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NC DOT launches programs to evaluate impacts of highway runoff on surface waters

Research has shown that runoff from hard surfaces carries various pollutants that have settled out of the atmosphere. In fact, some research indicates that the majority of nitrate in urban streams comes from washoff of atmospheric deposition on surfaces like streets and highways.

As North Carolina struggles to develop programs to restore and protect waterbodies suffering from nutrient over-enrichment—including the Neuse River and several of the state's most important drinking water supplies—it has become critical to know the amounts of nutrients that run off into sensitive surface waters from the state's 78,000 miles of highways.

In 1998, North Carolina's Department of Transportation became the first to receive a state-issued statewide NPDES stormwater permit. Under the mandate of this permit, NC DOT has launched a research program that will provide needed information on pollutant loading from highways. DOT expects that within two years, it will have a database that will allow characterization of runoff from various kinds of highways across the state. Parallel projects will also allow DOT to identify areas where highway runoff threatens sensitive waters and provide information about the most effective ways to reduce the effects of highway runoff on surface water quality.

Characterization of highway runoff

In a project just completed on highways in Charlotte*, Dr. Jy S. Wu and colleagues at the University of North Carolina at Charlotte produced important data on highway runoff quality and developed a protocol that will allow them to relate runoff characteristics to roadway imperviousness and traffic conditions across the state.

The researchers measured precipitation, runoff, and atmospheric loading; collected runoff; and counted traffic at three sites:

(1) a 100% impervious 3-lane concrete bridge that carries 25,000 vehicles per day (urban);
(2) a 3-lane asphalt highway with grassed shoulders and 61% imperviousness that carries 21,500 vehicles a day (urban); and
(3) a four-lane highway with a grassed median and 45% imperviousness that carries 5,500 vehicles per day (rural).

They analyzed runoff samples for dissolved and suspended solids, chemical oxygen demand, oil and grease, a variety of metals, and several forms of nitrogen

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Please see page 15 of this issue for important information regarding your subscription to the *WRRI News*.

IN THIS ISSUE

Director's Forum

Use adaptive management to revise Neuse total nitrogen TMDL

Kenneth H. Reckhow, Director, Water Resources Research Institute

This Director's Forum contains the substance of comments submitted to EPA on the Neuse Estuary total nitrogen TMDL.

In just over a year, the N.C. Division of Water Quality (DWQ) must submit to EPA a nitrogen reduction goal for a revised TMDL (total maximum daily load) for the Neuse River Estuary (see article on page 4). Many people will say "it's about time!" given that North Carolina became focused on water quality problems in the Neuse almost four years ago. However, I urge EPA to set the nitrogen reduction goal submittal date to coincide with completion of the WRRI Neuse Modeling and Monitoring (ModMon) study. Here's why:

The Neuse ModMon study, funded through DWQ, has been underway for two years. The first stage, completed in December 1998, provided a valuable background scientific assessment and initial evaluation of predictive models. The second stage, scheduled for completion in December 2000, is specifically designed to evaluate and apply models for TMDL development.

EPA and NC DWQ advocate use of the water quality model CE-Qual-W2 for the Neuse nitrogen TMDL. As a consequence, CE-Qual-W2 is the primary nutrient response model in the ModMon project. However, it is generally recognized that the CE-Qual-W2 Neuse model is not yet ready for TMDL assessment. The model's prediction error is quite high, and it does not predict all variables (e.g., fish) of concern in the Neuse.

The first problem, large prediction error, is characteristic of all water quality models addressing complex processes of eutrophication in an estuary (whether the modelers are private consultants, agency scientists, or university researchers). Natural phenomena—from algae blooms to tornadoes— are difficult to predict with reliability. The fact that models are not highly accurate doesn't mean that we should abandon them or neglect scientific assessment but that we should develop modeling and management strategies to address uncertainty.

The second problem with the CE-Qual-W2 model, as with most eutrophication models, is failure to include difficult-to-assess responses such as fishkills. At best, we can roughly predict conditions conducive to fishkills, just as we can define conditions conducive to tornadoes. However, the limits of scientific knowledge prevent us from confident prediction that a fishkill (or tornado) will occur even when "conditions are right."

In general, the response to these problems with predictive water quality models is to neglect estimation of prediction uncertainty, require a "margin of safety," and base decisions on precur-

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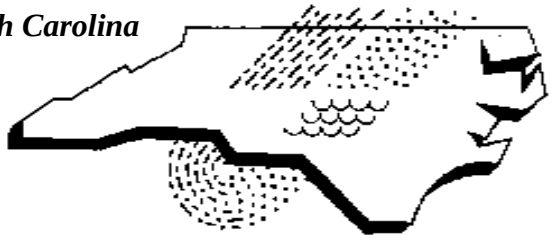

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WRRI offices are located at 1131 Jordan Hall
on the North Carolina State University campus
Mailing address: Box 7912, NCSU, Raleigh, NC 27695-7912
Telephone: (919) 515-2815 General Email: water_resources@ncsu.edu

WRRI Staff

Director/Kenneth H. Reckhow (Ken_Reckhow@ncsu.edu)
Associate Director/ Robert E. Holman (Robert_Holman@ncsu.edu)
Newsletter Editor and Tech Transfer Spec/ Jeri Gray (Jeri_Gray@ncsu.edu)
Business and Administrative Officer/ Mary Sanford (Mary_Sanford@ncsu.edu)
Secretary/ Julie Mason (Julie_Mason@ncsu.edu)
Accounting Technician/ Frances Yeargan (Frances_Yeargan@ncsu.edu)

sor variables or a subset of important variables. At first glance, a margin of safety seems like a reasonable approach when outcomes appear to be highly uncertain. However, a margin of safety also means that funds that might otherwise go to different public needs (schools, parks, social services, etc.) are required to achieve this additional assurance. Taking these funds away from other societal needs, or requiring additional nitrogen removal to accommodate future growth is a public choice involving a trade-off. Therefore, the magnitude of this trade-off should be explicitly estimated, acknowledged, and not merely captured in an uncritically chosen margin of safety. In addition, failure to assess important variables, regardless of the uncertainty, simply means that decisions are only partially based on the water quality problems of concern. The result of either an incomplete modeling study or indiscriminate application of a margin of safety can be unnecessarily expensive requirements and an inefficient use of scarce resources.

For these reasons, it seems sensible to coordinate the requirement for a revised TMDL with development of the TMDL modeling strategy under ModMon. In addition, we urge that agencies not rely solely on CE-Qual-W2 for TMDL modeling. Indeed, because of the limitations of CE-Qual-W2, ModMon scientists have developed alternative modeling and assessment strategies that will be evaluated and collectively applied for TMDL development.

Margins of safety are fine if resources are available, but adaptive strategies that allow fine-tuning of management actions are a more efficient way to deal with uncertainty. Continuation of water quality monitoring after the ModMon modeling is complete will provide feedback to adapt strategies to overcome model prediction errors. Furthermore, five-year basinwide planning is compatible with adaptive management. Acknowledging and adapting to the limits of our TMDL models, rather than proceeding on a fixed timetable and an inflexible management scheme, seems prudent.

