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EDITORIAL

Toxic Pollutants--A Crossroads in Water Pollution Control

by

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Professor Emeritus

The rapid growth of the chemical industry since World War II and our increasing awareness of the potential adverse effects of toxic substances on human health and the environment is forcing a reevaluation of water pollution control policy and programs at both federal and state levels to give increased attention to the management of toxic wastewater discharges.

The 1972 and 1977 amendments to the Federal Water Pollution Control Act set the stage for the present effort to deal with toxic wastewater discharges to surface waters through changes in water quality standards, effluent limitations, construction grants regulations, and NPDES permits. But progress has been excruciatingly slow. First, EPA took no action after the 1972 Act until forced to do so by the Natural Resources Defense Council litigation and settlement agreement of 1976. Some reasons for this are understandable. The list of potential toxic chemicals--synthetic organic chemicals--is long and growing longer. Solid scientific data relating concentration of such chemicals to human and animal health is difficult to obtain. Second, decades of institutional preoccupation with relatively simple conventional pollutants and effects makes it difficult for professionals and regulatory agencies to adjust to new demands posed by synthetic organic chemicals that cannot be neatly categorized in terms of such parameters as BOD, COD, SS, and so on.

The present generation of NPDES State/Federal wastewater discharge permits, ambient water quality standards, and drinking water standards does not adequately address synthetic organic chemicals. So it is at least begging the question to assert that compliance with such standards is sufficient to assure safe use of water for all of its intended purposes, particularly for sources of public water supply.

Lacking numerical standards for all but a few of these substances, reliance is increasingly being placed on bioassay techniques to assess general toxicity of effluents and receiving waters. Bioassay is an excellent integrating tool that has been used effectively in North Carolina. Despite its many advantages, however, we must recognize that it does not address latent health effects arising from long-term consumption of water containing carcinogens and other delayed-response synthetic organic chemicals. Research on causal relationships between exposure dosage and health effects has not moved ahead as it should have, and we can expect the needed regulatory data to emerge piece-by-piece for many years to come--if not indefinitely. In the absence of definitive quantitative data, we must move ahead with the best information available.

We cannot cope with the problem of toxic wastewaters responsibly, in my opinion, in the absence of full disclosure by industrial waste dischargers on the composition of their wastes. Proprietary rights can be protected right along with public health and safety. Only with such information can proper permits be written, meaningful monitoring systems developed, and adequate water quality and drinking water protection programs maintained.

New EPA water quality regulations adopted late last year encourage and support steps of this type. States are now asked to review water quality data and information on discharges to identify specific water bodies where toxic pollutants may be adversely affecting water quality, or the attainment of the designated water use, or where the levels of toxic pollutants are at a level to warrant concern. They must adopt criteria for such toxic pollutants applicable to the water body sufficient to protect designated uses.

What I am suggesting is that we are facing a regulatory future with respect to water quality management that will be more complex and more subject to periodic updating and change than in the past. There will be special burdens on regulatory agencies and the private sector to be more introspective and sensitive to the need for continuing reevaluation and updating of policies and programs to assure that they are fully responsive to the changing demands of today and tomorrow.

A final word relative to the North Carolina program for the control of pollution from toxic wastes. The Division of Environmental Management recognizes the problem and the challenge it faces. Its bioassay program is viewed nationally as a model for other states. Ambient water quality standards are being updated to better account for toxic pollutants. A Statewide Toxics Program to direct additional resources toward the evaluation and elimination of toxic wastewaters has been proposed, and the initial phase was funded by the General Assembly during the 1984 short session. *But this is just a start!* A full accounting of toxic pollutants and their control will take a sustained effort over the years to come. It deserves strong public support.

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MORE ATTENTION FOCUSED ON AQUATIC WEEDS IN NORTH CAROLINA

North Carolina has a host of aquatic weed problems that threaten large reservoirs, small impoundments, rivers, and drainage canals. A recent survey of county governments in the state done by the Office of Water Resources found over 20 counties with significant aquatic weed problems. Aquatic weeds of concern included Brazilian elodea, hydrilla, water primrose, naiad, and alligator weed.

Two aquatic plants, hydrilla and alligator weed, are causing especially severe problems in North Carolina water bodies and represent an even greater threat for the future. Efforts are underway on several fronts to control these problem weeds. The state Aquatic Weeds Council has endorsed special control efforts using approved herbicides for hydrilla and alligator weed at several locations. With funding support from the U. S. Army Corps of Engineers and the Office of Water Resources, scientists at N. C. State University began a program of herbicide treatment for control of the aquatic weed hydrilla at Reedy Creek Lake in William B. Umstead Park. Other lakes infested with hydrilla in the Wake County area will receive attention, including Lake Bond near Cary. Dr. Ken Langeland in the Crop Science Department at N. C. State University, with support from the Water Resources Research Institute, is evaluating the effectiveness of various chemical control procedures for hydrilla and alligator weed in North Carolina.

Several approaches for biological control of aquatic weeds are under study. Christine A. Nolepa with the N. C. Department of Agriculture is conducting studies on the use of insects for control of alligator weed. In this study two insects, the alligator weed flea beetle and the stemborer, are evaluated at sites in eastern North Carolina to determine their potential for control of alligator weed. These insects feed upon the plants and show some potential for biological control. One of the problems associated with these insects is that they do not overwinter in this state.

In another biological control study, Dr. Ron Hodson at N. C. State University is conducting research on the use of sterile grass carp for control of hydrilla. In this research, changes in weed infestations and fish populations after introduction of sterile grass carp will be evaluated. The study will also seek to develop the technology to produce sterile triploid grass carp. This Water Resources Research Institute project is being supported by the City of Raleigh.

