

# Virginia Water Central

## Virginia Water Legislation in the Wake and on the Horizon

The use and potential abuse of Virginia's water were the focus of 97 bills considered by the Virginia General Assembly in 1998. The issues ranged from licensing teenage boaters to regulating poultry waste. The question remains, however, which bills are likely to have significant impacts on the state?

In an effort to answer that question, more than 20 Virginians in water-related fields were interviewed in July by phone and e-mail. The sources included lawmakers, economic developers, regulators, local utility managers, and environmentalists. This article summarizes their assessments of the water bills considered in 1998 and the issues likely to be revisited in 1999. [Ed. note: For a list of people interviewed and their choices of significant bills, see page 4.]

### Animal Waste Management

No bill was mentioned more than HB1207, which calls for the State Water Control Board to regulate poultry manure in the Chesapeake Bay watershed. In recent years concerns have increased about the contribution of poultry manure to nonpoint-source pollution. The poultry waste bill was carried over until 1999. In the interim, the Virginia Department of Environmental



Quality (DEQ) is conducting a study of poultry-waste regulation. Dennis Treacy, head of DEQ, said he expects the study committee to offer some conclusions by the end of the year, and these findings will be integral to the attention the bill gets in 1999.<sup>1</sup>

Jack Frye, director of the Division of Soil and Water Conservation in the Department of Conservation and Recreation, gave his assessment of why the administration opposed the bill. He said that poultry growers agreed to self-regulation efforts in 1995 and that they have shown an "increasingly improved track record... This bill runs right in and regulates the industry without giving it a chance," Frye said.

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<sup>1</sup> Meanwhile, the U. S. EPA and Agriculture Department are preparing a nationwide plan, due by November 1998, for reducing nutrient runoff from livestock operations, including poultry.

Del. Raymond R. Guest, Jr. (R-15<sup>th</sup> District), co-chair of the House Conservation and Natural Resources Committee, agreed with Frye. "I thought the industry was making strides forward," he said. "[I]f the industry can perform, then we don't need the bill."

But others who consider the industry's efforts at nutrient management insufficient are hoping for the bill's eventual passage. Joseph H. Maroon, Virginia executive director of the Chesapeake Bay Foundation, considered this bill among 1998's most important (and most hotly debated). "[Chicken waste] is laden with nitrogen and phosphorus, major pollutants of Virginia's surface and groundwater and the Bay," he said.

Kay Slaughter, a senior attorney at the Southern Environmental Law Center in Charlottesville, said DEQ's study is a "good, minimal first step." Asked if the industry's voluntary efforts were sufficient, Slaughter said they don't eliminate the need for a law. "We don't expect people to drive under the speed limit voluntarily; [instead] we have a law," Slaughter said. "It's good when industries go beyond the law, but we think there needs to be a baseline."

Del. M. Kirkland Cox (R-66<sup>th</sup> District), co-chair of the House Chesapeake and Its Tributaries Committee, co-sponsored the poultry waste bill. He said the key to passage of that bill will be cost sharing. "We need to help out farmers, [because] those [best management practices] cost money," he said. In this context, Cox and others voiced support for innovations in poultry-manure management, such as the use of Phytase.<sup>2</sup>

Other observers had different perspectives on animal waste management. Jim Warfield, spokesman for the Fairfax County Water Authority<sup>3</sup>, said the authority is concerned with anything that can result in an outbreak of the *Cryptosporidium* parasite. Although no *Cryptosporidium* outbreak has occurred in Virginia, a 1993 outbreak in

Milwaukee killed over 100 people and sickened another 400,000. Warfield said that outbreak "really woke the water industry up."

Warfield mentioned two bills that concerned his agency: the poultry waste bill, and HB991, which deals with the general permit process for confined animal feeding operations.<sup>4</sup> HB991, which passed, tightens general-permit rules for livestock operations, in particular hog producers. It increases the required inspections of hog operations from once every five years to once every year.

Several people praised this bill, including Robert G. Burnley, the Virginia Economic Development Partnership's director of technical services.<sup>5</sup> Burnley said passage of HB991 (and its twin senate bill, SB661) "...confirmed the value of general permits and the whole general-permit concept...[The use of] general permits, when properly administered ...saves valuable resources for the regulatory agencies, protects the environment, and saves time and money for the permit applicant."

But Ms. Slaughter disagreed. She said general permits simply are not enough when dealing with the largest facilities, which have as many as 2,500 hogs. Virginia, she added, is "behind" many other states that require larger operations to have individual permits that take into account a site's topography and an operation's waste load.

## Water Transport of Waste

Trash riding on water got about as much attention as animal waste flowing into water.