Impacts of highway runoff *continued*

and phosphorous. Among the findings were the following:

- Total suspended solids (TSS) loading from the highways with grassed roadside shoulders and shoulders and median were lower than from the bridge. TSS loading from the site with the median was 30% less than from the site with only a grassed roadside shoulder. Reduced loading was attributed largely to simple runoff reduction. However, monitoring revealed that as precipitation depth increased, TSS removal attributable to runoff reduction decreased.
- Nitrogen compounds (NO_{3+2}-N, NH_3-N, TKN) were deposited on the urban highways at higher rates than on the rural highway. Atmospheric sources accounted for 10-30% of NO_{3+2}-N and 70-90% of TKN and NH_3-N in runoff at the urban sites.
- TSS and nitrogen pollutant loading rates were higher for the bridge site than rates reported in other studies of impervious roadways. Nitrogen and phosphorus loading rates for this site were within the range of loading rates reported for agricultural runoff. The researchers say loadings from this site are higher because bridges receive more de-icing chemicals and other maintenance activities. They note that runoff from bridges is of nationwide concern.
- Concentrations of nitrogen and phosphorous in runoff from all the Charlotte sites were higher than the average concentrations measured for rural highways in a nationwide study but lower than average concentrations for urban highway sites in the national study. However, when concentrations were converted to long-term loading rates, the Charlotte highways yielded 35.0, (Site 1) 11.3 (Site 2) and 21.4 (Site 3) kilograms per hectare per year (kg/ha-year) of total nitrogen compared to the U.S. average of 14.9. kg/ha-year. Moreover, in spite of its median and roadside shoulders, Site 3 yielded a total phosphorous loading rate (9.1 kg/ha-year) almost 3 times the reported U.S. average (3.4 kg/ha-year).

Using methods developed in this project, Wu and colleagues will now monitor roadway runoff at ten sites distributed across the mountains, Piedmont and Coastal Plain and will develop seasonal pollutant loading factors for a variety of roadway surfaces and traffic volumes in each area. Sampling sites have been chosen on I-40 in New Hanover County, Wake County, Forsyth/Guilford Counties, and Buncombe County. University City Boulevard (N.C. 49) and W.T. Harris Boulevard in Mecklenburg County, U.S. 601 in Union County, and U.S. 74 in Rutherford County will also serve as sampling sites.

Data from the current and completed studies will serve to quantify nutrient and other pollution from highway runoff. According to the UNC-C researchers, highway pollutant loads in North Carolina are representative of roadway conditions across the southeastern United States.

Stormwater outfall inventory

The NC DOT stormwater program focuses on protecting "sensitive waters," defined as High Quality Waters (including all water supply and shellfishing waters), Outstanding Resource Waters, Nutrient Sensitive Waters, Trout Waters, and any waters of the state which have a rating of partially supporting or not supporting. To identify where highway runoff may be affecting sensitive waters, DOT has contracted with Ogden Environmental and Engineering Services to inventory its existing stormwater outfalls. Ogden will use a geographic information system (GIS) to record the location of DOT outfalls and match them with locations of sensitive waters. DOT will use information on outfalls and sensitive waters to prioritize locations for outfall retrofitting. Beginning in 2000, DOT will retrofit one priority outfall in each of its 14 districts each year for three years

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Under TMDL agreement, new rules for Neuse could be adopted by end of 2001

Under a tentative agreement with the U.S. EPA on a total maximum daily load (TMDL) for total nitrogen for the Neuse River Estuary, North Carolina has committed to consider initiating a new round of rulemaking for the Neuse River Basin. The N.C. Division of Water Quality (DWQ) has agreed to reconsider its 30% nitrogen reduction goal for the Neuse Estuary by July 1, 2000,and to prepare a draft revision of its currently submitted TMDL and, if the new TMDL requires it, initiate rulemaking to implement the new TMDL by March 31, 2001. In the meantime, the Neuse River Nutrient Sensitive Waters Management goals and rules adopted in August 1998 will continue to be implemented, except for wastewater discharge permit allocations, which may have to be revised.

Deadlines for a revised TMDL for nitrogen in the Neuse Estuary are being driven by an agreement settling a lawsuit against EPA by the Neuse River Foundation (NRF). NRF filed the lawsuit in 1996, charging that EPA had not fulfilled its responsibility under Section 303(d) of the Clean Water Act to require states to set total maximum daily loads for pollutants degrading streams. EPA and NRF settled the lawsuit in June 1998, with EPA agreeing to require North Carolina to establish a TMDL for nitrogen for the Neuse River Estuary by October 31, 1998. In March of this year, NC DWQ submitted the second revision of the required TMDL to EPA and announced availability of the TMDL for public review and comment. Public comment was taken until May 14. The final TMDL is to be submitted June 14.

Because there is a great deal of uncertainty about nonpoint source loadings of nitrogen to the Neuse Estuary, and because a water quality model that can predict responses in the estuary to nutrient reductions is still under development, DWQ opted to develop a "phased" TMDL for nitrogen for the Neuse. The first phase is the TMDL to be submitted June 14. The second phase is the revised TMDL to be established in March 2001.

The TMDL for the first phase is a 30% reduction in nitrogen at New Bern from the 1991-1995 baseline load. This is the same goal stated in the Neuse River Basin Nutrient Sensitive Waters Management Strategy. However, the Neuse NSW rules allocate specific nitrogen loads (in pounds) to the point source category (wastewater dischargers) only. The TMDL plan allocates loadings to various nonpoint sources as well, thereby quantifying reductions expected of each nonpoint source category.

The TMDL document states a total baseline nitrogen load at New Bern of 9.65 million pounds per year and a yearly total allocation of 6.76 million pounds per year. Total loading at New Bern calculated for the Neuse NSW rules was 8.7 million pounds per year. Calculations for the TMDL added loading from the Trent River at Pollocksville and atmospheric deposition.

The TMDL calculates the point source share of baseline loading delivered to the Neuse Estuary to be 2.34 million pounds per year and, to achieve a 30% reduction, allocates point sources a total yearly loading at the estuary of 1.64 million pounds. According to the TMDL submission, the Neuse NSW rules probably will not accomplish a point source reduction to the TMDL level. Additional rulemaking to revise point source allocations is expected soon, and NPDES wastewater discharge permits in the Neuse River Basin will not be reissued until the Environmental Management Commission provides guidance to DWQ on the issue.

The TMDL plan calculates the total nonpoint source (all sources other than wastewater dischargers) baseline nitrogen load at New Bern at 7.31 million pounds per year and targets total nonpoint source reductions of 2.19

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Impacts of highway runoff *continued*

during the term of the permit, which ends May 31, 2003.

BMP evaluation

While university researchers and contractors are carrying out projects to help DOT evaluate the effects of highway runoff on sensitive waters, the department itself will be assessing the effectiveness of best management practices (BMPs) for reducing the effects of runoff. According to David Chang, a Project Manager with DOT's Hydraulics Unit, his unit will select BMPs listed in the N.C. Division of Water Quality's stormwater guidelines that are applicable to highways and perform field evaluations. By the end of this year, DOT will produce a "tool box" identifying effective BMPs and their recommended uses. DOT will also field test additional BMPs and add them to the toolbox over the next four years.

The NC DOT stormwater program includes additional elements about which the WRRI News will report as they evolve.

* This project was funded by the Center for Transportation and the Environment, the U.S. Department of Transportation and the N.C. Department of Transportation through the Institute for Transportation Research and Education (ITRE) at N.C. State University. A complete summary appears in the journal article cited below:

Wu, Jy S., Craig J. Allan, William L. Saunders, and Jack B. Evett. 1998. "Characterization and Pollutant Loading Estimation for Highway Runoff." *Journal of Environmental Engineering* 124 (7, July 1998): 584-591.

million pounds per year. Allocations in pounds representing a 30% reduction from the total baseline loading are designated for four nonpoint source categories: agriculture, urban (loading from urban stormwater runoff), forestry, and open water (direct atmospheric loading to waters).

The forestry category is considered uncontrollable "background" loading and given an allocation at New Bern of 1.38 million pounds, equal to its total loading. The 30% reduction needed from forested land is to be accomplished by an additional 0.34 million pounds per year reduction in the agriculture category and an additional 0.065 million pounds per year reduction in the urban category. Urban areas are now expected to accomplish a 40% reduction, and agriculture, a 37% reduction. DWQ asserts that Neuse NSW strategies for agriculture plus best management practices to be implemented under the recently announced Conservation Reserve Enhancement Program (CREP) will result in the required reduction in the agriculture category. It offers the Neuse NSW stormwater rule as assurance that urban areas will accomplish the required 40% reduction in nitrogen loading from stormwater.

