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Environmental PROTECTION

Management and Problem-Solving for Environmental Professionals

JULY 1997

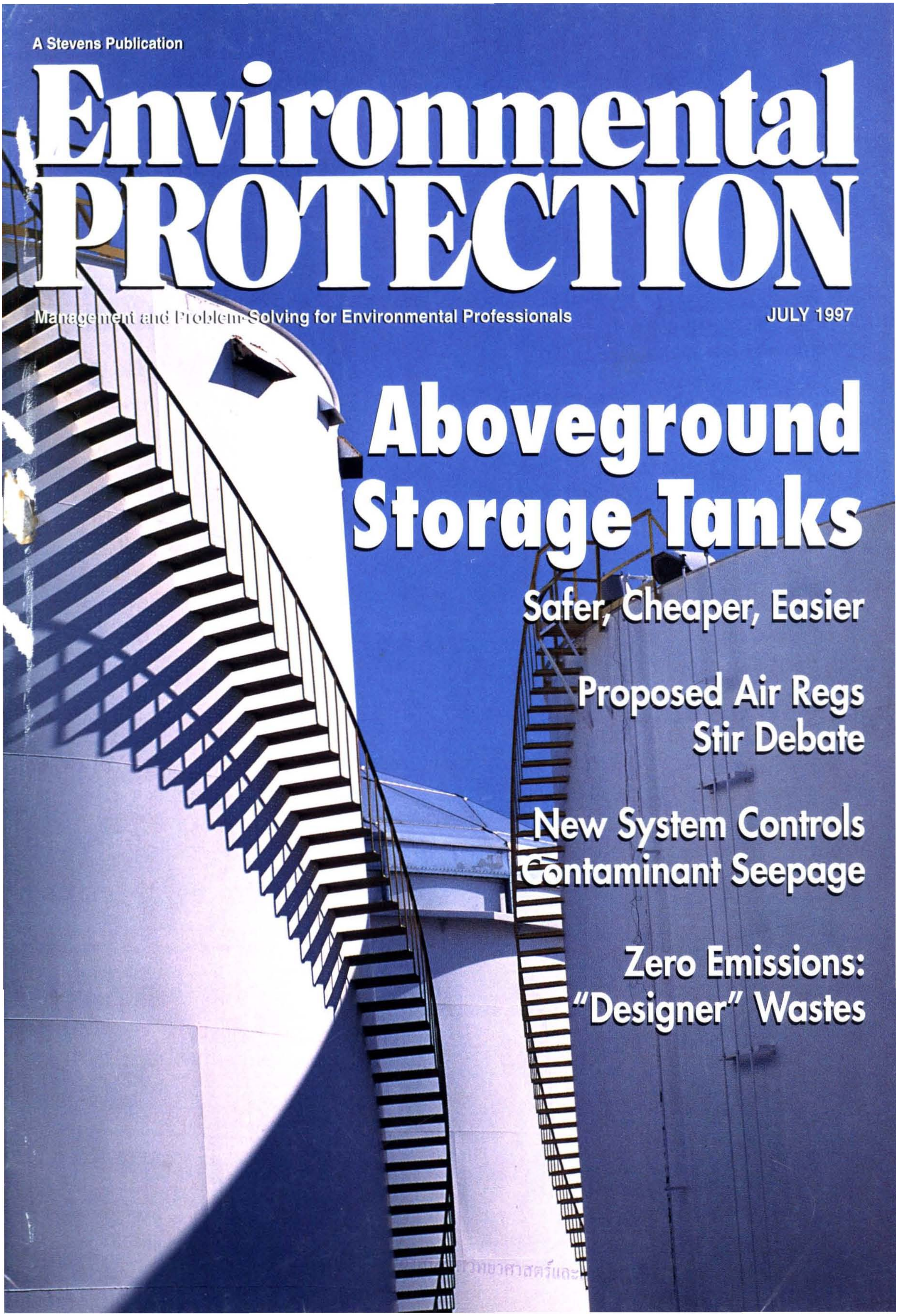
Aboveground Storage Tanks

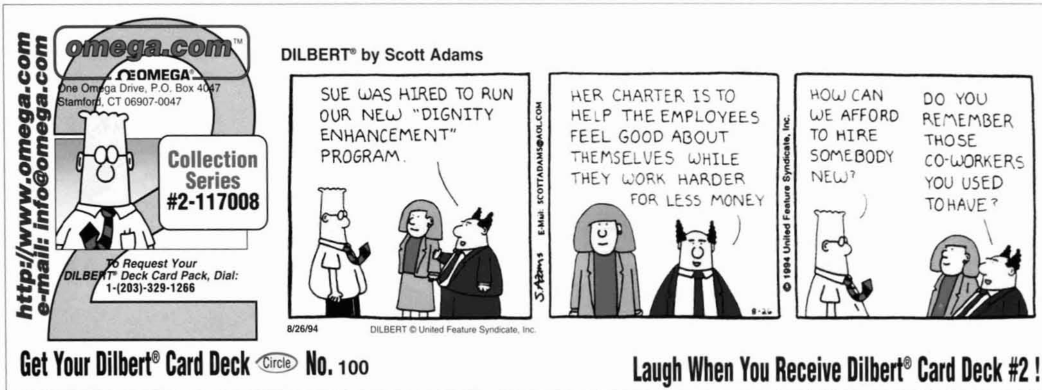
Safer, Cheaper, Easier

Proposed Air Regs Stir Debate

New System Controls Contaminant Seepage

Zero Emissions: "Designer" Wastes





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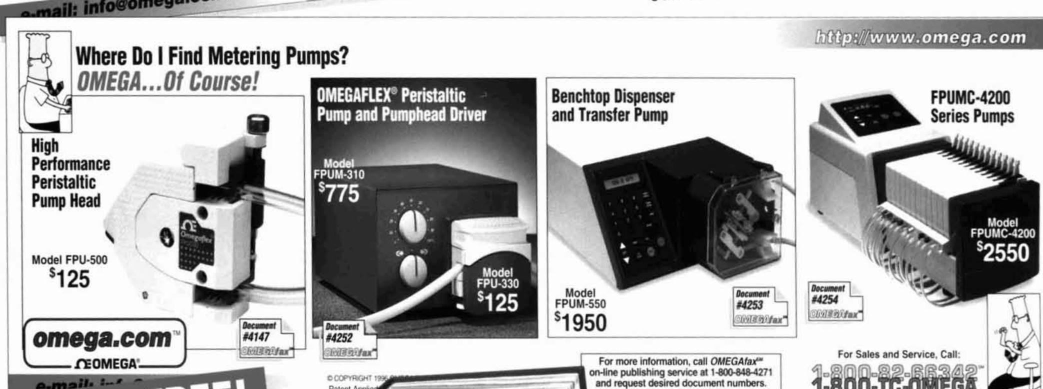

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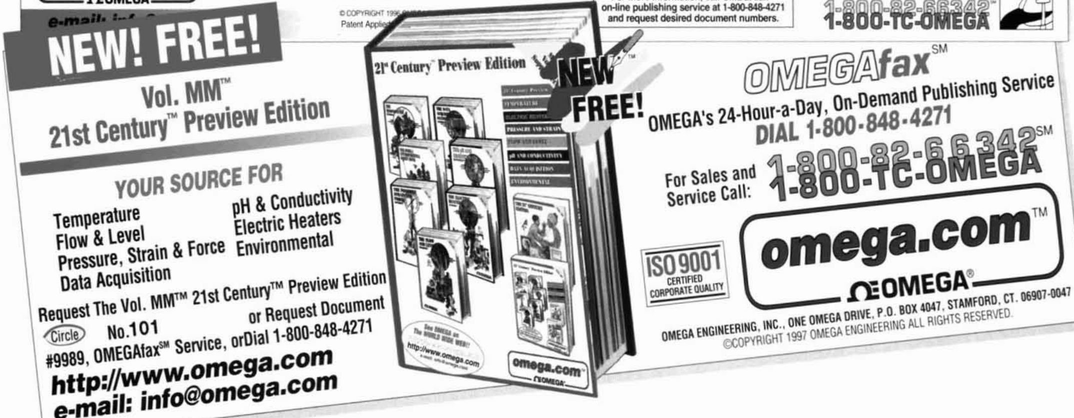

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111	128	145	162	179	196	213	230	247	264	281	298	315	332	349	366	383	400
112	129	146	163	180	197	214	231	248	265	282	299	316	333	350	367	384	401
113	130	147	164	181	198	215	232	249	266	283	300	317	334	351	368	385	402
114	131	148	165	182	199	216	233	250	267	284	301	318	335	352	369	386	403
115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405

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

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

B. Type of Business (check only one):
A ❑ Manufacturing. If manufacturing, please check the appropriate SIC (check only one):
❑ (20) Food
❑ (21) Tobacco
❑ (22) Textile
❑ (23) Apparel
❑ (24) Lumber & Wood
❑ (25) Furniture
❑ (26) Paper
❑ (27) Print/Publish
❑ (28) Chemicals
❑ (29) Petrol. & Coal
❑ (30) Rubber/Plastic
❑ (31) Leather
❑ (32) Stone/Clay/Glass
❑ (33) Primary Metal
❑ (34) Fab. Metal
❑ (35) Mach., except Elect.
❑ (36) Elect. & Electron Mach
❑ (37) Trans. Equip.
❑ (38) Instr./meas./analyze /controlling
❑ (39) Miscellaneous Mfg.
B ❑ Mining
C ❑ Agriculture
D ❑ Engineering & Contracting
F ❑ Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
L ❑ Consulting
M ❑ Insurance
E ❑ Utilities, public, private & cooperative
Type of Govt:
G ❑ City
H ❑ County
I ❑ State
J ❑ Federal
K ❑ Transportation
N ❑ Labs
O ❑ Training
P ❑ Real Estate
Z ❑ Misc. Services ____________

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

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

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

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

Environmental PROTECTION

G. Which of the following Tanks and Process Controls product(s) /services do you plan to purchase in the next 12 months?(Select all that apply)
800 ❑ Aboveground Storage Tanks
801 ❑ Underground Storage Tanks
802 ❑ UST Tank Vaults
803 ❑ Level Controllers/Monitors
804 ❑ Flowmeters
805 ❑ Leak Detectors
806 ❑ Cooling Towers
807 ❑ Heat Exchangers
808 ❑ Secondary Containment Systems
809 ❑ Groundwater Monitors
810 ❑ Lift Station Controls
811 ❑ Aeration Systems
812 ❑ Recorders

H. What is your reason for purchasing the selected products/services? (Select one)
813 ❑ New Construction
814 ❑ Plant Upgrade
815 ❑ Replacement/Maintenance

I. What is your projected budget for the selected products/services? (Select one)
816 ❑ Over $200,000
817 ❑ $100,001-$200,000
818 ❑ $50,001-$100,000
819 ❑ $10,001-$50,000
820 ❑ $5,000-$10,000
821 ❑ Under $5,000

J. How immediate is your need for the selected products/services? (Select one)
822 ❑ 0-3 months
823 ❑ 4-6 months
824 ❑ 7-9 months
825 ❑ 10-12 months
826 ❑ over 12 months

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❑ (24) Lumber & Wood ❑ (35) Mach., except Elect.
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❑ (26) Paper ❑ (37) Trans. Equip.
❑ (27) Print/Publish ❑ (38) Instr./meas./analyze /controlling
❑ (28) Chemicals
❑ (29) Petrol. & Coal ❑ (39) Miscellaneous Mfg.
❑ (30) Rubber/Plastic

B ❑ Mining L ❑ Consulting
C ❑ Agriculture M ❑ Insurance
D ❑ Engineering & Contracting E ❑ Utilities, public, private & cooperative
F ❑ Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
Type of Govt:
G ❑ City H ❑ County
I ❑ State J ❑ Federal
K ❑ Transportation
N ❑ Labs O ❑ Training P ❑ Real Estate
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contents

Environmental Protection • July 1997 • Volume 8, Number 7

About the cover:
The American Petroleum Institute estimates that over 6.6 billion barrels of petroleum are consumed each year in this country. All petroleum products must be stored during the distribution process and aboveground storage tanks (ASTs) play a major role in the storage. The annual market for AST products and services, which includes new construction, retrofit, repair and inspection, is estimated to range between $1.5 to $2.0 billion. Look at the articles on pages 14 and 18 for suggestions on purchasing and managing ASTs.

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Mark W. Howard, Photographer

features

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departments

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First Priority: Prevent LAST Spills

Accidental petroleum releases from leaking aboveground storage tanks (LASTs) can be devastating to the environment. In 1988, an Ashland Oil Co. 40-year-old AST in Pennsylvania experienced a catastrophic failure and released 3.8 million gallons of diesel fuel. Over 750,000 gallons of fuel flowed into the Monongahela River and threatened the water supply of about 1 million people in Pennsylvania, Ohio and West Virginia.

Two years later, about 200,000 gallons of fuel leaked from a tank farm in Fairfax County, Va., owned by Star Enterprise, a Texaco affiliate. The company finally settled in 1992 with the facility's nearby residents for $200 million in compensation for decreased property values, medical expenses and other damage claims.

According to Sen. Charles S. Robb (D-Va.), a strong advocate of strict AST regulation in the wake of the Star Enterprise incident, "Many remember the *Exxon Valdez* spill that dumped 11 million gallons of oil off the coast of Alaska, but it's estimated that as much as five times that amount seeps into our groundwater each year from unregulated aboveground storage tanks."

Currently in the United States there are an estimated 800,000 to 900,00 ASTs. The oil pollution prevention regulations that pertain to ASTs were established in 1973 under the Clean Water Act (CWA) and set forth spill prevention procedures, methods and equipment requirements.

The CWA was amended by the Oil Pollution Act of 1990 (OPA), which is far stricter and more sweeping than any previous oil pollution liability and prevention law. It imposes strict liability for a comprehensive list of damages resulting from an oil spill into the water from a vessel or a facility's AST. It also requires an owner or operator of an AST that could reasonably be expected to cause substantial environmental harm from an oil release to file a facility response plan with the EPA.

In an effort to ease OPA's information collection burdens, in September the EPA intends to publish CWA amendments regarding oil spill prevention plans. The proposed rule will tentatively include changes such as allowing the use of integrated contingency plans and state plans that meet the requirements of 40 Code of Federal Regulations Part 112 in lieu of CWA-mandated spill prevention control and countermeasure plans.

