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### WASTE REDUCTION COULD HELP SOLVE U.S. WASTE CRISIS BUT MAY FACE INSTITUTIONALIZED OBSTACLES

While increasingly stringent and costly "end-of-pipe" pollution control measures command the lion's share of attention and both public and private investment in environmental protection in the United States, a little known movement called waste reduction/pollution prevention may be emerging from obscurity to lead the country into a more effective, less expensive, less confrontational era of environmental protection.

But, at least one key speaker at the March conference, "Waste Reduction/Pollution Prevention: Progress and Prospects within North Carolina" believes obstacles to adoption of waste reduction/pollution prevention as a national priority may have become institutionalized.

Held to promote waste reduction/pollution

prevention, the conference was sponsored by WRI and the N.C. Pollution Prevention Program in cooperation with the N.C. Hazardous Waste Management Branch, the Governor's Waste Management Board, and numerous professional, trade, and environmental groups.

### Approach Can Reduce Wastes Significantly

The waste reduction/pollution prevention concept is that waste **is** pollution and that it is better to avoid producing waste than to try to clean it up at the "end of the pipe." The concept applies to all wastes from hazardous industrial wastes to household garbage.

While some purists claim that recycling is not waste reduction, mainstream proponents count as waste reduction any technique that ultimately cuts down on waste generation. All proponents of the

approach agree that an aggressive waste reduction program anywhere--from factories to homes--can cut the volume of waste generated significantly.

### **Public's Growing Intolerance of Pollution Is Making Approach More Attractive to Industry**

James L. Lounsbury, director of the EPA's newly created Waste Minimization Staff, told the 330 conference participants that the American public is becoming very intolerant of toxic pollution and that environmental laws and regulations are becoming increasingly prescriptive. This makes it more and more difficult and expensive for generators and managers of wastes--whether they are industrial plants, municipal landfills and wastewater treatment plants, or military installations--to clean up to the point required by law.

Therefore, waste reduction is becoming increasingly attractive to industry, Lounsbury said, because it reduces waste management costs by decreasing the amount of waste that must be treated and disposed of.

Lounsbury's theme was echoed by other speakers, including Roger N. Schecter, Director of the N.C. Pollution Prevention Program who recently spent eight months helping EPA organize a multimedia waste reduction effort.

### **Waste Reduction Can Support Economic Development**

Schecter said that local and state governments also like the waste reduction/pollution prevention approach because it helps support economic development.

Institution of waste reduction practices, Schecter said, can allow new development in areas where the environment or treatment facilities such as municipal wastewater treatment plants cannot tolerate additional waste loads. An aggressive waste reduction program might also help in getting public approval for siting necessary waste treatment and disposal facilities, he said.

"Perhaps if the public were shown that industry is doing everything it can to reduce its wastes and that zero waste is not achievable, they would be more likely to understand that it is necessary to have some waste treatment and disposal facilities."

### **Design of Environmentally Friendly Products Is Long-term Waste Reduction**

Donald Huisingh, NCSU Professor of University Studies currently serving as Visiting Professor at the University of Lund/TEM in Sweden, pointed out that designing consumer products to be recyclable or biodegradable could be a major force in solving waste problems throughout the world.

Huisingh, who served as leader of the Toxic Substances Project during the administration of Governor James B. Hunt, Jr. and in that capacity organized the state's first waste reduction/pollution prevention conference in 1982, said that a conference held in Vienna in February on developing design criteria for environmentally friendly products points to a possible next thrust for U.S. waste reduction/pollution prevention programs.

"In addition to reducing wastes generated by the manufacturing processes of currently produced items--the major focus of current waste reduction programs (in industry)--priority attention should be given to the development of criteria...to help product designers and manufacturers consider the life cycle impacts of their products.

"Such efforts would address factors of raw materials composition and production, product manufacture, consumer use of the products, and disposition of the products at the

end of their useful lifetimes. Issues pertaining to product safety, durability, repairability, reuseability and recyclability are among the factors that should be addressed by the product design criteria."

### **Waste Reduction Tied to International Competitiveness and Bottom Line Enhancement**

Speakers in the 16 workshops held over the course of two days also testified to the benefits of waste reduction.

In the textiles industry workshop, leader Samuel B. Moore, President of Burlington Research, Inc. of Burlington, NC, told participants that waste reduction/pollution prevention can play a key role in helping the textile industry survive and compete under the onslaught of foreign imports and public pressure to reduce its impact on the environment.

"Because of the large volumes of water used to process our fabrics, yarn, fibres, and garments, we are a target (for environmental regulation)," said Moore. "The American public will view the cheaper foreign textile product as a product that is produced on the other side of the world and is, therefore, not polluting their environment. This is a misunderstanding of the problem, but the American public is not used to thinking in terms of worldwide pollution."

In the food processing workshop led by Dr. Roy Carawan of the NCSU Food Science Department, food processors heard from Jim Waynick of The Equity Group of Reidsville how waste reduction practices are allowing it to comply with city waste effluent limitations without building an expensive pretreatment facility.

Waynick said that the company determined it could reduce the waste load from its breaded meat production process by about 50 percent by preventing batter losses from drips and leaks, changing its clean-up practices, and retraining its clean-up crews.

"We thought we had a problem, but we didn't realize what an opportunity we had," Waynick told the workshop participants. "The product and ingredients we were losing were costing us hundreds of thousands of dollars per year. In addition, we were faced with the prospect of having to install a system to pretreat our waste before discharging it to the city treatment plant. That would have required a major capital expenditure."