A revised TMDL

To meet its commitment to establish and implement a second-phase TMDL by March 2001, DWQ needs to answer two critical questions: Will a 30% reduction in total nitrogen at New Bern bring about the water quality improvements desired, and if not, what reduction is required? And will the management measures being implemented accomplish the needed reduction?

To answer the first question, DWQ proposes to rely upon the nutrient response model (CE-Qual-W2) currently being fine-tuned and calibrated for the Neuse Estuary under the Neuse ModMon program. Other modeling approaches being investigated under ModMon will also be considered when the revised TMDL is set. If the modelling is not considered by EPA to be adequate for the task, then DWQ must add a "margin of safety" to the current 30% reduction goal to set a revised TMDL.

To develop rules to implement a revised TMDL, DWQ would like to know how well controls under the Neuse NSW program are working. However, because most of these efforts are not required to be fully implemented until 2003, their effectiveness before that date will be difficult to assess.

Marion Smith, Executive Director of the Neuse River Foundation, said that the TMDL submitted by NC DWQ in March is a significant improvement over the original submission. "However," she said, "we remain unconvinced that 30% is a sufficient reduction. We are also concerned about a lack of clearly identified consequences that should be in place if North Carolina fails to achieve the required reductions."

The NRF contends that a 30% reduction is only what scientists agreed is the minimum required to produce a detectable improvement and that a 50% reduction in nitrogen loading at New Bern is required to return the impaired estuary to its designated uses.

EPA is expected to make a decision on North Carolina's final TMDL submission by mid July.

N.C. Coastal Resources Commission sets aside water quality proposals

In May 1998 the N.C. Coastal Resources Commission (CRC) published in the *N.C. Register* a notice of rulemaking indicating the commission's intent to amend its shoreline protection rules and extend these rules to inland public trust waters in the 20 coastal counties. The CRC proposed to create a "Coastal Area Shoreline Area of Environmental Concern (AEC)" that would include shorelines adjacent to inland public trust waters and to require vegetated buffers, limit built-upon area, and encourage nonstructural shoreline stabilization in the new AEC.

At its March 1999 meeting, CRC voted to continue its effort to require a buffer on waterfront lots throughout the coastal region but turned other water quality protection proposals over to a stakeholder group. The N.C. Division of Coastal Management (DCM) has hired an independent facilitator to work with the group to study the proposals and make recommendations for coastal water quality protection.

The 30-foot buffer under consideration would apply to all lots along public trust waters in the 20 coastal counties. Only water-dependent structures, such as piers, boat ramps and shoreline erosion-control structures, would be allowed in the buffer, and property owners would have to get permits to build those structures. Public hearings on the buffer proposals will be held this summer in each of the 20 coastal counties.

The commission will continue to examine its proposal to initiate rulemaking to encourage the use of nonstructural shoreline stabilization. A CRC committee had separated shoreline stabilization from the other May 1998 proposals at an earlier meeting.

For a schedule of the coastal water quality stakeholder group's meetings and buffer public hearing information visit the DCM web site at http://dcm2.enr.state.nc.us/main_page.htm.

The N.C. Environmental Management Commission will hold its September 1999 meeting in New Bern, NC, in conjunction with the September meeting of the N.C. Coastal Resources Commission. The joint meetings are being arranged in recognition of the 25th Anniversary of the Coastal Area Management Act (CAMA).

DENR reorganization will be delayed

The anticipated reorganization of the N.C. Department of Environment and Natural Resources (DENR) will be delayed until the department completes a study of state and local roles in environmental protection. According to Assistant Secretary Bill Holman, DENR reorganization will probably be addressed by the 2000 session of the General Assembly.

The issue of DENR reorganization revolves around questions about the relationship between public health and environmental protection programs, particularly regulation of on-site wastewater systems (septic systems) and public drinking water systems.

Background

In 1997, Governor James B. Hunt, Jr. proposed transferring public health functions in the Department of Environment, Health and Natural Resources to the Department of Human Resources, thereby making two new departments: Environment and Natural Resources and Health and Human Services (DHHS). Among the divisions to be transferred was the Division of Environmental Health, which oversees regulation of public drinking water systems and, in cooperation with local health departments, on-site wastewater systems and programs that assure sanitation of food service facilities, lodging facilities, milk production facilities, bedding, shellfish harvesting and processing, and other public health programs.

A large number of environmental, business, and professional organizations objected to separating on-site wastewater and drinking water programs from environmental programs. On the other hand, many representatives of the N.C. Public Health Association, the N.C. Local Health Directors Association, and the N.C. Environmental Health Supervisors Association spoke out in favor of keeping these programs in a health agency.

In August 1997 the General Assembly enacted legislation generally following the Governor's proposal to create the two new departments but delaying transfer of the Division of Environmental Health until the legislative Environmental Review Commission (ERC) studied and recommended appropriate placement of on-site wastewater and public drinking water. The ERC charged the two new departments with convening stakeholders and developing a proposal that interested parties could support.

A stakeholders group was convened in early 1998 but failed to come to agreement on placement of environmental health programs. The group did express the consensus opinion that more study was needed and that issues related to commission jurisdiction were of primary concern. In August 1998, the General Assembly enacted legislation (HB 1433) extending the study and expanding it to include, among other things, the organization, functions, powers, and duties of the various boards, commissions, and councils having jurisdiction over environmental, public health, and natural resources programs.

As required by legislation, DENR and DHHS in February of this year reported to the General Assembly. They proposed splitting the Division of Environmental Health, keeping on-site wastewater, public drinking water, and well construction programs in DENR and transferring the other programs to DHHS. Local health directors and the N.C. Association of County Commissioners strongly objected to the split.

Therefore, according to Holman, the study of DENR reorganization will continue, with emphasis on the possibility of additional public health programs being delegated to local governments. The Environmental Review Commission is charged with reporting on DENR reorganization, functions of boards and commissions, and a number of other issues related to roles of various agencies and organizations in environmental and natural resource management as well as on various environmental policies.

Digest

$221 million in CREP funds. In March Governor James B. Hunt, Jr. and USDA Secretary Dan Glickman met on the banks of the Neuse River in Goldsboro to announce that North Carolina will receive $221 million in federal funding through the Conservation Reserve Enhancement Program (CREP). The state will add $54 million for a total of $275 million to fund restoration of up to 100,000 acres of wetlands and riparian areas in the Neuse, Tar-Pamlico and Chowan river basins and in the Jordan Lake watershed. CREP uses financial incentives to encourage farmers to remove environmentally sensitive land adjacent to streams and rivers from agricultural production and plant and maintain long-term vegetative covers.

Pilot Farmland Preservation. In 1998, the N.C. General Assembly appropriated $250,000 for a pilot grant program by the state's Farmland Preservation Trust Fund. The N.C. Department of Agriculture and Consumer Services, which administers the fund, contracted with the Conservation Trust for North Carolina (CTNC) to design the pilot farmland preservation grant program. The program that CTNC designed awards grants for purchasing future development rights on farmlands (with a matching financial requirement) or to help cover immediate transactional costs and longer-term monitoring and stewardship costs for donated agricultural conservation easements. Grants have been awarded to the Land Trust for Central North Carolina to help protect farms in Rowan and Iredell counties, to the Piedmont Land Conservancy to acquire a conservation easement on farms in the Sutphin Mill community in Alamance and Chatham counties, to the Blue Ridge Rural Land Trust affiliate of the Southern Appalachian Highland Conservancy for a conservation easement in Alleghany County, and to Forsyth County's Farmland Protection Program (the only locally

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April, May action of the N.C. Environmental Management Commission

At its regular meetings in April and May, the North Carolina Environmental Management Commission took the following action:

April

■ Approved extending the deadline by which certain wastewater dischargers in the Jordan Lake watershed must meet minimum treatment technology for nitrogen and phosphorus removal or show by a calibrated model that other nutrient limits are appropriate.