Patricia Jackson, executive director of the James River Association<sup>6</sup>, said she

<sup>2</sup> Phytase is a feed additive that can decrease phosphorus in poultry waste by about 30 percent.

<sup>3</sup> The Fairfax Authority serves 1.2 million people, more than one in five Virginians on public water.

<sup>4</sup> Individual animal-feeding operations can apply for general waste-discharge permits designed for this industry. Less detailed data is needed for a general permit than for an individual permit.

<sup>5</sup> The partnership, created in 1995 by the General Assembly, is a private, non-profit corporation whose mission is to promote economic expansion.

<sup>6</sup> The mission of the private, non-profit James River Association is to promote "conservation of the natural and historic resources of the James River Watershed, consistent with orderly and sustainable growth."

focused particularly on bills pertaining to transportation of waste on river barges.

Identical house and senate bills HB816 and SB657, which passed, require the Waste Management Board to develop regulation of solid waste and medical wastes on Virginia waters [*Ed. note:* See related Notice on page 13]. HB818, which would prohibit water transport of wastes, was carried over. The constitutionality of HB818 is in question: A ruling is expected from the state attorney general on the applicability of interstate commerce laws.

Ms. Jackson said the passed bills should have a significant impact, because the docking facilities for the barges will now be defined as solid-waste facilities. This empowers DEQ to inspect and regulate the docks. She also said the bills originated with concerns by property owners in Charles City County over barges filled with out-of-state trash. "This was a real example of citizens jumping in" and taking action, Jackson said.

But Barbara Wrenn, who as president of Wrenn Environmental Consulting tracks and writes about water legislation, takes a different view. "I really think a lot of this is waste phobia from people who really don't know how tightly it is regulated," Wrenn said of the barge bills. "We accept tankers delivering gas to the corner station, and gasoline is a much higher risk. So I watched (the bills) to see what the waste phobia would do. I don't know if the threat is truly there."

### **Tax Exemption for Wetlands and Erosion Control**

Ms. Wrenn also took issue with two tax-exemption bills that passed. HB1419 and HB1425 both allow localities to offer property tax incentives: 1491 for placing wetlands and riparian buffers in perpetual easements; 1425, for erosion-control improvements. Wrenn said that from a conservationist's point of view the bills make a lot of sense, but she questioned whether localities would actually use this authority. "I don't want to be a naysayer. I think the goal is admirable; I just don't know if [local governments] will give up the money," she said.

Mr. Frye, of the Soil and Water Conservation Division, described the tax-exemption bills as important laws that "provide another tool in the toolbox" and give local governments more ways to encourage conservation.

### **Water Quality Improvement Fund**

The action that received the most praise from people contacted for this article wasn't a bill at all but an appropriation.

The \$57 million budgeted for the Water Quality Improvement Fund dwarfed the \$15 million the fund began with last year. Created in 1997 with the passage of the Water Quality Improvement Act, the fund provides grants to help control point- and nonpoint-source pollution.

Larry J. Land, Virginia Association of Counties' director of policy development, called the budget "a big commitment." He said the money shows the state is extremely serious about improving water quality.

Praise ran high for adding money to the fund, but where and how to spend the money was another issue altogether. At least five bills that would affect the use of the fund—HB473, HB814, HB1089, SB49, and SB493—were introduced and carried over; HB814 and HB1089 were mentioned in interviews. Currently the Act restricts funds used for *point-source* reduction to nutrient-removal projects in Chesapeake Bay tributaries with approved "tributary plans." HB814 would allow funds to be used throughout the Bay watershed, not just in areas with an approved tributary plan. HB1089 would allow funds to be used for point-source projects other than biological nutrient removal.

Terrell J. Reid, utilities administrator with the Lynchburg Department of Public Works, said eligibility for grants should be open to point-source projects *throughout* Virginia, as HB819 would stipulate. Moreover, HB1089, by giving the DEQ the discretion to award grants based on the anticipated water-quality improvement, would "increase competition for the funding, encouraging innovation and leading to greater water quality benefits," Reid said.

But Ms. Jackson, of the James River Association, said she opposed all the bills that broadened eligibility for Water Quality Improvement Fund grants. "I see it as basically a grab for money...and this is not the place to get it," she said.

## Wait 'til Next Year

Many of the 1998 session's prime water-related issues were not resolved. Regulation of poultry waste will remain a leading issue for years, according to legislators and private citizens contacted for this article. DEQ

Director Treacy said confined livestock permits "have been pretty much dealt with," but others like Ms. Slaughter plan to bring the issue back repeatedly in the hopes that Virginia will adopt an individual permit system. And water transport of medical and solid waste is a relatively new arena for regulators, with affected citizens pledging to monitor the regulatory system closely.

