NEWS

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SAFE DRINKING WATER FUNDS MAY INCREASE

A one-year extension of the Safe Drinking Water Act cleared the Senate Environment Committee last month authorizing $63.7 million for fiscal 1983. Funds for all existing programs would be similar to that in 1982 but the legislation would add $8 million for identification of aquifers that are the sole source of a community's drinking water. The total authorization is approximately $16 million more than the Reagan administration requested and includes $29.4 million in state grants.

CONGRESS GETS PROPOSED CLEAN WATER ACT CHANGES FROM ADMINISTRATION

The Reagan administration has submitted to Congress proposed revisions to the Clean Water Act, including major changes in pretreatment requirements, increase penalties for violation of the Act, extends compliance deadlines and would exempt defense-related federal facilities from the Act's requirements.

EPA did not recommend to Congress any waivers from best available technology (BAT) effluent limitations. The administration decided not to push for a waiver to the regulations at this time because "the majority of BAT and best control technology (BCT) rules have yet to be promulgated and further experience with the problems that may arise from their implementation will determine whether and to what degree waivers are necessary," says EPA Administrator Anne M. Gorsuch.

Included in the Administration's proposed amendments is an extension of life of NPDES permits from the current five years to not more than 10 years. The bill also eases the requirements for controlling thermal discharges.

Another change would extend the Presidents'a authority to exempt military property from the Act's requirements, including "all government-owned facilities and properties which are essential to operational capabilities of the Armed Forces."

In related action the Senate voted for a fiscal 1982 supplemental appropriations bill that would put $2.4 billion into EPA's sewage treatment construction grants program under provisions of the Clean Water Act.

SYMPOSIUM FEATURES 3 P CONCEPT

A symposium held May 26-27 in Winston-Salem had as its theme the "3 P" concept: Pollution Prevention Pays.

Sponsored by the Governor's Waste Management Board, the symposium is the beginning of efforts to promote the concept in North Carolina.

The idea behind 3 P is that reducing or eliminating pollution at its source, rather than using end-of-pipe control technology, can be economically beneficial to industries as well as environmentally sound. Manufacturing procedures and equipment are designed with pollution prevention in mind, and wastes are recycled or reused.

Some 200 participants, primarily representatives of industry and government, heard speakers describe how low-or non-pollution technology can and does save industries millions of dollars annually.

Speakers included Dr. Joseph T. Ling of the Minnesota Mining and Manufacturing Company (3M) which first introduced the 3 P concept in 1975. 3M sought a means of complying with environmental regulations that would be less expensive than traditional waste treatment methods. The 3 P program evolved and since then has prevented the annual generation of 130,000 tons of air pollutants, and 13,500 tons of sludges. Annual energy savings are equivalent to 228,000 barrels of fuel oil.

Another speaker, Dr. Dan Meyer of the Dow-Corning Corporation, noted that the value of recycled by-products, including disposal-avoidance costs, at the company's Midland, Michigan plant alone exceeded $8 million in 1981.

A symposium proceedings, to be published by Pergamon Press, will be available later this summer.

For further information on the 3 P concept, contact Dr. Don Huisiugh, Office of the Governor, (919) 733-6500.

CONFERENCE LOOKS AT WATER MANAGEMENT CHALLENGES FOR THE 1980s

Governor James B. Hunt, Jr. was keynote speaker at the North Carolina Conference on Water Management for the 1980s, held May 25 in Raleigh.

In his remarks Hunt noted that "North Carolina's future depends on a safe and adequate supply of water. And a safe and adequate supply of water depends on constant cooperation between government and the private sector." He stressed the need for voter support of the five-year $300 million Clean Water Bond, which, he said, will be placed on the ballot when economic conditions are more favorable.

Hunt also reminded the more than 350 participants of their role in the conference: to take part in discussion and set forth ideas on the state's water management issues.

Following the morning's presentations, which covered a variety of topics within three broad categories--water supply, water quality, and river basin management--participants were invited to attend one of three concurrent discussion sessions, each of which addressed one of those categories.

Numerous ideas were expressed during these sessions, outlining what participants felt were major needs and areas of concern for North Carolina. A summary of the conference is being prepared by the NRCD Office of Water Resources. Comments and recommendations will be used by the state in refining North Carolina's water agenda for the 1980s.

Conference sponsors were the N. C. Department of Natural Resources and Community Development, the Water Resources Research Institute, the N. C. Water Resources Congress, the N. C. League of Municipalities, the N. C. Association of County Commissioners, and the N. C. Chapters of the American Waterworks Association and the Water Pollution Control Federation.

MONITORING OF MERCURY LEVELS CONTINUES IN HIGH ROCK LAKE

The N. C. Division of Environmental Management continues to monitor High Rock Lake and its tributaries after finding elevated levels of mercury in fish from the tributaries. Efforts by different state agencies are aimed at identifying and eliminating discharges of mercury to the system.

After a preliminary investigation, intensive monitoring was begun in August 1981 in High Rock Lake and its Leonards Creek and Abbotts Creek tributaries to evaluate mercury levels in the water column, in fish tissue, and in the sediments after elevated levels of the metal were reported. Through this approach the sources of mercury and its fate can be determined and the recovery of stream stretches evaluated.

An important part of the monitoring is the collection of fish samples throughout the system. Results show elevated levels of mercury in numerous fish in Leonards and Abbotts Creeks but in few fish in High Rock Lake itself.

Monitoring is to continue as long as elevated levels of mercury are found in the system.

A research project recently approved for funding by the Water Resources Research Institute will examine the relative importance of natural weathering as a source of mercury in streams.

Dr. M. M. Kimberly and Dr. H. S. Brown of the Department of Marine, Earth, and Atmospheric Science at N. C. State University will test the hypothesis that sulfide ore deposits in the Rocky River drainage basin are contributing detectable mercury to streams. They will also test the hypothesis that minnows are good indicators of local mercury abundances.

DISCUSSIONS CONTINUE ON OIL SPILL CLEAN-UP

No decision has been reached on final clean-up action in the aftermath of a May 5 oil spill on the Cape Fear River. The oil has stabilized on marsh plants along the river bank, and officials are attempting to determine what clean-up measures, if any, could be performed without further damaging the environment.

The U. S. Coast Guard, which is leading clean-up operations, has not issued a final spill report. But estimates indicate that about 190,000 gallons of No. 6 fuel oil, leaked from one or more of six ships in the river, reached from above downtown Wilmington to about 10 miles downstream. Tide cycles carried most of the oil to a narrow band along the west bank of the river where it adhered to marsh plants.

Early efforts focused on identifying critical tidal areas and containing the spill to protect them.

No fish kills and very few oiled birds have been reported. Two weeks after the spill considerable new growth was noted on the oiled plants along the river bank, with no oil in the substrate. On Eagle Island, between the Cape Fear and Brunswick Rivers across from the terminal where the spill occurred, plants were heavily coated, with some oil in the substrate. The N. C. Department of Natural Resources and Community Development has a proposal to the Coast Guard to test different clean-up procedures on the Island.

Providing technical assistance to the Coast Guard are the NRCD Office of Coastal Management, the Enforcement and Emergency Response Branch of the Division of Environmental Management, the Division of Marine Fisheries, the U. S. Fish and Wildlife Service, and N. C. Wildlife Resources.