■ Approved asking the General Assembly for legislation necessary to carry out some recommendations of the Neuse Riparian Buffer Stakeholder Advisory Committee. (Bills to carry out the recommendations have been introduced by Sen. Charles Albertson. S 1049 provides for compensatory mitigation as an alternative to maintenance of riparian buffers and authorizes the EMC to delegate responsibility for buffer programs to local governments. S 1050 appropriates funds to DENR to develop statewide stream delineation maps and to the Wetlands Restoration Fund for buffer restoration. These bills affect appropriations and therefore are still alive in the General Assembly. Two other bills related to riparian buffers are also still alive in the General Assembly: H 1241 Protect/Restore Riparian Buffers and H 955 Riparian Buffers Tax-Exempt by Rep. Billy Creech.)

May

■ Approved holding public hearings on (1) adopting a new air quality rule for the control of emissions from abrasive blasting operations, (2) adopting a new section in the air quality rules to implement the federally mandated Risk Management Program, (3) amending the Title V Permit Content rule and (4) amending the New Source Performance Standards rule.

■ Approved holding public hearings on increasing annual fees for wastewater and groundwater laboratory certification.

■ Adopted a temporary rule putting into place, with two changes and one exception, recommendations of the Stakeholder Advisory Committee on the Neuse Riparian Buffer Rule. Changes made to rules recommended by the advisory committee were related to forestry operations and utility crossings in buffers. Recommendations for local program delegation will not be put into place as a temporary rule. The General Assembly must provide the EMC authority to do so. At the same time, the EMC approved initiating rulemaking (with publication in the *N.C. Register* of a Notice of Rulemaking) to put the new Neuse Riparian Buffer rules into place permanently. Local program delegation will be part of the permanent rulemaking.

■ Approved the final Lumber River Basinwide Water Quality Plan. Issues raised by commissioners regarding water quality in this basin were efforts to restore Lockwoods Folly River for shellfishing and mercury in fish tissue. Commissioner Charles Peterson expressed pessimism about the likelihood of restoring Lockwoods Folly given the recent ditching and draining that has taken place near the river. Commissioner Marion Deerhake once again warned that atmospheric deposition of mercury is "very, very serious" in the basin and suggested that the TMDL for mercury established for the Lumber should consider sources far beyond the basin borders.

■ Approved initiating rulemaking (with publication in the *N.C. Register* of Notice of Rulemaking) on nonpoint source controls for the Tar-Pamlico Nutrient Sensitive Waters Management Strategy. Many of the nonpoint source control recommendations to emerge from stakeholders groups are similar to programs put into place in the Neuse, except that phosphorous reductions are targeted along with nitrogen in the Tar-Pam. Commissioners devoted extensive discussion to the question of whether to notice rulemaking on controlling atmospheric sources of nitrogen, in particular ammonia from animal operations. Commissioner Robert Cook asserted that there is not enough hard data on which to base estimates of the contribution of animal operations air emissions to nutrient problems. In the end, the commission decided to publish the notice of rulemaking for atmospheric sources as a way of elevating visibility and debate on the issue, noting that noticing rulemaking does not obligate them to adopt or even draft rules. EMC Chairman David Moreau agreed to appoint two technical advisory committees recommended by the Tar-Pam stakeholders groups: one on agricultural accounting and one on atmospheric emissions. The commission also adopted four resolutions recommended by Tar-Pam stakeholders groups

■ Approved a major variance requested by Gaston County to the Water Supply Watershed Protection Rules.

■ Discussed a timetable for responding to EPA's "NOx SIP call," or the federal mandate to put into place a state plan to reduce emissions of nitrogen oxides. EPA wants the state to accomplish reductions by requiring controls on stationary sources, principally utilities. The state wants to include mobile sources, mainly motor vehicles, in its reduction plan and has sued to be able to use its own plan. Legislation will be required to allow the EMC to adopt rules to accomplish reductions from vehicles, and that legislation has been introduced in the General Assembly by Rep. Joe Hackney and Sen. Brad Miller (H 323 = S 593, Ambient Air Quality Improvement and H 1099 Sulfur Content Limits for Gasoline). For details on the state NOx plan visit web site http://www.ehnr.state.nc.us/EHNR/newsrels/airfinal.htm

Current action of the 1999 Session of the N.C. General Assembly

The 1999 Session of the North Carolina General Assembly convened January 27. Lawmakers seemed to be focused on budget matters until April 14, the deadline for filing public non-money bills. On that date, literally hundreds of bills were filed in both chambers. In order to remain alive in the 1999 session, any of those bills or resolutions (other than those that must be referred to the appropriations or finance committee) must have been passed by one chamber and received by the other by April 29. Following is a list of environment-related bills that made this "crossover" deadline. Other environment-related bills are also still alive in the General Assembly by virtue of the fact that they affect appropriations. Some of these are mentioned elsewhere in this issue.

RATIFIED BILLS

SB 27 An act to repeal the prohibition against the Department of Transportation using Bermuda grass along certain roads. This act repeals G.S. 136-18.1, which restricted the use of Bermuda grass to sections of highway where the abutting property is not in cultivation and directed NC DOT to try to eliminate Bermuda grass on shoulders of highways through cultivated farm areas.

H 326 An act to allow the Division of North Carolina Aquariums to dispose of exhibits from the collections of the N.C. Aquariums in accordance with generally accepted practices for accredited zoos and aquariums, to require that the net proceeds of any sale or lease of exhibits be credited to the N.C. Aquariums Fund, and to require the Division of N.C. Aquariums to report on receipts to and expenditures from the N.C. Aquariums Fund.

BILLS THAT CROSSED OVER

H 222 An act to strengthen the littering law by increasing the minimum and maximum fines and by requiring community service in those instances where it is currently permissive.

H 316 (= S 247) An act to encourage prescribed burning for forestry and wildlife purposes under certain conditions.

H 638 An act to authorize the owners of certain innovative septic systems in the counties of Camden, Chowan, Currituck, Gates, Hertford, Pasquotank, Perquimans, Tyrrell and Washington to transfer the ownership of the systems to one or more units of local government.

H 684 An act authorizing the towns of Apex, Cary, Garner, and Morrisville to adopt ordinances regulating removal, replacement, and preservation of trees and shrubs within the towns and the towns' extraterritorial planning jurisdiction.

H 746 (= S 872) An act to amend the Natural and Scenic Rivers Act of 1971 to remove the limit on the amount of acreage the state may acquire for inclusion in the New River Scenic River Area of the North Carolina Natural and Scenic Rivers System.

H 968 An act to modify the procedures concerning final administrative decisions in contested cases heard by the Office of Administrative Hearings.

H 1008 (= S 777) An act to provide for the regulation of certain excavation and grading activities under the Sedimentation Pollution Control Act of 1973 instead of the Mining Act of 1971. Excludes from the definition of "Mining" "excavation or grading where all of the following apply: (1) The excavation or grading is conducted to provide soil or other unconsolidated material to be used without further processing for a single off-site construction project for which an erosion control plan has been approved in accordance with Article 4 of Chapter 113A of the General Statutes. (2) The affected land, including nonpublic access roads, does not exceed five acres. (3) The excavation or grading is completed within one year. (4). The excavation or grading does not involve blasting, the removal of material from rivers or streams, the disposal of off-site waste on the affected land, or the surface disposal of groundwater beyond the affected land. (5) The excavation or grading is not in violation of any local ordinance. (6) An erosion control plan for the excavation or grading has been approved in accordance with Article 4 of Chapter 113A of the General Statutes."

H 1027 An act to allow the stocking of animals by certain persons. Relates to stock of wild animals and birds.

H 1039 An act to require the Department of Environment and Natural Resources to develop a strategy and a plan for beach management and restoration and to identify financing alternatives for this purpose.

H 1125 An act to conform the definition of an inactive hazardous substance or waste disposal site under the inactive hazardous sites response act of 1987 to federal law.