—Lisa Garcia,  
Special Correspondent  
to Water Central

## The People and Their Choices of Significant Bills

(HB = House Bill; SB = Senate Bill; HJ = House Joint Resolution)

Robert G. Burnley, dir. of technical services, Virginia Economic Development Partnership: HB991, HB814  
Del. M. Kirkland Cox (R-66<sup>th</sup> Dist.), Chesapeake and Its Tributaries Committee: HB1207, HB816.  
Jack E. Frye, director, Division of Soil and Water Conservation: HB1419, HB1425, HB1207.  
Del. Raymond R. Guest (R-15<sup>th</sup> Dist.), Cons. and Natural Res. Committee: HB991, HB1207.  
Patricia Jackson, executive director, James River Association: HB816, HB818, HB1207, HB1394, SB656, SB657, SB582, SB597.  
Larry Land, director of policy development, Virginia Association of Counties: HB1394.  
Joseph H. Maroon, Virginia executive director, Chesapeake Bay Foundation: HB1207, SB582.  
Terrell J. Reid, utilities administrator, City of Lynchburg Department of Public Works: HB1089.  
Kay Slaughter, senior attorney, Southern Environmental Law Center: HB1207, HB991.  
Del. Vic Thomas (D-17<sup>th</sup> Dist.), Cons. and Natural Res. Committee: HB1207, HB816, HB904, HB903, HB1380, HJ174.  
Dennis Treacy, director, Virginia Department of Environmental Quality: HB991, HB1207.  
Jim Warfield, spokesman for Fairfax County Water Authority; HB991, HB1207.  
Barbara Wrenn, president, Wrenn Environmental Consulting, Inc.: HB816, HB1419, HB1425, HB1207.

## Index to Bills Mentioned in Interviews

(P = Passed; F = Failed; CO = carried over to 1999)

HB814 Eligible uses and locations for Water Quality Improvement Act funds (CO).  
HB816 Regulation of water transport of wastes (P); same as SB657.  
HB818 Prohibition of water transport of wastes (CO); same as SB656.  
HB904 No-wake speed for boats (P).  
HB991 Confined animal feeding operations (P); same as SB661.  
HB1089 Eligible uses for Water Quality Improvement Act funds (CO).  
HB1207 Poultry waste management (CO).  
HB1380 Age requirement for boaters (P).  
HB1394 Water permit fees (F).  
HB1419 Wetlands/riparian buffers taxation (P).  
HB1425 Property tax exemption for erosion control improvements (P).  
HJ174 Study of mandatory boating education (P).  
SB582 Wetlands mitigation banks (CO).  
SB597 Water permit fees (CO).  
SB656 Prohibition of water transport of wastes (CO); same as HB818.  
SB657 Regulation of water transport of wastes (P); same as HB816.  
SB661 Confined animal feeding operations (P); same as HB991.

## SCIENCE BEHIND THE NEWS

### Don't Panic, But There's a Huge Crowd of Bacteria Outside (and In)

Right now, there are an estimated 1000 bacteria on each square centimeter of your skin, and *100 billion* per square centimeter in your large intestine. Those bacteria normally are doing you no harm, yet ingesting only about 100 or so of some other kinds of bacteria can make people sick. To make matters more complicated, other bacteria are free-living (not living within a host, such as a human) and perform functions upon which all life depends.

With these seeming contradictions about whether bacteria are “good” or “bad,” along with the microscopic size of bacteria, it's not surprising that people may have misconceptions about these organisms or their impacts. Are bacteria simply scourges to conquer or sources of genes to manipulate? Read on: There's a lot about bacteria that *doesn't* meet the eye.

#### How Do We Know Anything about Bacteria?

For as long as there have been human life and human disease, people have been aware of the *impacts* of bacteria and other **microbes**<sup>1</sup>, even as they were ignorant of the microbes themselves. As a *relatively* recent example, in 1610 the colony of Virginia established its first sanitation law. The law stated, “No [one may] make clean any kettle, pot or pan, or such like vessel within twenty foote of the olde well...” The colonists knew that wastes could contaminate their water, but it would take over 200 more years before scientists discovered the microbial causes of many waterborne diseases.

Bacteria were first seen in the late 1600s under the microscopes of Antony van Leewenhoek. Not until the mid-1800s, however, did scientists develop the research procedures (such as isolating and culturing



species) necessary to connect specific diseases or other activities to specific microbes. In the late 1800s, scientists isolated the causes of many bacterial diseases, and they also made major advances in the knowledge of beneficial bacterial activities, such as recycling nutrients in soil and water. In this century, scientists began to explore and understand microbes' biological and chemical processes. The science has advanced now to the study of microbes at the molecular and genetic levels.

