:** Modeling, visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** HAZ DISPERSION is a modeling tool for off-site consequence analysis. Its models include ADVISOR, EXPERT, DEGADIS, SLAB, AFTOX and INPUFF.

**Product name:** BREEZE® HAZ FIRE/EXPLOSION

**Features:** Modeling, visualization, product demonstration, CD-ROM


**Cost:** Varies

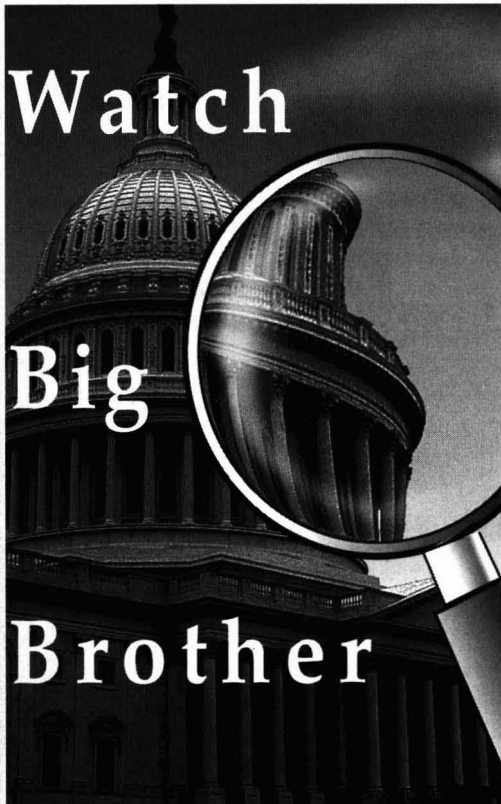
**Description:** HAZ FIRE/EXPLOSION contains models for fire and explosions, including three different fire models, and two models for calculating the effects of vapor cloud explosions.

**Product name:** BREEZE® ISC SUITE

**Features:** Modeling, visualization, 3D visualization, product demonstration, CD-ROM

**Cost:** Varies

**Description:** ISC SUITE models air dispersion and includes ISC, BPIP, EVENT, GRAPHICS, PERCENT, WINDROSE, METVIEW, OLM and RUNAVG. 



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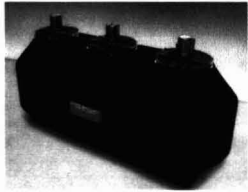
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Compiled by Ingrid Truemper

### Cooling tower



Delta's newest induced draft cooling tower expands seamless corrosion proof plastic towers to larger capacities. The tower is available in seven different models, which range in capability from 250 to 500 cooling tons. The towers are designed to handle routine to extremely corrosive applications. Delta Cooling Towers Inc.

Circle 69 on card.

### Colorimeter



The DC1200 series of single-test, direct-reading colorimeters measure chlorine, chlorine dioxide, bromine or molybdenum down to 0.05 ppm. The portable meter features a water-resistant design for field or lab use. The microprocessor design enables the factory-programmed calibrations to optimally match non-linear curves. Omega.

Circle 70 on card.

### Liquid level controller



The 4052 Pump-Down Control features an adjustable universal on delay function to prevent out-

puts from closing due to input fluctuations caused by turbulent conditions. Features include heavy-duty output contacts for pump control and alarm activation, high and low alarm outputs, and an SPDT power loss relay. Time Mark Corp.

Circle 71 on card.

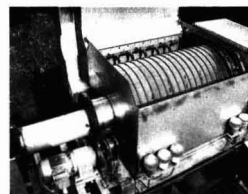
### Air dryer line



The ultrapac 2000 is a silicone-free compressed air purification system that includes built-in pre-filters and post-filters, condensate drainage and an electronic monitoring system that indicates when cartridges need replacement. Units range in size from 4 to 360 cfm. ultrafilter inc.

Circle 72 on card.