H 1160 (= S 1084) An act to extend [to Dec 31, 2000] the pilot program under which the Division of Soil and Water Conservation of the Department of Environment and Natural Resources conducts all inspections of animal waste management systems in certain counties [Columbus and Jones].

H 1218 (= S 1132) An act to make clarifying, conforming, and technical changes to various environmental laws. Changes G.S. 143-215.94E(i) related to civil penalties for failure to follow through with closure or upgrading of underground storage tanks to replace reference to G.S. 143 215.94K with reference to G.S. 143-215.94W.

H 1288 (= S 1164) An act to establish metropolitan planning boards to assist the Department of Transportation in the development of transportation plans and programs for urban areas of the state.

S 249 An act to extend the moratorium on issuing shellfish leases in Core Sound, to require the Division of Marine Fisheries and the primary investigator to report the results of the shellfish mapping and human use mapping of Core Sound the to Joint Legislative Commission on Seafood and Aquaculture and the Marine Fisheries Commission, to authorize rather than require the Secretary of Environment and Natural Resources to require fisheries license agents to post bonds, and to establish an interim crab license.

S 313 (= H 597) An act to allow Mecklenburg County to continue to levy stormwater fees if bonds have been issued and are outstanding.

S 368 An act to authorize the Department of Transportation to construct access to rivers and streams.

S 829 An act to direct the Joint Legislative Transportation Oversight Committee to study issues related to prohibiting the erection of outdoor advertising on a portion of interstate highway 40 [from the Orange-Alamance County line to the municipal limits of the City of Wilmington] and to impose a moratorium pending the committee's report to the General Assembly.

S 878 An act to allow certain nonprofit water corporations to be eligible for revolving loans and grants from the Drinking Water Treatment Revolving Loan Fund. Provides that nonprofit organizations incorporated under Chapter 55A of the General Statutes may apply for loans and grants from Drinking Water Treatment Revolving Loan Fund established by G.S. 159G-5(d) subject to approval by the Local Government Commission.

S 953 An act to authorize the Department of Environment and Natural Resources to distribute funds from the Wetlands Restoration Fund and to convey interests in real property acquired under the Wetlands Restoration Program to federal and state agencies, local government, and private nonprofit conservation organizations.

S 979 An act to repeal the Public Settlement Reserve Fund and to make conforming changes to the law requiring the Attorney General to report to the General Assembly on public monies. Corrects an unintended requirement that environmental cleanup settlement funds in excess of $75,000 be deposited in the Public Settlement Reserve Fund.

S 1004 An act revising the procedure used by the N.C. Board for Licensing of Geologists to address complaints and investigations and authorizing the Board to assess civil penalties.

S 1019 An act to clarify the authority of Land Surveyors to enter on land.

S 1047 An act to prohibit the taking of shellfish within one hundred fifty feet of a publicly owned pier beneath which the Division of Marine Fisheries has deposited cultch material.

S 1048 An act to create a grants committee to set priorities for, review applications to, and award grants under the Fishery Resource Grant Program and to make clarifying, conforming, and technical changes to the Fisher Resource Grant Program statute.

S 1081 An act to require the Department of Transportation to expand the use of recycled materials in road maintenance. Focuses on use of "hot in-place recycling" for road and highway maintenance. [According to Purdue University Civil Engineering, "Hot-In-Place-Asphalt-Recycling is a process of correcting asphalt pavement surface distress by softening the existing surface with heat, mechanically removing the pavement surface, mixing with recycling agent, possibly adding virgin asphalt and/or aggregate and replacing it on the pavement without removing the recycled material from the original pavement site.]

S 1127 An act to codify the joint resolution dedicating properties as part of the State Nature and Historic Preserve, including the codification of name changes of certain lands previously accepted into the State Nature and Historic Preserve, to remove certain lands from the State Nature and Historic Preserve, to codify these removals, and to delete certain lands from the State Parks System.

S 1140 An act to ban new or replacement billboards on a portion of U.S. Highway 52 and N.C. Highway 752 in Surry County. Adds "new or replacement" to ban language, thereby repealing ban on existing billboards on this area of highway near Pilot Mountain State Park.

S 1159 An act to expand the circumstances under which the Department of Environment and Natural Resources may allow the use of land-use restrictions to protect public health at contaminated sites. [This legislation is considered important to DENR's efforts to put risk-based cleanup policies into effect and to brownfields programs.]

S 1161 An act to direct the Department of Environment and Natural Resources and representatives of the food service industry to review the rules and guidelines governing local oil and grease water pretreatment programs to determine whether those programs are equitable, effective and economically manageable.

Research scientists are urged to reclaim their intellectual property

Would Stephen King work for two years on a thriller, then give it to a publisher, ask for no payment and no royalties, and give up the movie and paperback rights? Of course not.

Then why do university research scientists put years into an investigation, then give an article documenting the findings to a journal publisher, ask for no payment or royalties, and give up the rights to derive other works from the article and even to reproduce it for their own university classes?

Is it because Stephen King's writing has market value and the writings of university research scientists do not?

Not according to David E. Shulenburger, Provost at the University of Kansas. According to Shulenburger, articles documenting research have definite market value and great intellectual value. Advancements in both basic and applied science depend upon access to work done by others and to accumulated knowledge of natural phenomena. Further, Shulenburger said, publishers of scientific journals to whom university scientists give their work are among the most profitable in the world, with profit margins three to four times the 5% of the publishing industry in general.

Schulenburger was among the speakers at a colloquium on scholarly communication at N.C. State University in February. The colloquium was one of a series of events organized by the NCSU Libraries' Scholarly Communication Subcommittee to give the university community an opportunity to learn about and discuss issues related to ownership of intellectual property. University provosts and directors of research libraries in the Research Triangle and across the country are sponsoring these discussions to inform faculty about the value of their copyrights, and the new economics of scholarly publishing and, at the same time, to seek ideas for solving the "scholarly communication crisis."

Describing a crisis in scholarly publishing, Schulenburger said that university scientists virtually give their work away because they must publish in recognized journals to win tenure, promotion, and research support, and because they look upon the results of research and scholarship as a free good to be shared as widely as possible, not as a product to be marketed. He said that as a result of these pressures and attitudes—plus the frequent inattention of scientists to the copyright agreements they sign—publishers are gaining a monopoly hold on the intellectual property of scientists employed and supported by universities and then licensing the property back to university libraries at prices they can no longer afford.

Between 1986 and 1996, the cost of scholarly journals increased 148% while the consumer price index increased only 44 percent. As journal prices have increased, so has the number of specialized scientific journals needed by university scientists conducting research in narrow disciplines. Many research libraries saw some increase in their budgets from special appropriations or fund-raising efforts, but it soon became evident that these increases could not continue and that diverting funding from teaching and research to libraries was not an option. Trying to cope with price increases and increase in demand for new titles, research libraries have established cooperative loan agreements but have still had to cut back on journal subscriptions, decreasing faculty access to needed research materials.

Shulenburger believes that unless universities can solve the scholarly publishing crisis and guarantee that researchers are able to share the results of their work, scholarly endeavors—and perhaps U.S. leadership in science and technology— will be damaged irreparably.

Scholarly journals do add value to faculty work through refereeing, editing, indexing and archiving publications, but their profits currently far exceed the value they add, said Shulenburger. By supporting faculty and the research infrastructure, universities create value, he said. "It's time they reclaimed part of that value."

To reclaim some of what their faculty create, universities must deal with the issue of copyrights, he said, but university ownership of the intellectual property of faculty is not the answer. Instead, Shulenburger proposed establishment of a National Electronic Article Repository (NEAR), to which all articles published by university faculty would pass after a lag period of perhaps 90 days. Universities could require faculty to retain limited rights to their published articles and provide the rights to NEAR. The University of Kansas Board of Regents has already adopted such a requirement that will become effective when a repository is established.