LEGISLATURE PROVIDES RESOURCES FOR KEY WATER RELATED PROGRAMS IN NRCD

Four new or expanded water-related programs in the North Carolina Department of Natural Resources and Community Development received support from the 1984 General Assembly. Additional funds were provided for nutrient-sensitive watersheds; a statewide toxic program; pollution prevention pays (PPP); and coastal water management. In addition, the General Assembly put $2,889,000 in the budget to provide the State cost-share portion for seven civil works and six watershed projects.

Briefly, the four major new thrusts include:

- Nutrient Sensitive Watersheds - This new program is directed to correcting the complex problem of increased eutrophication of the state's waters. Specifically, the program provides funds to encourage the use of best management practices to reduce erosion and the movement of nutrients in runoff water in three major watersheds: the Jordan and Falls of Neuse Reservoirs and the Chowan River.

- Statewide Toxic Program - Additional resources will be provided to the Division of Environmental Management (DEM) to strengthen its efforts toward evaluation and elimination of toxic wastewater in North Carolina. The detection of biocides by DEM's mobile laboratory with biological monitoring is an example of the success of this program.

- Pollution Prevention Pays (PPP) - Funds were provided to expand NRCD's recently initiated program by working with industries, small businesses, and municipalities to promote reduction, prevention, recycling, and elimination of waste materials before they become pollutants. (See related story on WNC industries receiving PPP awards.)

- Coastal Water Management - Support is provided for a new program designed to fulfill specific recommendations of the Governor's Coastal Water Management Task Force. A primary concern of that task force was to address the conflict between the interest of agriculture and forestry in clearing and draining more land and fisheries and wildlife in trying to maintain productive saline nursery areas and wildlife habitat in the Albemarle-Pamlico peninsula and surrounding area. These concerns will be addressed with the inventory and classification of water resources, demonstration projects, economic incentives, and research.

PHOSPHATE BAN BILL FAILS TO PASS

A bill to ban the sale of phosphate detergents in North Carolina was laid to rest for this year after the state legislature adjourned without passing it. The bill is expected to be presented again in 1985.

The controversial bill, part of an effort to reduce the amount of nutrients entering the state's waterways, would have prohibited the sale of laundry detergents containing more than .05 percent by weight of phosphorus. North Carolina would have become the seventh state, and the first in the Southeast, to enact such a ban.

Supporters of the ban, including state government water officials and environmentalists, were optimistic when the bill was passed by a vote of 70-27 in the House of Representatives. In the Senate, however, the bill faced strong opposition; and after a number of delays, it came to rest in a Senate Special Ways and Means Committee, where it remained until the legislative session adjourned. Strong lobbying by the bill's opponents--headed by representatives of the N. C. Soap and Detergent Association and phosphate producers--was credited with the bill's demise. They argued that consumers forced to use nonphosphate detergents would face higher costs in terms of hot water, laundry additives, damaged clothes and washing machines. Opponents also claimed that the ban would result in a relatively small reduction in phosphorus inputs to rivers and lakes. In addition, they argued that the state would lose sales tax from "bootlegging" of phosphate detergents--consumers buying the banned products in neighboring states.

Supporters of the ban have presented it as a cost-effective first step in reducing nutrient inputs to waterways, one that would be of minimal inconvenience and cost to consumers. The ban would be especially economical compared with another method of nutrient reduction, phosphorus removal at the municipal wastewater treatment plant, supporters said. Costs for expensive phosphorus removal equipment would be passed along to the taxpayer.

NUTRIENT-SENSITIVE WATERSHED CLASSIFICATION FOR NEUSE CONSIDERED

The state Division of Environmental Management is studying the possibility of designating the Neuse River as "nutrient sensitive waters" (NSW). Lower reaches of the Neuse have been experiencing serious problems with blue-green algae growth.

Falls Lake, which was formed by damming the upper Neuse River, has already been classified nutrient sensitive, as have Jordan Lake and the Chowan River. The N. C. Environmental Management Commission applied the NSW classification to those bodies of water, giving the state authority to regulate nutrient inputs.

The Chowan was the first river in the state to display massive blooms of blue-green algae, a sign of nutrient overenrichment. The river was designated NSW in 1979 in an effort to stem the input of nitrogen and phosphorus from municipal and industrial wastewater. Concern over possible severe algae blooms on the newly built Falls and Jordan Lakes led to their being labeled NSW in 1983.

The matter of a possible NSW designation for the Neuse will be decided by the Environmental Management Commission after the Commission has heard recommendations from DEM.

WATER QUALITY AND SEDIMENTATION RECEIVE MORE ATTENTION IN WESTERN NORTH CAROLINA

Erosion and sedimentation is a major water quality problem in North Carolina and even more of a problem in western North Carolina because of the region's steep slopes and rapid rate of development. A Western North Carolina Tomorrow water quality and sedimentation task force report lists the sources of accelerated erosion and sedimentation beyond normal levels:

1. Highway construction, which by far has the highest rate of erosion per acre
2. Housing and subdivision development, much of which is taking place on steep mountainsides
3. Mining activities, including orphan mine sites as well as gravel and sand mining
4. Industrial and commercial development, which is also increasing within the region
5. Agricultural activities, especially fields being used to grow row crops, very often next to one of the region's streams
6. Forestry activities, including logging road construction

A major issue facing the task force centered on actions needed to reduce erosion caused by poorly designed and developed mountain subdivisions. The report includes some 19 recommendations for action at the state level and 11 recommendations for action at the local and regional levels.