This fall the EPA also plans to publish in the *Federal Register* a notice about a voluntary approach to leak and spill prevention and cleanup. As part of this proposed Oil Cooperative Program, companies will be offered incentives like cost savings, technical assistance and public recognition in exchange for cleaning up contamination and going beyond the requirements of spill prevention laws. The agency's goal is to set up an open process for input into the program's design and implementation. (For further information, contact Hugo P. Fleishman with the EPA's Oil Pollution Response and Prevention Center at 703-603-8769.)

Because of LAST releases' potentially disastrous impact on groundwater and other natural resources, the EPA and AST owners and operators must work together to ensure better AST construction, improved plans for spill prevention and more thorough inspections of ASTs.

Angela Neville

Angela Neville, JD, REM
Editor, *Environmental Protection*

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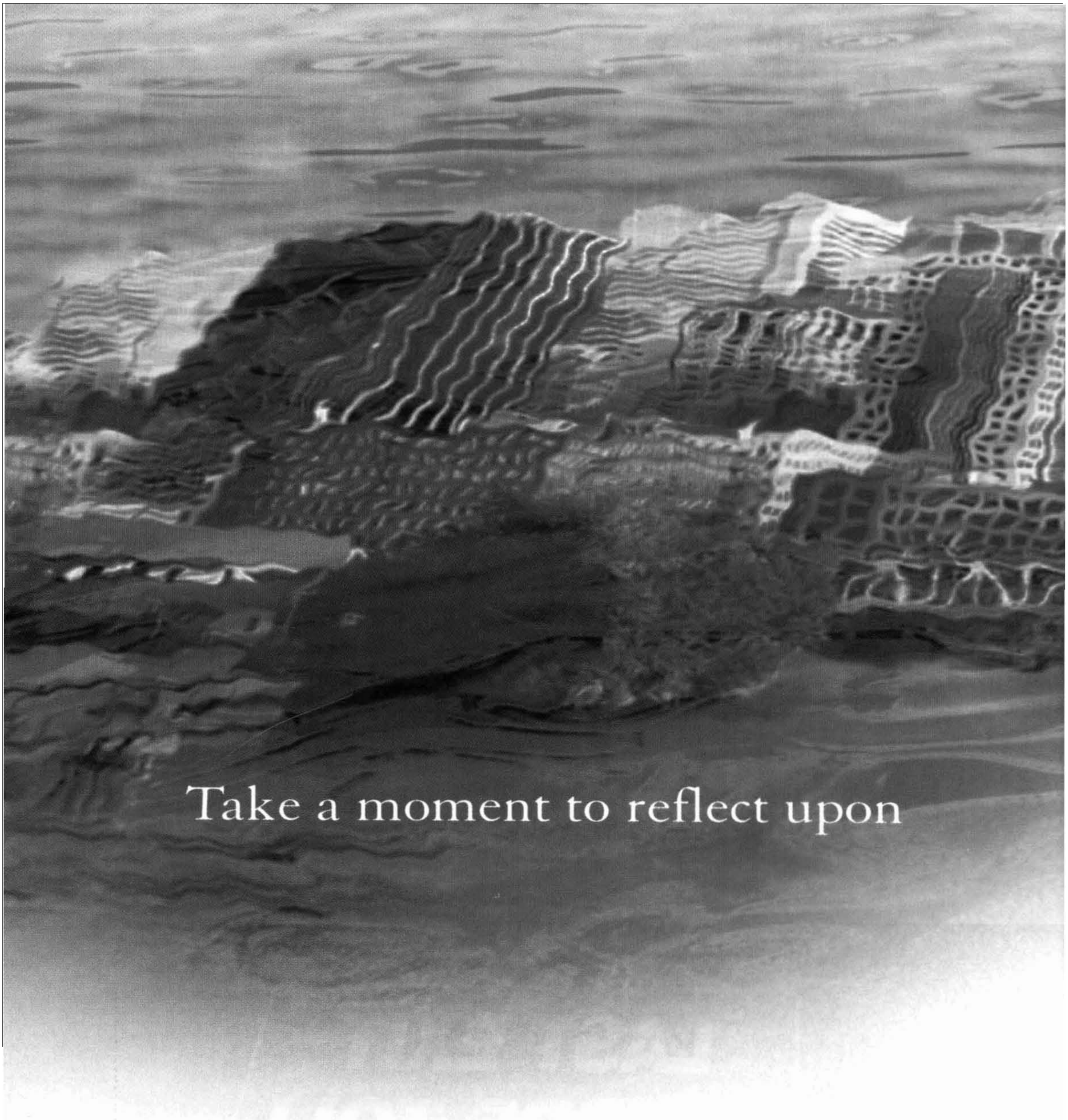

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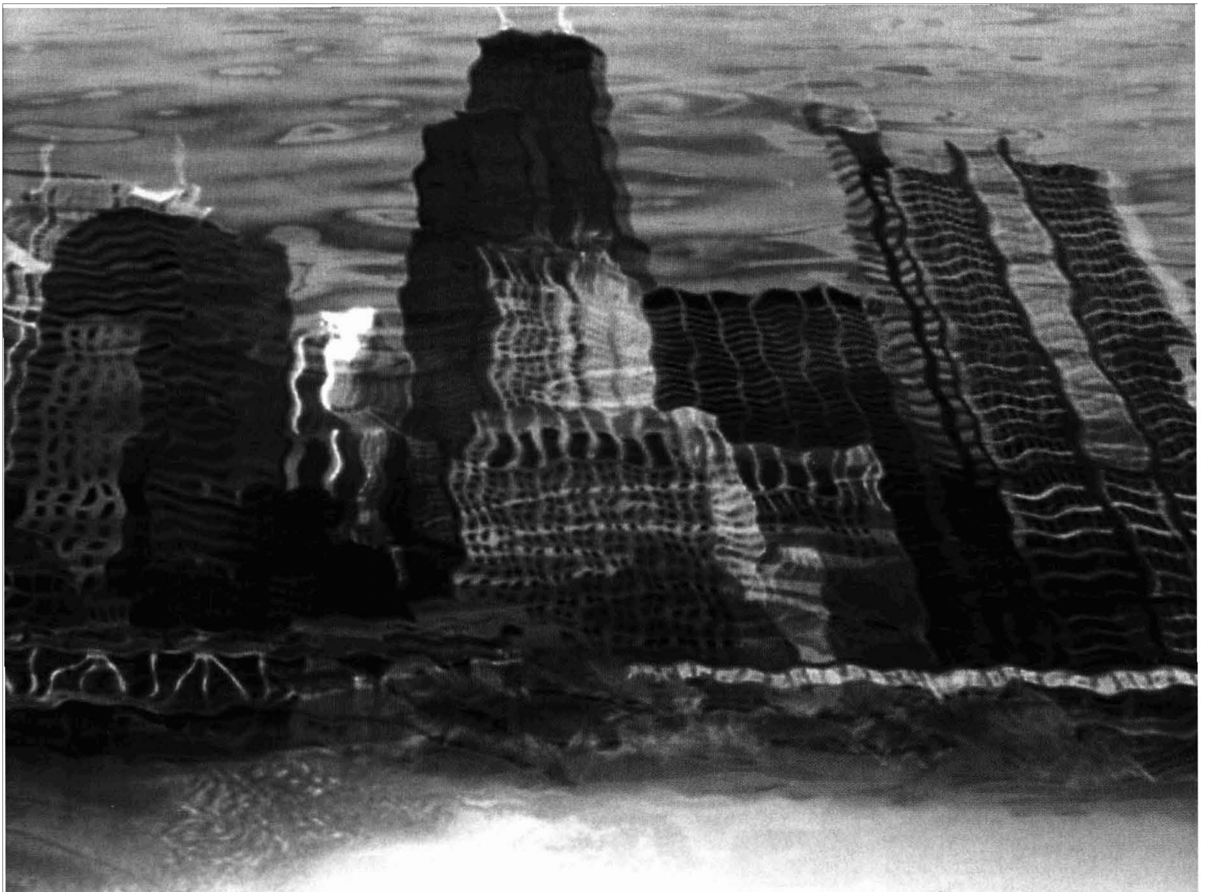

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APPLICATION NOTES detailing a series of solid phase

extraction methods for use in environmental testing laboratories are available from J.T. Baker. Included are step-by-step instructions for sample preparation techniques required by EPA Method in a simple format. **J.T. Baker.**
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NEW FROM CONTROL INSTRUMENTS is a 4-page color brochure describing the Model 650 flame ionization detector (FID). It is fully heated to avoid condensation and clogging during sampling. Air-aspirated sample draw system eliminates pumps. It needs no bottled air to support its flame. **Control Instruments Corp.**
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ACCIDENTAL RELEASE PREVENTION Facility Self-Assessment provides a step-by-step approach to preparing a Risk Management Program (RMP) by June 1999 to comply with the EPA's Clean Air Act 112(r) RMP Rule. Included is a chart to determine if your facility must develop an RMP. **Environmental Resources Management Group.**
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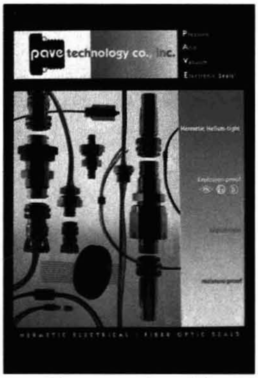
SEALED BULKHEAD CONNECTORS are detailed in a



new 24-page catalog with a wide range of electrical or fiber optic hermetic seals. PVC or Teflon insulated cable seals, flat cable or multi-pin styles are featured. Custom designs available. **PAVE Technology Co.**
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THE HIGHLAND HT-FIBRE-THANE® underground protected steel technology is explained in a free 4-page brochure. Tanks are warranted for 30 years and are tested in accordance with Steel Tank Institute ACT-100-U® and Underwriters Laboratories standards. **Highland Tank.**
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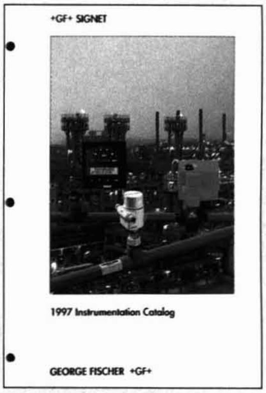
FIRE-RATED HAZMAT storage buildings are described in full-color flyer from Haz-Stor. Photos show fork lift and manual loading, optional door configurations and buildings of different sizes. Available in 8-foot, 10-foot and 12-foot depths accommodating three, four or five rows of 55-gallon drums. **Haz-Stor.**
Circle 161 on card.

THE NEW 1997 +GF+ SIGNET Instrument Catalog offers flow and analytical sensors, transmitters, monitors, controllers and fittings designed for simple installation, operation and maintenance. Applications range from chemical processing to water and wastewater treatment. **George Fischer Inc.**
Circle 165 on card.



THE ULTIMA® SAMPLING MODULE, which samples any confined space, is described in a new data sheet from MSA Instrument Division. Two versions are available, both capable of drawing samples from up to 100 feet. Rated NEMA 4X to withstand severe environmental conditions. **MSA Instrument Division.**
Circle 162 on card.

THE *1997 HAZMAT COMPLIANCE CATALOG* offers

two new ordering media: the Internet and Electronic Data Interchange (EDI). It contains employee handbooks, newsletters, video-based training, software, forms and signs designed to provide solutions to safety and compliance challenges. **J.J. Keller & Associates Inc.**
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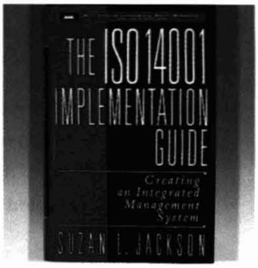
DEVELOP A SUPERIOR EMS with *The ISO 14001*



Implementation Guide: Creating an Integrated Management System by Suzan L. Jackson. Contains step-by-step instructions for implementing an effective and cohesive EMS that will help cut costs, increase efficiency and focus energies. **John Wiley & Sons Inc.**
Circle 164 on card.

Toxic Release Data

WASHINGTON, D.C.—EPA Administrator Carol M. Browner reported May 20, 1997, that the release of pollution into communities has decreased by 46 percent since the Clinton administration doubled the number of chemicals that industry must make public under the U.S. Environmental Protection Agency's Right-to-Know program that began in 1986.

Currently 643 chemicals are required to be reported under the EPA's annual Toxic Release Inventory. The EPA in June 1996 increased by about 30 percent the number of industrial facilities required to report the toxic chemicals they release into the air, water and land. To date, releases of pollution, reported air emissions, discharges to surface water and land were all down by at least 4.9 percent from 1994 to 1995. Only underground injection releases showed an increase of 19.5 percent.

Texas Compliance Program

AUSTIN, Texas—The Texas EnviroMentor program helps small businesses abide by environmental laws. The new program matches volunteer professionals with small businesses who need help complying with environmental air, water and waste regulations.

The EnviroMentor program is a department under the Texas Natural Resource Conservation Commission (TNRCC). It is free to independently owned Texas businesses with 100 or fewer employees. Eligible companies have to report environmental violations and must be willing to correct violations discovered by volunteers.

To request help from an EnviroMentor or to volunteer, contact the Small Business Assistance division of the TNRCC at (800) 447-2827.

Car Emissions Program

CARSON CITY, Nev.—The Nevada Department of Motor Vehicles and Public Safety is testing a new procedure that will help bring the lingering problem of carbon monoxide pollution from gasoline-powered vehicles into check. The MCI-sponsored program will enable emission inspection facilities to access vital inspection-related information and standardize emissions reporting.

The testing procedure is simple: an electronic search matches the tested vehicle to its record in the centralized Vehicle Information Database. An electronic response provides vehicle information that helps set the parameters for conducting the emissions test. Vehicles that fail must be brought into compliance before registration can be renewed, and passing vehicles will be automatically updated. The data from the test is then entered into the vehicle profile. Because the on-line system is paperless, consumers do not have to keep track of their emissions data.

Petition Fees Increase

WASHINGTON, D.C.—The U.S. Environmental Protection Agency has increased the fee it charges to process petitions for tolerances or legal residue levels in food and feed by 3.33 percent, effective June 9, 1997. The basic fee for establishing a new tolerance is $64,025. The Federal Food, Drug and Cosmetic Act authorizes the EPA to establish pesticide tolerance levels for raw agricultural commodities and requires the agency to collect fees to cover the costs of processing petitions for tolerances. The increased fees are published in the *Federal Register* on May 9.