AQUATIC WEED CONTROL IN NEW HAMPSHIRE LEGISLATION

The State of New Hampshire adopted legislation designed to prevent the further introduction and dispersal of exotic aquatic weed species and to manage existing infestations. This legislation was in response to the spread of water weeds and the potential damage to water usage for boat navigation and swimming.

Under the legislation, responsibility for aquatic weed control resides with the water supply and pollution control commission. The Commission is authorized to:

- display and distribute promotional material and engage in educational efforts informing boaters of the problems with exotic aquatic weeds
- eradicate small new infestations of exotic aquatic weeds
- make matching grants to lakefront associations, private businesses, citizens and local governmental agencies for the management of exotic aquatic weeds where eradication is deemed impossible.

Funding for these legislative provisions comes from an additional fee of $.50 for private boat registrations.

A copy of the legislation is available from the Water Resources Research Institute, North Carolina State University, 124 Riddick Building, Raleigh, North Carolina 27650-5999, telephone: 919/737-2815.

RESEARCH USES FABRIDAM FOR WATER MANAGEMENT

A new dam which adjusts itself to control water level during different seasons was unveiled May 12 by the North Carolina Soil and Water Conservation Commission during an agricultural field tour in Edgecombe County. The dam, called a fabridam, is like a large water-filled innertube hooked into a cement base. Unlike the spillway system of a traditional dam, it adjusts automatically to fluctuations in the water level, thus maintaining a constant water level both in the impounded water upstream and in the water table within the watershed.

The first of its kind in the Southeast, the fabridam is designed to maintain adequate moisture for agricultural crops upstream during the growing season while increasing drainage and providing flood protection during the winter months. The fabridam is the result of a cooperative effort between the USDA Agricultural Research Service, N. C. Agricultural Research Service, N. C. Soil and Water Conservation Commission, USDA Soil Conservation Service, Edgecombe County Drainage District, and 15 cooperating farmers and landowners in the Conetoe Creek Watershed.

The dam is an energy efficient method of irrigating crops which will allow for experimental monitoring. During severe flood conditions, it will deflate completely, insuring against flood damage to crops. Weeds and debris which would normally clog a spillway will flow over the fabridam. In addition to a higher water table during dry periods, the research team is expecting further benefits from the fabridam. The water control feature in the channel system will improve fish and wildlife habitat in the project area, plus reduce the potential for pollutants, nutrients, insecticides and sediments offsite.

Researchers feel that there are 10 million acres of land in the Atlantic Coastal Plains and 40-50 million acres elsewhere that are suitable for this type of dam. The Soil Conservation Service will use the results of this research for future PL-566 flood prevention and agricultural water management projects and for modifying existing projects where flood prevention and drainage are the primary purpose. The gross benefits to farmers are expected to exceed $3 billion annually with additional benefits to non-farm agricultural businesses.

. . . *Tuesday Letter NACD*

DOES YOUR HOME WATER PURIFIER REALLY WORK?

Logan City used to maintain a sign at Dewitt Spring in Logan Canyon--the source of Logan City's drinking water--which said the water was "99.48% pure." Today, citizens in Logan, and all across America, are asking the question, "is any water pure enough to drink?" A new consciousness of water quality has flooded the nation, and people worry about the long term health hazards of drinking water that isn't absolutely pure. This "mania," if such it is, has created a market for home water purifiers with sales exceeding a million units a year.

The question to be asked now is, "do these units really work?" Manufacturers make convincing claims about their products, but these claims are rarely documented.

Alberta Seierstad, research chemist with the Utah Water Research Laboratory, has a new project to test home purifiers, and she has promised to make the facts available in an extension service publication as soon as all the tests are complete. "Most units," Bert says, "operate by filtration or adsorption; many utilize activated carbon, but the media may consist of silver impregnated carbon, submicron filters, reverse osmosis membranes, ion exchange resins, magnetic devices, or some combination of the above."

Seierstad says different kinds of units will be tested for their ability to remove bacteria, organics (total organic carbons, trihalomethanes), metals, anions, and cations. Since the devices are often installed to reduce or remove offensive odors, tastes, and particulates, these things will also be evaluated.

. . .*Aquarius Utah State University*

YADKIN-PEE DEE COMMITTEE SPONSORS CANOE TRIP, SETS OTHER GOALS

The Yadkin-Pee Dee River Committee recently sponsored a 400-mile canoe trip down the main stem of the river from W. Kerr Scott Reservoir to Georgetown, South Carolina.

The trip was intended to inform people in the basin of the river's condition and its importance. It is one means the Committee is using to generate interest in the river and follow up on efforts begun during the three-year Yadkin-Pee Dee River Basin Planning Study.

Rep. Robie Nash, in a talk on river basins at the May 25 N. C. Conference on Water Management, described the trip as well as the goals of the Committee.

The Yadkin-Pee Dee River Committee, a volunteer citizens group, held its first annual meeting in August 1981. Since then, said Nash, it has been "refining its organization and looking at ways the Committee can work with the state on tackling and solving problems. We want to look ahead and use the information and recommendations of the Yadkin-Pee Dee Study as a starting point."

Nash continued, "As we complete the organization and get it working, there will be many opportunities to encourage water conservation, soil conservation projects, flood control projects, reforestation, and other measures that could lead to the orderly development of the basin."

NEW RESEARCH PROJECTS BEGIN

University funds will help the Water Resources Research Institute to initiate and extend a number of research projects in water management and water quality. The following one-year projects will begin July 1, 1982:

Abatement of Heavy Metals in Industrial Effluents by a Catalyzed, Electrochemical Removal Scheme. Heavy metals, which are toxic and can accumulate in the environment, are found in significant amounts in effluent from many industries, particularly electroplating operations. The number of electroplating plants is expected to increase in North Carolina along with the growth of the microelectronics industry, since plating is an integral part of circuit board preparation.

Various technologies are currently used to remove the metal cations and the associated anions (typically cyanide) from the effluent. Most commonly used for metal removal is a precipitation reaction, a complex operation not always totally effective, which results in a solid sludge that in turn must be dealt with.

This research project will test the efficiency of a simple, one-step treatment technology: the use of an electrochemical removal scheme to remove both metals and cyanide in a single operation. Drawbacks to the use of this technology have included the slow rate of many electrochemical reactions. In this study a simple catalyst, submonolayer metallic lead, will be used to enhance these reactions. This catalyst, applied to a porous, flow-by carbon electrode, would be used in the simultaneous removal of the heavy metal cations and the oxidation of the cyanide ions. No solid sludge is generated in this process, but rather a solid, metallic product is formed, which conceivably can be recovered for its economic value.

Principal Investigator: Dr. Peter S. Fedkiw, Department of Chemical Engineering, N. C. State University.

Hydrology of Forested Wetlands in Eastern North Carolina. Use of North Carolina's coastal wetlands has become one of this State's most controversial land-management issues.

Of major concern is the impact of wetland changes on the biological productivity of adjacent estuaries. Slugs of freshwater drainage from altered wetlands can have a detrimental effect on juvenile stages of finfish and shellfish by changing salinity levels in the estuaries.

Significant progress has been made in understanding the hydrology, or water flow, of agricultural drainage systems in eastern North Carolina. A general drainage model has been developed. This research will fill in gaps in our knowledge of wetlands drainage by providing information on the hydrology of forested palustrine wetlands, both in the natural and drainage conditions. Palustrine (as opposed to estuarine) wetlands include bogs and fens. The study will also provide information for the forestry segment of an overall drainage model.