Representatives of the electroplating industry, the furniture industry, the microelectronics industry, the printing industry, and other industrial operations told similar waste reduction success stories in industry workshops. In another workshop, local government representatives presented evidence of the usefulness of the waste reduction approach in solving the solid waste crisis facing municipalities.

In their remarks, State Representative Bruce Ethridge, Secretary of Natural Resources and Community Development S. Thomas Rhodes, the Governor's Science Advisor Earl R. MacCormac, N.C. Citizens for Business and Industry representative Joe Harwood, and Sierra Club/Conservation Council of N.C. lobbyist Bill Holman all voiced support for and optimism about the future of waste reduction/pollution prevention.

### **Huge Investment in Pollution Control Establishment Clouds Future of Waste Reduction**

However, in the concluding plenary session, Joel Hirschhorn, Senior Analyst with the Congressional Office of Technology Assessment, admonished conference participants not to assume that waste reduction/pollution



prevention will become national policy simply because it works.

Hirschhorn said that even though waste reduction offers immediate help for the waste crisis facing the country, obstacles to its adoption may have become institutionalized.

**Waste Reduction/Pollution Prevention  
Represents New Paradigm  
in Environmental Protection**

"The switch from pollution control to pollution prevention is a classic example of a paradigm change," he said. "A changeover to a new paradigm takes time...In the interim, most people fail to see the advantages of the new paradigm, and the old prevails."

But, he said, it is crucial that the change in thinking about the relationship between waste and pollution begin now. Businesses, industries, and government agencies which have been on the leading edge of the waste reduction movement are ready to forge ahead into a second phase, which cannot come about until strong public support is in place.

Hirschhorn said that through simple practices already pioneered and proven effective, industrial wastes in the United States could be reduced significantly in a short period of time at substantial savings to the companies involved. However, at the same time, companies and state programs which have pioneered waste reduction need to be engaged in research and development that would allow greater progress after the "low hanging fruit has been picked."

"As industry's waste reduction paybacks decrease and projects become more complex and dependent on R&D, public policy will play a more critical role," he said.

Unfortunately, he said, almost no visible support has emerged for the bills now pending in Congress that would expand the EPA's waste reduction program in a substantial way. He pointed to a number of non-technical factors standing in the way of support for a major national waste reduction program.

First, he said, waste management has become a big industry in the United States over the last few years. "Companies in the waste management and pollution control business fear a loss of markets," he said.

Even companies which have discovered the benefits of waste reduction largely decline to support a national waste reduction program, he said. "Their own waste reduction programs give companies a competitive advantage. Many of these companies don't want to give up this advantage so they're not going to share their expertise or support a national waste reduction program. In addition, industry largely feels that national waste reduction legislation would lead to burdensome waste reduction regulation.

"In addition, environmental groups, which could have a major influence on public awareness and public policy, do not actively support a federal waste reduction program because they are stake holders in the regulatory establishment," he said. "They fear that a federal waste reduction program would lead to a loss of support for established regulatory programs."

Finally, Hirschhorn said, the general public has little faith in the federal government's ability to solve environmental problems, and the national media do nothing to educate the public about the potential of waste reduction.

"Only 11 percent of the people in this country think that our environment will get better. That shows how they feel

about our regulatory establishment. It also indicates the kind of news they get.

"Waste reduction is good environmental news. It doesn't compete well with all the bad environmental news for media attention."

Hirschhorn asserted that a major national waste reduction program, perhaps under an EPA assistant administrator, is necessary to keep the approach alive and that broad support--which does not now exist--is necessary to bring this about.

**N.C. WATER LEADERS  
DISCUSS IMPLICATIONS FOR STATE  
OF GLOBAL CLIMATE CHANGE**

While they did not claim to be able to predict local effects

with certainty, university and state government scientists who have conducted preliminary studies on the effects in North Carolina of global climate change due to the build up of greenhouse gases in the atmosphere said at the March meeting of the N.C. Water Resources Association (NCWRA) that major effects are inevitable and that the situation requires immediate attention.

"It is time to begin the discussion of the impact of global climate change on North Carolina's water resources," said Dr. David H. Moreau, who succeeded Raymond J. Burby, UNC-CH Professor of City and Regional Planning, as president of the NCWRA at the meeting. "This is a matter of great uncertainty, but scientific work done so far suggests that there are going to be some very significant effects in the United States and in North Carolina."

Noting that current scenarios of the possible effects of global climate change differ widely, Moreau said that research is needed to predict more accurately the effects of global warming on precipitation patterns and sea levels and the likely ecological responses to these changes, to identify areas of the world most likely to be impacted, and to develop public policy to deal with the economic and social problems these changes cause.

**Most Scenarios Say N.C. Coast Would Be Wetter,  
While Interior Areas Would Experience Frequent Droughts**

In an overview of published literature on climate changes that the atmospheric build up of carbon dioxide and other gases is likely to bring about, Dr. James N. Woodman, director of the NCSU Atmospheric Impacts Research Program, said that some scientists predict a two to eight degree (F) rise in the average surface temperature of the earth within the next 50 years and that such a temperature change would have profound effects on North Carolina's coastline, forests, water resources, and agroecology.

Many scenarios predict that coastal areas will become wetter while interior areas will experience much drier conditions, with frequent severe droughts possible. Irrigation of agricultural crops in many regions is likely to be curtailed under these scenarios, Woodman said, and marginal farmland might become unusable.