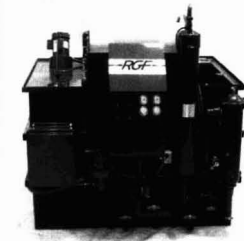
### Drum screens



Hercules® drum screens, helix screens and compactors are suitable for a variety of applications,

including raw sewage, storm water, food byproducts, chemical wastes and industrial effluents. Moyno Industrial Products. Circle 73 on card.

### Batch treatment system



The Model ESP 100 processes up to 200 gallons per hour, and is available in both manual and fully automatic. It contains computerized controls to automatically process wastewater and monitor critical operations and process requirements and includes an automatic self-cleaning reactor. RGF Environmental Systems Inc.

Circle 74 on card.

### Gas manifold/ support tower



The Model T8000 series gas man-

ifold and support tower provides a way of transferring clean air from a distant sample inlet to a laboratory with minimum contamination. Applications include measuring ozone, hydrocarbons, carbon monoxide and nitrogen oxides. G.O. Environmental Inc. Circle 75 on card.

### Measurement device



The MiniRanger Plus is an ultrasonic level measurement device for liquids up to 33 feet and for solids up to 16 feet. It is available in rack and panel mount models that have an easy-access RJ-11 jack on the face plate. The unit also features two integral relays and a 4-20 mA output. Milltronics.

Circle 76 on card.

### Chemicals



More than 5,000 Spectrum brand chemicals and reagents are now available, including laboratory reagents, high-purity solvents, deuterated compounds, organic compounds, electronic/cleanroom grade chemicals and ACS, USP/NF/BP and FCC grade chemicals. Cole-Parmer Instrument Co. Circle 77 on card.

highlight

## Gas analyzer

The ProLine AR-180NI analyzer provides multi-component gas analysis capability in a general-purpose 19-inch rack mounting case. Up to three gas components can be measured. The unit's multiple sensor technologies are used in the measurement of typical industrial and process gases. Anarad Inc.



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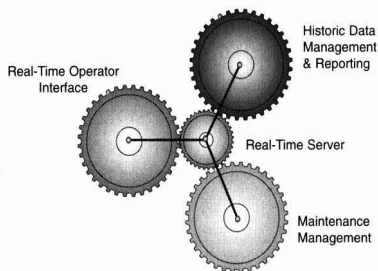
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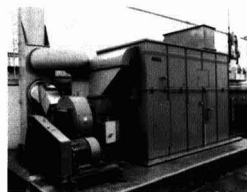
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## NEW PRODUCTS

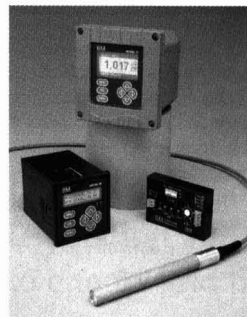
### Thermal oxidizer system



Anguil's thermal oxidizer system destroys toxic and organic vapor contaminants from the exhaust streams of driers, ovens, coaters, laminators, paint booths and other industrial processes. It features a destruction efficiency of 95 to 99.9 percent. Standard sizes range from 100 scfm to 100,000 scfm. Anguil Environmental Systems Inc.

Circle 79 on card.

### Analyzers



GLI's analyzers measure conductivity in all applications and display parameters of percent passage, percent rejection, difference, conductivity, resistivity and TDS. The Dry Cal™ method provides accuracy over the conductivity ranges of ultra-pure water to two Siemens. GLI International Inc.

### Interface meter

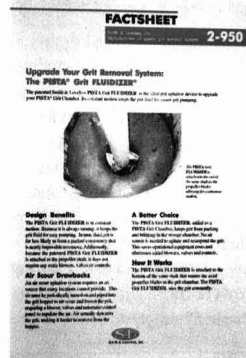


The Model 122 Interface Meter is 7/8-inch in diameter, ideal for narrow drive-in equipment and

1-inch wells. It accurately measures the depth and thickness of non-aqueous product layers in monitoring wells and tanks. Batteries are located in easy-access drawers and give 120 hours of use. Solinst Canada Ltd.