This Institute-sponsored work is the first part of a long-term project envisioned by the investigator to study the hydrology of drained and undrained forested wetlands. The objective of the current work is to measure hydrologic characteristics of drained, intensively managed pine plantations for use in the hydrologic modeling of drainage systems.

Hydrologic conditions in managed pine stands vary widely during a rotation because of changes in vegetative cover and drainage conditions. The three stages of a rotation are: (1) preharvest, when roads, main and secondary canals, and some field ditches are installed; (2) site preparation and regeneration, when additional field ditches may be installed; and (3) plantation development, when field ditches are not maintained and are allowed to fill in naturally.

Runoff will be monitored continuously from each of these three stages of rotation and at different points in the drainage system. Runoff will be related to rainfall and water table depth.

Principal Investigator: Dr. Jimmy D. Gregory, Department of Forestry, N. C. State University.

Integrated Management of Hydrilla in North Carolina. A noxious aquatic weed that has become established in North Carolina threatens to disrupt use of our waters.

Hydrilla (Hydrilla verticillata) Royle) was first introduced into Florida in the 1960s. It has spread throughout the State and to other states, transported by boats, trailers, waterfowl, and aquarium dumping (it is used as an aquarium plant).

This competitive, rapidly growing weed was identified in 13 Wake County locations and one each in Columbus and Scotland Counties. It is present in Neuse River tributaries and near Falls of the Neuse and Jordan Reservoirs. Infestations are likely in these reservoirs.

The purpose of this research is to develop some safe, practical management recommendations for North Carolina and other southeastern states based on what has been done elsewhere. Additional research will continue to develop new information on hydrilla and how to manage it.

Specific objectives include the following:

1. To determine the potential of selected fish species for biological control of hydrilla control in North Carolina.

2. To determine the efficiency of herbicides currently labeled for the control of hydrilla in North Carolina.

3. To determine the efficacy of physical control methods for hydrilla in North Carolina.

4. To integrate the most effective biological, chemical, and physical techniques into a management program.

Researchers will also assess the potential for re-establishment of hydrilla stands following winter dieback through production and germination of turions and tubers.

Principal Investigators: Dr. Ronald G. Hodson, Dr. David J. DeMont, Dr. Melvin T. Huish, Department of Zoology, N. C. State University; Dr. Gilbert N. Rhodes, Jr., Department of Crop Science, N. C. State University; and Dr. Graham J. Davis, Department of Biology, East Carolina University.

Evaluation of Vegetative Filter for Dairy Waste Treatment in Southern Appalachia. The dairy industry ranks sixth in North Carolina's agricultural income. In some mountain counties dairies are the leading agricultural source of income. These dairies also have the potential for degrading water quality through feedlot runoff and production of wastewaters unless properly managed.

While 200 cows is the usual minimum for routine compliance with the NPDES permit system, the average size of a North Carolina mountain dairy herd is 85 cows. Therefore voluntary efforts by the smaller dairies to limit pollutant loading becomes important. Difficulties arise, however, when financial resources, topography, and land availability preclude using conventional treatment technology.

One low-cost, innovative technology for reducing the pollution potential from small livestock facilities is the overland flow vegetative filter system. Wastes are treated in a settling basin followed by flow through a vegetative filter. This system has been tested in other states but not yet adapted to the terrain and climatic conditions of the southern Appalachian Mountains.

The objective of this study is to establish, monitor the performance of, and demonstrate the effectiveness of an overland flow vegetative filter at a small (50 cows) dairy farm in Buncombe County.

The study is a cooperative effort by the Buncombe County Rural Development Panel, the Land-of-Sky Council of Governments (COG), state agricultural agencies, and N. C. State University. Work on the initial, six-month phase of the two and one-half year project is supported by the Land-of-Sky COG. WRRI funding will permit the project's second (one-year) phase to begin, and a third, one-year phase will follow.

Principal Investigator: Dr. Frank Humenik, Department of Biological and Agricultural Engineering, N. C. State University.

Phase II: Extended Analysis and Specific Identification of Organic Pollutants in Haw River Water. This research extends the scope of an ongoing Institute study to identify synthetic organic pollutants in the Haw River.

As Phase II of the current study, the project will allow for a more comprehensive investigation of organic contamination in the Haw, a potential source of drinking water for the town of Chapel Hill and other communities in the region. Computerized gas chromatography/mass spectrometry (GC/MS) is used in the research to identify the extractable organic pollutants.

The Haw River, which feeds into Jordan Reservoir, drains urbanized and industrial areas including Greensboro and Burlington. In a preliminary analysis of trace organics from the Haw sampled below Burlington, several synthetic compounds were detected and identified by GC/MS.

The overall goal of this project is to assign chemical names or structures to the greatest possible number of these compounds identified as contaminants in Haw water, with estimates of their concentrations. To this end, Phase II will permit an increase in sampling sites and analyses, seasonal variation, and quanitative as well as qualitative work.

The extended research will provide comprehensive data from which the suitability of the Haw as a potable water source may be judged. The results should also permit a judgment of the specific effect of organization on the background organic water quality of the Haw.

Additional funding for this research comes from the Z. Smith Reynolds Foundation.

Principal Investigator: Dr. David S. Millington, Director, GC/MS Laboratory, Department of Environmental Sciences and Engineering, UNC-Chapel Hill.

Financing Water Supply and Wastewater Services in North Carolina in the 1980s. Several factors are now converging to create the prospect of significant consumer rate increases for urban water supply and wastewater treatment.

These factors relate to the costs of building and operating facilities. They are: (1) population growth and accompanying demand on water services, (2) rising construction costs, (3) high interest rates, (4) federal budget cuts, and (5) more distant sources for water supplies. The net effect of these changes is not yet clear, but they all point to a new, very different era in financing basic water services. Steps must be taken to mitigate the effects of high construction and financing costs of new facilities and attention given to deferring or eliminating the need for such facilities.

This research addresses the problem in three ways. First, the investigators will estimate the impacts of continued growth in demand, inflation in construction costs, increases in the cost of capital, and reductions in federal support on the total cost and consumer rates for water supply and wastewater services in urban areas of North Carolina in the 1980s. They will then identify alternative means for mitigating the effects of increasing costs. And finally, they will identify the long-term financial and economic implications that may result from those alternatives.

Computer-based analytical models for cash flow and financial accounting for water supply and wastewater services will be developed. These financial and cash-flow models will be used in conjunction with a water demand and capacity expansion model to analyze the implications of alternative rate structures and rate levels on the capital and capacity needs of municipalities.

Principal Investigators: Dr. David H. Moreau and Dr. Dale Whittington, Department of City and Regional Planning, UNC-Chapel Hill.

Mercury Sources and Modes of Transport in the Rocky River Drainage Basin. Rocky River is one of the most industrially polluted streams in North Carolina. Its drainage area includes parts of Mecklenburg, Cabarrus, Union, and Stanley Counties. The area also has a high density of mineral deposits that may be contributing significantly to the metal load of the river.

One objective of this study is to differentiate between industrial and natural sources of mercury in the river's drainage basin. The investigators will test the hypothesis that sulfide ore deposits in the basin are contributing detectable mercury to the streams.

Another objective is to estimate the potential for variation in mercury solute concentration due to increased erosion or reservoir construction.

A third research objective will test the hypothesis that minnows are good indicators of local mercury abundances.