On the other hand, he said, other scientists predict the rising levels of carbon dioxide in the atmosphere will form a cloud cover that will force down global temperatures.

"Either change would have a major impact," he said. "All we know with certainty is that in the next 40 to 50 years, something significant will happen, but no significant research is going on nationally or internationally to deal with it."

### Public Policy Can Encourage or Discourage Rational Adjustment to Changes

Dr. Kerry V. Smith, University Distinguished Professor of Economics and Business at NCSU, said that the nation needs the capability to predict not only climate and ecological changes but also the economic impact and the public policy implications of such changes. Economists and public policy specialists, such as water resource planners, have a major role to play in preparing the public and public institutions to deal with the situation, he said.

Smith said economists can help predict the long-term course of climate change by doing research to predict rates of increase in the types of economic activity that drive up the demand for and use of energy and lead to the build up of greenhouse gases. Policy experts can evaluate which policies would commit the United States and other nations to continued atmospheric impacts and can help elected officials and the public in the United States make rational choices among policy alternatives.

"Because of our past policies, we are already committed to an impact," said Smith. "We need to know more about the nature of that impact so that areas likely to be affected can begin now to consider the investments they're making and the ways in which they can adjust to the changes. Those who set public policy also need to consider whether policy encourages or discourages rational adjustment to changes."

As an example, Smith said, we should be asking what government will do to bail out farmers, businesses, and homeowners negatively affected by climate changes and if the promise of a bailout will encourage unwise investments.

### Task Force Needed to Deal with Policy Questions Related to N.C. Coastal Impact

Dr. George Everett, Deputy Director of the N.C. Division of Environmental Management, said that North Carolina faces a number of coastal issues related to predicted effects of climate change.

If there is a two to six-and-one-half foot rise in sea level over the next 100 years as some have predicted, then the coastal area of North Carolina will experience significant shoreline retreat, saltwater intrusion into fresh water supplies, inundation of wetlands, and creation of new wetlands.

Among the questions policy makers in the state will have to face are:

- \* What can be done along the coast to assure that areas that may one day become the state's wetlands are able to function effectively as such? Should development continue in these areas? What can and should be done about hazardous waste sites, solid waste landfills, and sewer systems in these areas that may be inundated?
- \* Should engineered barriers against rising waters be considered and if so, when should construction of those barriers begin?
- \* What will be the fate of existing coastal infrastructure, and can future infrastructure be built to withstand the effects of sea level rise.

"We need a high-level task force to think about these and other questions related to the effects in our state of global climate change, to think about tomorrow," said Everett.

### LOCAL GOVERNMENTS PROVIDE RESOURCES FOR WATER PROTECTION THROUGH AGRICULTURAL COST SHARE PROGRAM

More and more local governments in North Carolina are taking advantage of water supply and

water quality protection opportunities offered by the State's Agricultural Cost Share Program by supplementing funding for local technical assistance. According to Jim Cummings of the N.C. Division of Soil and Water Conservation, there has been "an explosion in the hiring of local conservation technicians" under the state's cost sharing provisions.

The N.C. Agricultural Cost Share Program for Nonpoint Source Pollution Control currently shares with farmers in 55 counties the cost of installing runoff controls. However, all 100 counties in the state are eligible for technical assistance funding to pay half the cost of hiring conservation technicians. Cummings said in April that 80 positions for technicians had been funded across that state and that more were pending.

"It's happening in a number of ways and for a number of reasons," said Cummings. "In some places local governments get involved with their Soil and Water Conservation Boards to target watershed protection. In other places, local governments may be concerned about solving highly localized water quality problems.

"In the Piedmont, the major motivation seems to be water supply protection. In the western part of the state, there seems to be a greater need to correct some specific problems."

For instance, Cummings said that the cities of Reidsville and Statesville are providing cost-share funding for technicians to work strictly with farmers in their city water supply watershed areas. These technicians are in addition to the technicians funded by Rockingham and Iredell Counties and the state. Buncombe County, however, is putting its resources behind an effort to solve an acute and severe water quality problem caused by animal operations.

Cummings said the Agricultural Cost Share Program is also encouraging an unusual degree of cooperation among local governments.

"In the 16 western counties that just came into the Agricultural Cost Share Program last summer, we have an arrangement that may be unique in the country," he said. "There the 16 Districts and local governments went together to hire an engineer to work with area farmers on designing and constructing animal waste management systems."

According to Cummings, Soil Conservation Service personnel are spread thin at this time and the SCS engineers are often unable to provide assistance for such projects because their primary responsibilities center on helping farmers comply with conservation requirements of the 1985 Food Security Act or other federal programs.

"Local governments are recognizing that SCS personnel can't handle all the needs and are responding by committing their own resources," said Cummings.

### PIEDMONT TRIAD COMMUNITIES COOPERATE TO MEET LONG-TERM WATER NEEDS

In the wake of the Corps of Engineers' decision to pull

out of the Randleman Lake Project, Randolph County and five Triad cities have agreed to build a smaller project to meet the water needs of the area.

The Piedmont Triad Regional Water Authority (PTRWA), originally organized in 1986 to take advantage of the water supply possibilities of the Corps-planned project,

has signed an irrevocable agreement with the cities of Randleman, High Point, Jamestown, Archdale and Greensboro and Randolph County whereby the governments will share water until the project is completed and share the costs of developing the new water supply. The goal is to have the new water supply available by the year 2000.