However, an agreement among universities to support NEAR might need protection from antitrust action, Shulenberger said.

Another possible solution to the scholarly publishing crisis is to return publishing to nonprofit scholarly societies and university presses, where it resided prior to the 1960s, and to exert pressure on these publishers to hold down costs. And yet another is to create new publishing ventures. The Association of Research Libraries has implemented a project called SPARC—Scholarly Publishing & Academic Resources Coalition—to provide opportunities for new publishing ventures and promote access to information for research and teaching. Last year SPARC helped University of Arizona biologist Michael Rosenzweig launch *Evolutionary Ecology Research* as a low-priced alternative to the commercial journal he had founded a dozen years ago.

Rosenzweig and his entire editorial staff abandoned the thriving commercial journal because they believed the publisher had made it so expensive that many libraries could no longer afford it.

Although problems with scholarly publishing have been gathering for decades, the situation is now considered a crisis because commercial publishers are establishing on-line journals and claiming copyrights to materials published electronically. The medium that many had looked to as a potential alternative outlet for scholarly work is now threatened by the same commercial interests that dominate the print medium.

Universities are not close to solving the scholarly publishing crisis. Many universities (including NCSU and UNC-Chapel Hill) have established copyright task forces to study issues of ownership of intellectual property and make recommendations for changes to copyright policy. But, while a number of proposals are being floated, the primary efforts of university and library administrators are still directed at engaging faculty in the discussion, because, everyone agrees, it is most appropriately the role of research scholars to exert control over their intellectual property.

WRRI will protect right to publish project technical completion reports

Part of the primary mission of WRRI is to disseminate findings of research projects it sponsors. One way the Institute carries out this mission is to publish full technical completion reports on projects. The Institute also publishes summaries of research reports on its web site and plans to publish full text reports on the web in the future. However, the Institute also encourages researchers to publish project results and findings in relevant journals. The Institute is now in the process of incorporating into its standard subcontracts, language to assure that researchers can continue to publish findings of WRRI research in scientific and professional journals and at the same time preserve the Institute's ability to publish technical completion reports.

A copyright primer

Who owns the copyright to scholarly works produced by university faculty?

In most university settings (including throughout The University of North Carolina system) faculty members own copyright to all copyrightable material they produce, unless special arrangements were made prior to production of the material (such as work for hire or copyright provisions in a contract).

What is a copyright?

A copyright is a bundle of rights that includes the right to

- Reproduce the work. *Scholars who give up this right cannot reproduce their articles for distribution in classes or include them in a coursepack without paying or having students pay royalties.*
- Distribute the work. *Scholars who give up this right give up the ability to control the conditions under which their research results are disseminated.*
- Perform the work. *Scholars who give up this right cannot read their published papers at a conference or symposium.* *
- Display the work. *Scholars who give up this right cannot produce posters incorporating figures, tables, and text from their articles or post their articles to their Internet sites.* *
- Produce or license derivatives of the work. *Scholars who give up this right give up the ability to update, revise or expand their work and to control how the work might be revised.*

For more information about copyright and the scholarly publishing crisis, visit the following websites:

Association of Research Libraries' Office of Scholarly Communication: http://www.arl.org/scomm/index.html

The NCSU Scholarly Communication Center: http://www.lib.ncsu.edu/issues/SCC/scholcom.html

The Institute for Research on Higher Education's *Policy Perspectives* Vol 7, No 4, March 1998 "To Publish and Perish" http://www.irhe.upenn.edu/cgi-bin/cat.pl#V7N4

Dr. David E. Shulenburger, Provost, University of Kansas http://www.ukans.edu/~provost/Arl.html

For information on other issues related to the privatization of research information and the "shrinking public domain" visit these websites:

The Union for the Public Domain http://www.public-domain.org/old.html

Arnold P. Lutzker, The Digital Millennium Copyright Act http://www.arl.org/info/frn/copy/primer.html

Prue Adler, Proposed Database Protection Legislation http://www.arl.org/info/frn/copy/copytoc.html

* *Teachers at nonprofit educational institutions can display and perform works in a face-to-face classroom setting. They may also display or perform some portion of their work under fair use provisions of the copyright laws.*

At the May meeting of the N.C. Environmental Management Commission, Department of Environment and Natural Resources General Counsel Dan McLawhorn briefed commissioners on the Hunt administration's plan for converting anaerobic swine waste lagoons and sprayfields to new technology. Read the Governor's plan at web site: http://www.ehnr.state.nc.us/EHNR/files/hogs/hogplan.htm

Digest *continued*

funded farmland preservation program operating in the state) for development rights on a farm in the Kernersville area.—*Conserve Carolina* Spring 1999

Willingness to pay for earth-friendly pork. According to the Leopold Center for Sustainable Agriculture at Iowa State University, research indicates that many people would be willing to pay more for pork if they knew it was produced in environmentally friendly ways. Attitudinal surveys and willingness-to-pay experiments were conducted recently by an ISU economist using participants from Iowa Falls and Ames in Iowa; Raleigh, North Carolina; and Corvallis, Oregon. In the willingness-to-pay experiment randomly selected consumers used real money to bid for real products. During four rounds of bidding, consumers were given increasing amounts of information about the various systems under which the products were produced. Participants were willing to pay increasing premiums as more environmental attributes (such as less odor and more groundwater protection) were attached to the products. More than 90 percent of the participants said they would buy a meat product that had environmental attributes specified on the label.—*Leopold Letter* Spring 1999 (on the web at http://www.leopold.iastate.edu/centers/leopold/99-1porkniche.html)

NPDES Storm Water Phase II. In January, the U.S. EPA announced a delay in signing of the final rule to set requirements for bringing smaller municipalities and construction sites under 5 acres into the federal storm water permitting program. The NPDES storm water Phase II rule was proposed January 9, 1998 (*Federal Register* Vol 63 No 6). The rule is now scheduled to be signed October 29, 1999. The effective date will be when the rule is published in the *Federal Register*, probably several weeks after signing. Permits will be required 2-3 years after the effective date.

UNC-W scientists say a large part of N.C. estuaries may not fully support fisheries

According to a report published in October 1998 by the UNC-Wilmington Center for Marine Science Research, one-third to three-quarters of North Carolina's estuaries may not fully support the food chains that sustain the states' commercial fisheries. The report details water quality, sediment, and fauna sampling conducted in N.C. sounds, estuaries, and rivers under the federally funded Environmental Monitoring and Assessment Program (EMAP). Courtney T. Hackney, principal investigator for the project, also reported results of the project to the state's legislative Environmental Review Commission and the N.C. Environmental Management Commission this past winter.

Between 1994 and 1997, UNC-W scientists sampled 165 sites, most selected randomly and sampled once. Twenty sites were sampled twice, as were 9 reference sites and 5 sites which were part of a non-random transect. Sampling was conducted between July 1 and September 30 and therefore provides a snapshot of the most extreme part of the annual cycle in estuaries, when the harshest conditions with respect to dissolved oxygen, salinity and temperature are to be expected.

Scientists measured dissolved oxygen, salinity and temperature of water column samples. They analyzed sediment samples for pesticides, hydrocarbons and trace metals and tested sediment samples in the laboratory for biological toxicity. They also sifted sediment samples to determine the presence and community make up of bottom-dwelling creatures (benthic infauna, which serve as food for some fish). They trawled for fish, crab, and shrimp at each sampling site in 1994 and 1995, examined their catch for sores, and analyzed some to determine if contaminants had accumulated in their body tissue.

The contaminants that scientists found in sediment samples most often were nickel, arsenic, DDT, chromium, PCBs and mercury. When they considered the adverse effect of any one contaminant found at individual sites, they concluded that 41% of all randomly selected sites were contaminated and that 20% were highly contaminated. When they added together the adverse effects of all the contaminants found at individual sites, they concluded that 81% of all sites were moderately or highly contaminated. The majority of highly contaminated sites were in the Albemarle Sound, Neuse River and Pamlico River.