By studying the spatial distribution of mercury and other trace elements in water, sediment, and minnows with respect to known mineral deposits and industrial sources, the investigators can differentiate between industrial and mineral-deposit contributions to the river. The correspondence between mercury abundance in water and oxide coatings and mercury concentrations in minnows will help evaluate the usefulness of minnows as indicators of local mercury contamination. Neutron-activation analysis will be used to analyze the fish samples.

Research results should be useful in predicting the effects of development in the Rocky River basin on mercury contamination.

Principal Investigators: Dr. M. M. Kimberley and Dr. H. S. Brown, Department of Marine, Earth, and Atmospheric Sciences, N. C. State University.

NEW INSTITUTE REPORTS *Environmental Factors Promoting and Regulating N_2 Fixing Blue-Green Algal Blooms in the Chowan River, N. C.* by Hans W. Paerl, Report 176.

In order to identify the environmental factors promoting and sustaining blue-green algal bloom potential in the lower Chowan River, primary productivity, N_2 fixation and the physical-chemical parameters regulating these processes, were examined at a location previously known to support blooms. A combination of parameters were found to be promoting blooms during 1980. Periods of weak thermal stratification, particularly during warming periods, coupled with phosphorus sufficiency, were crucical to N_2 fixing blue-green algal bloom development. Phosphorus sufficiency could be established at relatively low ambient orthophosphate levels ($<5\mu gP \cdot \ell^{-1}$). Indirectly, nitrogen sufficiency was important as well. Spring diatom and green algal blooms relied heavily on nitrogenous nutrients (nitrate and ammonia) for maximum development; the degree of spring bloom development was related to the potential for subsequent deoxygenation of river sediments and overlying waters during warm, weakly stratified summer periods. Maximum deoxygenation was usually coupled with maximum blue-green algal bloom development.

Additional physical and chemical features proved to be crucial factors in altering bloom development. Pulp mill effluent, which was a highly significant water mass during the drought year 1981, altered spring bloom development. Effluent showed negative effects on photosynthetic production, both through strong coloration of waters, thereby restricting transmission of photosynthetically active radiation (P.A.R.), as well as chemically inhibiting growth. The chemical inhibition affected non blue-green algal growth more severely than blue-green algal growth. This form of inhibition is related to the strong metal chelating abilities of humic constituents of effluent, inducing a trace metal deficiency which blue-green algae could overcome. Hence, it appears that high humic loading (due to pulp mill effluent) may potentially favor blue-green algal over more desirable diatom and green algal species, since blue-green algae can form surface scums (alleviating restricted P.A.R. transmittance) and can counter growth inhibition due to humic chelation of essential trace metals.

Salinity increases, observed during the drought of 1981, were strong deterrents to blue-green algal bloom formation during the summer months, even when other environmental conditions proved conducive to blooms. Both the reduction in effluent-inhibited spring phytoplankton growth and absence of blue-green algal blooms in 1981 led to nearly a 3-fold reduction in primary productivity compared to 1980.

It should be noted that 1981 was an unusually dry year, thereby emphasizing the growth-altering effects of pulp mill effluent and elevated salinity. In the case of pulp mill effluent, which is discharged during all years, undesirable alteration (favoring blue-green algal growth) of the producer level of the food chain might be expected in the long run.

The researcher stressed that constraints on both nitrogenous and phosphorus inputs be instituted. At their current levels both nutrient sources lead to blue-green algal blooms, either directly or indirectly. It was shown that spring nitrogen inputs created the potential for deoxygenation of bottom waters. These deoxygenation events lead to periodic pulses of phosphorus release. Coupled with the fact that nitrogen requirements of summer blue-green algal blooms are met by N_2 fixation, restraining phosphorus loading (of sediments) on a year-round basis would be a useful step towards alleviating bloom potential.

Trihalomethane Formation in Water Treatment Plants in North Carolina by Philip C. Singer, James J. Barry III, Glenn M. Palen, and Alan E. Scrivner, Report 179.

This study of trihalomethanes in drinking water showed that this class of contaminants is formed during the course of water treatment in nine of the larger cities in North Carolina. Concentrations of these suspected carcinogens frequently exceeded the established maximum contaminant level at three of these locations.

Examination of several potential surrogate measures of trihalomethanes suggests that ultraviolet absorbance and total organic carbon are good indicators of trihalomethanes and their precursors. In addition, statistical analysis of data was used to identify seasonal variations, temperature effects, geographical trends, and other water quality characteristics and treatment practices contributing to the formation of trihalomethanes. The use of a standardized trihalomethane formation potential procedure proved to be particularly useful in this regard.

Chlorination and coagulation practices at the Sweeney water treatment plant, in Wilmington, NC, were examined in an effort to reduce trihalomethane production. The point of initial chlorine application was shifted to a point following sedimentation, reducing finished water THM concentrations substantially. Similar results were demonstrated, on a laboratory-scale, for Chapel Hill and Raleigh waters.

(EDITOR'S NOTE: Either of the reports described here may be obtained free from the Water Resources Research Institute, North Carolina State University, 124 Riddick Building, Raleigh, NC 27650-5999, Telephone (919) 737-2815. A fee of $8.00 prepaid is charged for out-of-state requests.)

STATE-CF INDUSTRIES AGREEMENT

The North Carolina Department of Natural Resources and Community Development and CF Industries Inc., which operates a fertilizer manufacturing plant on the Chowan River in Hertford County, have reached agreement on four actions aimed at reducing the flow of nutrients into the river.

"The management people at CF Industries have been most cooperative," said Joseph W. Grimsley, secretary of the Department of Natural Resources and Community Development. "Our agreement on these four basic but vital actions is a significant step toward control of one source of nutrients in the river."

The two parties have been negotiating since March 11, 1982, when the Environmental Management Commission denied a request by the Division of Environmental Management that CF Industries be ordered to take certain actions to control its nutrient input into the river. The commission ordered the division and the company to resume negotiations on how best to monitor and control the company's nutrient input.

"We have accomplished through negotiation the substance of what we could not accomplish through a contested case," Grimsley said. "I think these actions attest to the effectiveness of dealing with environmental issues through manager to manager communications whenever possible. The CF Industries problem is extremely complex, and we appreciate the company's cooperation."

The department and the company have agreed on the following key points:

--Specific locations for placement of automatic samplers in the river upstream and downstream from the plant. DEM personnel will operate the samplers. The company also agreed to review flow calculation procedures.

--The company will provide a material balance study of nitrogen air emissions using the existing data from the facility. It was agreed that the inventory would include all significant air emissions of nitrogen from the facility's processes.

--The company agreed to provide a careful evaluation of the east ditch drainage area through a flood plain, provide the division with previous monitoring data from the east ditch and work with the division on future monitoring in the area.

--The company agreed to consider redirecting stormwater drainage away from the west side of the property. DEM personnel believe this action will reduce nitrogen flushing to the river. The division agreed not to consider a new drainage point as a point source discharge.

The river frequently experiences large scale "blooms" of blue-green algae in the summer, limiting commercial fishing and recreational activities on the river. The algal blooms are supported by excessive amounts of nutrients flowing into the river from sources throughout the river basin, which extends from Virginia into North Carolina.

Grimsley pointed out that the problems on the Chowan River are far from solved and that it will take continued efforts and hard work, plus cooperation from the state of Virginia, to halt eutrophication (over enrichment) of the river.

"We will continue to make every effort to restore this great river to a cleaner, healthier condition so our citizens can enjoy this great resource to the fullest," Grimsley said.