Key recommendations for state-level action included:

1. Amend current state sedimentation law to require prior plan approval for private projects. (This amendment was added by the 1984 General Assembly.)
2. Provide necessary resources to the DNRCD to conduct a prompt plan approval process for private projects under this new amendment.

3. Require performance bonding or other forms of security to ensure compliance with erosion control requirements for large developments (5-10 acres of disturbed land or larger).

4. Remove loophole in existing sedimentation law which exempts logging roads from being constructed to meet erosion control standards. Logging roads often create sediment damage, and many subdivisions begin as logging roads. The State Forestry Division should administer a program to reduce sediment from private logging operations.

5. Request Department of Transportation to develop a model standard for building state-qualified roads on mountain terrain which meets sedimentation standards.

Major recommendations for citizens and local government actions were:

1. All counties should have subdivision regulations that set standards for private roads and have predevelopment review requirements.

2. A county should notify a land developer of state law requirements concerning his responsibilities to control erosion when he applies for a local building or development permit.

3. Counties and cities should strongly consider a cross-compliance, or "leveraging," approach in which developers are forced to prove that they have submitted to and have obtained approval from the State Land Quality Section of erosion control plans before granting local building permits, sewer taps, electrical connections, water taps, etc.

For details on this report contact Susan M. Smith, Natural Resources Coordinator, Western North Carolina Tomorrow, Box 222, Cullowhee, NC 28723, Telephone (704) 227-7492.

WNC INDUSTRIES RECEIVE AWARDS FOR POLLUTION PREVENTION PAYS

The Western North Carolina Tomorrow organization, with a 60-member regional leadership council operating in the 17 western counties of the state, has recognized three industries for their emphasis on pollution prevention instead of pollution control. Industries receiving the Pollution Prevention Award were E. I. du Pont de Nemours & Co., Inc., of Brevard; Emerson Electric Co., Special Products Division, of Murphy; and Hampshire Hosiery (Ellen Knitting Mills) of Spruce Pine.

David Huskins, a member of WNCT's natural resources committee, said, "This award program is designed to recognize business and industrial organizations whose very method of management and operation exemplifies the compatibility of sound economic and environmental management."

Huskins said WNCT felt it was important to recognize those businesses and industries in the 17 westernmost counties that are protecting the environment and running successful companies through efficient use of their raw materials and resources.

"The Award of Excellence program, in addition to honoring specific companies who have incorporated effective resource use," he said, "is designed to increase public awareness of the pollution prevention pays concept."

All of the industries recognized have planned, completed, and are in the process of:

- Evaluating the raw materials and products they use to find those materials which will be the most economical and cause the lease environmental problems;

- Changing equipment or industrial processes to use resources such as water and energy more effectively; and

- Working through the management of their company to encourage new ideas concerning product improvement and pollution prevention.

ACID PRECIPITATION AND DRINKING WATER QUALITY IN EASTERN U. S. STUDIED

North Carolina was one of the states included in a 1981-83 study by the New England Water Works Association to learn about the quality of drinking water in states receiving acid precipitation. Acid rain may dissolve harmful elements from soils and, indirectly, from water supply distribution systems.

In this study, which was conducted under the sponsorship of EPA, samples of raw and finished water were collected and analyzed from more than 270 surface water and groundwater supplies in the New England states, New York, New Jersey, Pennsylvania, West Virginia, Virginia, and North Carolina. Historical records dating back to 1886 were also used to search for water quality changes over time.

The quality of water sampled and analyzed was compared with that specified by EPA's National Interim Primary Drinking Water Regulations. The regulations have maximum contaminant levels (MCLs) for health-related substances including lead, cadmium, and mercury. Secondary maximum contaminant levels (SCMLs) exist for pH, copper, zinc, and other substances.

The study showed that although solution products of acid rain do not exceed EPA primary Drinking Water Regulations, in the water supply sources studied, many tests for aluminum showed levels that could be of concern to patients using kidney dialysis. (EPA has no MCL or SMCL for aluminum.) Because of the low alkalinity and pH observed at numerous water sources, it is possible that future acid deposition could have a detrimental effect on water quality. Quantification remains a problem, however.

Authors of the study report, Acid Precipitation and Drinking Water Quality in the Eastern United States, are Floyd Taylor and Judith A. Taylor of the New England Water Works Association; George E. Symons and John J. Collins, retired consultants; and Michael Schock of the Illinois State Water Survey. Copies of the report are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Telephone (703) 487-4650. Cost $17.50, subject to change.

REPORTS DESCRIBE AGRICULTURAL NONPOINT STUDIES

Agricultural Nonpoint Source Control: Case Studies in North Carolina is the title of a series of four reports from the N. C. State University Department of Biological and Agricultural Engineering. The reports describe studies done as part of the large-scale, multi-agency effort that constituted the agricultural portion of the state's nonpoint source control program.

States were required under Public Law 92-500, Section 208, to identify, and formulate control plans for, nonpoint sources of pollution. Responsibility for the agricultural component of the North Carolina effort was assigned to the N. C. Soil and Water Conservation Commission. They in turn coordinated a 208 Agricultural Task Force, composed of the N. C. Division of Soil and Water Conservation, the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, the N. C. Department of Agriculture, the N. C. Agricultural Extension Service and the N. C. Agricultural Research Service at NCSU, the N. C. Farm Bureau, and the N. C. Grange. The N. C. Forest Service served in a liaison capacity.

Report No. 1 is "Literature Review." The review focuses on sediment, nitrogen, and phosphorus the major agricultural pollutants of concern in the studies.