EPA Policies Questioned

WASHINGTON, D.C.—After three years of litigation, a federal district court in *U.S. vs. Florida Cities Water Company and Avtar Utilities Inc., 1996* (M.D. Fla) ("Florida Cities") rejected several key components of the EPA's generic enforcement policy for assessing penalties under the Clean Water Act.

The court reduced by over 99 percent the maximum statutory penalty in connection with the defendant's sewage treatment facilities, emphasizing the absence of any environmental harm or quantifiable risk of harm from the defendant's violations.

Specifically, the court addressed three EPA enforcement policies. First, the EPA's civil penalties were based on a generalized risk of pollution rather than evidence of actual environmental harm. Second, although violations could have been resolved in prior administrative settlements, the EPA still attempted to seek liability for violations that were the subject of previous administrative settlements. And finally, the court also rejected the EPA's seeking to hold the parent corporation liable for Clean Water Act violations of a subsidiary without evidence that the parent company directed or caused the violation.

Rural Air Pollution

ATLANTA—According to a new air pollution standard for ground-level ozone proposed by the EPA, that will possibly be enacted on July 19, large portions of the rural United States can be cited as ozone non-attainment areas. Summertime ozone levels tend to fluctuate dramatically in urban areas, dropping to near zero at night, then building up during the day. By contrast, rural ozone levels show smaller fluctuations, with a lower but longer-lived daytime maximum and less fall-off at night.

"Lowering the permissible ozone concentration and averaging it over eight hours instead of one hour brings more rural sites into non-attainment," Dr. William L. Chameides, regents professor at the Georgia Institute of Technology, said.

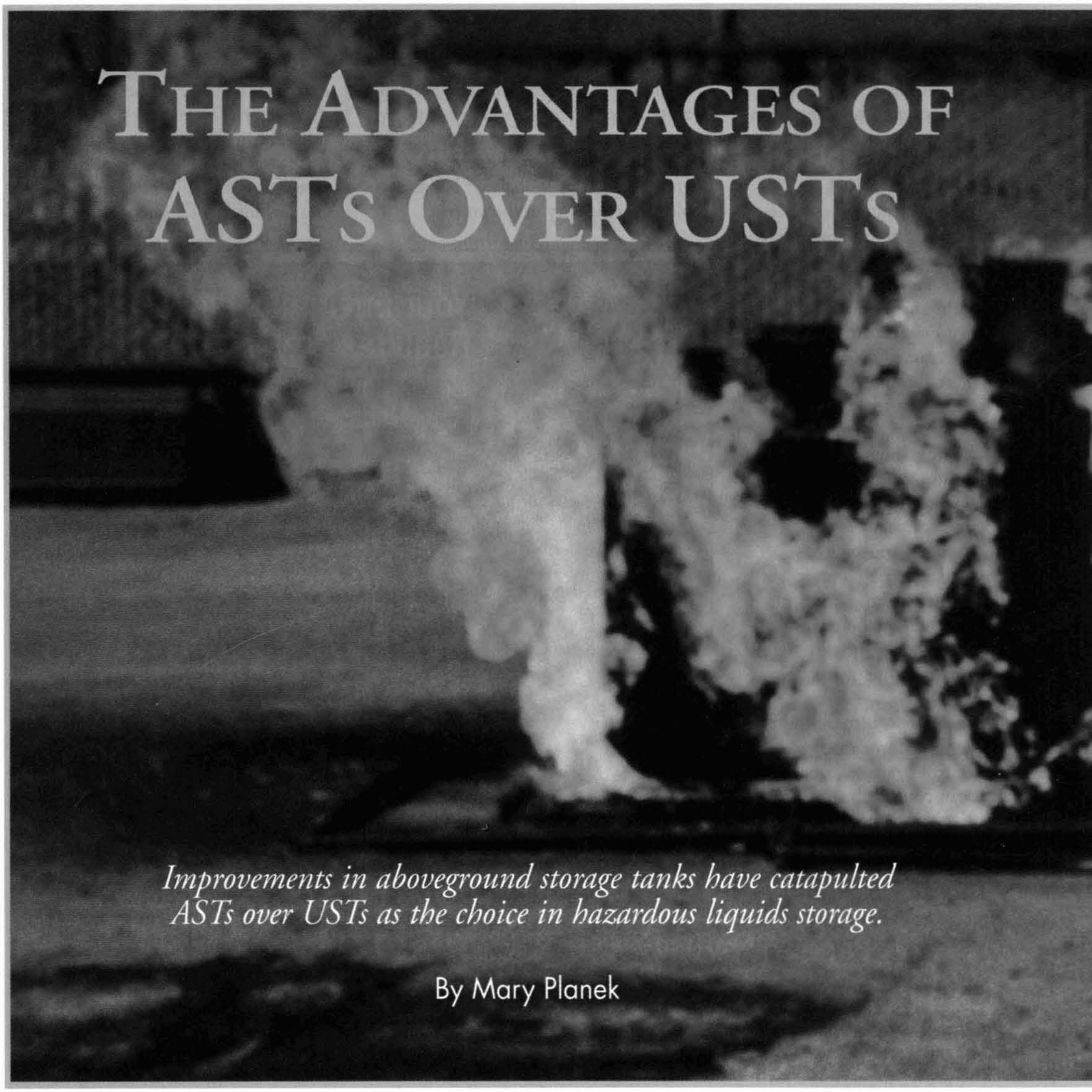
Requiring rural areas to meet the new standard would enforce a major change in ozone control strategies, since few rural areas can control the pollutant emissions that cause their non-attainment problems. Therefore, communities and states would have to take a more regional approach, requiring co-operation between political entities that have not always worked together in the past.

Hydrogen Production

OAK RIDGE, Tenn.—Some futurists dream about using hydrogen as a fuel to replace the dwindling supply of fossil fuels because it burns cleaner and uses renewable resources, including waste materials. Jonathan Woodward of the Department of Energy's Oak Ridge National Laboratory found a new method that extracts hydrogen from certain forms of abundant complex sugars like cellulose and starch.

Extracting hydrogen from sugars is appealing. Sugars are easily obtainable and easily reproduced. Cellulose, the basic building block of all plant matter, can be found in wood and paper products—even old newspapers. The only waste in burning hydrogen is water, unlike fossil fuels that produce various pollutants as by-products.

Although more research and development is needed to reduce the costs of the catalyst used to speed up the rate of hydrogen production, the research group headed by Woodward has doubled the efficiency of the process. Because hydrogen is a major industrial chemical, the use of hydrogen fuel in industries is one way the new technology may be used. The researchers also forsee using the new hydrogen technology to fuel automobiles, as a fuel for domestic as well as industrial facilities or simply as a fuel for fuel cells. EP



The Advantages of ASTs Over USTs

Improvements in aboveground storage tanks have catapulted ASTs over USTs as the choice in hazardous liquids storage.

By Mary Planek

ConVault AST undergoes a fire test.

Aboveground storage tanks (ASTs) offer several advantages over undergound storage tanks (USTs) for storing flammable liquids, including less environmental risk, current exemption from extensive federal regulations, reduced insurance costs, easy visual inspection and portability.

With fire safety improvements and technological advances—including secondary containment, fire insulation and physical damage protection—ASTs have moved to the forefront for safe, economical storage of fuel and other hazardous liquids.

Regulatory officials usually regard ASTs with secondary containment as the safest method for storing hazardous materials. The tanks are typically subjected to fewer environmental and fire code inspections and less-sophisticated leak detection methods are permitted. AST tank owners must comply with state regulations that may include a spill prevention control and countermeasure (SPCC) plan, engineering studies, site assessment, employee training and certification, inspection reporting and containment and response activities.

Costs Versus Benefits

Since AST prices can vary tremendously from region to region, a cost-benefit analysis is an important consideration. Useful analysis must include: examination of the state and local fire, building and zoning codes; identification of usable space in relation to storage requirements; careful evaluation of the design

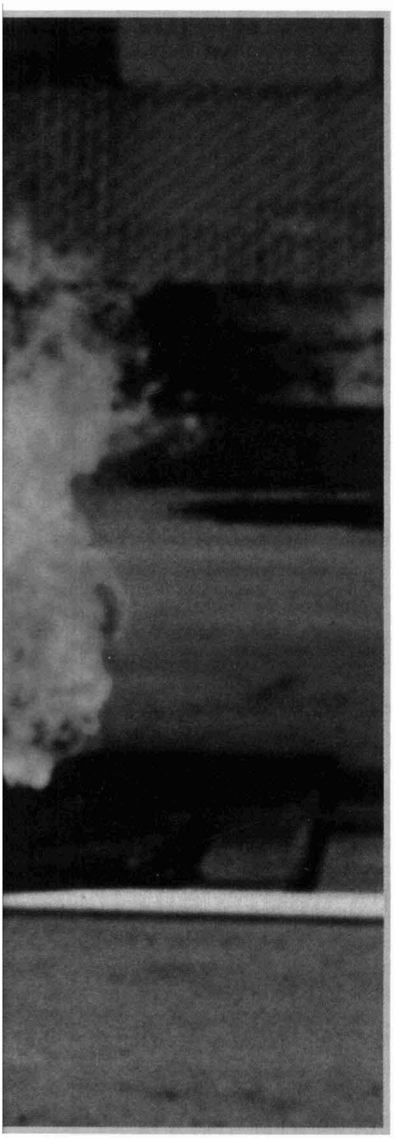


Photo courtesy of Tek-Rite

parameters; anticipation of future federal regulatory requirements and careful examination of the tank manufacturer's experience and track record.

Safety First

The codes that pertain to AST installations depend on the purpose and location of the particular installation. Fire codes are the most prevalent. Fire marshals have the strongest influence on whether an AST can be installed in a particular location.

All three model fire codes allow aboveground storage of fuel in fire-protected tanks. Underwriter's Laboratories conducted testing and developed U.L. 2085, "Insulated Aboveground Tanks for Flammable and Combustible Liquids" as a standard for ASTs. The standard covers protected tanks including vehicle impact and ballistic resistance in accordance with UFC Appendix Standard A-II-F-1, as well as fire-resistant (insulated) tanks in accordance with NFPA 30A. Another testing lab, Southwest Research Institute (SWRI), uses the SWRI 93-01 listing to designate "Testing Requirements for Protected Aboveground Flammable Liquid/Fuel Storage Tanks" in accordance with UFC Appendix Standard A-II-F-1.

The main difference between a protected and fire-resistant tank is the maximum allowable temperature rise of the primary steel tank during the fire test. The higher degree of safety of a protected tank is based on the fact that heptane, a major component of gasoline, has an auto-ignition temperature of approximately 400 degrees F.

The protected tank designation reduces required separation distances from other tanks and/or buildings by as much as 50 percent and allows dispensers to be mounted directly on the tank. Protected tanks tested for vehicle impact resistance may also be installed without the need for costly and space-consuming crash barriers or bollards.

Capacity and Cost

Concrete-encased protected ASTs range in capacity from 250 to 12,000 gallons. Thermally insulated double-wall steel protected tanks range in size from 300 to 15,000 gallons. A concrete-encased AST may provide superior impact and projectile resistance, thermal protection and durability, resulting in lower insurance costs and less maintenance.

Tank Features

After the field of protected and fire resistant ASTs has been narrowed to those bearing an appropriate test label, certain design features should be evaluated.

- **Fire Rating:** A two-hour fire rating, required by NFPA 30A, UFC Appendix Standard A-II-F-1, and the BOCA NFPC and the SBCCI SFPC, is standard on all fire-resistant and protected tank designs. The two-hour fire test is followed by a hose-stream test to ensure the tank integrity after exposure to fire and a leak test to show complete primary containment after fire exposure.
- **Materials of Construction:** Thermal insulation and secondary containment are the primary requirements for safe aboveground storage of fuel. In the double-wall steel tank design, a porous insulation material between the two steel tanks provides thermal protection while the outer steel tank provides secondary containment. Reinforced concrete provides a two-hour fire barrier for the inner steel tank and its contents. One tank design uses a nonmetallic, high-density polyethylene (HDPE) liner between the steel tank and the concrete encasement to provide secondary containment. The liner isolates the corrosive concrete from the primary steel tank. The U.S. Environmental Protection Agency is considering reducing inspection frequency for ASTs exhibiting additional structural support within the tank insulation material. Fiberglass reinforced plastic (FRP) tanks are inherently non-corrosive, but they should be enclosed in concrete or some other material to withstand ultraviolet damage as well as fire exposure. FRP technology is being investigated by the national fire codes for limited aboveground use.

Regulatory officials usually regard ASTs with secondary containment as the safest method for storing hazardous materials.

- **Leak Detection:** Detection of leaks in the monitoring space is important to evaluate, since integral enclosed secondary containment prevents visual inspection of the primary tank. Some forms of thermal insulation in the interstice are not conducive to monitoring. Spill-control equipment, including automatic shutoff devices and overfill alarm systems, are suggested. Most leaks from ASTs aren't from tank failure but from human carelessness, overfilling, spilling or collisions.
- **Warranty:** Warranties range from one to 30 years. A 20- or 30-year warranty is optimal for most fire-resistant and protected ASTs. Tank manufacturers

providing a longer-term warranty are guaranteeing their confidence in their system, and their staying power in the industry. In your evaluation, it is important to compare the price based on the same term of warranty.

• **Venting:** The emergency venting mechanism, whether provided by device or form of construction, should relieve pressure during a fire and prevent a catastrophic failure of the primary tank. Double-wall steel tanks have an emergency vent in the secondary containment to prevent excessive vapor growth. "Venting by form of construction" is a new alternative available on tanks with the HDPE liners. The label identifies those tanks that will passively vent themselves through a minor fracture in the concrete exterior if vapors begin to grow within the interstice caused by a severe pool fire exposure.

• **Configuration/Appearance:** Tank aesthetics is an important consideration, especially near commercial buildings. The natural finish of concrete-encased tanks often matches or compliments the surroundings more effectively than a bare steel tank. Dual or multi-compartment tanks are available in many AST designs for storing different types of fuel in a limited space. The rectangular shape available from some manufacturers may be more desirable, because its lower profile is compact and fits easily next to buildings.

• **Installation:** Several AST designs do not require excavation or diking. These tanks can be shipped as a complete fuel storage and dispensing system. Most tanks can be installed in a few hours using a boom truck or crane and be ready for fuel delivery. Additional expenses are limited to the cost of a concrete pad and electrical service, if desired. Accessory packages provide optional "turn-key" fuel storage and dispensing systems.