The PTRWA plans to acquire approximately 6,000 acres of land in Randolph and Guilford counties, of which 3,000 would be inundated. While the PTRWA project is smaller by 4,000 acres than the original Corps project, it is expected to provide basically the same conservation pool as the project proposed by Corps and is projected to provide a safe yield of 48 million gallons of water supply per day. The flood control and recreation features in the Corps plan have been eliminated from the PTRWA project at a savings of about \$60 million. The cost of the reduced project is approximately \$56 million, or about half the cost of the original plan.

#### **EPA SEEKS PUBLIC INPUT ON GROUNDWATER PESTICIDE STRATEGY**

The EPA has re-leased a public document outlining its pesticide

strategy regarding agricultural chemicals in groundwater. EPA's proposal is designed to prevent pesticide contamination of the nation's groundwater and establish a framework for state efforts to protect groundwater.

The EPA approach, now under public review, would limit the amount of pesticides considered acceptable in groundwater. Maximum Contaminant Levels, the enforceable drinking water standards under the Safe Drinking Water Act, are expected to be used to help determine unacceptable levels of pesticides in underground sources of drinking water. Where pesticides approach or exceed unacceptable levels, more stringent measure would be undertaken to prevent further contamination.

With the new groundwater strategy, each state would have the opportunity to manage pesticides. Should the states not act EPA could develop alternative approaches such as further limiting certain pesticides uses on a statewide or countywide basis.

EPA's strategy also considers the possibility of national registration of pesticides based on groundwater concerns.

According to EPA groundwater management officials in Region IV workshops will be held this summer to seek more input for an EPA plan to prevent additional groundwater contamination from agricultural chemicals.

EPA's contact regarding the proposed pesticide strategy is:

Groundwater Strategy Project  
Office of Pesticides Programs  
U.S. EPA (TS-766C)  
401 M. Street, S.W.  
Washington, DC 20460

#### **HOLMAN NAMED TO DIRECT ALBEMARLE-PAMLICO ESTUARINE STUDY**

Dr. Robert E. Holman has succeeded Dr. Douglas Rader as

Director of the Albemarle-Pamlico Estuarine Study (APES) being conducted cooperatively by the EPA and the N.C. Department of Natural Resources and Community Development (NRCD) under the National Estuary Program.

Holman was formerly Coordinator of the Water Supply Protection Program in NRCD's Division of Environmental Management, a position he had held since 1985.

He earned the B.A. in biology from Bridgewater College, the M.S. in marine biology from Old Dominion University, and the Ph.D. in botany from North Carolina State University

and has served with the N.C. Division of Environmental Management since 1979 when he joined the division as coordinator of the Chowan River Project. From 1983 to 1985, he served as head of DEM's Biological Monitoring Group.

#### **NEW WRRRI REPORT FOCUSES ON WATERSHED PROTECTION IN WESTERN NORTH CAROLINA**

Researchers at the UNC Water Resources Research Institute

say that even though Western North Carolina has traditionally been regarded as an economically depressed area, population growth in the area is posing a threat to the quality of the area's public water supplies.

Dr. David H. Moreau, Dr. Daniel L. Gallagher, and research assistant Mary Jo Moubry say in a new WRRRI report that recent population growth in the 24 counties of the state's geologic Mountain Province has been approximately the same as that of the state as a whole, and that this growth together with reluctance of local governments to adopt land-use policies creates a significant potential for pollution of drinking water sources.

Moreau, Director of WRRRI, and Gallagher, a former WRRRI staff research assistant, performed the study with assistance from Ms Moubry, a graduate research assistant in the Department of City and Regional Planning at UNC-CH. The study was funded by the North Carolina General Assembly.

The study, titled "WATERSHED PROTECTION IN WESTERN NORTH CAROLINA with Special Attention to the Pigeon River Upstream of Canton," assesses the threat to water supplies in the region through study of a variety of data, including population and construction trends, records of the numbers and locations of NPDES wastewater discharge permits, location of water supply sources, land-use records, estimates of agricultural chemical usage, and study of current land-use policies in each county. It examines in greater detail the potential for pollution in the Pigeon River Watershed in Haywood County through study of the same factors mentioned above together with examination of the topography and soils of the watershed, population distribution, and results of analyses of water samples taken from various sites on the Pigeon River.

According to the researchers, water quality monitoring done for the study as well as previous water quality monitoring by the N.C. Division of Environmental Management support the general conclusion that the Pigeon River Watershed is, at present, in good condition. There is little evidence to indicate a significant and imminent threat to the city of Canton's water supply, they say.

However, the researchers also say that there is sufficient evidence of pollution potential throughout the 24-county area to make the lack of water supply protection measures a great concern.

#### **Mountain Water Supplies Are Especially Vulnerable**

The researchers point out several factors that make water supplies in the mountain region especially vulnerable to pollution from human activity.

First, most public drinking water comes from streams because the geology of the area does not produce high-yielding wells.

Second, construction activity on steep slopes (average slope in the Pigeon River Watershed exceeds 25 percent) may result in heavy runoff and silt deposit in streams.

Third, agricultural activity centers in stream valleys where fertilizer and pesticide may be carried directly from fields into streams during rains.