Circle 81 on card.

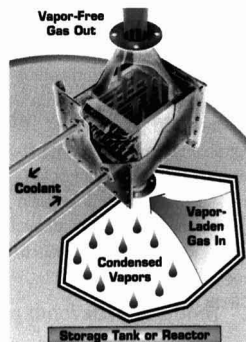
### Grit fluidizer



The PISTA Grit FLUIDIZER vane keeps grit in the storage chamber fluid to prevent compaction without adding an additional water source or any extra pumps, valves or controls. It is part of the PISTA Grit Removal System. Smith & Loveless Inc.

Circle 82 on card.

### Condenser



TV Series condensers are available for flows to 5,000 scfm and for pressure from full vacuum to 50 psig. Designs are compact and lightweight and pressure drop is usually less than 0.02 psig. The units' extended heat transfer surface enables small units to perform substantial condensing duties. Xchanger Inc.

Circle 83 on card.

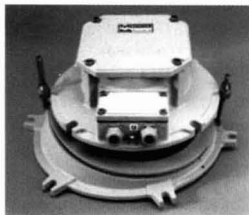
### Presaturated wipes



SATWipes® presaturated wipes are ideal for powder coating and other surface preparation applications because of their ability to reduce paint defects. The wiping system consists of a roll of saturated wipes that are dispensed through a resealable center-pull container. **Contec.**

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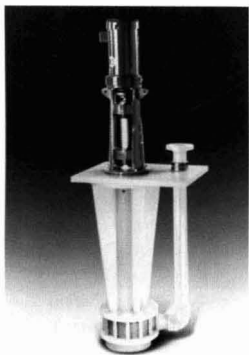
### Measurement products



BulkSonic™ is a full line of ultrasonic continuous level measurement products designed specifically for bulk solids measurement applications. Utilizing QUEST software, it secures reliable measurement in difficult and dusty applications. The two main products are transmitters and sensor/controller systems. **Monitor Mfg. Inc.**

Circle 85 on card.

### Full cantilever pump



The SGK full cantilever pump is designed to handle corrosive, abrasive and ultra-pure fluids in those applications where immersed bearings cannot be tolerated and where the pumps may have to run dry for extended periods of time. The unit is suitable to pump depths to 6 feet; deeper sumps can be accommodated. **Vanton Pump & Equipment Corp.**

Circle 86 on card.

### Odor controller



Bl-CHEM® Odor Controller combines three mechanisms: a fast-acting neutralizer for immediate odor relief; bacterial strains that degrade volatile amines and mercaptans; and a proprietary microbial stimulant. The products contain no oxidants or masking agents and are available in liquid or dry formulations. **Sybron Chemicals Inc.**

Circle 87 on card.

### Dust monitoring system



The Model 4200 Opacity/Dust Monitor is comprised of a transmitter and reflector with optional air purge and fail-safe automatic shutters. It features interference immunity, opacity measurement ranges from 0 to 10 percent and dust in mg/m<sup>3</sup>, no moving parts, analog outputs and more. **Land Combustion.**

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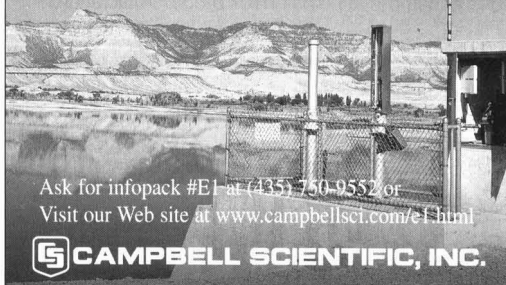
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## NEW PRODUCTS

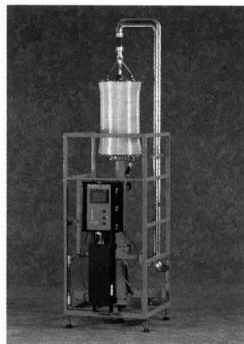
### Thermal anemometer



The 425 compact thermal anemometer measures and displays temperature and air velocity simultaneously, using a separate telescoping probe. It is equipped with hot wire NTC technology. Measuring range is from 0 to 4,000 fpm and -4 to +158 degrees Fahrenheit with advanced averaging functions. Testo Inc.