• **Field Testing:** AST designs should be provided with the appropriate fittings and instructions to ease field testing of the primary tank's integrity and the integral secondary containment. Fire codes, as well as the EPA, are beginning to require periodical tests during the life of the tank.

Future Considerations

Currently, 40 Code of Federal Regulations (CFR) 112 is the federal program governing ASTs. However, further development and enforcement of AST regulations is in progress. Issues being considered for requirements include: groundwater monitoring; cleanup and financial responsibility; tank labeling and registration; minimum inspection and testing frequencies; and registration to finance administration and inspections.

Tank Manufacturers

Because the number of AST manufacturers has increased tenfold in the last few years, look for experienced, professional organizations with an extensive record of tanks in service without failure. Some AST manufacturers provide assistance in preparing permit applications as part of their customer service pledge. Since every state and local area has distinct fire code requirements, a local manufacturer's experience may save you time and resources. EP

Mary Planek is a chemical engineer and president of Tek-Rite, in Oak Park, Ill., a firm specializing in technical writing and concentrating in aboveground fuel storage.

For more information, circle 154 on card

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Multi-media Environmental Management

To be effective, compliance programs for tank systems need to address all relevant air, water and waste regulations.

By J. Andy Soesilo, PhD, REM

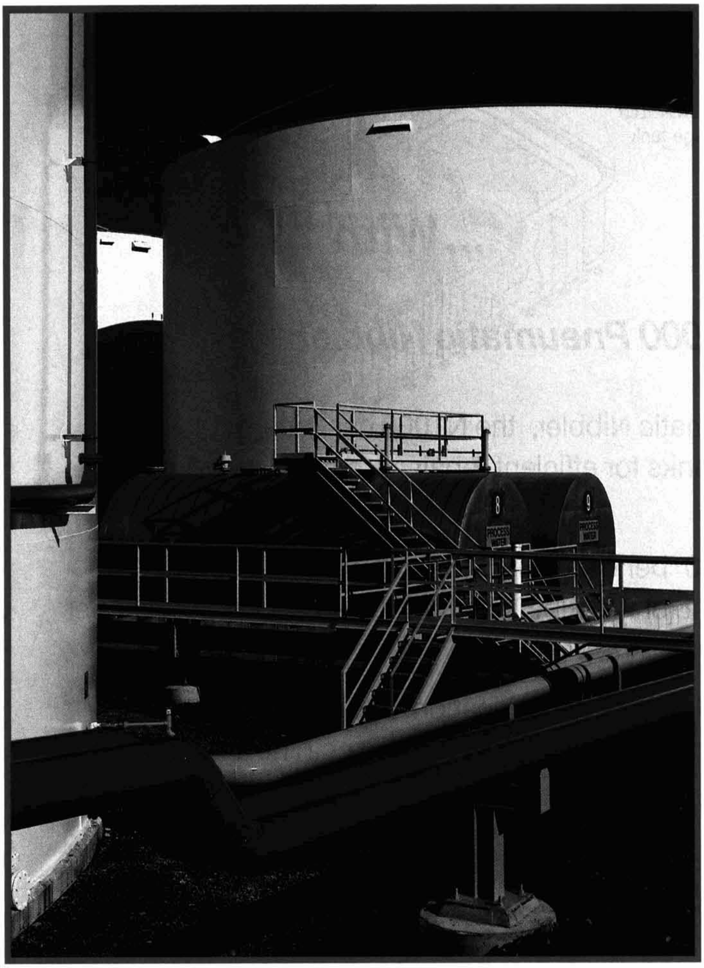


Photo by Mark W. Howard, Westfall EcoImages

Businesses and corporations engaging in activities that can degrade the environment are required to establish, maintain and improve their environmental management systems. To be effective, environmental management must be based on a multi-media approach that enables environmental managers to assess the financial, operational and management benefits of taking such an integrated approach to environmental activities.

The multi-media approach focuses on regulatory programs that address all environmental media (air, water and waste) at once, an approach that can be used to design an effective compliance program. The program includes proper waste and material handling management, and systematic monitoring and recordkeeping implementation. It also includes an accurate evaluation of whether a unit or structure requires an environmental permit, plan approval or registration—and if so, the type of required permit or notification. The program also tells you what, if any, exemptions from permitting or approval requirements exist. Knowing this information is beneficial not only for environmental compliance but also for facility development.

Illustrating a Multi-media Approach

Tank systems and the various environmental regulations that apply to them are good examples on which to apply the multi-media approach. Tanks are commonly used by small firms or large companies to store gasoline, oils, solvents and other materials. A tank is defined as a stationary device that contains an accumulation of materials, and is constructed of non-earthen materials—such as wood, steel, plastic or concrete—to provide structural support.

Environmental laws regulate tanks based on their size, configuration (aboveground or underground) and contents. By taking these three factors into consideration, the decision-making flowchart related to environmental requirements is displayed in **Figure 1**. The flowchart is based on Arizona laws; however, by making proper adjustment to local regulatory provisions, the flowchart can serve its function well for other jurisdictions.

Permitting Requirements

Tanks used to store hazardous waste exceeding accumulation time are subject to hazardous waste storage permitting requirements. Under the Resource Conservation and Recovery Act (RCRA), the permit to treat, store or dispose of (TSD) hazardous waste is known as a TSD permit. The accumulation time allowed under RCRA depends on the maximum amount of monthly hazardous waste generation. Generators producing more than 2,200 pounds per month are allowed to accumulate the waste up to 90 days in the calendar year. Generators producing less than 2,200 pounds, but more than 220 pounds, can accumulate the waste up to 180 days while generators of less than 220 pounds a month can accumulate the waste indefinitely.

In Maricopa County, Ariz., the county ordinance states that a tank with a capacity of more than 250 gallons and storing organic liquids with a true vapor pressure exceeding 1.5 pounds per square inch (psia) (77.5 mm Hg) is subject to air quality permitting requirements, specifically the state Non-Title V Permit.

This provision means that a 500-gallon tank used for storing gasoline is required to have a permit while the same size of tank for storing diesel fuel is exempt because the vapor pressure of diesel fuel is less than the threshold vapor pressure. An organic compound is defined as any compound of carbon excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates and ammonium carbonate.

UST or SPCC Plan?

In addition to an air quality permit, a tank used for storing petroleum products may also be subject to either spill prevention, control and countermeasure (SPCC) under the Clean Water Act or underground storage tank (UST) requirements. USTs are tanks or combinations of tanks and the underground piping that connects them with a volume of 10 percent or more beneath the ground's surface. The SPCC plan is required for an aboveground storage tank (AST) storing oil (of any kind or in any form) where a significant spill (in sufficient quantities) could reasonably be expected to reach United States waters (40 Code of Federal Regulations (CFR) 112.1). Under the SPCC provision, the term "U.S. waters" means virtually every water body including rivers, lakes, creeks, wetlands and even intermittently dry river washes.

The SPCC plan requirement applies to an AST with a capacity of more than 660 gallons. If the facility has more than one tank, the requirement pertains if the total capacity of all the tanks is greater than 1,320 gallons. The SPCC plan requirement also applies to a UST with a capacity of more than 42,000 gallons.

The UST regulations apply to petrole-

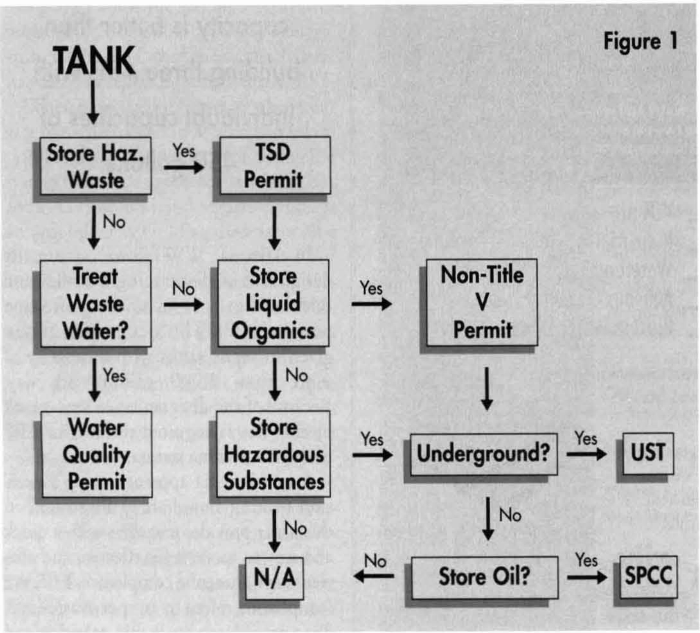


Figure 1

um and organics and inorganics designated as hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund. USTs storing hazardous waste are exempt from the UST requirements per 40 CFR 280.10b(1).

Some UST systems, specified in 40 CFR 280.10(c) and (d), are deferred from the UST regulations. Examples include tanks containing radioactive material, airport hydrant fuel distribution systems and the USTs used for storing fuel for emergency power generators. These tanks are required to partially comply with the UST requirements.

Other UST systems are also excluded from the UST regulations (40 CFR 280.10(b)). They include USTs with capacities of no more than 110 gallons, tank systems with *de minimis* concentration of regulated substances, overflow containment tank systems that are expeditiously emptied after use, and equipment containing regulated substances for operational purposes, such as hydraulic lift tanks and electrical equipment tanks.

If a UST system does not qualify for exclusion nor deferral, the tank is subject to full UST provisions, which include notification to environmental agencies, adherance to performance standards, corrective action and financial tank closure. Most deferrals are only subject to corrective action and financial assurance requirements.

Water Quality Permitting

Tanks designed as part of a wastewater treatment plant (WWTP) are regulated under the Clean Water Act. National Pollutant Discharge Elimination System (NPDES) permits are normally required for WWTPs because of their discharges to U.S. waters. If the WWTP output is not discharged but reused, such as to irrigate a golf course, a wastewater reuse permit is required instead of a NPDES permit. If the output is sent to the regional WWTP, the output must satisfy pretreatment requirements.

When you need to build a new tank system or replace an old one, designing a new AST with a 1,300-gallon capacity is better than building three ASTs with individual capacities of 450 gallons.

In Arizona, WWTPs are statutorily designated as discharging facilities and mandated to have an aquifer protection permit (APP). This designation is also given to septic tanks with a capacity of more than 2,000 gallons per day. Because of the designation, a septic tank of this size is required to have an APP under the Arizona statute.

A multi-media approach using a decision-making flowchart as illustrated in this paper provides managers with a quick and easy to use tool for effective and efficient environmental compliance. Effective compliance refers to proper waste-handling procedures, waste minimization and pollution prevention, while efficient compliance requires less permitting.

If a large-quantity generator stores liquid organic waste with a true vapor pressure greater than 1.5 psia, the generatormust ensure that the maximum accumulation time (90 days) will not be exceeded to avoid the TSD permitting requirement. If the generator is able to store the waste in a tank with a capacity of less than 250 gallons, the state Non-Title V air quality permit is also not required.

Sizing a tank system can be a determining factor in complying with environmental regulations, an understanding that is equally important in facility development planning. When you need to build a new tank system or replace an old one, designing a new AST with a 1,300-gallon capacity is better than building three ASTs with individual capacities of 450 gallons. Building a single tank will certainly eliminate the need to develop an SPCC plan. Optimizing tank capacity is possible through implementing proper material management and other good housekeeping practices.

Tank system configuration is also worth considering for facility planning and compliance. Federal UST regulations mandate that by December 28, 1998, all existing USTs are required to have corrosion protection and spill and overfill prevention. Options available to UST owners or operators include upgrading the existing UST with the required protective measures, closing the tank, replacing it with a new UST that meets the federal standards or replacing it with a new AST.

When you need to have a tank system at a particular location at a certain elevation in a facility, consider configuring the system so it is classified not as a UST, but as an AST, which is less regulated. This is accomplished by building the system on a recessed platform.

While a UST is continuously monitored for possible unseen leaks or structural damage, an AST provides easy access for monitoring and maintenance. To prevent the AST from becoming an open target for vandalism, accidents and long-term effects of exposure to the system, a vault can be constructed over the platform for protection.

Multi-media environmental considerations represent only a few factors that affect tank configuration decisions. Decisions are also influenced by other federal, state or local requirements, such as fire codes, installation costs, operation and monitoring, and liability related to environmental exposure as well as third-party exposure. These factors also require an in-depth analysis.

Non-environmental Factors

Multi-media environmental management as a managerial technique represents a holistic approach to managing environmental programs. Success depends on the technique being viewed as a system that skillfully integrates the regulatory, technical and financial decision-making process with the overall tangible and intangible benefits to the company. This successful achievement of integration makes the system an effective environmental management tool. EP

J. Andy Soesilo, PhD, REM, is in the Solid Waste section of the Arizona Department of Environmental Quality in Phoeniz, Ariz.

For more information, circle 153 on card.

By A. Scott McDowell, MS, REM

Growing Pains for the Environmental Profession

Environmental professionals need specialized credentials, not those worn by engineers and geologists.

PROFESSIONALS IN ALL TECHNICAL FIELDS know that solid professional credentials are a positive force in obtaining work for their company and advancing their career. In the field of environmental science, professional credentials present some unique problems.

In some states, notably North Carolina, environmental regulations state that a professional engineer (PE) or professional geologist (PG) must affix their professional seal to environmental site assessment reports and corrective action documents. One federal consent order for environmental remediation specifically states that a qualified geologist or engineer be designated as the project manager. In some cases, however, a PE or PG may not have experience, training and knowledge specific to the environmental field.

State and federal regulators may have difficulty defining the credentials of an environmental professional and default to the PE or PG credentials.

Evolution of the Problem

Environmental science is a young professional discipline that lacks the well-recognized professional credentials of the engineer or geologist. State and federal regulators may have difficulty defining the credentials of an environmental professional and default to the PE or PG credentials. The engineering and geologic professions have aggressively entered the environmental sciences field to take advantage of profit opportunities as the importance of environmental issues has grown for a number of projects, from reservoirs to highways.

Training in chemistry and biological sciences is the main difference between a professional trained specifically in the environmental field, and an engineer or geologist. Although environmental projects often involve engineering and geology, many involve evaluating the relationships between the mechanical and geologic aspects, and the chemical and biological aspects. One example is risk assessment, which evaluates fate and transport of contaminants to evaluate whether exposure exists and relates any exposure to human health effects. Another example is wetlands delineations. Wetlands delineations and mitigation involve engineering hydrology as well as complex soil science and botany.