The Environmental Management Commission instructed the division to give a progress report on the status of the CF Industries Inc. program by March 1983 and a final report on what has been accomplished by March 1984.

NORTH CAROLINA UNDERGROUND INJECTION CONTROL PROGRAM A hearing was held on Tuesday, April 27, 1982, to consider adoption by the Environmental Management Commission of proposed Criteria and Standards applicable to Injection Wells, and to receive public comment on the State's intention to seek primary enforcement responsibility from the U. S. Environmental Protection Agency.

Injection in North Carolina has been regulated by the Commission since 1967 under authority of the Well Construction Act. The proposed regulations are an extension of the Well Construction Standards adopted under that Act in 1971. The 1973 General Assembly enacted legislation which prohibits the injection of wastes into the sub-surface or groundwaters through wells. Current injection practices are mostly limited to injection of water used for heating and cooling in a heat pump; however, other types of injection activities which may be desirable in the future include: (1) injection of fresh water to recharge an aquifer, or to develop a salt-water barrier in an aquifer; (2) injection of water or a slurry to recover minerals where other methods are not feasible; (3) injection of gases or other inert substances for temporary storage; and (4) injection for recovery of geothermal energy.

The proposed regulations, setting forth procedures and requirements for permitting, construction, operation, monitoring, reporting and abandonment of wells used to inject non-waste fluids, have been revised by the staff based on comment received during and subsequent to the hearing. A summary of the comments received and the staff's response to the comments are included in the hearing record in the Department of Natural Resources and Community Development.

The Commission concurred with the hearing officer's recommendations at its June 10 meeting and adopted the amended regulations as proposed and gave a favorable report to seeking primacy of the federal Underground Injection Control Program.

NEUSE RIVER ALGAL BLOOMS One of the items on the work session agenda of the Environmental Management Commission at its June 10 meeting was an update by Divison staff on Neuse River algal blooms.

The Neuse River is one of the State's most valuable resources. It is used in numerous ways such as water supply, industry, recreation, and commercial and sport fishing. Therefore, maintaining the water quality is essential. The Neuse River Basin is the second largest basin lying entirely within the State's boundaries. The Neuse is formed by the confluence of the Eno and Flat Rivers near Durham and flows southeasterly approximately 220 miles to the Pamlico Sound. The basin has a drainage area of approximately 6200 square miles.

Nineteen seventy-nine data indicated the presence of algal blooms. While these populations were not massive, the information there was clearly a potential for increase of these growths.

The blooms increased dramatically in 1980 and a shift of populations toward more blue-green species was observed. Evaluations of the nutrient availability indicate sufficient levels, year round, to support extensive algal populations.

Small populations of diatoms normally dominate the river during the cooler months of the year. However, these populations increase in size during the spring and become mixed with small populations of green algae. During the warm months of the year, green and blue-green algal populations rapidly increase in number (decreasing diversity) and become dominant in bloom proportions. This trend is reversed during the cooler months of fall when diversity increases and population size decreases.

In all of the bloom occurrences, most of the upstream algal populations were diatoms, which were present as far downstream as New Bern. As each bloom moved downstream, the green and blue-green algae increased in numbers until the salt tolerant algal dominated.

Chlorophyll "a" concentrations ranged from less than 1 ug/l to 250 ug/l with the highest values being detected at the downstream stations during bloom occurrences. Values generally ranged below 40 ug/l (water quality standard) during cooler months of the year at all stations. As the temperature and amount of sunlight increased toward optimum levels, algal production increased, and therefore so did the Chlorophyll "a" values. Maximum values were recorded between the months of June and October, coincidental to blooms.

The Division maintains an extensive water quality monitoring program throughout the Neuse Basin. Forty-four sites are evaluated monthly for a variety of chemical, biological, and physical parameters. This monitoring system allows continued evaluation of the system.

CONFERENCES AND SYMPOSIA <u>International Symposium on Urban Hydrology, Hydraulics and Sediment Control</u>. This is the ninth annual conference on subjects related to urban hydrology and hydraulics to be held at the University of Kentucky. The dates are July 26-29, 1982. This Conference will serve the purpose of gathering current information from various institutions, including universities, government agencies and practicing engineering groups, and disseminating this information for the advancement of knowledge concerning these subjects and for implementation by field engineering applications.

For information regarding registration call Elizabeth Haden, Conference Coordinator, 606/ 257-3971. For program content call Harry J. Sterling, Symposium Chairman, 606/ 257-1748.

<u>Design Workshop--Small Alternative Wastewater Systems</u>. This workshop will be held July 26-29, 1982, in Atlanta, GA. The purpose of the workshop is to present the current design and cost anlysis of alternative collection and treatment systems.

For additional information contact: Charles R. Jenkins, Department of Civil Engineering, West Virginia University, Morgantown, WV 26506, 304/ 293-3580.

<u>Groundwater Computer Models</u>. This course is being offered July 12-16, 1982 by the Department of Engineering and Applied Sciences, University of Wisconsin-Extension. This course focuses on the basic methods of finite

differences and finite elements as applied to groundwater flow. Computer solutions to regional flow systems, flow to wells, well spacing, and seepage will be covered in the course. Extensive use of University computing facilities by the participants will provide a basic understanding of groundwater computer models.

General information may be obtained by writing to Engineering Registration, The Wisconsin Center, 702 Langdon Street, Madison, WI 53706, Telephone: 608/ 263-7756. Fletcher G. Driscoll is Program Director.

The Sixth National Ground Water Quality Symposium. This symposium is to be held September 22-24, 1982, in Atlanta, GA. The objectives are to better define the role of each of the non-federal government agencies charged with protection of ground water resources and to assist those agencies in developing meaningful ground water management strategies and programs.

If you are interested in attending the symposium, please contact: David M. Nielsen, Symposium Coordinator, National Water Well Association, 500 West Wilson Bridge Road, Worthington, OH 43085.

Engineering Foundation Conference--Stormwater Detention. This conference is being organized by ASCE Urban Water Resources Research Council and will be held August 1-6, 1982, at Franklin Pierce College, Rindge, NH. The primary objectives of the conference are: (1) to consolidate and evaluate facts, field experience, research data and expert opinion regarding the detention storage of urban runoff, (2) to develop stormwater detention research needs to enable federal, state and local agencies to establish research priorities, (3) to stimulate meaningful dialogue among a group of experts in the field of stormwater detention and, (4) to include strong international involvement.

To request an invitation or application, contact the Engineering Foundation, 345 East 47th Street, New York, NY 10017, Telephone: 212/ 644-7835.

A Symposium on Peat and Peatlands. The theme of this symposium will be the horticultural, agricultural, sylvicultural and industrial value of peat and peatlands and will be held in Shippagan, New Brunswick, Canada, September 12-15, 1982. It will be an opportunity for specialists in industry, governments and universities to share their knowledge of this industry and to discuss its future.

Topics to be discussed will include resource assessment, environment, mining, production processes, products, markets, regulations and investment opportunities. The programme will consist of a series of technical presentations by users, producers and researchers in the industry, as well as organized field tours of peat installations and peatlands in northeastern New Brunswick.

The symposium will be presented jointly by the New Brunswick Departments of Commerce and Development and Natural Resources, the Economic Expansion Commission of the Peninsula, the Department of Regional Economic Expansion of Canada and the Canadian National Committee-International Peat Society.