Circle 93 on card.

### Membrane filtration system



Vibratory Shear Enhanced Process technology is a membrane filtration system suitable for water and wastewater treatment. Units are modular and contain 100 to 1,600 square feet of membrane material, offering a capacity of 10 to 200 gpm per unit. New Logic International.

Circle 89 on card.

### Water analyzers

Mini Analyzers are a series of dedicated water analyzers. Thirty-four Series 942 models are available. All models feature one-touch operation, automatic zero and standardization, factory cali-



bration and LED narrow-band light source. Orbeco-Hellige.

Circle 90 on card.

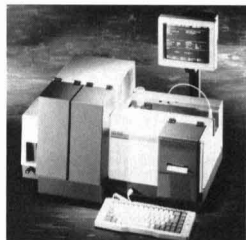
### Fugitive emissions monitor



The Passport® PID Fugitive Emissions Monitor is designed specifically to detect and monitor VOC leaks. The principle of operation is photoionization, which makes the unit ideal for low-level leak detection. MSA Instrument Division.

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### Analyzers



ThermoGLAS™ total chlorine, total sulfur and total nitrogen analyzers are rugged, simple to operate and cover a wide dynamic range with trace to percentage levels. Data can be reported in a user-defined format or directed to a LIMS system. Thermo Environmental Instruments Inc.

Circle 92 on card.



Continued from page 22

ting and one-fifth the area of conventional settling processes.

The application of DAF at the Warner plant, augmented by a creative approach involving the vertical stacking of various process components, led to an extremely compact design that was vital to the project's success. These space-saving features allowed the use of an advantageously located 8-acre site in Fairfield, instead of a previously proposed 27-acre site located farther from the reservoir. The more remote site would have required additional pumping and pipeline facilities and would have negatively impacted the surrounding residential neighborhood. These features reduced project costs by about one-third—from \$70 million to \$47 million—and resulted in more energy efficient operations since the additional pumping and pipeline facilities were not needed.

This year Hazen and Sawyer received the Engineering Excellence Awards from both the New York Association of Consulting Engineers and the American Consulting Engineers Council for the innovative design of the Warner plant.

#### **Anchorage Regional Landfill, Anchorage, Alaska**

The Anchorage Regional Landfill (ARL) is the largest landfill in Alaska and is estimated to receive an annual average of about 990 tons per day of solid waste. Since its incep-

tion in 1987, ARL has been designed and operated as a sanitary landfill with a liner and leachate collection system, daily cover and a groundwater monitoring system.

ARL is unique among landfills in several respects. Engineers performed a detailed geotechnical stability evaluation in 1994 in conformance with Resource Conservation and Recovery Act (RCRA) Subtitle D requirements. The ARL's engineering team designed the layout and configuration of existing and future cells to safely accommo-

have been installed in the landfill to measure the temperature and composition of gas, thus providing valuable information about landfill gas generation in cold climates. Additionally, the leachate collection and pre-treatment systems were designed to operate in the cold climate of Alaska. A bird control system consisting of ropes and netting over the landfill has successfully and humanely minimized bird attraction and has prevented bird conflicts with aircraft from the nearby Army airfield.

### **Honorable mention for other environmental achievers**

**Photo Fabricators, Van Nuys, Calif.**, received Southern California Treatment Plant of the Year from the California Water Environment Association for an outstanding environmental compliance record and its innovative waste minimization program.