Environmental science has many different disciplines. Although the available labels may correspond to the individual disciplines, they do not address the whole.

The Solution

Organizations such as the National Registery of Environmental Professionals (NREP) must become better known and more widely accepted, until their accreditations are acknowledged by the regulatory community.

So far, my home state of Virginia has avoided defining the professional environmental scientist by the PE/PG moniker. Virginia uses a definition similar to the federal regulations, especially the Resource Conservation and Recovery Act (RCRA), which defines "qualified groundwater specialist" on the basis of education and experience.

To protect human health and the environment, and to provide an even playing field for environmental professionals, it would make sense to have state and federal regulatory agencies recognize professional environmental credentials as defined by organizations such as the NREP. Also, policies that require a PE or PG for environmental site assessment documents should be reviewed and the requirement replaced with "qualified environmental professional."

The field of environmental science has come a long way. When the environmental field boomed, a variety of individuals and companies began to offer "environmental science" services.

One example of this is when the petroleum industry in Texas was depressed, causing petroleum engineers and geologists to suddenly become "environmental scientists." This early evolution created a confusing situation.

When I embarked on my professional journey in environmental science, I did so with the idea that if I specialized in water quality, I would make myself employable in a critical area for a long time. Society needs oil, energy and similar natural resources, but water is essential. If there is no water, there is no life. My decision has served me well, but I would like my credentials as a qualified environmental professional to be acknowledged. EP

For more information, circle 150 on card.

A. Scott McDowell, MS, REM, is a hydrogeologist and registered environmental manager for Hayes, Seay, Matter & Mattern Inc. in Roanoke, Va.

CONTAMINANT SEEPAGE CONTROL

Controlling organic chemical seepage and sediment from a riverbank provides an engineering challenge.

By Joel Karmazyn

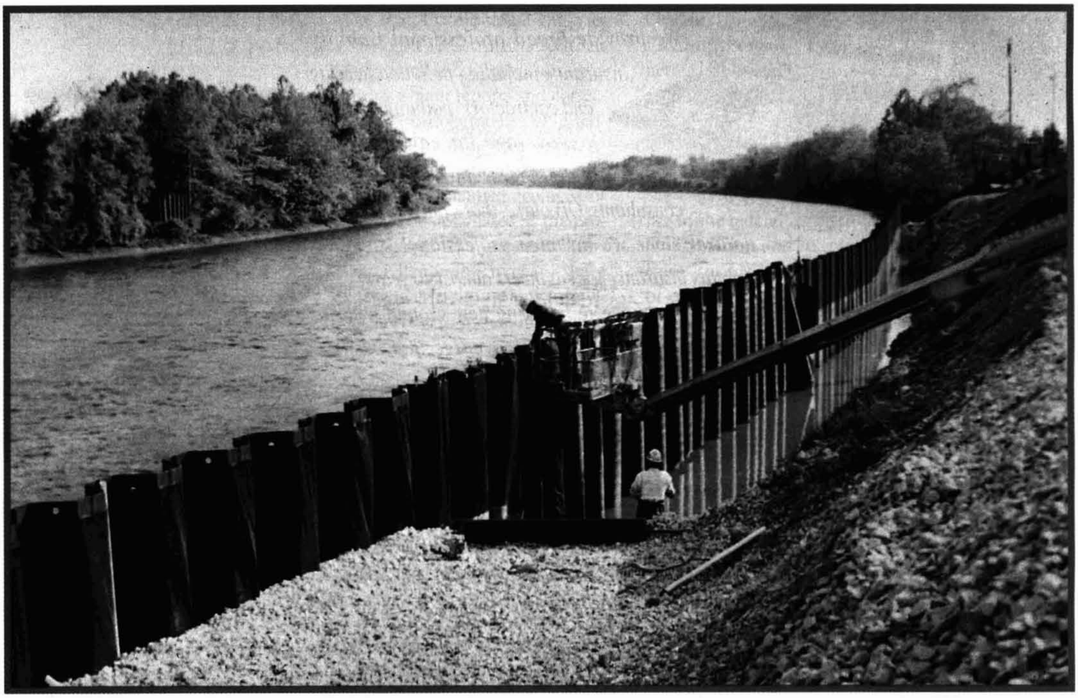


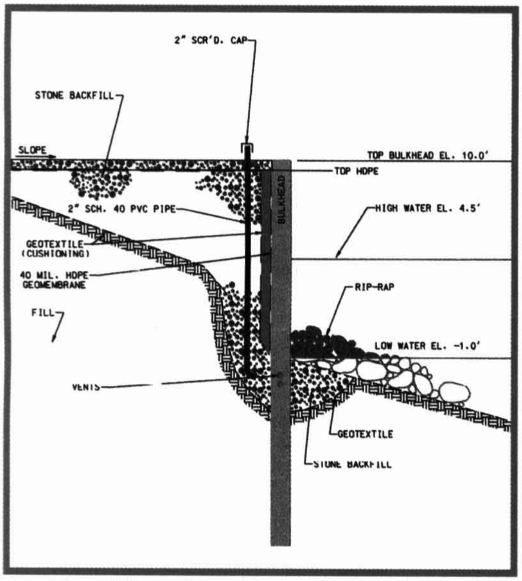
Photo courtesy of Joel Karmazyn

Liner installation.

The control of organic chemical seepage to surface-water bodies and sediment from steep embankments presents an engineering challenge while meeting regulatory standards. A unique riverbank cover system was built to curtail organic chemical seepage to a tidal water body and minimize intrusion into the river. The system also provides slope stability for an embankment constructed of chemical fill material. The embankment supports an industrial plant built on top of it.

The riverbank cover system is composed of a steel sheet pile bulkhead and clean gravel backfill to provide overall stability. Predesign investigations determined that construction of a vertical barrier at the top of the riverbank was not feasible because of hazards associated with the congestion of utilities and structures within the area. The bulkhead approach was selected to minimize the extent to which the system intrudes into the river.

Because of the river's tidal action, the potential existed for unbalanced hydraulic head between the inside and outside of the bulkhead system. An innovative, vented pile design was chosen and installed to allow free hydraulic communication between the river and the clean gravel backfill within the bulkhead. The system eliminated the need for a groundwater recovery system behind the sheet pile bulkhead. The vents consist of



Vented sheet pile design allows hydraulic communication between the river and the clean gravel backfill within the bulkhead.

vertical pairs of 1-inch-diameter holes located on each sheet pile below the river's mean low tide level, causing the water level in the clean gravel backfill to rise and fall in concert with the tidal action in the river (**See Figure 1**).

Inside the sheet piles a geomembrane was added above the elevation of the vent holes. This prevents leakage through the interlocks of the sheeting and ensures that any hydraulic conductivity through the bulkhead occurs through the vent holes. The height of the sheet pile bulkhead is above the 100-year flood level to provide erosion protection.

A trench was excavated along the toe of the riverbank, below the vent holes, on both the outside and inside of the sheet pile bulkhead. It was lined with a geotextile and backfilled with stone.

The trench system acts as a filter, protecting the vent holes from plugging with debris. Riprap was placed on the outside of the bulkhead to provide erosion protection. Three existing storm-water outfall lines from the plant were extended through the bulkhead. A bulkhead cap, fence and guardrail were installed along the entire length of the bulkhead for site security.

Groundwater seeps in the intertidal zone of the riverbank were causing a release of organic contaminants. A solution that would function passively was designed to disperse the organic contaminants, stimulating chemical, physical and biological degradation processes. The impact to groundwater flow was also minimized, contact between the river and contaminated fill was eliminated, and the existing structures in the manufacturing plant were not impacted.

Joel Karmazyn is an independent consultant who formerly worked for DuPont Environmental Remediation Services, a subsidiary of DuPont, in Wilmington, Del.

For more information, circle 166 on card.

REP Environmental Processes Inc. and ENSR Corp. re-established the **SUNOHIO** name as a division of ENSR in Canton, Ohio. It provides transformer maintenance, chemical destruction of PCBs, dielectric fluid reclamation, analysis, testing, recycling and disposal for operators of electrical equipment.

The Flexible Packaging Association awarded **Rexam Medical Packaging**, Madison, Wis., the fifth annual Green Globe Award for the production of a pouch that reduces packaging materials by as much as 90 percent.

Donald A. Deieso, PhD, was appointed the new president, CEO and member of the board of directors for **EA Engineering, Science and Technology Inc.**

e data resources inc. announced the reorganization of its technical group with Mark Cerino as chief technology officer and Gerald Tsui as the new director of GIS.

Buchart-Horn Inc./BASCO Associates and the **York County Industrial Development Corp.** won the private-sector Grand Prize in the Phoenix Awards™ for developing the *Industrial Plaza of York*, an adaptive reuse of a 6.2-acre factory site that was vacant for more than 35 years.

R&R International Inc. announces the opening of its new Washington, D.C., area office that replaces the firm's Baltimore location. Alan W. Katz will head the new office.

Berryman & Henigar has been awarded a $77,000 contract from the San Diego County Parks & Recreation Department to provide resident engineering and inspection services for Steele Canyon Park.

U.S. Environmental Protection Agency Region 5 and the Michigan Department of Environmental Quality issued an operating license and permit to **Wayne Disposal Inc.** for its hazardous-waste landfill that will also accept PBC-waste.

Pumpex Inc., a manufacturer of submersible wastewater, dewatering and sludge pumps, has received ISO-9001 quality certification for its development, manufacturing, marketing and sales of submersible pumps and accessories.

David Biderman was named association counsel at **Environmental Industry Associations** where he will provide legal and public policy counsel to EIA, the component associations and member companies in the solid waste services, hazardous waste services and equipment manufacturing and distribution industries.

John P. Woodyard, PE, of **Roy F. Weston Inc.** has been selected to serve on the board of directors for the Air and Waste Management Association, an international organization dedicated to promoting global environmental responsibility.

ThermoQuest Corp. was ranked 70 in the Silicon Valley 150. The figures for the survey are based on reports from each company for its fiscal year ending in 1996. EP

Getting Ready for the Next Millennium

Zero emissions manufacturing is poised to take the place of pollution control practices.

By Lawrence T. Molloy

Traditional pollution control firms need to get ready for the next generation of environmental management—industrial ecology (IE). The tools of industrial ecology—pollution prevention, waste minimization, and design for the environment—will be heavily used by industry in the future. But they offer limited opportunities for pollution control firms. One tool that offers substantial business opportunities is zero emissions (ZE), particularly the conversion processes needed to change wastes from one industry into viable material inputs for other industries.

Remediation firms are under pressure to deal with the declining hazardous waste market. Is the same true for traditional pollution control firms? Pollution prevention and waste minimization efforts have curtailed the volume of wastes, but will additional regulations and business pressure to improve margins make emissions control a thing of the past?

Probably so, argues European industrialist Gunter Pauli. His zero emissions concept (described in *Breakthroughs: What Business Can Offer Society*, Epsilon Press, Ltd., Longdene House, Haslemere, UK, 1996) builds on the concepts of zero defects and zero inventories and is an engineering management objective that blends business acumen with environmental concern. ZE seeks to transform manufacturing processes holistically, meaning that materials, energy use, distribution systems and all the other manufacturing aspects are coming under scrutiny with the goal of redeveloping industry so that emissions are reduced to zero. While a discussion of all of the repercussions of achieving zero emissions is beyond the scope of this article, there are several steps that engineering firms providing traditional pollution control solutions can take now to begin the transformation to becoming providers of ZE technologies.

Zero emissions is a tool of industrial ecology (IE). IE is an academic concept that is gaining wider prominence in industrial and environmental circles (**See Glossary**). One of the critical aspects of IE is the reduction of pollution loadings. At the manufacturing level this is primarily ZE. While achieving zero emissions includes using the other tools of industrial ecology—pollution prevention, waste minimization and design for the environment—these tools have not brought pollution control firms substantial business opportunities. However, converting wastes into viable feedstocks for other industries is a promising area. Fortunately, these approaches rely on many processes that are already a regular part of traditional pollution control.

Historically, manufacturing processes were linear. Materials went into one end of the manufacturing line and products and wastes that were processed for discharge came out the other end. In the ZE paradigm, industrial clusters are developed so wastes from one facility serve as material input elsewhere, and materials flow in loops among participants in the cluster. One example is Kalundborg, Denmark, where a refinery, power plant, gypsum board manufacturer, pharmaceutical firm and a town have developed a symbiotic relationship (**See Sidebar**).

Developing industrial clusters that link industries producing wastes to industries using them as material inputs is one of the first conceptual challenges that industries and material scientists will face. Engineers should begin using pollution control techniques a little differently. The goal is not to process wastes so they are benign enough for discharge, but convert them, or better yet, change materials or processes so the wastes become by-products that meet the specifications of another facility. In short, the goal is to produce designer wastes.

Dilution

Dilution is one process that has no place in the zero emissions paradigm because to think zero emissions means thinking like a commodity producer, and dilution and destruction are not processes used by upstream commodity producers in their refining processes. Producers of designer wastes need to think about how to market wastes as salable commodities; after all, materials specifications from manufacturers emphasize the concentration and purity of their products, which is the very opposite of dilution. Recycling and recovery technologies focus on separation, sorting and extraction principles that provide profit or at least some return on investment. In contrast, destruction technologies (e.g., many of the air pollution control technologies) offer little viable by-product.

Getting Ready

To prepare for the integration of industrial ecology and zero emissions, engineering firms need to focus on acquiring engineering skills and accessing technologies that convert wastes into designer wastes. Since a zero emission society will not happen overnight, the products and services offered must reflect the transition state first and then the fully integrated economy. For now, the focus should be on improved recycling and recovery technologies, several of which are:

- Data suggest that current technologies are already able to make extracting metals from waste streams more economical than virgin extraction. These technologies should be vigorously pursued.
- Membrane systems offer high purity and rapidly attained steady state. Operational requirements and expenditures for membrane systems are generally less than for other systems. Membrane filtration for water is gaining wider acceptance because of reduced chemical inputs for water treatment. Wastewater systems that rely on membranes extract a permeate that is industrially viable.
- The widely touted molten metal technology also fits well within the zero emissions paradigm. The catalytic extraction process dissociates a wide range of organic, organometallic, metallic and inorganic wastes into their constituent elements and then reconfigures them into synthetic gas, hydrochloric acid, metal alloys and ceramics. Unlike open-flame combustion systems, in which multiple free radical intermediates can form, this process minimizes or eliminates reaction pathways that lead to the formation of unwanted by-products such as nitrogen dioxide (NO_2), sulfur dioxide (SO_2), dioxin and furans.
- Water recovery and reuse techniques apply a variety of techniques—simple, involving the partial reuse of a secondary rinse stream; complex, changing entire processes to produce waste-free water; and comprehensive, plant-wide approaches integrating the reuse of water and wastewater streams.