#### Some Bacteria Basics

Bacteria are one-celled organisms distinguished largely by their cell type. Bacterial cells lack certain structures—such as an organized nucleus—that are found in the cells of most other organisms.<sup>2</sup>

Individual bacteria have distinctive shapes: rod-like, rounded, spiral, oval, box-like, or thread-like. While a microscope is needed to see individual bacteria, bacteria form **colonies** visible to the naked eye. The colonies have characteristic sizes, colors, shapes, and consistencies, depending on growth conditions.

<sup>1</sup> The term “microbes” refers to all microscopic organisms: Bacteria, viruses, single-celled animals (protozoa), many algae, and many fungi.

<sup>2</sup> Bacterial cells are called *prokaryotic*, while the cells of other organisms are called *eukaryotic*.

### Some Terms Related to Bacteria

- Disinfection:** A process that kills or slows the growth of *potentially harmful* microbes. The effectiveness of disinfection depends on concentration, time applied, and other factors.
- Coliform bacteria:** Bacteria whose primary natural habitat is the colon (part of the large intestine) of humans and other mammals.
- Epidemiology:** The study of the causes and transmission of diseases in large populations.
- Fermentation:** A process used by many microbes to get energy from organic matter, and involved in many beneficial bacterial activities.
- Infection:** Establishment of a disease-causing organism within a host.
- Microbiology:** The scientific study of microscopic organisms, or microbes.
- Pathogen:** A microbe that can cause disease under certain circumstances.
- Sterilization:** A process (by heat or other means) of killing *all* microbes.
- Virulence:** The capacity to cause disease.

Different species of bacteria can have different cell structures and chemical compositions. As a result, different types of bacteria can be distinguished with chemical procedures, especially the application of various dyes to stain the cells for microscopic examination.<sup>3</sup>

To grow and survive, bacteria need energy, water, and appropriate environmental conditions. A given species gets energy in one or more of four ways: 1) making “food” by photosynthesis; 2) decomposing non-living plant and animal remains; 3) preying on other microbes; 4) living as parasites within another organism. Water is crucial for bacterial growth. For example, dried foods can be stored for a long time because the bacteria that contribute to food spoiling do not have enough water to grow. And three important environmental conditions are temperature, **pH** (the measure of how acidic or basic a solution is) and oxygen (some need oxygen to grow, others need the absence of oxygen, and still others can adapt to either situation).

<sup>3</sup> One of the most important is the **Gram stain**, based on differences in the cell walls. It was discovered in the 1880s by Christian Gram.

An important feature of some bacteria is their ability to form **spores**. In this dormant state, a bacterium can exist for a long time can survive unfavorable environmental conditions.

**Mutations**—an inheritable change in the genetic material, DNA—normally occur at random within a population of bacteria, with potentially good or bad consequences for the bacteria (and, if it is a pathogen, with potential consequences for the host).

All of these aspects of bacterial biology contribute to the impacts of bacteria on humans and other living things, and on our ability to respond to those impacts.

## Bacteria and Water Resources

Bacteria are found in the water column and sediments of all aquatic environments, including such extreme habitats as hot springs and polar seas. The number of bacterial cells in natural waters can be one billion or more per liter (a liter is slightly more than a quart). Most kinds of aquatic bacteria are decomposers and are not pathogenic, but some pathogens can survive in water bodies, while for others water provides a route to a new host.

### Bacteria as Water-quality Indicators

Non-pathogenic **coliform bacteria** (see definition above for “coliform”) are used in testing water samples to indicate whether fecal material has contaminated the water, creating the possibility that *pathogenic* intestinal microbes are also present.

U. S. public water systems must test for total coliforms under a schedule based on the size of the water system. Typically, if a routine sample at a water supply system indicates that *any* coliforms are present (“**total-coliform** positive”), then the water system must test for **fecal coliforms**. Fecal coliform presence more likely indicates contamination because, while some kinds of coliform bacteria are normally found in aquatic environments, fecal coliform species typically only inhabit the large intestine, so contamination with feces is necessary for these bacteria to occur in a water body.

Recently, for example, Petersburg, Virginia, officials issued a precautionary “boil water” notice after city water samples tested positive for fecal coliforms.

### Waterborne Disease

Waterborne disease can be caused by bacteria, protozoan parasites, viruses, algae, and chemicals. The following chart identifies three of the more infamous waterborne bacterial diseases. A number of other kinds of pathogenic bacteria can also be transmitted by water.