Fourth, in many areas where steep slopes are dominant, soils are not well suited for septic tanks, and "package" wastewater treatment plants which discharge into streams are denser (in relation to population) than in the rest of the state. (58 NPDES wastewater discharge permits per 100,000 persons in the 24-county mountain region as compared to 30 permits per person elsewhere). In some cases wastewater discharge permits have been issued for locations upstream of public water supply intakes.

**Land-use Policies, N.C. Water Supply Protection Program Can Be Used by Local Governments to Protect Public Drinking Water Supplies**

According to the researchers, local governments in Western North Carolina have not shown an inclination to use the authority available to them to manage growth to protect their water supplies.

The researchers discuss the opportunities for watershed protection offered by State of North Carolina's new Water Supply Protection Program, which functions through a water supply reclassification mechanism, as well as the land-use tools local governments may adopt to protect watersheds. As examples, they discuss and evaluate the watershed protection programs of several North Carolina counties and cities.

They examine the growth management authority enacted by the 24 mountain counties and point out that few have enacted any programs to control land-use. Only six of the counties have any zoning regulations, only seven have subdivision regulations, and only two have local sedimentation and erosion ordinances.

The researchers recommend ways in which state government can create incentives for local governments to protect water supplies, and they recommend a number of specific measures that local governments in Haywood County and Canton can take to protect the Pigeon River Watershed.

The report, "WATERSHED PROTECTION IN WESTERN NORTH CAROLINA with Special Attention to the Pigeon River Upstream of Canton" is available to North Carolina residents at a cost of \$5 prepaid or \$10 if billed (Out-of-state cost \$8 prepaid, \$10 if billed) from the UNC Water Resources Research Institute, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 (919/737-2815).

**U.S. FISH & WILDLIFE SERVICE ISSUES PESTICIDE TOXICOLOGY REPORT**

pesticides used today. More than 160 million acre-treatments of pesticides containing these chemicals are estimated to be applied to agricultural crops and forests each year, and during the past decade, there has been an increase in the number of reports of wildlife die-offs related to their use.

A handbook prepared under the Cooperative Internship Program of The Institute of Ecology and the U.S. Fish and Wildlife Service provides a summary of available information on organophosphorus and carbamate pesticides in the wildlife toxicology literature and relates those data to potential hazards to wildlife by examining toxicity, environmental persistence, and use patterns of the pesticides included.

The handbook, titled "Pesticide Use and Toxicology in Relation to Wildlife: Organophosphorus and Carbamate Compounds," is available from the Publications Unit, U.S. Fish and Wildlife Service, Room 148, Matomic Building, Washington, DC 20240. A loan copy is available from the Water Resources Research Institute (919/737-2815).

Organophosphorus and carbamate compounds constitute a major portion of all

**N.C. STUDY DETAILS EFFECTS OF ACID RAIN ON N.C. MARINE ENVIRONMENTS**

In a study completed in 1984, Dr. Hans W. Paerl of the UNC-CH

Institute of Marine Sciences at Morehead City, concluded that nitrogen enrichment from acid rain can significantly affect the growth of nuisance algae in marine waters bordering land masses where industrial and urban development are extensive, including the eastern seaboard of the United States.

Paerl conducted his study in three locations in and near Bogue Sound during 1983-84. All three locations receive both acidic rain, which originates over the North American continent, and near-neutral rain, which originates over the ocean. Sampling and analysis of rainfall and surface waters after rainfall events showed that both oceanic and continental rain stimulate phytoplankton primary production. The sampling also provided evidence that continental rainfall, which is higher in soluble forms of nitrogen, leads to much higher magnitudes of stimulation (typically 30-70% higher growth yields) and that enhanced growth continues longer (6-7 days as compared to 2-3 days) in response to acid rain additions.

Some forms of algae provide food for organisms that are essential links in the food chain that ultimately produces fish and shellfish. Some forms, however, are not utilized as food, and overproduction of these forms can lead to oxygen depletion and fish kills. Still other species are toxic and can kill or contaminate shellfish. Problem growth of undesirable forms of algae is typically considered a sign of eutrophication, or over enrichment, of a body of water.

The role of acid rain in problems plaguing North Carolina's estuarine system was recently highlighted by an Environmental Defense Fund report which points to nitrogen enrichment as a factor equal in importance to phosphorus enrichment in eutrophication of some coastal waters. Phosphorus enrichment in North Carolina's estuaries is due primarily to agricultural runoff and point source discharges from municipal wastewater treatment plants and industrial operations. Agricultural runoff and wastewater discharges also contain some nitrogen; however, the Paerl study indicates that nitrogen from these sources is assimilated by algae in coastal rivers and does not play a significant role in estuarine eutrophication.

A summary of the Paerl study was published in the British scientific journal *Nature* in 1985. The study and other phytoplankton and nutrient research were funded by the North Carolina Sea Grant Program, the National Science Foundation, and the Water Resources Research Institute.

**DAM SAFETY PUBLICATIONS AVAILABLE**

The Federal Emergency Management Agency (FEMA) has produced two new publications for the general public and dam owners. "Dam Safety - Know the Potential Danger" is a 26-page booklet aimed at educating the public on the potential for dam breaks, threats to life and property, causes, mitigation, and responsible agencies. Copies of the book, FEMA Publication #L-152, are available by writing FEMA, P.O. Box 70274, Washington, DC 20024.