If you are interested in receiving additional information, write: Symposium 82, C.P. / PO Box 940, Tracadie, N.-B, Canada EOC 2BO, Telephone: 506/ 395-5764.

Meter and Pipe System School. Classes will be held August 18-20, 1982, at the Fayetteville Technical Institute. Topics to be covered will be Basic, Intermediate, and Advanced Meter; Basic, Intermediate, and Advanced Distribution; Customer Service; and Basic Intermediate, and Advanced Waste Water Collection.

For details write: Fayetteville Technical Institute, Adult Continuing Education, PO Box 35236, Fayetteville, NC 28303.

WATER RESOURCES CONDITIONS IN NORTH CAROLINA

Monthly mean streamflows during May ranged from about 25 percent below normal in the Mountains, western Piedmont, and eastern Coastal Plain to over 200 percent above normal in the southeastern Piedmont.

Although the first half of the month was relatively dry, scattered heavy rains dominated the weather scene during the latter half. Torrential rains in amounts up to 5 1/2 inches, deluged the Asheville area on the 26th causing extensive damages to crops, road fills, and highway bridges. Flooding also occurred on the 26th and 27th along numerous small streams in Forsyth, Surry, and Yadkin counties; however, damages were limited primarily to crops with minor street and residential flooding occurring in low-lying areas in and around Winston-Salem. No flooding occurred during the month on major streams such as the Yadkin, French Broad, and Cape Fear Rivers. As the month ended, most streams across the State had normal or above normal flow conditions.

Compared to long-term records for May, flows at USGS index gaging stations ranged from 72 percent of normal at South Yadkin River near Mocksville (Davie County) to 202 percent of normal at Deep River at Moncure (Lee County).

Although shallow ground-water levels showed a general downward trend in the eastern Coastal Plain region, levels elsewhere had variable trends reflective of localized climatic conditions. Compared to long-term averages, levels during the month were generally 1/2 to 1 1/2 feet above normal; however, levels in a few areas remained below normal.

. . . . . *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

"Coastal Energy Transportation Study: Alternative Technologies for Transporting and Handling Export Coal," (#12), 1/82, by P. D. Cribbins, et al, Coastal Energy Impact Program, Office of Coastal Management, NRCD, Box 28687, Raleigh, NC 27611. (W&E)

"Development and Management of Water Facilities for Small Communities, (Proceedings)," 9/24-25/81, ed. by W. R. Kerns, WRRC, VPI&SU, 617 N. Main St., Blacksburg, VA 24060-3397. (05F)

"The White Clay Creek Project - A Prototype Strategy for Protecting Small Stream Valleys," by WRC, U. of DE, Newark, DE 19711. (06A)

Water Quality Management

"The Aquatic Toxicity of Organic Compounds to Embryo-Larval Stages of Fish and Amphibians," (#133), 1982, by J. A. Black, et al, WRRI, U. of KY, 165 Anderson Hall, Lexington, KY 40506. (05C Effects of Pollution)

"Toxic Wastewater Control in North Carolina: A Citizens' Handbook on the National Pollutant Discharge Elimination System" 5/82, by NC League of Women Voters, 2637 McDowell St., Durham, NC 27705. (05B)

Miscellaneous

"Desalination - Desalination Directory 1981," (vol. 37, no. 1,2), 5/81, pub. by Elsevier Scientific Publishing Co., PO Box 330, 1000 AH Amsterdam, The Netherlands (03A Saline Water)

"Grass Carp Bibliography," 8/81, by C. R. Smith, et al, U. of Fl, Inst. of Food & Agricultural Sciences, Gainesville, FL 32611 (02I Aquatic Weeds)

"Proceedings of the Grass Carp Conference," ed. by J. V. Shireman, Aquatic Weeds Research Center, U. of FL, Inst. of Food & Agricultural Sciences, Gainesville, FL 32611. (02I Aquatic Weeds)

"Biological Synopsis of Grass Carp," by J. V. Shireman, et al, Center for Aquatic Weeds, U. of FL, Gainesville, FL 32601. (02I Aquatic Weeds)

SPECIAL

WATER QUALITY IMPLICATIONS OF HAZARDOUS CHEMICALS: A GROWING CONCERN IN WESTERN NORTH CAROLINA

Contributed by: Steven Berkowitz
Center for Improving Mountain Living

Recent events have led to increasing concern over the potential degradation of high-quality mountain water resources by hazardous chemicals. Three separate incidents are described here to provide an understanding of specific occurrences that could help serve as a basis for future efforts to minimize threats to the region's water quality.

Chemical Fire at Benfield Industries in Hazelwood

A fire occurred at Benfield Industries, a chemical repackaging plant in Hazelwood, Haywood County, on April 21, 1982. Over 2,000 people in the town and adjacent communities were evacuated for up to 48 hours due to the threat of major explosions and potentially toxic fumes. Chemicals suspected to have been present at the site during the blaze included creosote, paint thinner, turpentine, paint stripper, wood preservatives, acetone, toluene, xylene, chlorine gas, chlordane, 2,4-D, mineral spirits, napthas, methyl ethyl ketone, hydrochloric acid, various cleaning solutions, antifreeze, calcium chloride, rock salt, and trisodium phosphate salt.

The water quality impacts of the fire were analyzed by personnel of the North Carolina departments of Natural Resources and Community Development, Human Resources, and Agriculture, with the assistance of the Haywood County Health Department. The greatest water quality concerns were that smoke fallout could contaminate nearby surface-source, water supply watersheds, and that drainage of the massive quantities of water used to fight the fire could harmfully affect downstream areas.

Within 30 miles of the fire site are water supply watersheds that serve over 10,000 customers through the municipal systems of Waynesville, Canton, and Maggie. Water samples were taken from the Allen's Creek watershed, which serves Waynesville, and from the Pigeon River above Canton's water supply intake on the evening of the fire, April 21, and following the first significant rainfall after the fire, April 25. They indicated no detectable amounts of chlorinated hydrocarbons (i.e., chlordane, methoxychlor) or solvents.

Although strong odors from the fire were detectable many miles away, calm weather and the fire's intensity helped carry most of the potentially hazardous fumes far from Haywood County. The thick black smoke plume, typical of a hydro-carbon fire, rose straight upward with little mixing to about 4,000 to 5,000 feet, and westerly winds carried most of the plume eastward. The only air quality sample from the plume itself was taken by Joe Beck, Director of the Environmental Health Program at Western Carolina University. At approximately 5,000 feet above the fire site, chlorine gas levels of 0.5 parts per million were measured (potential health problems may occur at levels exceeding one part per million), and tests made for benzene, vinyl chloride, and hydrogen sulfide were negative. Surface soil samples were also taken the evening of the fire from locations within a three-mile radius of the site to check for possible fallout. Pentachlorophenol and 2,4-D levels were below detection limits, and although detectable levels of chlordane were found at two sites and creosote at four sites, these quantities were not felt to be significant, nor could they necessarily be attributed to the fire.

Drainage of water used to fight the fire was the most direct mechanism for carrying contaminants into surface or ground waters. Ed Steinel, Hazelwood fire chief, estimated that 2.5 million gallons of water were applied, primarily to cool tanks and prevent further explosions and chemical releases. Much of this water undoubtedly drained into Camp Branch, which runs adjacent to the site and enters Richland Creek within less than a quarter of a mile. Richland Creek moves swiftly over a rocky substrate through built-up portions of Hazelwood and Waynesville enroute to Lake Junaluska about four miles downstream from the fire site. It continues onward through rolling farmland for about three more miles below the lake and empties into the Pigeon River.