Report No. 2 is "Wayne-Lenoir and Union Counties Priority Watersheds." Six predominantly agricultural watersheds--three each in the Coastal Plain and Piedmont of North Carolina--were monitored in this study. They are located in agricultural "priority areas"; that is, areas chosen for detailed field monitoring because of their nonpoint pollution potential from fertilizers, animal waste, and cropland erosion. The major objective of this study was to quantify nonpoint source impacts on streams draining agricultural lands as well as determine relationships between watershed characteristics and stream monitoring. The study was also designed to provide additional water quality data for typical agricultural watersheds in the Piedmont and Coastal Plain of North Carolina.

Results of this study, according to the report, add to the increasing evidence that specific watershed yield factors depend upon complex interrelationships between land use or agricultural activities and management practices in addition to considerations such as topography, soil type, drainage, and stream channel conditions. Also, a good correlation was recorded between total phosphorus and total suspended solids.

Report No. 3 is "Chowan River Priority Watershed." A three-year study was conducted in the Chowan River Basin to measure water quality changes resulting from implementation of best management practices. Also, surveys were conducted to assess agricultural practices and farmer attitudes associated with the development and evaluation of an agricultural nonpoint source control program, and a supportive publicity, educational, and technical assistance program was conducted. Details of this project are also given in Report No. 211 from the Water Resources Research Institute, which contributed to the support of the project.

Report No. 4 is "Wake County Demonstration Farm." Two private farms were selected for this study done to characterize and quantify the effectiveness of a BMP system in reducing agricultural nonpoint pollution in the North Carolina Piedmont. At one farm (the experimental site), an integrated system of BMPs was implemented, including no-till/conservation tillage, terraces, waterways, farm ponds, irrigation, land application of water, and fertilizer and pest management. The other farm (control site) used no on-ground BMPs. Runoff during storm events was monitored. Results show significant differences in pollutant loads from the two sites. For instance, during the 18-month study period, 16.3 tons per acre of total suspended sediment was lost from the control site, while 0.141 tons per acre was lost from the experimental site. Also, an estimated 14.2 and 4.9 lbs of total phosphorus was lost from the control and experimental sites, respectively.

Copies of these reports are available from Dr. Frank Humenik, Dept. of Biological and Agricultural Engineering, N. C. State University.

INSTITUTIONAL SUPPORT SHOWN IMPORTANT IN BMP ADOPTION BY FARMERS

A study by researchers at Iowa State University has found a "strong and consistent relationship" between adoption of agricultural best management practices (BMPs) by farmers and institutional support such as cost sharing and technical assistance. BMPs, which include such things as reduced tillage systems, grass waterways, and soil testing, are a way of reducing agricultural nonpoint pollution and soil erosion.

The EPA-sponsored study examined the social and institutional factors that influence the adoption and maintenance of BMPs by farmers and landowners. BMPs are generally tried-and-true techniques familiar to farmers. Yet, there has been only marginal success in their implementation. So the issue has become how to get farmers to use them. This study, which involved interviews and surveys of farm operators, was set in three agricultural watersheds in east-central Iowa. It focused on the decision-making stage of the BMP adoption process--the effect of personal and socioeconomic characteristics of the farmer, farm enterprise characteristics, land ecological characteristics, and institutional factors.

Results of the study indicate that personal and socioeconomic characteristics of the farmer are relatively unimportant in explaining BMP adoption. Farm-firm characteristics and land ecological factors are both more important.

Most important, the study showed, is institutional support. While cost sharing is important, other institutional factors such as educational programs and technical assistance may be equally important. Therefore, a policy to increase these efforts may be cost effective. Results also indicated that the majority of farmers do not think there is too much government involvement in the areas of soil erosion and water quality.

The research showed that having a Soil Conservation Service conservation plan increases the use of BMPs. Also, past use of credit was positively related to BMP use. This makes the availability of credit a potentially effective policy alternative, the study concluded; i.e., directing incentive payments such as cost sharing. The development of a credit system with reasonable interest rates and an allocation system based to some degree on financial need could greatly increase the use of BMPs.

Researchers for this project were P. J. Nowak, P. F. Korsching, D. J. Wagener, and T. J. Hoban of Iowa State University, Ames, Iowa 50011.

The complete study report, Sociological Factors in the Adoption of Agricultural Best Management Practices, is available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. Telephone (703) 487-4650. Order No. PB 84-17036. Cost is $14.50, subject to change.

FLORIDA STRENGTHENS DRINKING WATER STANDARDS

The Florida State Environmental Regulation Commission now requires the nation's most stringent testing program for toxins in drinking water. The new rules establish maximum contaminant levels for the eight volatile organic compounds (VOCs) as well as sampling and analysis procedures for these and 119 synthetic organic contaminants.

Contaminant	Level, Micrograms Per Liter
Trichloroethylene	3
Tetrachloroethylene	3
Carbon Tetrachloride	3
Vinyl Chloride	1
1,1,1-Trichloroethane	200
1,2-Dichloroethane	3
Benzene	1
Ethylene Dibromide	0.02

The new rules were adopted in April by the Florida State Environmental Regulation Commission and are to take effect June 1, 1985, for systems serving more than 1,000 persons and January 1, 1987, for systems serving fewer than 1,000 persons. Testing for contaminants is to be performed at three-year intervals. The sampling is to be performed on finished water leaving the water treatment plant, except for ethylene dibromide (EDB), which is to be sampled before chlorination. The new requirements will not affect private drinking water wells in the state.