**Johnson Space Center, Houston**, received the 1998 White House Closing the Circle Award for its environmental program that led to a nearly 75 percent reduction in the amount of hazardous waste generated between 1994 and 1997.

date waste disposal in one of the highest seismic regions in North America.

A geosynthetic clay liner (GCL) was used in the composite liner system because of a lack of locally available clay. The GCL-high density polyethylene (HDPE) composite liner system was designed to be placed on a relatively steep (2.5 horizontal to 1 vertical) side slope.

Thermistors and gas monitoring probes

The Municipality of Anchorage was recently honored when its regional landfill received the 1998 Landfill Excellence Gold Award from the Solid Waste Association of North America. **EP**

*Angela Neville, JD, REM, is the editor-in-chief of Environmental Protection. For information about our upcoming 1999 Facilities of the Year competition, contact us at [aneville@cmpu.net](mailto:aneville@cmpu.net).*

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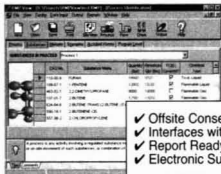
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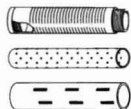
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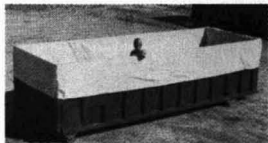
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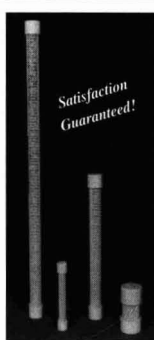
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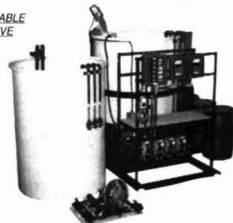
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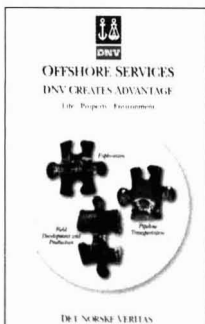


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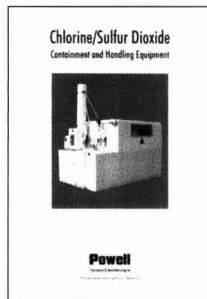
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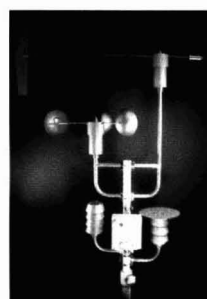


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Colorado's Pike's Peak, a member of the Rocky Mountain chain, is well known for its beauty and the easy access to its 14,110-foot summit. The mountain's stunning vistas inspired Katharine Lee Bates, a Massachusetts author and teacher, to craft the lines to her most famous poem, "America the Beautiful."

The mountain was discovered and named Grand Peak by Lieutenant Zebulon Montgomery Pike in 1806. Map makers honored Lieutenant Pike and renamed the mountain Pike's Peak. Ironically, Pike never climbed the mountain. The summit was first reached by Dr. Edwin James in 1820.

Present day adventurers can attack the summit by car, or via a cog railway that has operated on the peak since 1891. For hardier mountaineers, Barr Trail—the second highest road in the world—winds 13 miles and ascends 7,500 vertical feet to the top.



PHOTO ©WESTFALL ECOIMAGES, MARK HOWARD, PHOTOGRAPHER, WOODBRIDGE, VA

Contact Mark Howard via e-mail at [markwh727@aol.com](mailto:markwh727@aol.com)

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# FREE INFORMATION

Follow these simple steps:

**1**

Answer all questions completely, sign and date your card.

**2**

Circle the number(s) on the attached card that correspond to the advertisement & items mentioned in this issue that you would like FREE information on.

**3**

Detach and mail your postage-paid card today! For faster service, fax your card to:

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# IT'S THAT EASY!