No groundwater samples have been taken, since there are no groundwater users in the immediate vicinity of the fire site. Direct runoff from the site on the night of the fire was found to contain 2,4-D (2.3 parts per million), chlordane (0.31 parts per million), creosote (1,726 parts per million), and no detectable amounts of pentachlorophenol, toluene, or xylene. Creosote-type compounds were identified to include naphthalene, phenanthrene, pyrene, fluoranthene, benzanthracene, dimethylbenzene, methylbenzene, and methylethyl benzene. Chlordane, 2,4-D, creosote, and these creosote compounds are considered "hazardous constituents" in the states's Hazardous Waste Management Rules (1) or are included in EPA's list of 129 Priority Pollutants (2).

Water in Camp Branch reached a pH of 3.0 and had a grease and oil level of 130 parts per million on the evening of the fire. The pH in Richland Creek was measured at 6.0, down from a norm of 6.4 to 6.8. In chemical analyses of samples taken downstream along Richland Creek on the evening of the fire, chlordane, penta chlorophenal, toluene, and xylene were below detection limits. Levels of 2,4-D were measured to be 0.001 and 0.007 parts per million at sites one-half mile and three-miles, respectively, below the fire and below detection limits at the site one-mile below the fire. Creosote-type compounds were found at concentrations of 1.1, 1.6, and 0.9 parts per million at sites one-half mile, one-mile, and three-miles, respectively, below the fire. Creosote-type compounds identified included naphthalene, phenanthrene, pyrene, and anthracene.

(EDITORS NOTE: This article was compiled through the support of a mini-grant from the North Carolina Water Resources Research Institute to the Center for Improving Mountain Living, Western Carolina University.)

The pH in Camp Branch and Richland Creeks was back to normal by the morning of April 22. and the pH in Lake Junaluska had decreased only slightly from 6.43 on the afternoon of the fire to 6.15 the following morning. Water samples were again taken two days afterward of the leachate below the fire site and of Camp Branch upstream and downstream from the leachate discharge point. No pesticides were found in either stream sample, nor were any extractable organics detectable from the upstream sample. The leachate was again found to contain potentially harmful creosote-type compounds, including naphthalene, flourene, phenanthene, fluoranthene, pyrene, phenol, dimethylphenol, and anthracene, as well as pentachlorophenol. The downstream sample contained measurable quantities of the first five compounds found in the leachate, noted above. Total grease and oil levels were measured to be <1,210 and 3.0 parts per million, respectively, in the upstream, leachate, and downstream samples.

Little information is available to permit an assessment of the biological damage which may have resulted from the fire. Immediate damage to fisheries was, at most, minimal. Dan McCracken of the Haywood County Health Department observed 40 to 50 dead or dying fish in three different parts of Lake Junaluska on April 23. Subsequent observations by Mr. McCracken and Heath Dobson of the Department of Natural Resources and Community Development revealed no additional evidence of dead fish; nor could this small kill be attributed conclusively to the fire.

A boom was placed across the mouth of Richland Creek upstream of Lake Junaluska on April 22 in order to prevent any floating chemicals from entering the lake. No slick was observed to have developed behind this boom. However, many of the creosote-type compounds shown to be entering Camp Branch from the fire site are only slightly soluble in water and would have a strong tendency to be absorbed by the stream bottom substrate (2). Creosote from the Benfield plant, purchased by the author, was found to initially float on top of water when poured into a half-filled jar but to sink readily after the jar was slightly shaken.

As no sediment samples or stream macroinvertebrate data were collected below the fire site, it is not possible to document the extent to which contaminants may have been absorbed into the stream bottom or whether significant degradation of the stream macrofauna occurred. Qualitative observations by the author on April 23 indicated the apparent destruction of invertebrate populations on the bottom of Camp Branch immediately below the fire site. Sediment and rocks were heavily coated with oily chemicals. About one mile below in Richland Creek, invertebrates were found living but appeared sluggish and under stress. Rocks and bottom sediment also were coated with oily substances. Coating of rocks was noted to a decreasing extent for about three-miles downstream, below which no visible evidence could be found.

Even if more extensive biological and chemical data were collected, any evidence of degradation would be difficult to attribute to the fire. Seepage of creosote from the Benfield plant was found to be a problem over a year ago. During an investigation of the plant on January 8, 1981 by the North Carolina departments of Human Resources and Natural Resources and Community Development, leachate from the plant and downstream reaches of Camp Branch were found to contain many of the same creosote-type substances identified in the runoff below the site during the fire. Previous biological studies of Richland Creek and Lake Junaluska aquatic communities have also shown these water bodies to be highly degraded. During "gap-surveys" of stream macroinvertebrates made by the Department of Natural Resources and Community Development's biological monitoring unit in May 1981, Richland Creek was rated "poor," with only 12 different taxa found. In comparison, 48 taxa were found during a similar survey of Jonathan Creek and 58 taxa were found in Big Creek, two other Pigeon River tributaries in Haywood County. A fish survey of Richland Creek performed at the same time by the N. C. Wildlife Commission yielded only one fish, suspected to have ventured upstream from Lake Junaluska. The lake itself was ranked 50th out of 59 lakes surveyed in terms of water quality during the North Carolina Trophic State Index Survey, a part of the State's "Clean Lakes Project."

The Solid and Hazardous Waste Management Branch of the Division of Health Services has given plant owner Tom Benfield 90 days to completely clean up the site. The intensity of the fire and the volatile nature of most chemicals present lead state officials to believe the majority of the hazardous materials at the site had been consumed. Little visible clean-up has been accomplished six weeks after the fire, and local residents remain fearful of potential hazards at the site.

In Summary, many of the possible water quality impacts of the Benfield Industries fire in Hazelwood remain undetermined. The intense fire consumed much of the potentially harmful chemicals being stored at the site, and air patterns were such that most of the gases and smoke released to the atmosphere were transported far from the fire site and dispersed widely before there was a possiblity for surface fallout. Drainage of the massive quantities of water used to fight the fire tended to carry with it into Camp Branch and Richland Creek substances that had spilled on the property before or during the fire. At least one slug of acidic materials and creosote-type compounds was identified as having entered Camp Branch as a result of the fire. The biological impact to downstream communities and Lake Junaluska may have been masked, since these waterways already have suffered from chronic degradation.

<u>Fish-Kill Following Chemical Spill into Jonathan Creek</u>

A midnight release of 4,500 gallons of pentachlorophenol and tetrachlorophenol into Haywood County's Jonathan Creek occurred on May 14. Jay Davies of the State Wildlife Commission reported that more than 15,000 fish were killed, including about 400 brown and rainbow trout. Other species affected by the kill included largemouth bass, rock bass, red-breast sunfish, hog and white suckers, stonerollers, and redhorse. Essentially all fish in the four-and-one-half mile section of Jonathan Creek from where the chemicals were discharged down to the Pigeon River were killed. Some dead fish were also found in the Pigeon River below where Jonathan Creek enters, but whether these fish were killed in the Pigeon or floated down from Jonathan Creek was uncertain. The Pigeon's discharge averages over four times greater than Jonathan Creek's discharge near their point of confluence. Davies reported that the dead fish he recovered had ruptured abdominal cavities. The source of the chemicals is still under investigation, and the decision to take legal action against the suspects by the Division of Environmental Management has yet to be finalized.