Florida has been even more concerned with its water quality following a 1981 Environmental Protection Agency study of the state's drinking water, conducted as part of EPA's National Organic Groundwater Survey. Of the 75 public drinking water supplies sampled in that state, 25 percent were found with concentrations of VOCs.

TOXICS OF MOUNTING CONCERN IN A-II WATERS

When it classified certain waters of the Jordan Reservoir A-II last year, for use as sources of raw water supply, the Environmental Management Commission recognized the lack of definitive data on potential pollution from toxic chemicals. Neither Drinking Water, Ambient Water Quality Standards, nor NPDES Discharge Permits deal very effectively with these substances.

Since reservoir waters must be allocated by the Commission before withdrawal, the Commission had a fall-back position for requiring a subsequent review of the toxics question before the Jordan can be used as a raw drinking water source. This opportunity does not pertain to normal reclassification requests where allocation is not required.

So the Commission had to seek another course of action when it acted on a recent request of the Asheville/Buncombe Water Authority to reclassify the French Broad River to Class A-II from Class C so that it could be used as a source of raw water supply to supplement its existing high-quality sources. Under existing regulations the Commission had no recourse but to approve the reclassification request, but it underscored its concern by also asking the staff to request full disclosure by the principal industrial dischargers (including industrial dischargers to municipal facilities) as to all toxic chemicals in their wastewater and toxic chemicals which are handled and could possibly enter wastewater or stormwater.

Staff was asked to work with the dischargers to develop plans for protecting Asheville's future water supply from toxics and report back to the Commission in six months with recommendations as to needed further actions. The work plan includes the following:

1. Notify dischargers of the reclassification and request full disclosure of toxic chemicals which could potentially reach receiving waters.

2. Require dischargers to contact chemical suppliers on toxic chemicals present in products used.

3. Expand dischargers' monitoring requirements as appropriate based on industrial category and disclosure information. (May require initial detailed analysis for metals and synthetic organic chemicals.)

4. Require discharger to develop spill and treatment-failure control program.

5. DEM staff work with dischargers to synthesize above-collected information into an individual water supply protection plan.

6. Contact municipal and county officials to provide guidance on future industrial development.

In the meantime, the EMC Water Supply Committee will be examining alternative classifications for A-II waters to better cope with the emerging toxics problem.

GROUND WATER REGULATIONS ADOPTED

On June 14, the Environmental Management Commission approved amendments to two sets of ground water regulations. One involved "Classifications and Standards Applicable to the Underground Waters of the State of North Carolina" and the other "Criteria and Standards Applicable to Water Supply and Certain Other Type Wells."

In presenting the Hearing Officer's Report on the classification and standards amendments, Commission Member David H. Howells emphasized the lack of precedent among other states and the need for continuing review and further amendments as experience develops. A number of issues addressed by speakers at the classification and standards hearing will be studied by the Commission's Ground Water Committee for possible further amendments in the future. Issues now on the agenda for the Committee's next meeting include:

1. Perimeters of compliance, and policy relating to permit conditions applicable within the penalty perimeter;

2. Variance from the perimeter of compliance--arguments for and against allowing;

3. Antidegradation provision--how implemented and utility in protecting existing high-quality waters;

4. Protection of industrial/agricultural water supplies having a needed quality higher than GA (drinking water) standards;

5. Possible alternative chloride standard, others;

6. Exemption of certain dredge spoils disposal from the ground water standards.

REPORT DESCRIBES GROUND-WATER RESOURCES OF THE NATION

A new USGS report, prepared by Ralph C. Heath, former District Chief of the U. S. Geological Survey, describes the ground-water resources of the nation.

Ground water occurs in the rocks that form the earth's crust and thus is in the domain of geology. Because the geology of the country is complex, the occurrence of ground water, in detail, is extremely complex. This complexity makes it difficult for many people to develop an understanding of ground-water occurrence and availability and has resulted in problems of ground-water depletion and ground-water pollution whose correction will be both difficult and expensive. Fortunately, such problems are not yet widespread and can, with intelligent application of existing ground-water knowledge, be avoided in most other areas. However, to realize this goal, those engaged in water resources development and management and the general public need to become better informed on the nation's ground-water resources. The purpose of this report is to help meet this need.

The USGS report consists of sections that deal concisely with discrete parts of the overall subject. The sections are arranged in a sequence that begins with a discussion of the general aspects of geology and rocks and proceeds to a description of the ground-water systems in the 15 ground-water regions into which the United States, Puerto Rico, and the Virgin Islands are divided.

A section entitled "Ground Water Regions of the United States" also warrants special mention. It includes maps that show the boundaries of the regions and tables that summarize the physical and hydrologic characteristics of the regions.

The publication, titled Ground-Water Regions of the United States, is Geological Survey Water Supply Paper 2242. It is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

CORPS OF ENGINEERS INCORPORATES WATER QUALITY FEATURES IN ITS RECREATION FACILITIES AT NEW LAKES

The Wilmington District of the Corps of Engineers has given special attention to reducing runoff and protecting water quality at its existing and new recreation facilities at Jordan and Falls Lakes.

A recent outline sent by Colonel Wayne A. Hanson, District Engineer for the Corps of Engineers, to the North Carolina Department of Natural Resources and Community Development describes specific water quality features incorporated in recreational facilities at the new lakes.

Examples of the approaches used to protect water quality include:

- Since 1975, the Corps has incorporated erosion and sediment control features in all of its construction plans.

  The Corps entered into an agreement with the N. C. Sedimentation Control Commission in 1975 to develop, as an integral part of the site, plans for all construction projects and erosion and sediment control features.

- All Corps wastewater treatment systems upstream of both dams are nondischarging systems.