"Dam Safety: An Owners Manual" addresses preventative measures that dam owners can take to reduce the risks of dam failure. This book also emphasizes the need for safety programs and involvement in public policy decisions such as land use regulations, evacuation plans and safety programs. The manual's appendix provides an opportunity for each state to incorporate pieces of information such as safety policy and laws. This publications can be obtained by contacting William Bivins, FEMA Headquarters, 500 C Street, SW, Washington, DC 20472.

Review copies of both publications are available at the UNC Water Resources Research Institute, 219 Oberlin Road, NCSU Campus (Box 7912, NCSU, Raleigh, NC 27695-7912--919/737-2815)

**BULLETIN OFFERS INFORMATION ON DISPOSAL OF UNDERGROUND STORAGE TANKS**

Using information gathered from an extensive literature review

and discussions with government, industry, and trade union representatives, researchers at the Center for Environmental and Hazardous Materials Studies at Virginia Tech have analyzed various underground storage tank disposal options in terms of economic and environmental costs.

Disposal of unwanted tanks is increasing because many existing tanks--installed 15 to 20 years ago--are at the age when they may begin to leak, and owners want to protect themselves against liability for damage done by leaking tanks.

Options for disposing of underground storage tanks include:

- \* Reclaiming and incinerating any petroleum product and sludge and recycling the tank steel

This is the most environmentally sound but most expensive option. In addition, because of Superfund liability issues, recyclers are becoming more and more reluctant to accept used tanks.

- \* Abandoning the tank in place (after disposing of contents and residue)
- \* Pulling the tank up and sending it to a landfill (after disposing of contents and residue)

The above two options are less expensive but both pose greater potential environmental hazards.

A complete description of this project is found in VWRRC Bulletin 160, "Underground Storage Tank Disposal: Alternatives, Economics, and Environmental Costs," available from

Publication Services  
Virginia Water Resources Research Center  
617 N. Main St., Blacksburg, VA 240603397.

Out of state orders must be accompanied by a check or money order for \$6.

**VARIETY OF WATER-RELATED COURSES OFFERED BY TRIANGLE UNIVERSITIES**

Individuals interested in educational opportunities

related to water resources management will find a variety of courses available this fall at the University of North Carolina at Chapel Hill, North Carolina State University, and Duke University.

**UNC-Chapel Hill**

Department of City & Regional Planning (PLAN)

Planning 234 - Planning of Water Resource Systems (also listed as ENVR 284)

Department of Environmental Sciences and Engineering (ENVR)

ENVR 122 - Water Chemistry  
ENVR 123 - Organic Materials in Natural Waters  
ENVR 132 - Limnology and Water Pollution  
ENVR 137 - Ecology of Wetlands

ENVR 171 - Water Quality Evaluation and Control  
ENVR 176 - Ground Water Engineering  
ENVR 274 - Advanced Water & Wastes Treatment Processes I

Those wishing to take courses at UNC-Chapel Hill should request admissions information from the Evening College, which also serves those who want to enroll in regular courses as part-time students. The Evening College is headquartered in Abernethy Hall on the Chapel Hill campus (919/962-1134/1135).

**N.C. State University**

Department of Marine, Earth and Atmospheric Sciences (MEA)

MEA 443 - Weather Analysis and Forecasting I  
MEA 501 - Environmental Fluid Mechanics  
MEA 514 - Advanced Physical Meteorology

Department of Civil Engineering (CE)

CE 382-1 - Hydraulics  
CE 382-2 - Hydraulics  
CE 383 - Hydrology & Urban Water Systems  
CE 480 - Water Resources Engineering Project  
CE 484 - Water Supply and Waste Water Systems  
CE 543 - Hydraulics of Ground Water  
CE 571 - Theory of Water and Waste Treatment  
CE 580 - Flow in Open Channels  
CE 589T - Special Topics: Engineering Hydrology  
CE 673 - Industrial Water Supply & Waste Disposal  
CE 685 - Design of Coastal Facilities

Department of Biological and Agricultural Engineering (BAE)

BAE 321 - Water Management  
BAE 471 - Soil and Water Engineering  
BAE 578 - Agricultural Waste Management  
BAE 671 - Theory of Drainage-Saturated Flow.

Adults who wish to take regular courses at North Carolina State University should make application through the Division of Lifelong Education headquartered in the Jane S. McKimmon Center on Western Boulevard in Raleigh (919/737-3007).

**Duke University**

Department of Civil and Environmental Engineering (CE)

CE 124 - Environmental Engineering  
CE 122 - Fluid Mechanics  
CE 245 - Pollutant Transport Systems

School of Forestry and Environmental Studies (FES)

FES 211 - Applied Ecology and Ecosystem Management  
FES 311 - Ecological Toxicology  
FES 230 - Weather and Climate  
FES 234 - Watershed Hydrology  
FES 233 - Groundwater Hydrology  
FES 236 - Water Quality Management  
FES 335 - Water Quality Modeling  
FES 266 - Mathematical Modeling of Lake and Reservoir Water Quality

Adults over the age of 25 who wish to take regular semester courses as nondegree students at Duke should apply through Duke's Office of Continuing Education (919/684-6259).