The first round of successful zero emissions projects will be those that involve basic materials such as water. Water has many applications and is often used in different applications within one facility. Some of these applications can rely on non-potable water or water of variable quality. U.S. Filter Corp. is one company that has taken water recovery and reuse to the zero emissions level. Its work at Chrysler's truck assembly plant in Mexico, which recycles 100,000 gallons of water per day, has made the plant a zero emissions facility with regard to water since 1994. The success of U.S. Filter is based on working with the manufacturing facility and having a competent engineering team that understands plant operations and how all streams and processes interact with and rely on each another.

Real engineering opportunities will come to the firms that can foster alliance and cooperation among industrial facilities that are the basis for industrial clusters. Successful industrial clusters must be fiscally and environmentally sound.

As shown in the Kalundborg example, understanding waste streams as feedstocks requires engineers to know both their upstream and downstream counterparts. Historically, firms knew only their own waste streams and the techniques to handle them. Pollution prevention (P2) engineering firms typically work back up the pipe to understand the process that made the waste. But zero emissions engineers must also work

Glossary

Design for the Environment: Design for the environment (DFE) is the practice of incorporating various values of a product into its design from the ground up. DFE examines the lifestyle of the product and includes not only its primary use but the environmental consequences of its production, assembly, testing, servicing and recycling. The outcome will be engineering design of a factory that works in concert with the rest of the eco-industrial park to achieve zero emissions. Aspects of DFE include green" accounting systems, business planning practices and specification and standards.

Industrial Ecology: As defined by T.E. Graedel and B.R. Allenby in *Industrial Ecology* (Prentice Hall, Englewood Cliffs, N.J., 1995), industrial ecology is "an approach to the design of industrial products and processes that evaluates these activities through the dual perspectives of product competitiveness and environmental interactions. The concept requires that an industrial system be viewed not in isolation from its surrounding systems, but in concert with them." Tools of industrial ecology include design for the environment, pollution prevention, waste minimization and zero emissions.

Pollution Prevention: Pollution prevention is an essential first step toward zero emissions. Pollution prevention includes the development of methodologies and tools across a firm that generally improve the firm's environmental performance regardless of specific design and production activities. Pollution prevention thus includes clean technology to maximize the proportion of raw material used, efficient processes to minimize the amount of wastes produced, non-toxic materials and clean energy resources.

Waste Minimization: Closely related to pollution prevention, waste minimization focuses more on the end-of-pipe methodologies for managing wastes, particularly regulated wastes. As defined by the EPA, it includes source reduction or recycling undertaken by a generator that results in either the reduction or total volume or quantity of hazardous waste or reduction of the toxicity of the hazardous waste or both.

Zero Emissions: While the terms industrial ecology and zero emissions are often used interchangeably, zero emissions is more properly a subset of industrial ecology. The goal of zero emissions is to restructure manufacturing so there are no wastes. Zero emissions is applied industrial ecology at the manufacturing/service level: a practical approach with a concrete methodology to redesign industrial processes so they have no discharges.

Kalundborg: Sustainable Industry in a Cluster

Since 1970, the Danish town of Kalundborg has been developing a web of industrial cooperation that is fiscally and environmentally sound.

The town's electric plant recaptures surplus steam and distributes it to homes and the nearby oil refinery, saving 19,000 tons of oil per year. The oil refinery removes excess sulfur from its gas, making it suitable for the electric plant to substitute for coal, saving 30,000 tons of coal per year.

The removed sulfur is feedstock for the sulfuric acid plant. The electric plant desulfurizes its smoke by using a process that yields calcium sulfate, which in turn is used by the wallboard manufacturer, which obtains 100 percent of its energy requirements from excess gas from the oil refinery.

The oil refinery sends its wastewater to the electric plant, which purifies it and uses it as boiler feedwater and for cleaning industrial equipment. Excess heat from the electric plant warms aquaculture ponds that produce 250 tons of fish per year. The sludge from the ponds and from the biotechnology plant becomes fertilizer. Fly ash and clinker from the electric plant are sold for use in highway pavement and cement.

downstream, within the industrial cluster, to know who they will be supplying and to work toward producing designer wastes. Firms that succeed in achieving zero emissions will work upstream to modify materials and processes so the feed-stocks produced are an acceptable quality to identified purchasers downstream in the cluster.

Material, energy, and environmental constraints will force industry toward zero emissions manufacturing. Engineering firms historically reliant on pollution control work can use the move to provide waste-conversion technologies and services that assist industry in developing zero emissions plants and becoming part of industrial clusters. They need to view themselves as engineering the processes and solutions that provides upstream commodity resources. It's not just moving up the pipe—it's moving so far up the pipe that you are the materials vendor standing at the receiving door and delivering to the facility the products it needs.

Lawrence T. Molloy is an environmental engineer with The Crestwood Group, a firm specializing in technology transfer, in Seattle, Wash. EP

For more information, circle 152 on card.

Circle 122 on card.

 By J. Wilson Hershey, PhD

Building an Ethics Program

An analytical laboratory employs computer software to help integrate corporate values.

AN ANALYTICAL LABORATORY RUNS on the validity of its data. Any misrepresentation of data can destroy a lab's reputation and its ability to do business. Ethical lapses such as time traveling (electronically or manually recording the incorrect date or time a procedure is performed), peak shaving (reducing the area measured under a peak to meet quality control specifications) or falsifying data to avoid a short-term negative consequence can harm the environment or consumers of laboratory-tested products.

The 17-member Ethics Committee was formed to provide ongoing support to the entire ethics process. The group's main function is to give employees a place to turn when faced with ethical dilemmas.

A Matter of Ethics

Lancaster Laboratories took a proactive approach to business ethics using a Total Quality Management model. Our company was founded in 1961 by Dr. Earl H. Hess on two bedrocks: quality and the ethical treatment of everyone associated with the business. Those core values were informally instilled in new employees as the company grew by an all-pervasive culture of integrity. But as the staff approached the 500 mark and Dr. Hess began planning for his retirement, management wanted to formalize that culture using a system similarly used in quality management programs.

The first step was to define the ethical values that had been taken for granted. During a three-day retreat headed by Dr. Rushworth Kidder, president of the Institute for Global Ethics, a large group of employees hammered out a preliminary listing of values they agreed on as being central to Lancaster Laboratories' culture. The list was further refined by the entire employee population and became the company's formal Statement of Values (**See Sidebar**).

Next, the company implemented an ethical fitness training course for employees based on materials supplied by the Institute for Global Ethics. The concepts were later incorporated in a course developed in-house titled "Putting Our Values to Work." In this course, employees analyze ethical dilemmas and find ways to resolve them using various paradigms. Rather than teaching a "when-you're-faced-with-this-problem-do-that" approach, the instructors strive to help the participants become "ethically fit" so they'll have the tools necessary to analyze any dilemma and find a solution to it.

Dr. J. Wilson Hershey is the president of Lancaster Laboratories in Lancaster, Pa., headquarters of Thermo Analytical, a wholly owned subsidiary of Thermo TerraTech Inc., a Thermo Electron company.

Role Playing

The case studies used in the course are actual laboratory examples for which there is no clear-cut single answer. For example: You're a chemist whose work involves analyzing for compounds at very low limits of quantitation (LOQs). Today you ran a batch of samples for a major client. It's important the job is done well since the potential for additional work from this client depends on your department's ability to do good work and within short turnaround times.

You analyzed the samples at a dilution due to a huge contaminant peak, but the one compound the client was interested in was not detected above the LOQ. You could rerun the sample, but it would cost a great deal of time and money because many blanks would be needed to flush the instrument afterward. Time is something your department is short of since a large number of samples were delivered yesterday. You've hit one of those gray areas, and therein lies your dilemma. Should you run the sample again at a lower dilution to get "better" results (i.e., lower LOQ and possibly detect the compound of interest) or are your original results "good enough"?

The most common dilemmas involve a "right versus right" clash of two valid but opposed principles, which typically fall into four paradigms—truth versus loyalty, short-term versus long-term, justice versus mercy, and self versus community. Holding up the given example to the scrutiny of the short-term versus long-term paradigm forces employees to ask the question: Is it better to save time and money for my department today by not repeating the analysis (short-term) or is it better to rerun the sample at the lower dilution to give the client more exacting results, and in the process pave the way for a possible lasting relationship with him (long-term)?

To obtain the best possible resolution, solutions are tested against three decision-making rules drawn from philosophers: 1)What is the greatest good for the greatest number (consequentialism)? 2) If adop ted universally, would the world be a better place (Kant's categorical imperative)? 3) Do unto others as you would have them do to you (Golden Rule)?

Finally, the proposed solution is screened against

Lancaster Laboratories' Statement of Values to ensure consistency between our beliefs and our actions.

Software Helps Determine Standards

Advocating noble values in a philosophical, classroom sense is easy, but translating them into everyday life can be difficult. We use SynergEASE software from Development Dimensions International Inc. (DDI) to integrate corporate values into our management systems.

When we implemented the SynergEASE program, we selected dimensions from the data base that matched our core values of integrity, teamwork and client-service. The software then broke down the dimensions into actual behaviors. Teamwork, for example, is demonstrated through actions like assisting others in solving problems and sharing credit for good ideas.

We use the resulting sets of behaviors as criteria in hiring, job plans and performance appraisals. Our management team has also participated in a 360-degree assessment on the dimensions. The ratings provided our company leaders a picture of themselves as well as a behavior-specific development plan generated via the SynergEASE program.

To provide ongoing support to the ethics process, the company formed a 17-member Ethics Committee. The group's main function is to give employees a place to turn when faced with ethical dilemmas. Problems submitted in writing or through a designated voice mailbox are channeled in the appropriate direction or handled by committee members.

Building an ethics program at Lancaster Laboratories has been a long and painstaking process. We've had few models to follow and many trial-and-error runs. But with the commitment of our employees and a strong desire to make it work, we've forged a multi-pronged program that meets our needs well. EP

For more information circle 151 on card.

Statement of Values

Lancaster Laboratories' heritage has at its core the ethical treatment of everyone involved with our business. As a corporate community, we embrace our heritage of integrity and strive to live by the following principles:

Fairness and honesty in all our relationships.
Mutual trust.
A respect for ourselves and others.
A sense of caring that leads us to act responsibly toward each other and society, now and in the future.
Loyalty to our clients and one another.
A spirit of open-mindedness as we deal with all.
Dedication to service.
Good stewardship of our resources.
A commitment to continuous improvement.

We take each personal responsibility to live these values in all of our dealings, knowing full well our pledge may involve difficult choices, hard work and courage.

Photo courtesy of TNRCC.

Stricter Clean Air Standards

New standards for ozone and particulate matter stir a debate between the EPA and industrial groups.

By Dave Schell

Just when you thought it was safe to sit back and relax for five minutes behind your desk, think again! The U.S. Environmental Protection Agency is ready to release new, stricter air standards for ozone and particulate matter, but it won't come without a battle. Over-regulated industry, tired of being handed unrealistic and expensive regulation, feels the proposed standards are not necessary. On the other side, the American Lung Association and asthmatic children throughout the nation are tired of breathing unclean air.

Under the Clean Air Act, the EPA regulates six common air pollutants: ground-level ozone (smog), carbon monoxide, lead, nitrogen dioxide, sulfur dioxide and particulate matter. The regulation is scheduled to be reviewed every five years to determine if new standards are needed. The final standards are on a court-ordered schedule for July 1997.

Ozone, the main ingredient in smog, is generated when nitrogen oxides (NO_x) and volatile organic compounds (VOCs) emissions react with oxygen and sunlight. When inhaled at very low levels, ozone can cause acute respiratory problems, aggravate asthma and cause inflammation of lung tissue. Children are most at risk to ozone because their respiratory systems are still developing. Children make up 25 percent of the population and 40 percent of asthma cases.

The Battle Begins

The EPA last reviewed the ozone standard in 1979 and found no reason to lower it. In 1991, the American Lung Association sued the EPA for failure to review the adequacy of the standard. As a result, the EPA was given until March 1993 to decide on further review of the standard. Even though the EPA decided it would not review the standard any further, the American Lung Association filed another lawsuit in May 1993 to challenge the EPA's decision, because the review was using data compiled before 1989. In July 1994, the EPA decided to revisit its decision, but the actions would extend past the Clean Air Act's 1995 deadline for the review. The final lawsuit was brought in October 1994 when the American Lung Association sued the EPA to expedite the review process. The lawsuit resulted in a court-ordered schedule for the EPA to review the ozone standard by December 31, 1995. The EPA announced its plan for stronger ozone standards on November 27, 1995, and is under a court order to produce a final rule by July 19, 1997.

Ozone is currently regulated at 0.12 parts per million (ppm) over one hour. Under the proposed regulation, ozone would be measured at 0.08 ppm over eight hours. If a 3-year average of the third highest ozone reading each year is above 0.08 ppm, the area would be classified as non-attainable.

Protecting Human Health

The EPA anticipates the new standards will significantly reduce children's respiratory problems by 15 percent to 20 percent and reduce the risk of hospital admissions to 1,600 less and emergency room visits to 5,000 less for respiratory causes. There would also be a reduction in yield losses of agricultural crops up to $1 billion.

Particulate matter is a mixture of solid and liquid particles found in the air, and may be caused by such things as wind-blown dust, fuel combustion, coal stoves and car exhaust. Particulates are a concern because they lodge in the deep recesses of lung tissue and cause lung damage and respiratory problems such as asthma, bronchitis, emphysema, chest pain and shortness of breath. Particulate matter is described by its diameter, which is measured in microns. Particulate matter 10 microns in diameter would be labeled as PM-10.

In 1993, the American Lung Association sued the EPA to require the agency to review the adequacy of the particulate matter standard. On November 27, 1996, the EPA announced it would not revise the PM-10 standard but would develop a new standard for PM-2.5 by June 1997. Recently, the EPA requested a 60-day extension for the final rule and received a 3-week extension to publish the final rule by July 19, 1997. The extension gives the EPA more time to review public comments.