  The Corps adopted a zero discharge policy for point sources at all development at Falls and Jordan Lakes in 1978. In some cases, septic tanks with tile fields were used. In cases where soils are too impervious for tile fields to function properly, the Corps adopted low-pressure distribution or mound-type systems. For the larger sites, central treatment plants followed by spray irrigation were employed.

- Special emphasis has been given to restricting the amount of impervious cover to less than 6 percent, and with its new facilities, the first 1/2 inch of runoff from impervious surfaces is to be controlled.

- Clearing, grading, drainage, and paving were accomplished in a manner to minimize the potential water quality impacts of Corps development at Falls and Jordan lakes.

  For example, for roads, the Corps only cleared the minimum necessary for construction as opposed to highway work where clearing is often taken to the right-of-way limit. In large parking areas, islands are left in their natural state, if possible; and if not, they are landscaped. Tree removal in and around building sites is held to a minimum. Tree surveys are made at each site and designs are planned to preserve as many trees as possible.

- The Corps maintains 50-foot buffers along both sides of all perennial streams potentially affected by construction of its future facilities except where roads must cross the streams and will minimize the direct discharge of runoff through ditches, culverts, or along roads crossing the natural buffers.

- All new fuel storage tanks will be constructed and installed to at least the standards listed in the N. C. Department of Natural Resources and Community Development's Fuel Tank Review Committee Report, with the stipulation that the fuel tanks will be located above the 100-year flood elevation.

These and other details on existing and new recreation facilities were described by Chris Meshaw of the U. S. Army Corps of Engineers at a May 30 public meeting on recreational facilities and their relationship to water quality at Falls and Jordan Lakes.

ADDITIONAL RESEARCH SUPPORTED BY THE INSTITUTE

In the June issues of the NEWS, 10 new research projects were described. Two more new Institute-sponsored studies are described here.

Interactive Effects of Phosphorus and Sediment Pollution on Lake Productivity. Two of the most widespread water quality problems faced in North Carolina and other states in the Piedmont region are phosphorus loading and turbidity from suspended clays. Phosphorus loading and its role in eutrophication of lakes is perhaps the most well studied problem in applied limnology. An abundance of studies have shown phosphorus to be the limiting nutrient governing primary productivity in most unpolluted freshwater systems.

Chief among other problems is turbidity from suspended sediments. The most striking feature of streams, rivers, ponds, and reservoirs in this state is their muddy waters. Turbidity from suspended clays ranks with phosphorus as a top water quality problem.

When dealing with simultaneous phosphorus and clay loadings in lakes, a number of unknowns remain as to how most water quality parameters will behave.

This study, by Dr. Benjamin E. Cuker, Department of Biology, Shaw University, will be the first field test of suspended clay-phosphorus interactions on water quality. Information generated in this study will help water quality managers make cost-effective decisions when dealing with a combination of these two pollutants.

Joint support for this project comes from the Water Resources Research Institute, the City of Raleigh, and Shaw University.

Effects of Complex Effluents on Aquatic Organisms. Most instances of aquatic pollution are due to inputs of complex mixtures or effluents (e.g., from textile mills, municipal sewage treatment plants, agricultural runoff) rather than from single compounds. However, the great bulk of existing toxicological data has been generated from studies with pure compounds.

Pollution of aquatic environments, marine and freshwater, clearly can impact human health through the contamination of drinking water and foodstuffs, and via transfer of contaminants into the atmosphere. However, organisms inhabiting these environments generally receive a higher dose than affected human populations and are probably at greater risk for suffering impaired health.

This pilot study is aimed at examining the effects of complex effluents on a model aquatic organism, the bluegill (Lepomis macrochirus).

While the ultimate aim of the research is to examine oxidant/free radical-mediated effects of complex effluents, this preliminary study will be limited to examinations of three types of compounds suspected of generating toxic free radicals. These are chlorinated phenolics, mercaptans, and bipyridilium herbicides. This preliminary study will be conducted by Dr. Richard T. Di Giulio at the School of Forestry and Environmental Studies, Duke University.

NEW INSTITUTE REPORTS

A Study of Radium-226 and Radon-222 Concentrations in Ground Water Near a Phosphate Mining and Manufacturing

Facility by Barry F. Mitsch, James E. Watson, Jr., and James A. Hayes, Department of Environmental Sciences and Engineering, UNC-Chapel Hill.

Samples of water taken during a three-year study from wells located near a phosphate mining and manufacturing facility near Aurora, NC, were collected and analyzed for radium-226 and radon-222. Results indicated that mining and manufacturing were not having a detrimental effect on the radionuclide concentrations in the ground water of the area. Natural hydrogeologic factors can account for the differences in radioactivity observed in the various aquifers sampled. Wells sampled repetitively over time did not exhibit significant changes in radium or radon concentrations. Baseline data were established which can be used to evaluate possible future radionuclide concentrations in ground water resulting from expansion of mining activities.

This report is No. 216.

Benthic Nutrient Cycling in the Pamlico River by Edward J. Kuenzler, Daniel B. Albert, Gregory S. Allgood, Stephen E. Cabaniss, and Catherine G. Wanat, Department of Environmental Sciences and Engineering, UNC-Chapel Hill.

The Pamlico River is a large and important estuary in North Carolina. High levels of phytoplankton productivity have been attributed to abundant nutrient inputs, partly from the drainage basin and partly from the sediments. This study was conducted during the period April 1981 - July 1983 to assess the magnitude of chemical and biological transformations of nitrogen and phosphorus in the surface sediments and of the fluxes of these nutrients between the sediments and the overlying water.