**UNIVERSITIES COUNCIL ON  
WATER RESOURCES TO HOLD  
ANNUAL MEETING JULY 5-8**

The Universities  
Council on Water  
Resources (UCOWR)  
will hold its annual

meeting in Coeur d'Alene, Idaho, July 5-8, 1988. The program focuses on the implications of global climate change for water resources and includes presentations on:

- \* Results of Regional Analyses of the Impact of Climate Change on the United States
- \* Climate Change and Water Resources
- \* Needs and Opportunities for a National Research Program on Global Climate Change
- \* Climate Change and the Social Sciences
- \* Modeling the Hydrologic Effects of Climate Change
- \* Climate Change and Water Use in Agriculture

Dr. David H. Moreau, Professor of City and Regional Planning at UNC-CH and Director of the UNC Water Resources Research Institute, is program chairman and president-elect of UCOWR. Dr. Miguel Medina, Jr. of Duke University is president.

The registration fee for the meeting is \$195 in advance or \$225 after June 1. The fee includes coffee breaks, two luncheons, a lake cruise and dinner buffet, and the UCOWR banquet. Participants also will be provided with a copy of the Proceedings. For registration information write:

**Idaho Water Resources Research Institute  
Morrill Hall 106  
University of Idaho  
Moscow, Idaho 83843**

Or call:  
Diane Weber at (509) 335-5531  
Peggy Hammel at (208) 885-6429

The block of rooms reserved for UCOWR at meeting headquarters, The Coeur d'Alene Resort, will be released June 1.

**GROUNDWATER QUALITY MANAGEMENT  
SHORT COURSE OFFERED AT  
UNC-CHAPEL HILL JULY 10-15**

A course designed  
to provide ground-  
water technologists,  
environmental

scientists, geologists, planners, and administrators with the background and tools needed to address the management of groundwater quality is being offered through the Department of Environmental Sciences and Engineering and the Division of Extension and Continuing Education at UNC-Chapel Hill.

Topics to be covered include:

- \* processes that affect groundwater quality--hydrodynamics, sorption-desorption, biological transformation, and chemical transformation
- \* the use of mathematical models to solve groundwater quality problems (models will be supplied to each participant at no additional cost)
- \* ways to combine technical considerations with management strategies

The course begins with registration on Sunday, July 10, and continues through 12:30 p.m. on Friday, July 15. The fee of \$300 includes all instruction and materials, computer software for mathematical modeling, coffee breaks, a Sunday evening social, and a Thursday evening banquet.

Pre-registration is requested prior to July 1. For registration and accommodations information call the UNC-CH Division of Extension and Continuing Education at (919) 962-1106.

**POSITIONS AVAILABLE**

The City of Burlington, NC, seeks to fill the position of **Utilities Administrator/Field Operations**. Reporting to the Public Works/Utilities Director, the person in this position performs highly technical, administrative, and supervisory work in the operation of two water treatment plants, two wastewater treatment plants, maintenance services, laboratory services, and the industrial pretreatment program. A BS degree in engineering or related science is required, with a master's degree in environmental engineering or environmental science preferred. Five years of experience in the water technology field, good leadership abilities, good written and oral communication skills, and the possession or earning of Grade A and 4 operators' certificates are required. Position effective July 1, 1988. Submit resume to:

Personnel Department  
P.O. Box 1358  
Burlington, NC 27215

**WATER RESOURCES CONDITIONS  
FOR APRIL**

Streamflow increased  
throughout the state  
during April but

remained in the below-normal range in the Piedmont and Blue Ridge. April marked the third consecutive month of below-normal flow in these provinces. In the Coastal Plain, monthly streamflow was near normal for the first time since October 1987.

During mid month, scattered showers and thunderstorms significantly increased streamflow across the state and interrupted the decline, which had continued through March and into early April.

In contrast to surface-water flows, groundwater levels in unconfined (water-table) aquifers were above average throughout the state at month's end. Levels declined during April in the Blue Ridge and Piedmont but rose in the Coastal Plain. Levels in the index wells near Blantyre, Mocksville, and Elizabeth City are 1.5, 1.1, and 1.7 feet higher than the levels for the April 1986 drought conditions, respectively.

At month's end, index reservoirs in the western Piedmont had a combined volume of 82 percent of capacity as compared to the long-term average of 92 percent. During April 1986, volume was 82 percent of capacity.

**WORKSHOP ON EFFLUENT TOXICITY  
TO BE HELD JUNE 8**

Speakers from state,  
federal, and local  
governments;

universities; and the private sector will discuss various topics related to strategies for reduction of effluent toxicity at a workshop to be held from 8:00 a.m. to 4:00 p.m. June 8 at the Hilton at University Place in Charlotte, NC. The workshop is sponsored by the N.C. American Water Works Association, the Water Pollution Control Association, and the West Piedmont Section of the N.C. Professional Wastewater Operators Association.

Pre-registration fee is \$35.00. Late registration fee is \$45.00. Pre-registration must be received by June 1. For a workshop brochure and registration form, write:

NC AWWA/WPCA  
c/o Bob Griffin  
Char-Meck Utility Dept.  
5100 Brookshire Blvd.  
Charlotte, NC 28216



## NEW PUBLICATIONS RECEIVED BY THE INSTITUTE

(Residents of North Carolina may borrow these from the Institute for a two-week period. Where individual copies are desired, readers are encouraged to request copies from the organization issuing the publication. The addresses are provided by the NEWS for this purpose.)