# Environmental PROTECTION

## FREE INFORMATION

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PLEASE SEND ME FREE INFORMATION ON THE FOLLOWING ITEMS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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### 12/98 BUYING PLANS SURVEY - TRAINING PRODUCTS & MISCELLANEOUS SERVICES

1. Which of the following TRAINING PRODUCTS AND MISCELLANEOUS SERVICES do you plan to purchase in the next 12 months? (select all that apply)

- 800  ISO 9000/14000 Certification
- 801  Training Videos
- 802  Training CD-ROM Products
- 803  Training Manuals
- 804  HAZWOPER Training
- 805  UST Installation/Removal Training
- 806  Software, Compliance Documentation
- 807  Software, Environmental Management

- 808  Software, Regulatory Compliance
- 809  Software, EPA/OSHA Compliance
- 810  OSHA Training
- 811  Radiation Training
- 812  Legal Services
- 813  Insurance, Environmental Liability
- 814  Pollution Prevention Consulting Services

- 817  \$50,001-\$100,000
- 818  \$10,001-\$50,000
- 819  \$5,000-\$10,000
- 820  Under \$5,000

2. What is your projected budget for the product(s)/service(s)?

- 815  Over \$200,000
- 816  \$100,001-\$200,000

3. How immediate is your need for the selected products/services? (select one)

- 821  3-6 months
- 822  7-9 months
- 823  10-12 months
- 824  Over 12 months

### SUBSCRIPTION INFORMATION

YES, I would like to receive/continue to receive *Environmental Protection*.  No.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Title \_\_\_\_\_

Business Phone (\_\_\_\_) \_\_\_\_\_ FAX No. (\_\_\_\_) \_\_\_\_\_

Please peel address label from cover and affix below. For faster service, photocopy this side only and send to our FAX # (312) 922-3165.

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_  Home  Bus.

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_ ZIP+4 \_\_\_\_\_

- 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 \_\_\_\_\_

- B. Type of Business (check only one):
- A  Manufacturing. If manufacturing, please check the appropriate SIC (check only one):
- (20) Food  (31) Leather
  - (21) Tobacco  (32) Stone/Clay/Glass
  - (22) Textile  (33) Primary Metal
  - (23) Apparel  (34) Fab. Metal
  - (24) Lumber & Wood  (35) Mach., except Elect.
  - (25) Furniture  (36) Elect & Electron Mach
  - (26) Paper  (37) Trans. Equip.
  - (27) Print/Publish  (38) Instr./meas./analyze/controlling
  - (28) Chemicals  (39) Miscellaneous Mfg.
  - (29) Petrol. & Coal
  - (30) Rubber/Plastic

- B  Mining
- D  Engineering & Contracting
- E  Utilities, public, private & cooperative
- F  Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
- G  City  County  State  Federal
- K  Transportation
- O  Training
- Z  Misc. Services

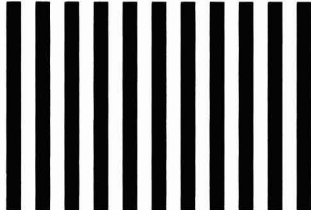
- C  Agriculture
  - L  Consulting
  - M  Insurance
  - F  Services/Consulting
  - G  None of the above
  - H  Other (please specify) \_\_\_\_\_
- E. What types of Pollution Control are you responsible for? (check all that apply)
- A  Air  B  Water
  - C  Noise  D  Solid Waste Disposal
  - E  Industrial Hygiene
  - F  Toxic & Hazardous Material
  - G  Energy Control/Energy Conservation
  - I  Recycling
  - J  Other (please specify) \_\_\_\_\_
  - H  None of the above

- C. Number employed at this location:
- 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 & control