Current regulations for particulate matter measure particles 10 microns or less (PM-10). Allowable concentrations under current standards are 150 micrograms per cubic meter for 24 hours (one-time release) and an annual average of 50 mg/m^3. Under proposed regulation, the EPA would separate the particulate size into 10 microns and 2.5 microns and add more complex measures. The current PM-10 standards would remain the same, except for using a 98th percentile reading to determine the annual average. Standards for PM-2.5 would be set at 50 micrograms per 24 hours and annual averages no greater than 15 mg/m^3 with non-attainment areas based on the 98th percentile of annual readings.

The EPA anticipates the new PM standards would save nearly 20,000 lives each year, reduce hospital admissions by 9,000 each year and result in 60,000 fewer cases of chronic bronchitis symptoms each year.

How small is a micron? Human hair is about 70 microns in diameter. Bacteria range between 0.4 and 100 microns, while pollen ranges between 10 and 100 microns. Tobacco smoke, cooking smoke and other smoke is composed of multiple particulate ranging between 0.01 and 1 micron. Atmospheric dust, which occurs naturally, ranges between 0.01 and 3 microns. Current technologies exist for air filtration, including using common air filters for particulate between 1 and 100 microns and using high-efficiency particulate air (HEPA) filters or electronic precipitation equipment for particulate under 10 microns.

The Battle Continues

Industry views on the new regulation are not favorable. Many industry organizations agree that the 1990 Clean Air Act standards should be implemented before newer standards are developed. The EPA has been accused of ignoring the cost-justification process for the new standards and attempting to place itself above the cost-justification process. Industrial groups, ranging from small foundries to petroleum refineries, also point out that the EPA's own Clean Air Scientific Advisory Committee urged the EPA to implement a more-detailed research program to address unanswered questions regarding the health effects of particulate matter less than 2.5 microns. The EPA has decided to continue with the regulatory process without the suggested research. Many industry representatives argue that current scientific evidence has shown the current ozone standard protects human health.

Some politicians are worried that the new standards may jeopardize the Clean Air Act program by creating a rebellion from industry. Senator John Chafee (Rep-RI Chairman of the Senate Environmental and Public Works Committee) has stated that he would like to see the EPA take a more cautious approach in the new air standards.

The EPA estimates 140 counties currently violate the ozone or particulate matter standards. If the new standards pass as written, approximately 800 counties will fall into non-attainment. Many counties meeting the standards as written now will need to incorporate stricter methods to once again achieve attainment.

Once the new standards are released, areas have up to 10 years to meet the new standards after the area has been designated as being non-attainment. There are two 1-year extensions available and areas can extend the implementation date to June 2011 to meet the new standards.

This article was researched with the help of the American Lung Association, the Air Quality Standards Coalition and the US-EPA Region 111. At the time of research, the final standards were under a court-order to be published on July 19, 1997. Discrepancies between this article and the final standards may occur. Please contact your regional EPA office for the final standards. EP

Dave Schell is the environmental specialist at The Wilton Co. in Mount Joy, Pa. He is currently planning to write a book on environmental planning for industry.

For more information, circle 167 on card.

For more information on the standards, please contact the following groups:

American Lung Association
(202) 785-3355
Diane Maple, director of media relations

EPA Region III Office
(215) 566-2194
Tom Casey, PM coordinator

Air Quality Standards Coalition
(800) 257-1292
Glen Cooney

You can also visit the EPA's Website at http://ttnwww.rtpnc.epa.gov/naaqspro/.

Package Wastewater Treatment

This spotlight profiles a variety of package wastewater treatment systems currently available. Package plants are popular due to their economy, adaptability and easy installation. Ideal for pollution control for facilities located beyond the reach of city sewer lines—such as mobile home parks, factories, service stations, resort areas and other small complexes of people—package wastewater treatment systems can be custom designed to meet virtually any application. They can also provide pretreatment for factories within a city. Systems are capable of treating domestic wastewater through extended aeration or modified activated sludge processes.

Typically, the systems are pre-built in the factory and shipped to the project site as self-contained units requiring minimal field assembly. The systems are designed to conform to widely accepted criteria set by health agencies.

Some units can handle up to 300,000 gallons per day of domestic wastewater. Package wastewater treatment systems also can be set up as circular field-erected systems with capabilities of processing 500,000 gpd.

Options include primary, secondary and tertiary treatment, accompanied by more advanced processes, such as nitrification, denitrification and industrial sludge separation.

Jet Plants

Jet package wastewater plants operate on the extended aera-

tion principle, treating wastewater by aerobic digestion. The basic plant consists of aeration and settling tanks, blowers, motors, equipment housing, necessary electrical components and controls, air lift sludge return pumps and piping, valves and fittings, baffles, transfer pipes and adjustable V-notch effluent weirs. The systems also feature non-clogging, no-maintenance air seal diffusers. **Jet Inc.**
Circle 168 on card.

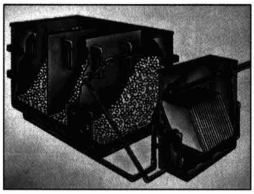
Package Treatment

Associates International Package Treatment plants can be shipped in a 20-foot container. Systems are built in a factory and installed on site. They use a combination of hydraulic flocculation, gravity clarification, adsorption rough filters and other technologies.

Plants can be modified to serve diverse customers. **Associates International.**
Circle 169 on card.

Catalytic Oxidation

The BioSorb System, designed for housing developments, ho-



tels, resorts, work camps, schools, airports, mining and oil drilling sites, food production plants, livestock facilities and marinas, features RGF's unique catalytic oxidation process to destroy contaminants through oxidation. Also used is the High Efficiency BioSorb Media and Clarifier, which achieves 95-percent BOD reduction. **RGF Environmental Systems Inc.**
Circle 170 on card.

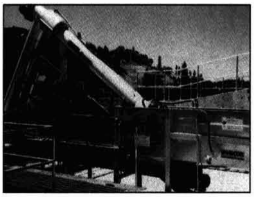
Versatile Systems

Met-Pro Systems Division Package Wastewater Treat-

ment Unit is designed for multiphase wastewater treatment including pH adjustment, flocculation and high rate clarification. Corrosion-resistant, compact skid-mounted unit has flexible design that accommodates future treatment changes. **Met-Pro Corp. Systems Division.**
Circle 171 on card.

Pretreatment System

Combi® Pretreatment System is a totally self-contained,



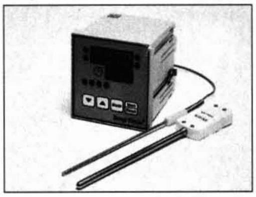
prefabricated headworks system for sewage or septage receiving. It screens influent, dewaters the screenings and classifies grit. The screened, degritted flow is well-prepared for optimum operation of the treatment plant and the captured solid waste is dewatered for disposal. **Hycor Corp.**
Circle 172 on card.

Sludge Treatment

The Biothane Upflow Anaerobic Sludge Blanket (UASB) Process treats up to 350 gpm with COD loads as high as 6,000 kg per day. Contains a settler and influent distribution network with external pulsing valve. Instrumentation and pumps come skid-mounted. **Biothane Corp.**
Circle 173 on card.

Temp Control Timer

The CN530 Series is a microprocessor-based, fully-pro-



grammable combination temperature controller and timer. Ideal for use on batch-type equipment. Digital displays combine temperature and timer functions into a single 1/4-DIN size enclosure. Programs through menu-driven structure with prompts. **Omega.**

Circle 175 on card.

Water Velocity Monitoring

The high resolution Global Flow Probe measures

flows in open channels and partially filled pipes. Consists of a protected Turbo-Prop positive-displacement sensor and an expandable handle to a digital read-out display. Ideal for storm water runoff studies, measuring river, stream, ditch and sewer flow. **Global Water.**

Circle 176 on card.

Policy Reporter

The *ELI Guidance & Policy Document Reporter* provides over 3,000 agency documents with graphics and worksheets on CD-ROM. Subject matter index organizes documents by topics and sub-topics. Key-issue analysis enhances

research. **Environmental Law Institute.**

Circle 177 on card.

Federal Regs on CD-ROM

Receive regulatory information that is no more than a few

weeks old on CD-ROM. Each carries all the regulatory changes published in the *Federal* or *State Register* through the first day of the month. All information is fully coded and changes are clearly noted so users can identify new information. **RegScan Inc.**

Circle 178 on card.

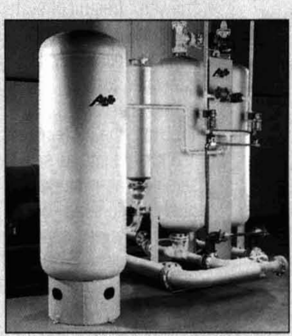
Disposable Gas Detector

The GASBUG is a miniature, pocket-size detector that

requires no battery replacement or calibration over its two-year warranted life. Available in H_2S and CO versions. Gives audible and visual alarms when preset levels are exceeded. Low-battery warning occurs with 48 hours life remaining. **Lumidor Safety Products.**

Circle 179 on card.

Oxygen-Generating System

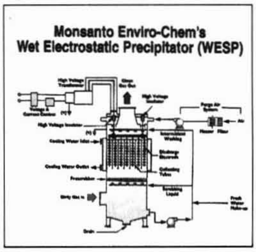


AirSep's new Vacuum Pressure Swing Adsorption (VPSA) Oxygen Generating Systems serve the environmental industry with reliable, power-efficient products designed for tons-per-day output. The new line of ASV-series systems offers oxygen output capacities of 5,000 to 60,000 SCF an hour at purities of 92 percent. Minimum dew point specifications for these on-site oxygen-producing systems are minus 100 degrees F. **AirSep Corp.**

Circle 174 on card.

Precipitator

The Wet Electrostatic Precipitator (WESP) handles sub-



micron particulate problems and eliminates visible plumes in gas streams. The solid-state power supply package provides direct corona discharge power to the gas stream, operates for at least 48 hours without air purge and rigid mast electrode design. **Enviro-Chem Systems/Monsanto.**

Circle 180 on card.

Wireless Communications

The new Scott Wireless/Talk-Around features face-

piece-mounted radios and belt-mounted transceivers. Two channels—programmable and universal—allow firefighters to receive and transmit directions or warnings between each other while maintaining audible contact with a command center without wires. **Scott Health and Safety.**

Circle 181 on card.

Continuous Monitoring

The Model 7011 Continuous Monitoring Analyzer op-

erates with sensors for *in situ* constant turbidity readings, self-cleaning for use in liquid systems and self-cleaning for densities of up to 8 percent. Now certified to fulfill new European Community CE certification standards for electro-magnetic compatibility (EMC). **Royce Instrument Corp.**

Circle 182 on card.

Odor Containment

For wastewater treatment facilities with odor emission

problems, Vapor Guard™ structural-fabric covers with large zippered doors provide quick and open access to weirs, baffles and troughs for daily operation and maintenance. The flat profile minimizes emission equipment costs and integrates directly with catwalks. **ILC Dover Inc.**

Circle 183 on card.

Battery Saving

Re-energize all types of ni-cad, nickel metal hydride and lithium ion rechargable batteries with the Celtronic Battery Saver System. It reverses the electro-chemical imbalance caused by normal use and recharge of battery chemistries. Ideal for 2-way radios, cell phones, survey and emergency equipment and more. **Wenco Electronics.**

Circle 184 on card.

CFR on the Net

Get the current *Code of Federal Regulations* via Internet or

CD-ROM. Incorporates new rules issued each month. Easy-to-use format is available by individual title or complete set and can be searched or browsed. **Counterpoint Publishing.**

Circle 185 on card.

Modular Tank

Store wastewater, potable water, sewage, sludge, slurries and other liquids in ModuStor tanks. They are rapidly bolted

together from modular components with standard hand tools. Site preparation is minimal. Dozens of standard sizes and custom sizes are available. Options include liners, covers, drains and more. **ModuTank Inc.**

Circle 186 on card.

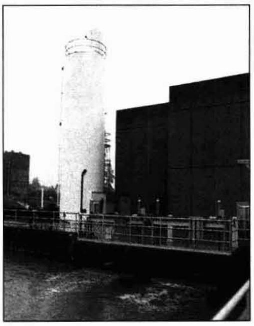
Solvent Recovery

Skid-mounted steam-regenerable solvent recovery systems from Vara handle a range of flow from 1,000 cfm to 30,000 cfm. The Revolver™ is made up of four carbon adsorbers connected with a unique rotary valve assembly. Requires less activated carbon, reduced utility demand rates and less maintenance. **Vara International.**

Circle 187 on card.

Bulk Chemical Handling

The WHM® bulk chemical handling systems for receiv-



ing, storing and slurrying lime and other bulk chemicals is available in four models: enclosed, factory-mounted for bulk chemicals; lime feeder, slaker, grit screen and screw; enclosed, factory-mounted for powdered activated carbon; and KD pre-fab knocked down units. **U.S. Filter.**

Circle 188 on card.

Portable Stack Emission

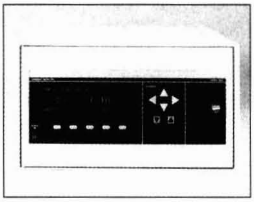
The Testo 350 is a portable stack emission analyzer that

meets the Southern California (SCAQMD) EPA requirements. Sets up within minutes and collects and stores data independently for up to 48 hours. Measures O_2, CO, NO_x, NO, NO_2, SO_2, rH, fpm, efficiency, draft and pressure. **Testo Inc.**

Circle 189 on card.

Air Monitors

Horiba Instruments AP-360 series of ambient air



monitors have been designated Reference or Equivalent Methods in accordance with 40 CFR 50-53. Analyzers are available for loan for long-term evaluation free to qualified potential Horiba customers. It is unaffected by high background concentrations of ammonia. **Horiba Instruments Inc.**

Circle 190 on card.

Digital Display Flowmeter

McMillan Models S-110, S-111 and S-112 Flowmeters

measure low liquid or gas flow rates. Suitable for industrial, commercial- and laboratory-flow applications. The flowmeters also incorporate Pelton-type turbine wheels to determine the flow rate of gas or liquid. **McMillan Co.**

Circle 191 on card.

Air Sampler

The BDX II is small and lightweight, yet durable. Mon-

itiors for asbestos using the NIOSH Method 7400 and the OSHA reference sampling method, and for lead using NIOSH Methods 7082, 7105 or 7300. Features include anti-temper control covers and rechargeable battery pack for 10 hours of power. **Sensidyne.**

Circle 192 on card.