Jonathan Creek was considered to be one of the best trout streams in Haywood County. The Wildlife Commission began efforts to re-stock the stream with the release of 6,000 brown trout and a small number of rainbow trout on May 16. State officials feel confident that the stream can again safely support fish communities.

Pentachlorophenol, a widely used wood preservative, is moderately to highly soluble in water and shows little tendency to be absorbed into the stream bottom substrate at near-neutral pH levels (2). Jay Davies reported that the stream macroinvetebrate communities appeared to be unaffected by the spill. However, no detailed biotic investigation of bottom-living organisms was made. During a qualitative gap-survey by the Department of Natural Resources and Community Development's biological monitoring group in May 1981, 48 taxa of benthic invertebrates were found. Given the highly toxic nature of the substances released (EPA standard for pentachlorophenol to protect fresh water aquatic life is 55 micrograms per liter on an acute toxity basis; reference #3), it seems probable that some damage may have occurred. Fish have been shown to bioaccumulate pentachlorophenol when continually exposed to low levels, while detoxification and release of built-up levels has also been demonstrated when contaminated fish are again exposed to clean water (2).

While the immediate impact of this chemical spill was devastating to the lower portion of Jonathan Creek, it is unlikely that any long-term accumulation of pentachlorophenol within the Jonathan Creek-Pigeon River ecosystems occurred, although this possibility has not been thoroughly explored. It is also possible that as a result of this spill pentachlorophenol or its degradation products may have accumulated within sediments or biota on the bottom of Lake Waterville, which begins about three miles downstream from the Jonathan Creek confluence.

Suspected High Cancer Rates Being Probed in Cherokee and Macon Counties

The North Carolina Department of Human Resources has assembled a Task Force to evaluate the possible significance of increasing cancer death rates in Cherokee and Macon Counties. The investigation was prompted by an article published in the March 15 issue of Inquiry magazine by Keith Schneider, a free-lance writer from Charleston. The article claims that cancer rates in Cherokee County rose sharply in 1979 and 1980 and suggests the increase might be associated with the use of the herbicide Tordon by residents and state and federal agencies to control weeds, multiflora roses, and trees at rural homesites, along roadways, and beneath utility rights-of-way. It speculates that picloram, the active ingredient of Tordon, might be carried readily into the groundwater as a result of the area's high rate of rainfall, contaminating rural well and spring water supplies.

The state's investigation, headed by Dr. Greg Smith of the Solid and Hazardous Waste Management Branch of the Division of Health Services, is intended to verify whether these two counties indeed have an unusually high cancer rate and if so to isolate the responsible agents.

From 1972 to 1976, crude cancer mortality rates in Cherokee and Macon counties both averaged 24% higher than the statewide rate (4). When adjusted for age, race, and sex, however, Cherokee's rate dropped to just below the adjusted statewide rate, and Macon's rate dropped to 26% below the state's. Only unadjusted crude rates have thus far been published for recent years. In 1979, Cherokee and Macon county's cancer death rates were 59% and 60% higher, respectively, than the statewide rate (5). In 1980, Cherokee's cancer mortality rate was 47% higher and Macon's rate 74% higher than the state's overall rate (5). Age difference in cancer susceptibility is just one factor making meaningful interpretation of raw cancer statistics difficult. In 1980, 57% of the people in North Carolina who died of cancer were over 65 years old and 83% were over 55 (6). Statewide, 14.6% of the population is over 60 (7), while in Cherokee and Macon counties, 20.3% and 24.7%, respectively, of the people were over 60 (8).

Only isolated water samples have been analyzed for picloram or other exotic chemicals to date. Water samples from public and private water supplies, ground water monitoring wells, and streams are not normally analyzed for pesticides. Robert Wood of the Cherokee County Health Department reported that individual samples from two private water supplies have thus far been evaluated and no detectable levels of picloram or other pesticides were found. The Department of Natural Resources and Community Development analyzed for picloram and 2,4-D in March and May 1982 at their regular monitoring station on the Hiwassee River above Murphy, which drains a portion of Cherokee County. No detectable levels were found either time.

Rather than begin a random sampling program, the Department of Human Resources Task Force intends to first isolate areas where further detailed investigation is justified, based upon evidence that cancer incidence or application of potentially hazardous chemicals has been concentrated in specific geographic areas. Investigators are designing a survey which will be given to area residents to help determine where different types of cancers are occurring and to identify any possible common environmental exposure factors among cancer patients. Concurrently, data are being collected from various agencies to determine the types and quantities of chemicals that have been applied in the two counties and where in the counties usage has predominated. Agencies thought to have used Tordon include TVA, the U. S. Forest Service, Duke Power Company, the N. C. Division of Forest Resources, and the state and federal departments of agriculture. Farmers have also been using Tordon principally to control multi-flora rose.

According to information compiled by Schneider that was included in an article appearing in the Philadelphia Inquirer (9), Tordon is one of 37 "restricted use" pecticides registered by EPA, meaning that it can only be applied by trained applicators under a special use permit. Instructions on Tordon containers warn that the herbicide should not be used where groundwater is less that 10 feet from the surface or within a half-mile of streams or springs used for irrigation or household purposes. Picloram, its main active ingredient, is reported to be highly persistent and mobile in the environment. The potential carcinogenicity of picloram is sharply disputed. Both the EPA and the National Cancer Institute have officially concluded that picloram is not carcinogenic. However, a six-month "registration standard review" to re-evaluate the chemical was initiated by EPA in March (9).

EPA's data on picloram were developed during three research studies whose methodologies and results have been questioned. Two of these studies were performed by Industrial Biotest Laboratory of Illinois, which was closed last summer by the U. S. Justice Department after its former president and three assistants were indicted for falsifying data, fabricating test results, and substituting fresh test animals for those that died during testing. The picloram studies were among 160 of the lab's pesticide research studies considered to be invalid. The third study was conducted by Gulf Research South Institute of Louisiana. During 1977, the year of its picloram studies, an EPA audit of the lab uncovered serious deficiencies in its scientific procedures. A strong critic of picloram is Dr. Melvin D. Reuber, former director of the Experimental Pathology Laboratory at the Frederick, Maryland Cancer Research Center, which is funded by the National Cancer Institute. In 1979, Reuber reviewed hundreds of tissue slides that had been prepared as part of the Gulf South picloram study as well as studies by Dow Chemical Company, the sole producer of Tordon. He published his findings last year (10). While Gulf South and Dow researchers had found no malignancies, Reuber identified dozens which were evident throughout the bodies of rats fed both large and small doses of picloram. Dr. Reuber was forced to resign his position at the Experimental Pathology Laboratory in April 1981 after publicly stating his belief that malathion, being advocated for use in controlling Mediterranean fruit files in California, is a carcinogen, which contradicted National Cancer Institute Studies (9).

EPA reports that Dow is repeating past studies of picloram, which they expect to complete by mid-1985. EPA's registration review, however, is scheduled for completion by September 1982 (9).

In summary, there may very well be justification for concern over the potential carcinogenicity of Tordon. However, there has yet to be any evidence of its presence in dangerous levels within the water or lands of Cherokee or Macon counties. Nor has the significance of increased cancer rates in these counties been either verified or adequately explained. The current investigation of the Department of Human Resources should provide more answers to these questions. No date has yet been projected for completion of the state's study.

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ITEMS OF INTEREST:

And more . . . .

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