Water Quality Management

- "Agricultural Chemicals in Ground Water: Proposed Pesticide Strategy," 12/87, USEPA, Office of Pesticides and Toxic Substances, Washington, DC 20460. (04B)
- "Pesticide Use and Toxicology in Relation to Wildlife: Organophosphorus and Carbamate Compounds," (#170), by USF&WLS, avail. from Publications Unit, U.S. Fish and Wildlife Service, Matomic Bldg., Rm. 148, Washington, DC 20240. (05C)
- "Effectiveness of BMPs for Stormwater Management in Urbanized Watersheds," (#159), 1/88, by C.Y. Kuo, et al., avail. from WRRRC, VPI&SU, 617 N. Main St., Blacksburg, VA 24060-3397. (05B Stormwater Mgt.)
- "Developments at Thirteenth International Conference on Water Pollution Research, Rio De Janeiro, Brazil, August 17-21, 1986," (PB88-102512), 9/87, by USA Nat'l. Comm. for Rep. of The US to The International Assoc. on Water Pollution Research and Control, avail. from U.S. Dept. of Commerce, NTIS, 5285 Port Royal Rd., Springfield, VA 22161. (05D)
- "Surface Water Quality Concerns in the Tar-Pamlico River Basin," (#87-04), 12/87, by D. N. Rader, et al., avail. from Water Quality Section, DEM, NRCO, PO Box 27687, Raleigh, NC 27611. (05B)
- "Technical Assessment of Low-Pressure Pipe Wastewater Injection Systems," avail. from NTIS, 5285 Port Royal Rd., Springfield, VA 22161, price \$13.95. (05D)

Water Quality Management

- "Dam Safety: An Owner's Guidance Manual," (FEMA 145), 8/87, by CO Div. of Disaster Emergency Services, avail. from Federal Emergency Management Agency, Earthquakes and Natural Hazards Programs Div., Rm. 625, 500 C St., SW, Washington, DC 20472. (08A)
- "Aspects of SIMSYS2D--A System for Two-Dimensional Flow Computation," (ISBN: 0-8330-0839-0), 12/87, by J. Leendertse, avail. from The RAND Corp., 1700 Main St., PO 2138, Santa Monica, CA 90406-2138. (05B Estuary Modeling)
- "Ground Water Pumping Tests--Design and Analysis," (ISBN 0-87371-108-4), by W. C. Walton, avail. from Lewis Publishers, Inc., 121 S. Main St., PO Drawer 519, Chelsea, MI 48118, price \$49.95. (02F)

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ANNOUNCEMENT

PLEASE REVIEW YOUR ADDRESS AS IT APPEARS ON THIS NEWSLETTER. IF YOU WISH TO HAVE YOUR NAME DELETED OR IF YOUR ADDRESS NEEDS TO BE CORRECTED, PLEASE INDICATE THE ACTION WE SHOULD TAKE DIRECTLY ON THE REVERSE SIDE OF THIS PAGE, ADJACENT TO YOUR ADDRESS LABEL AND RETURN THE LOWER PORTION OF THE PAGE TO US FOR CORRECTION.

IT WILL HELP US TREMENDOUSLY IF YOU WILL RETURN CHANGES TO US PROMPTLY SO THEY CAN BE MADE PRIOR TO OUR NEXT MAILING. IF WE DO NOT HEAR FROM YOU, WE WILL ASSUME YOUR ADDRESS IS CORRECT AS SHOWN ON THE LABEL.

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RETURN TO:

**WATER RESOURCES RESEARCH INSTITUTE  
OF THE UNIVERSITY OF NORTH CAROLINA  
Box 7912  
North Carolina State University  
Raleigh, NC 27695-7912**

"Planning Models for Urban Water Supply Expansion," (PB88-109-590/AS for set), 9/87, by MIT, avail. from NTIS, 5285 Port Royal Rd., Springfield, VA 22161, price \$53.50.

Three volumes: I - Planning for the Expansion of Regional Water Supply Systems, (PB88-109608)  
 II - Cost Allocation Policies for Regional Water Supply Systems, (PB88-109616)  
 III - The Regional Intertemporal Cost Allocation Problem: A Simplified Methodology  
 Based on Shapley Value, (PB88-109624)

Miscellaneous

"Hybrid Striped Bass Culture--Status and Perspective," (#87-03), 9/87, by R. Hodson, et al., UNC Sea Grant College Program, CB 8605, NCSU, Raleigh, NC 27695-8605. (08I Aquaculture)

"USGS Yearbook Fiscal Year 1986," (ISSN 0892-3442), 1987, by USGS, for sale by the Superintendent of Documents, USGPO, Washington, DC 20402. (USGS)

"Water Resources Research Program of the U.S. Geological Survey, Fiscal Year 1986, (Administrative Report)," 1987, by USDI, Geological Survey, Reston, VA 22092. (USGS)

"White Oak River Status Report," 12/87, by Div. of Water Resources, NRCD, PO Box 27687, Raleigh, NC 27611-7687. (Neuse/White Oak)

"Low-Level Radioactive Waste Management in the Southeast," 4/86, avail. from Southeast Compact Commission, 3901 Barrett Dr., Suite 100-B, Raleigh, NC 27609. (05B)

"Alternatives to Shallow Land Burial for the Management of Low-Level Radioactive Waste," 4/86, by W.J. Lee, by Governor's Waste Management Board, 325 N. Salisbury St., Raleigh, NC 27611. (05B)

"A Citizen's Guide to North Carolina's Process for Licensing Low-Level Radioactive Waste Management Facilities," 4/86, by Governor's Waste Mgt. Bd., 325 N. Salisbury St., Raleigh, NC 27611. (05B)

**NOTE: Twenty-six hundred copies of this newsletter were printed at a cost of \$971.25 or 37 cents a copy.**

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