Robotics Chamber

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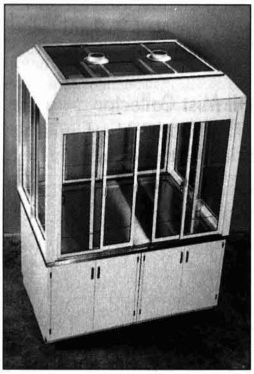


botics Chamber. Versatile design, accessiblity, multiple accessories and mini-environment options can protect robotics from potential damage while maintaining a clean area or venting a hazardous one. HEMCO.

Circle 193 on card.

Spill Kits

Waterproof, softside kits feature GREEN STUFF® Ab-

sorbent Products with the capacity to absorb virtually any chemical spill or leak up to 15 times its own weight. Available with socks, pads, pillows and protective gear. Custom kits available to meet specific requirements. **Green Stuff Absorbent Products Inc.**

Circle 194 on card.

Water Monitor

The Turner Designs TD-4100 XD is a non-fouling

continuous on-line oil-in-water monitor. Designed for offshore oil production, refining and the petrochemical industry. Continuously verifies the effectiveness of oil-in-water treatment systems and detects upsets and unexpected discharges. **Turner Designs.**

Circle 195 on card.

Water Level Meter

Solinst Model 101 provides accurate water level measure-

ments. Ideal for boreholes and sandpipes. Long-lasting non-stretch tape has stainless steel conductors and permanently marked measurements. Accurate in cascading water. **Solinst Canada Ltd.**

Circle 196 on card.

Gas Detection

GAS Plus configures automatically when coupled with any of EIT's 22 gas-specific sensors. Calibrated sensors can

be stored off-line for up to nine months without warm-up time or re-calibration. Sensors remove for remote bench calibration, reducing employee exposure to hazardous environments. **EIT.**

Circle 197 on card.

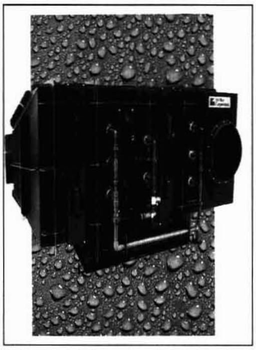
GC Software

Labs can connect HP gas chromatographs (GCs) directly to a LAN with ChemServer software. Improves signal clarity, requires no extra bench space and uses no analog or serial cables. It exports reports to PC-based applications for manipulation and use in reports. **Hewlett Packard Co.**

Circle 198 on card.

Oil Mist Collector

The O/M-1 Mist Eliminator is ideal for machine shops and



other facilities generating mists and fogs from metalworking sources using a 3-stage technology. Compatible with mineral oils, soluble oils and synthetics and accommodates multiple mist sources. Low-pressure design minimizes energy consumption. **Tri-Mer Corp.**

Circle 199 on card.

Portable GC

Peakworks™ for Windows® chromatography software al-

lows users to control the Model GC311 from an easy-to-use Windows environment and a temperature programmable oven, which allows simultaneous measurement of VOCs and SVOCs. Dual-detector capability and can be run with two detectors in parallel or in series. **HNU Systems Inc.**

Circle 200 on card.

Recycling Pan

The PIG® Reusable Pan captures liquids previously lost

as a result of leaks and drips for recycling. Chemical-resistant polyethylene pan holds up to 6 quarts of liquid. Ideal for catching leaks and drips under drums, for draining oil filters and for vehicle oil changes. **New Pig Corp.**

Circle 201 on card.

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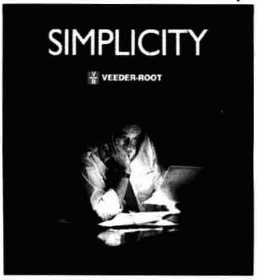

four-hour, 7-day per week real-time monitoring includes compliance reporting, inventory and risk management for USTs and petroleum product piping. **Veeder-Root.**

Circle 202 on card.

Personal Gas Monitor

The FoxTox series of single-gas monitors for personal monitoring meet OSHA's Confined Space Regulation 29 CFR 1910.146 Appendix E. Includes interchangeable toxic gas sensors for CO, NO, NO_x, SO_2, CI_2 and H_2S. User-programmable and factory preset alarms are included. **North Safety Products.**

Circle 203 on card.

Circle 131 on card.

product literature

Circle 132 on card.

Tri-Nox Literature

Technical Bulletin describes "Tri-Nox" technologies for the control of No_x, one of the most common, and most regulated industrial emissions. Systems operating at General Electric, ICI Petrochemical and others are described, along with the system's ability to accommodate loadings of 100,000 ppm and greater. Tri-Nox systems can be engineered to simultaneously scrub inorganic compounds and particulates.

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Circle 135 on card.

Air Monitoring Products Catalog

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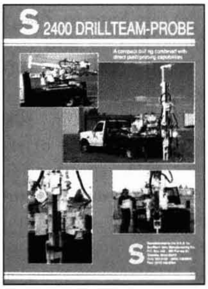

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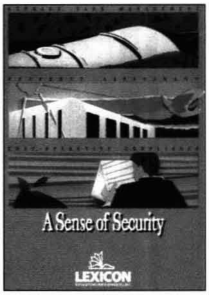

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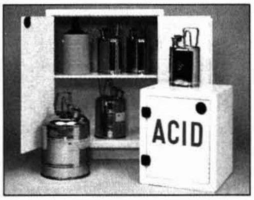

store containers of acid and other corrosive liquids near point of use. Available in countertop and floor-standing sizes with a built-in bottom well for spill containment. Plastic hinges and door latches and fiberglass-reinforced plastic are corrosion resistant. **Safety Storage Inc.**

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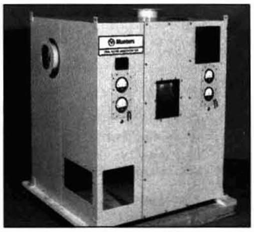
VOC Abatement

The Mini Rotor Concentrator Model IZS-1100 is ideal for low-concentration VOC



abatement for small air volumes. Features a zeolite-based rotor concentrator that concentrates the VOC into an air volume 10 to 20 times smaller. The VOC can be combusted in an oxidizer or recovered by condensation. **Munters Zeol.**

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dilute concentration as low as 1 NTU for one year from date of manufacture. **Hach Co.**

Circle 206 on card.

Toxic Gas Sensor

The SDS-Series 4-20mA transmitters with digital dis-

play use maintenance-free disposable electrochemical cells for toxic gases. EX-5000 Series transmitters with catalytic-type sensors can be integrated to form complete toxic and combustible gas monitoring systems. **ENMET Analytical Instrument Division.**

Circle 207 on card.

Portable Dust Monitor

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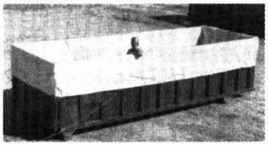

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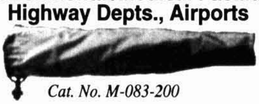

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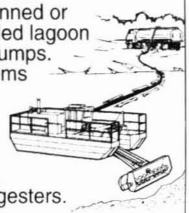

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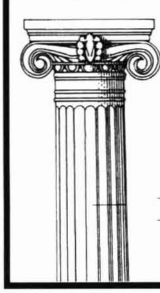

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Certified Environmental Analytical Laboratory specializing in asbestos, lead/metals and indoor air quality.

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EMSL Analytical, The Empire State Building, Suite 1524, New York, NY 10118. (212) 290-0051, FAX: (212) 290-0058. Internet Address: http://www.EMSL.com.
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See our ad in Classifieds

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Rocky Mtn. Center for Occupational & Environmental Health, Bldg 512, SLC, UT 84112. (801) 581-5710, FAX: (801) 585-5275. E-Mail: ccrandall@ rmcoeh.utah.edu
Training in occupational & environmental health including lead & asbestos.

University of Southern California, University Park, Los Angeles, CA 90089-0021. (213) 740-3995, FAX: (217) 740-8789. E-Mail: www.osc.edu/dept/issm.
Offers occupational/environmental health continuing education courses

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Excel Partnership, Inc., 75 Glen Rd., Sandy Hook, CT 06482. (800) 374-3818, FAX: (203) 426-7811. E-Mail: www.xlp@xlp.com.
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101	118	135	152	169	186	203	220	237	254	271	288	305	322	339	356	373	390
102	119	136	153	170	187	204	221	238	255	272	289	306	323	340	357	374	391
103	120	137	154	171	188	205	222	239	256	273	290	307	324	341	358	375	392
104	121	138	155	172	189	206	223	240	257	274	291	308	325	342	359	376	393
105	122	139	156	173	190	207	224	241	258	275	292	309	326	343	360	377	394
106	123	140	157	174	191	208	225	242	259	276	293	310	327	344	361	378	395
107	124	141	158	175	192	209	226	243	260	277	294	311	328	345	362	379	396
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109	126	143	160	177	194	211	228	245	262	279	296	313	330	347	364	381	398
110	127	144	161	178	195	212	229	246	263	280	297	314	331	348	365	382	399
111	128	145	162	179	196	213	230	247	264	281	298	315	332	349	366	383	400
112	129	146	163	180	197	214	231	248	265	282	299	316	333	350	367	384	401
113	130	147	164	181	198	215	232	249	266	283	300	317	334	351	368	385	402
114	131	148	165	182	199	216	233	250	267	284	301	318	335	352	369	386	403
115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405

Card Expires September 1997

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

FREE SUBSCRIPTION INFORMATION 07/97

❑ **Yes!** Send/Continue to send *Environmental Protection* free of charge.

❑ No, I'm not interested at this time.

Signature (Required)__________ Date ______

Name __________

Title __________

Company __________

Address __________

City __________ State ______ Zip ______

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Fax __________ E-Mail __________

FOR FASTER SERVICE USE PEEL OFF LABEL

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

B ❑ Mining
C ❑ Agriculture
D ❑ Engineering & Contracting
F ❑ Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
Type of Govt:
G ❑ City
I ❑ State
H ❑ County
J ❑ Federal
K ❑ Transportation
N ❑ Labs O ❑ Training P ❑ Real Estate
Z ❑ Misc. Services __________
L ❑ Consulting
M ❑ Insurance
E ❑ Utilities, public, private & cooperative
E ❑ Services/Consulting
F ❑ None of the above__________

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

D. In your job function do you recommend, specify or purchase? (check all that apply)
A ❑ Pollution Control Equipment
B ❑ Instrumentation
C ❑ Chemicals
D ❑ Parts & equipment for maintenance opera tion and control

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

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

Environmental PROTECTION

G. Which of the following Tanks and Process Controls product(s) /services do you plan to purchase in the next 12 months?(Select all that apply)
800 ❑ Aboveground Storage Tanks
801 ❑ Underground Storage Tanks
802 ❑ UST Tank Vaults
803 ❑ Level Controllers/Monitors
804 ❑ Flowmeters
805 ❑ Leak Detectors
806 ❑ Cooling Towers
807 ❑ Heat Exchangers
808 ❑ Secondary Containment Systems
809 ❑ Groundwater Monitors
810 ❑ Lift Station Controls
811 ❑ Aeration Systems
812 ❑ Recorders

H. What is your reason for purchasing the selected products/services? (Select one)
813 ❑ New Construction
814 ❑ Plant Upgrade
815 ❑ Replacement/Maintenance

I. What is your projected budget for the selected products/services? (Select one)
816 ❑ Over $200,000
817 ❑ $100,001-$200,000
818 ❑ $50,001-$100,000
819 ❑ $10,001-$50,000
820 ❑ $5,000-$10,000
821 ❑ Under $5,000

J. How immediate is your need for the selected products/services? (Select one)
822 ❑ 0-3 months
823 ❑ 4-6 months
824 ❑ 7-9 months
825 ❑ 10-12 months
826 ❑ over 12 months

N9707F

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July 1997

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115	132	149	166	183	200	217	234	251	268	285	302	319	336	353	370	387	404
116	133	150	167	184	201	218	235	252	269	286	303	320	337	354	371	388	405

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

FREE SUBSCRIPTION INFORMATION 07/97

❑ **Yes!** Send/Continue to send *Environmental Protection* free of charge.

❑ No, I'm not interested at this time.

Signature **(Required)**__________ Date _____

Name __________

Title __________

Company __________

Address __________

City __________ State _____ Zip _____

Zip+4 __________ Phone __________

Fax __________ E-Mail __________

FOR FASTER SERVICE USE PEEL OFF LABEL

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
❑ (29) Petrol. & Coal ❑ (39) Miscellaneous Mfg.
❑ (30) Rubber/Plastic

B ❑ Mining L ❑ Consulting
C ❑ Agriculture M ❑ Insurance
D ❑ Engineering & Contracting E ❑ Utilities, public, private & cooperative
F ❑ Govt. including municipal or district sanitary water or wastewater treatment sys. or plants
Type of Govt:
G ❑ City H ❑ County
I ❑ State J ❑ Federal
K ❑ Transportation
N ❑ Labs O ❑ Training P ❑ Real Estate
Z ❑ Misc. Services __________

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

E ❑ Services/Consulting
F ❑ None of the above__________

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

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

Environmental PROTECTION

G. Which of the following Tanks and Process Controls product(s) /services do you plan to purchase in the next 12 months?(Select all that apply)
800 ❑ Aboveground Storage Tanks
801 ❑ Underground Storage Tanks
802 ❑ UST Tank Vaults
803 ❑ Level Controllers/Monitors
804 ❑ Flowmeters
805 ❑ Leak Detectors
806 ❑ Cooling Towers
807 ❑ Heat Exchangers
808 ❑ Secondary Containment Systems
809 ❑ Groundwater Monitors
810 ❑ Lift Station Controls
811 ❑ Aeration Systems
812 ❑ Recorders

H. What is your reason for purchasing the selected products/services? (Select one)
813 ❑ New Construction
814 ❑ Plant Upgrade
815 ❑ Replacement/Maintenance

I. What is your projected budget for the selected products/services? (Select one)
816 ❑ Over $200,000
817 ❑ $100,001-$200,000
818 ❑ $50,001-$100,000
819 ❑ $10,001-$50,000
820 ❑ $5,000-$10,000
821 ❑ Under $5,000

J. How immediate is your need for the selected products/services? (Select one)
822 ❑ 0-3 months
823 ❑ 4-6 months
824 ❑ 7-9 months
825 ❑ 10-12 months
826 ❑ over 12 months

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