Field and laboratory studies were made of the fluxes of ammonium, phosphate, and oxygen between water and sediments in relation to chemical transformations and the gradients present in the upper layers of sediment.

Results of this study lead to several recommendations. The pulses of ammonium and phosphate which arise when the bottom waters become anoxic in summer are fairly large relative to the needs of phytoplankton, providing perhaps 6-8 percent of the N and 20-30 percent of the phosphorus needed. The fluxes of ammonium are more important than those of phosphate because nitrogen is limiting in the summer. Phytoplankton consumption by zooplankton and other filter feeders in the estuary may also contribute to maintenance of low algal abundances in summer. It appears important, then, to avoid introduction of large additional loads of inorganic nitrogen from the watershed to the estuary in summer. The high levels of productivity in the winter have not been considered a problem. In view of the importance of the Pamlico River and the difficulty in making predictions of its future, it is recommended that consideration be given to initiation of a mathematical model of its organic productivity in relation to water quality. The first step would be to establish the goals of the model based on the needs of the state and to assemble a competent team with a commitment to reaching those specific goals. Additional research is also needed to improve the methods for measuring processes such as nitrification and denitrification which take place in a very thin layer at the sediment surface. Finally, a critical need for modeling nutrient cycling or organic productivity of this estuary is information on rates of water-column regeneration of nitrogen and phosphorus.

This report is No. 215. Copies of Institute reports are available free to residents of North Carolina and may be purchased by nonresidents for a fee of $8 by writing to the Institute.

POSITIONS AVAILABLE

Environmental Engineer II. B.S. in Civil Engineering required with a basic understanding of hydrology. Familiarity with computers and a knowledge of PL/1 would be helpful. For further information contact Mr. John D. Wray, Office of Water Resources, NC Dept. of Natural Resources and Community Development, P. O. Box 27687, Raleigh, NC 27611. Telephone: 919/733-4064.

Applications are invited for the position of Director of the Arizona Water Resources Research Center. The Center, located at the University of Arizona, is an interdisciplinary organization formed in response to the 1964 U. S. Water Resources Research Act. The program of the Center is devoted to assisting water-related research activities at the three state universities and to the dissemination of results of such research in the state. It also conducts research investigations within its organization, with special emphasis on the urban, industrial, and agricultural water-use issues of arid and semi-arid regions.

Send curriculum vitae and the names of three references to the Chairman of the Search Committee: Dr. Paul H. King, Department of Civil Engineering and Engineering Mechanics, University of Arizona, Tucson, Arizona 85721. Closing date is November 1, 1984.

WATER RESOURCES CONDITIONS IN NORTH CAROLINA

May. Streamflow for May was excessive (in the highest 25 percent of record) statewide. This is the third consecutive month that streamflow was above average at key reporting sites.

On May 28 and 29, runoff from heavy rainfall caused flooding in Stokes and Forsyth Counties. Stages at Little Yadkin River near Dalton (Stokes County) and Yadkin River near Enon (Forsyth County) reached 25- and 8-year flood levels, respectively. The National Weather Service reported rainfall in excess of 6 inches at King, NC, in a 24-hour period. One death and excessive property and agricultural damage resulted from the flood waters. Minor flooding occurred in residential areas on some small streams in Raleigh.

Monthly mean flows at selected stations as compared to long-term mean for May were: French Broad River at Asheville (mountains), 189 percent; South Yadkin River at Mocksville (Piedmont), 251 percent; and Contentnea Creek at Hookerton (Coastal Plain), 181 percent.

Ground-water levels in shallow water-table wells rose in the mountains and Piedmont province and declined in the Coastal Plain province. Levels continued to be about 6 feet above long-term averages in the mountains. Water levels were at record high at the Mocksville well (Davie County); this is the fourth consecutive month previous record high water levels have been exceeded at this well.

June. Streamflow decreased seasonally; month-end flows were near mean after several months of above mean flow. Monthly mean flows at selected index stations as compared to long-term means for June were: French Broad River at Asheville (mountains), 111 percent; South Yadkin River near Mocksville (Piedmont), 114 percent; and Contentnea Creek at Hookerton (Coastal Plain), 354 percent. The monthly mean flow of Contentnea Creek at Hookerton was the third highest for June since records began in 1928; however, month-end flow was near mean.

Ground water levels in water table wells declined in the mountains and Piedmont province and rose in the Coastal Plain province. Water levels were at record highs for the month of June at the Mocksville well (Davie County) and at the Blantyre well (Transylvania County) Levels were about 6 feet above average in the mountains, 2 to 4 feet above average in the Piedmont, and near average in the Coastal Plain.

. . . *U. S. Geological Survey*

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 Resources Planning

"Water Supply Study Hampton Roads, Virginia (Chowan River and Tributaries Virginia and North Carolina)," (Draft EIS and Feasibility Report), (84-5266), 5/84, Dept. of the Army, Norfolk Dist., Corps of Engrs., Ft. Norfork, 803 Front St., Norfolk, VA 23510. (EIS)

"Water Management on Claypan Soils in the Midwest," #186, 4/84, by S. K. Sipp, et al., WRC, Univ. of IL, Urbana, IL 61801. (02G)

Water Quality Management

"The Effects of Salinity on the Potential of a Blue-Green Algal (Microcystis aeruginosa) Bloom in the Neuse River Estuary, N. C." (Working Paper 84-1) 3/84, by H. W. Paerl, et al., Inst. of Marine Sciences, Univ. of NC, Morehead City, NC 28557, Price: $1.25. (02L)