Nearly one-fourth of the sites sampled had dissolved oxygen levels below 5 milligrams per liter. Thirty percent of the sites had low infaunal communities.

Fifteen percent to 50% of fish collected had sores or tumors, with the higher percentage occurring at highly contaminated sites. Spot and croaker from Pungo Creek, Pamlico Sound and Pamlico River showed uptake of contaminants, especially PCBs, but body burdens were below levels known to harm human health.

Duplicate sampling indicated that sediment contamination, in general, is not getting markedly worse. However, the scientists say that there is evidence of a large pool of DDT within the Coastal Plain that can be mobilized and carried to estuarine waters by heavy storms. They say that their work strongly suggests that areas of North Carolina's estuaries have a reduced capacity to support commercial fisheries and will remain in that condition for many years to come.

The report, *Sediment Contamination in North Carolina's Estuaries*, by Courtney T. Hackney, Jude Grimley, Martin Posey, Troy Alphin and Jeff Hyland can be obtained from the Center for Marine Science Research at the University of North Carolina at Wilmington (910/256-3721 or http://www.uncwil.edu/cmsr/). It is publication #198.

WRRI report available

WRRI has recently published a peer-reviewed technical completion report on a research project for which it provided funding. Single copies of WRRI reports are available free to federal/state water resource agencies, state water resources research institutes, and other water research institutions with which exchange agreements have been made. Single copies of publications are available to North Carolina residents at a cost of $4 per copy prepaid ($6 per copy if billed) and to nonresidents at a cost of $8 per copy prepaid ($10 per copy if billed). Send requests to WRRI, Box 7912, North Carolina State University, Raleigh, NC 27695-7912 or call (919) 515-2815 or email: water_resources@ncsu.edu.

Slurry-Phase Bioremediation of Contaminated Soil from a Former Manufactured-Gas Plant Site Report No. 320 November 1998

Michael D. Aitken, David C. Nitz, Denise V. Roy, and Chikoma Kazunga Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill

Before the mid-1960s, most combustible gas for heating, cooking, and lighting came from manufactured-gas plants (MGPs), which created the gas from coke, coal, and oil. When natural gas became more readily available, the MGPs were decommissioned, and many of the buildings demolished. However, the storage tanks under the plants remained, still containing tars and other liquids when they were filled in with soil and demolition debris.

The tars contain, among other things, polycyclic aromatic hydrocarbons (PAH). Of the 16 PAH regulated by the U.S. EPA, seven are known carcinogens. Contact of ground water or surface water with these tars results in the dissolution of the tar constituents, particularly benzene, a known carcinogen, and naphthalene, both relatively water-soluble compounds.

The objectives of the research were to evaluate the biological treatment of contaminated soil from an MGP site using bench-scale slurry-phase reactors, and to evaluate the effects of strategies to enhance PAH degradation in the contaminated soil. Study of biodegradation of PAH is needed since there are few options in place to treat contaminated soils at MGP sites, and in many cases the off-site migration of contaminants is assumed to be mitigated by natural attenuation.

The effect of increased solids residence time (SRT) in the slurry-phase reactor was evaluated by comparing two residence times (18 days and 35 days) over a period of five months. The effects of greater mixing at a solids residence time of 18 days were also investigated. The researchers evaluated whether the biomass in the reactors was capable of mineralizing five specific PAH. Then the effects of a nonionic surfactant (Brij 30) and additional carbon sources on PAH solubilization and degradation in treated soil from the slurry-phase reactor were evaluated. In principle, surfactants can improve the rate of PAH dissolution into water and thus potentially increase the bioavailability of the PAH.

The experiments produced the following findings:

- The reactors contained active PAH-degrading biomass capable of mineralizing all of the compounds tested except for benzo[a]pyrene.
- Increased SRT (beyond18 days) in the reactor did not significantly increase PAH removal.
- Mixing in the first experiments was inadequate and led to aggregation of tar or some other separate phase containing the majority of the PAH; however, greater mixing at 18 days SRT prevented phase separation.
- Removal of benzo[a]pyrene probably was limited by biological activity, whereas removal of the other six PAH that were examined probably was limited by mass transfer.
- Addition of the surfactant and/or carbon substrates to treated soil from the reactor did not enhance PAH degradation.

Recommendations

Further study is needed on the degradation of benzo[a]pyrene. The researchers suspect that its rate of degradation may be inherently so slow that the mere presence of other degradable PAH reduces the degradation rate to undetectable levels. Also, more research about the application and behavior of surfactants in soil systems is crucial before conclusions can be drawn on their efficacy in remediation of PAH-contaminated soils.

Use of a surfactant less hydrophobic than Brij 30 may help enhance biodegradation of PAH in the field. Also, it is of great importance that the surfactant used have minimal impact on the biological activity in the system. While there is too little information in the literature to evaluate surfactants on this basis, this information should be a priority for further research. Another area of exploration is whether biological activity in PAH-contaminated soil leads to the accumulation of inhibitory metabolites.

People

Kenneth H. Reckhow, Director of WRRI, has been named president-elect of the National Institutes for Water Resources, a network of 54 state water resources research institutes.

Tommy Stevens was named Director of the N.C. Division of Water Quality in March. Stevens had served as deputy director since June 1998. He was previously the water quality supervisor in the Department of Environment and Natural Resources Fayetteville Regional Office.

Carol Bond, Environmental Coordinator for the City of Raleigh's Department of

continued

Public Utilities died April 10 following a brave battle with cancer. Carol helped initiate the department's WaterFest, a festival focused on educating the public, and particularly school children, about drinking water and wastewater treatment. The festival has attracted thousands of children and adults for the last several years. Carol also wrote and illustrated a children's educational coloring booklet on water and, on occasion, transformed herself into Wanda Water to bring water education to life. She also served as secretary for the Lower Neuse River Basin Association and was active in the N.C. chapter of AWWA/WEF.

Public Hearings on proposed reclassifications of water bodies

Reclassification of Wesser Creek (Swain County) as Trout Waters and Reclassification of Rough Creek (Haywood County) as Trout Waters and Outstanding Resource Waters
May 25, 1999 - 6 pm
Haywood County Commissioners Boardroom
Waynesville

Reclassification of Lake Waccamaw (Columbus County) as Outstanding Resource Waters
June 21, 1999 - 6 pm
Southeastern Community College Auditorium
Whiteville

Reclassification of Lake Phelps (Washington & Tyrell Counties) for Primary Recreation and as Outstanding Resource Waters
June 24, 1999 - 6 pm
Creswell Town Hall
Creswell

Reclassification of Lake Montonia (Cleveland County) as High Quality Waters
July 13, 1999 - 6 pm
Kings Mountain City Hall
Kings Mountain

For additional information contact Liz Kovasckitz with the N.C. Division of Water Quality at (919) 733-5083 Extension 572

Publications

❒ The N.C. Office of Environmental Education in partnership with the N.C. Association of County Commissioners, the N.C. League of Municipalities, and the N.C. American Water Works Association/Water Environment Association has produced **Educators Guide to Environmental**

1998-99 Water Resources Research Seminar Series

Monday, May 24, 1999, 3 pm. Groundfloor Hearing Room, Archdale Building, downtown Raleigh. "Optimizing Buffers to Reduce Pollutants in Runoff." *Associate Professor Richard McLaughlin, Department of Soil Science, North Carolina State University.*

North Carolina Precipitation/Water Resources

	March	April
Rainfall (+/- average)		
Asheville	2.82" (-1.81")	2.44"(-0.92")
Charlotte	1.31" (-3.12")	4.12"(+1.44")
Greensboro	1.96" (-1.76")	4.37"(+1.53")
Raleigh	3.69" (-0.08")	3.53"(+0.94")
Wilmington	3.07" (-0.81")	5.02"(+2.15")