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



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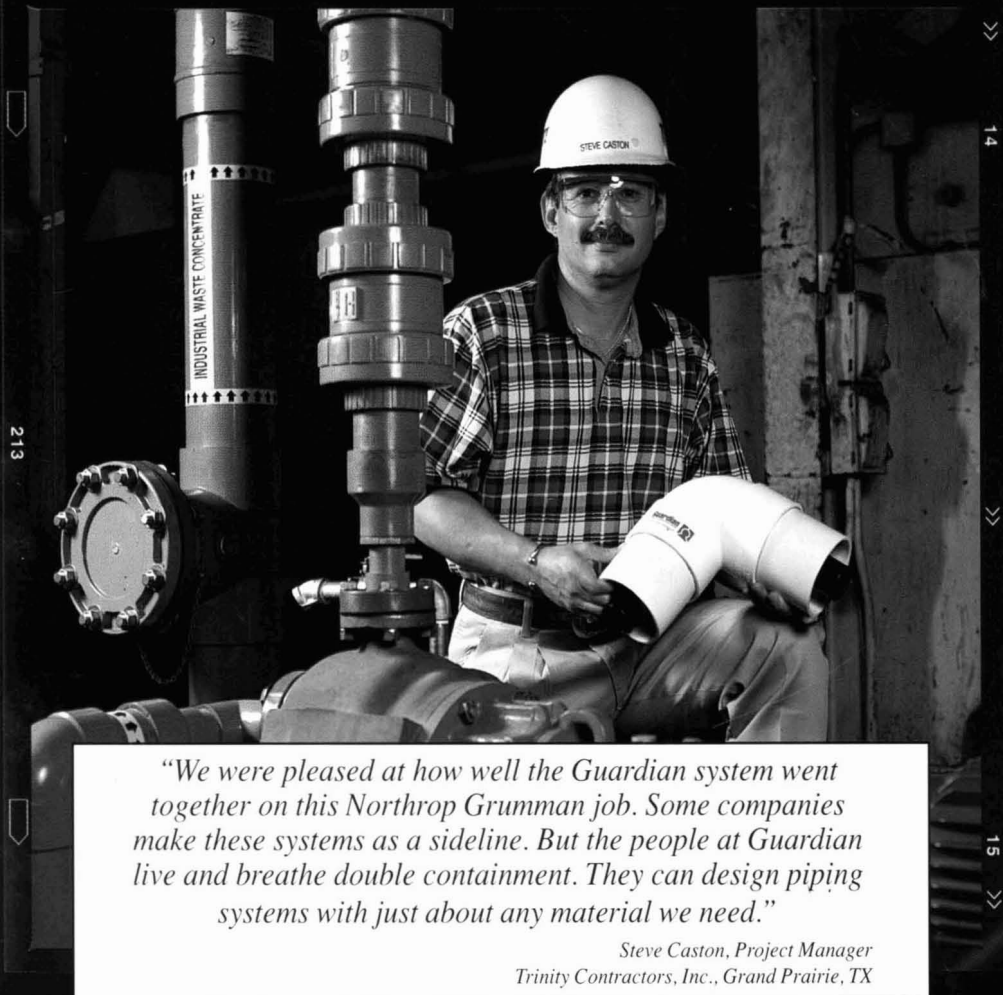
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**PROTECTION**

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**650 S. Clark St. Floor 6**  
**Chicago IL 60605-9626**





# "What I Like About Guardian Is Their Commitment To Double Containment."



*"We were pleased at how well the Guardian system went together on this Northrop Grumman job. Some companies make these systems as a sideline. But the people at Guardian live and breathe double containment. They can design piping systems with just about any material we need."*

*Steve Caston, Project Manager  
Trinity Contractors, Inc., Grand Prairie, TX*

Over the past decade, Guardian piping systems have gotten glowing reviews in many different industries. Our focus on double containment piping systems works for customers on a variety of levels. We're able to offer more sizes and materials — from carbon steel to copper to **Corzan® CPVC** engineered plastic. We deliver products as soon as you need them. And we offer you superior design assistance.

To help assure the integrity of your system, Guardian uses unsplit containment fittings. Our pre-tested/assembled components minimize the number of field joints. And when coupled with our

patented Centra-Guard™ leak detector, your system comes with a full 5-year warranty. We'd like an opportunity to tell you the rest of the story. Please contact us for information and design assistance.



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