"Groundwater Contamination in the United States," 1983, by V. I. Pye, et al., avail. from Univ. of Pennsylvania Press, Univ. of Pennsylvania, Philadelphia, PA 19104, Price: $14.95. (02F)

"Theory, Design, and Operation of Nutrient Removal Activated Sludge Processes," by the Univ. of Cape Town, City Council of Johannesburg and Nat. Inst. for Water Research of the CSIR, 1984, avail. from Water Research Commission, P. O. Box 824, Pretoria 0001, South Africa, ISBN 0908356 13 7. (05D)

The following volumes of "Agricultural Nonpoint Source Control Case Studies in North Carolina" are available from the Department of Biological and Agricultural Engineering Extension, Box 7625, NCSU, Raleigh, NC 27695, Telephone 919/737-2675: (05B)

I. Literature Review, 11/83, by J. M. Foreman
II. Wayne-Lenoir and Union Counties Priority Watersheds, 2/84, by F. J. Humenik, et al.
III. Chowan River Priority Watershed, 11/83, by F. J. Humenik, et al.
IV. Wake County Demonstration Farm, 5/84, by J. B. Atkins

"Australian Water Quality Criteria for Organic Compounds," (#82), 1984, by B. C. Nicholson, Dept. of Resources and Energy, Australian Water Resources Council, Canberra. (05G)

"1983 Annual Summary of Phytoplankton in B. Everett Jordan Reservoir," 3/84, (#84-02), by DEM, NRCD, PO Box 27687, Raleigh, NC 27611. (05C)

"Isotopic Studies of the Natural Sources of Radium in Groundwater in Illinois," (#187), 4/84, by R. H. Gilkeson, et al., avail. from WRC, Univ. of IL, Urbana, IL 61801. (02F)

"Final Report of the Nationwide Urban Runoff Program, Executive Summary," 12/30/83, Office of Water, USEPA, Washington, DC 20460. (05B Urban Runoff)

"The Ecological Impacts of Wastewater on Wetlands--An Annotated Bibliography," (EPA-905/3-2/84, avail. from USEPA, Region V, Water Div., 230 S. Dearborn St., Chicago, IL 60604. (EPA)

"The Relationship of Urban Runoff to Land Use and Groundwater Resources - Knoxville, Tennessee, Study," (TVA/ONRED/AWQ-84/1), 3/84, by J. D. Milligan, et al., TVA, Office of Natural Resources and Economic Dev., Div. of Air and Water Resources, Chattanooga, TN 37401. (05B Urban Runoff)

Water Quantity Management

"National Water Summary 1983 - Hydrologic Events and Issues," (USGS Water-Supply Paper 2250), avail. from Br. of Dist., Text Products Section, USGS, 604 S. Pickett St., Alexandria, VA 22304, Price: $9. (USGS)

"Ground-Water Regions of the United States," (Geological Survey Water-Supply Paper 2242) 1984, by R. C. Heath, for sale by Supt. of Doc., USGPO, Washington, DC 20402. (02F)

"Streamflow and Velocity as Determinants of Aquatic Insect Distribution and Benthic Community Structure in Illinois," (#183), 12/83, L. L. Osborne, et al., WRC, Univ. of IL, Urbana, IL 61801. (02HW)

"Flood Characteristics of Urban Watersheds in the United States," (USGS Water-Supply Paper 2207), 1984, prepared in Cooperation with US Dept. of Transportation Fed. Highway Adm., avail. from Dist. Br., Text Products Section, USGS, 604 S. Pickett St., Alexandria, VA 22304, Price: $3. (04A)

Miscellaneous

"Environmental Law Workshop, May 18-19, 1984, Raleigh, NC" cosponsored by UNC Sea Grant College Program, the NC Bar Foundation and the NC Institute of Government. For further information contact UNC Sea Grant College Program, Box 8605, Raleigh, NC 27695. (06E)

"Guide to Energy R&D Programs for Universities and Other Research Groups," 6/84, by US Dept. of Energy, Office of Energy Research, Washington, DC 20585, avail from US DPE-TIC, PO Box 62, Oak Ridge, TN 37830.

"Acute Sensitivity of Selected Australian Freshwater Animals to Copper and Zinc," (#81) 1983, by J. F. Skidmore, *et al.*, Dept. of Resources and Energy, Australian Resources Council, Canberra. (05C)

Note: Two thousand one hundred and twenty-five copies of this newsletter were printed at a cost of $693.90, or $0.33 per copy.

YOU are invited to:

WATER RESOURCES LUNCHEONS

September 6, 1984
and
November 2, 1984

The Water Resources Research Institute will begin a series of water resources luncheons this fall. These sessions will be held at approximately two-month intervals.

On September 6, the speaker is Joan Kovalic, Executive Director for the Interstate Conference on Water Problems (ICWP). Ms. Kovalic is one of the best qualified individuals to describe and predict changes taking place in federal roles in water resources.

On November 2, the luncheon speaker is Marian Mlay, Director of EPA's new Office of Ground Water Protection. Ms. Mlay will describe new programs and new emphasis in EPA's role to help protect ground water. She will give special attention to those issues which are important in our geographic part of the nation.

These luncheons will be held at the North Carolina State University Faculty Club. These meetings are designed to provide an opportunity for water resources leaders to interact and obtain the latest on new program initiatives in water resources.

- -

I would like to attend the Water Resources Luncheons on September 6 and November 2.

NAME ______________________________

ADDRESS ______________________________

TELEPHONE NO. ______________________________

Mail to: Water Resources Research Institute
225 Page Hall
Box 7912
N. C. State University
Raleigh, NC 27695-7912

ITEMS OF INTEREST:

AND MORE . . .

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