Streamflow **Index Station** (County, Basin)	**March mean flow (CFS)** (% of long-term median)		**April mean flow (CFS)** (% of long-term median)
Valley River at Tomotla (Cherokee, Hiwassee	368	(86%)	211 (62%)
Oconaluftee River at Birdtown (Swain, Tenn)	700	(88%)	566 (77%)
French Broad River at Asheville (Buncombe, FB)	1,750	(60%)	1,980 (78%)
South Fork New near Jefferson (Ashe, New)	388	(68%)	292 (54%)
Elk Creek at Elkville (Wilkes, Yadkin/Pee-Dee)	81	(69%)	68 (63%)
Fisher River near Copeland (Surry, Yadkin/Pee-Dee)	154	(67%)	119 (56%)
South Yadkin River near Mocksville (Rowan, Yadkin/PD)	280	(56%)	275 (69%)
Rocky River near Norwood (Stanly, Yadkin/Pee-Dee)	655	(22%)	710 (50%)
Deep River near Moncure (Lee, Cape Fear)	1,446	(47%)	1,070 (60%)
Black River near Tomahawk (Sampson, Cape Fear)	576	(41%)	397 (39%)
Trent River near Trenton (Jones, Neuse)	111	(39%)	126 (74%)
Lumber River near Boardman (Robeson, Lumber)	1,222	(47%)	1,100 (61%)
Little Fishing Creek near White Oak (Halifax, Pamlico)	201	(67%)	112 (64%)
Potecasi Creek near Union (Hertford, Chowan)	204	(44%)	99 (42%)

Groundwater **Index well (Province)**	**March depth below surface (ft)** (departure from average for month)	**April depth below surface (ft)** (departure from average for month)
Blantyre (Blue Ridge)	29.47 (+1.19)	28.59 (+1.27)
Mocksville (Piedmont)	16.09 (-0.80)	16.31 (-0.88)
Simpson (Coastal Plain)	3.27 (-0.13)	4.42 (-0.49)

Source: U.S. Geological Survey's *Water Resources Conditions in North Carolina*

Education Programs at Water Treatment and Wastewater Treatment Plants. The guide is aimed at educating the public on the importance of water treatment and wastewater treatment plants and improving public awareness of treatment facilities as valuable environmental education resources throughout North Carolina. For copies of the guide, contact the N.C. Office of Environmental Education, P.O. Box 27687, Raleigh, NC 27611-7687; Phone (919) 733-0711; web site: http://www.enr.state.nc.us/ENR/ee.

❒ The Center for Watershed Protection offers the following recent publications for watershed managers and others interested in watershed protection

■ **Site Planning Consensus Agreement** ($3)

■ **Better Site Design: A Handbook for Changing Development Rules in Your Community** ($35)

■ **Nutrient Loading from Conventional and Innovative Site Development** ($20)

■ **Rapid Watershed Planning Handbook**. ($40)

Make check payable to and mail to Center for Watershed Protection, 8391 Main Street, Ellicott City, Maryland 21043; call (410) 461-8324; or visit web site: http://www.pipeline.com/~mrrunoff/

❒ The Conservation Trust for North Carolina has updated its publication **Conservation Easements: An Introduction for North Carolina Landowners** and has commissioned a study and booklet, **Mountain Residential Design**, about designing residential areas to protect open space and streams in the N.C. mountains. For information, call CTNC at (919) 828-4199 or visit web site: http://www.sunsite.unc.edu/ctnc.

❒ **Proceedings of WRRI's 1999 Annual Conference and its Mountain Water Resources Conference** are available. Proceedings contain abstracts of all presentations. Cost in-state is $4 prepaid and $6 if billed. Cost out-of-state is $6 prepaid and $8 if billed. To order, write WRRI at Box 7912, NCSU, Raleigh, NC 27695-7912 or call (919) 515-2815 or email water_resources@ncsu.edu.

Conferences and workshops

The N.C. Stream Restoration Institute will present **Stream Restoration and Protection** Aug 17-20, 1999, at the Radisson Hotel in Asheville, NC. Presentations will describe current government programs and technical topics associated with designing, implementing and monitoring stream restoration and protection projects. Optional workshops are available for practitioners to learn more about river mechanics, field techniques for stream restoration, data collection and analysis. 11 PDHs will be offered to P.E.s. For a brochure contact Terry Pollard with the N.C. State University Water Quality Group at (919) 515-8182 or visit web site: http://www5.bae.ncsu.edu/programs/extension/wqg/workshop/asheville_conf_intro.htm. Registration is due by July 1.

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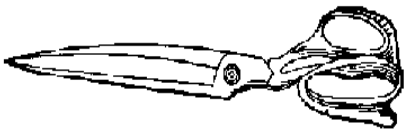

WRRI NEWS SUBSCRIPTION UPDATE

(ADD? DELETE? ADDRESS CHANGE?)

Please review your address as it appears on this newsletter. If you wish to have your name removed from our mailing list, or if you address needs to be corrected, please indicate the action we should take directly on the reverse side of this page adjacent to your address label and return the lower portion of the page to use for correction.

It will help tremendously if you will return changes promptly so that they can be made prior to our next mailing. If we do not hear from you, we will assume your address is correct as shown on the label.

If you know others who would benefit from receiving the WRRI News, pleas ask them to send name, affiliation, address, and phone number to the address below with a request to be added to the mailing list.

Return to:

Water Resources Research Institute
of The University of North Carolina
Box 7912, N.C. State University
Raleigh, NC 27695-7912

The University of Massachusetts at Amherst Environmental Engineering Program will present its **Institute in Drinking Water Treatment** Aug 2-4, 1999, at the Hotel Northampton in Northampton, MA. The Institute teaches fundamentals of drinking water treatment, presents new developments in treatment technology and regulations, and demonstrates application of principles using pilot-scale and full-scale plant studies. For information contact Jodi Ozdarski, Institute Secretary, at (413) 545-0685 or visit web site: http://www.ecs.umass.edu/cee/dwi.html

The Federal Remediation Technologies Roundtable will present **Subsurface Remediation: Improving Long-Term Monitoring & Remedial Systems Performance** June 8-11, 1999, in St. Louis, MO. The conference will highlight issues related to the performance of subsurface remediation technologies, showcase practical approaches to monitoring remedial performance, and identify research needs. For information call (703) 318-4797 or visit web site: http://www.clu-in.org/products/moreinfo/subsurf.htm

Web Sites

Sandia National Laboratory has developed an interactive web site to help operators and regulators decide if **natural attenuation** will work to remediate contaminated watersheds. It provides a preliminary screening guide and information about testing: http://www.sandia.gov/eesector/gs/gc/snap.html

EPA has developed an inventory of 180 **watershed-related training courses**, sponsored by federal and state agencies, as well as the private sector. The one-page course summaries provide information to determine your level of interest and contacts for further information: http://www.epa.gov/OWOW/watershed/wacademy/catalog.html

EPA's **Pesticidal Chemicals Classified as Known, Probable or Possible Human Carcinogens** web site categorizes pesticides by carcinogenicity and lists registration date, use patterns and regulation status: http://www.epa.gov/pesticides/carlist/table.htm

North Carolina Water Resources Association

NCWRA

North Carolina Section of the American Water Resources Association

Luncheon and Forum Schedule

Sept 13, 1999	Stormwater: NPDES Phase II
Dec 6, 1999	Cape Fear Basin: Water Quantity Issues
Feb 14, 2000	Mitchell River Watershed: Case Study
April 10, 2000	Capacity Use
Sept 11, 2000	Land Use Planning

All luncheon/forums take place at 11:30 am at the Jane S. McKimmon Center on the N.C. State University campus. For additional information call Robert Holman at WRRI (919/515-2815).

WATER RESOURCES RESEARCH INSTITUTE
OF THE UNIVERSITY OF NORTH CAROLINA
BOX 7912
NORTH CAROLINA STATE UNIVERSITY
RALEIGH NC 27695-7912

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