Disease	Pathogenic bacteria	Infection route
Cholera	<i>Vibrio cholerae</i> (certain types)	Ingestion of water contaminated with feces
Dysentery	<i>Shigella</i> , <i>Escherichia coli</i> (certain types)	Ingestion of food/water contaminated with feces
Typhoid	<i>Salmonella typhi</i>	Ingestion of food/water contaminated with feces

Infectious waterborne diseases are a serious health problem throughout the world. According to World Health Organization estimates, as of 1993 nearly half of the people in the world’s developing nations had water-related health problems.

On a much smaller scale, the United States also continues to see waterborne-disease **outbreaks**, usually due to untreated or improperly treated water.<sup>4</sup> Since 1971, the U. S. EPA and the Centers for Disease Control (CDC) have kept records of waterborne diseases (see the following table). According to this data, from 1971 to 1994 waterborne bacteria caused an average of five disease outbreaks and 1000 illnesses per year. Just this past August 11, however, a *Federal Register* notice indicated that EPA and CDC will conduct a study to estimate the occurrence of waterborne disease in the

<sup>4</sup> Two or more people must have an acute illness that is associated with water for the U. S. EPA and the Centers for Disease Control to consider the event a waterborne “outbreak” of a disease.

United States. The notice states that there is no “obvious or easy answer” to the question of how much infectious disease results from drinking water, particularly drinking water that meets existing standards.

Causes	U.S. waterborne disease outbreaks, 1971-1994	Illnesses
Protozoans	148	448,486*
Bacteria	113	21,240
Chemicals	71	4,333
Viruses	59	14,213
Unidentified	349	83,201
TOTAL	740	571,373

\*Over 400,000 of the 1971-1994 cases were caused by the 1993 outbreak of the protozoan *Cryptosporidium* in Milwaukee.

**Source:** *Under the Microscope: Examining Microbes in Groundwater* (p. 16), American Water Works Association, 1996.

A current newsmaker from the waterborne bacterial-disease world is a particular variety, or **strain** (0157:H7), of the species *Escherichia coli* (it was, for example, the subject of *Time* magazine’s cover article on August 3, 1998). Harmless strains of *E. coli* occur normally in great numbers in the human large intestine, but pathogenic strains of *E. coli* can be transmitted from one infected person’s waste to another person via contaminated food, water, or surfaces, or by direct person-to-person contact.

### Bacteria in Virginia’s Waters

Bacterial levels are an issue for Virginia’s surface water quality and for its drinking water systems. According to a June 1998 draft report by the Virginia departments of Environmental Quality and Conservation/Recreation, 1165 stream miles were “impaired” between 1992 and 1997 because they did not meet the bacterial standard; this was out of a total of 2166 impaired stream miles. (DEQ estimates that its 1992-97 sampling covered 17,000 stream miles, out of an estimated 49,200 miles of perennial streams in Virginia.) Bacteria-related problems are also the reason that 14 Virginia water-supply systems were

identified last spring by the U. S. EPA as either having had chronic contamination problems or having failed to test properly (out of 20 total so identified) ("20 tap-water systems in Va. are on EPA list," *Richmond Times-Dispatch*, March 26, 1998).

## Facts for Perspective on Bacteria in the News

### Contamination Processes

- Waterborne disease outbreaks in the United States are usually associated with unfiltered surface-water supplies, non-disinfected groundwater, treatment deficiencies, or contamination of distribution systems.
- Feces from infected people are a primary source of pathogens that reach water supplies. But mammals, fish, crustaceans, and protozoa may also transmit some pathogens to water or water-distribution systems.

### Infection and Disease Processes

- Microbes can enter the body through broken skin, by ingestion, or by inhalation. Microbes that enter by ingestion or inhalation may be able to cross mucous membranes (the linings of the intestines, respiratory systems, and genito-urinary tract).<sup>5</sup>
- In most cases, a person becomes *infected* by contacting an unusually large number of pathogenic bacteria at one time, rather than a few repeatedly over a long period of time. For some bacteria, the number of cells that can cause infection is only 100 or so; for others, the number is in the range of 10,000; and still others need to be as numerous as 1 million cells per milliliter of water.<sup>6</sup>
- If infected, what leads to disease? Humans house a large number of bacteria that

<sup>5</sup> For example, pathogenic *E. coli* can be ingested in contaminated water; *Leptospira*, which in severe cases causes jaundice, can infect humans through wounds; and eating contaminated shellfish can result in typhoid fever, caused by a type of *Salmonella*.

<sup>6</sup> Scientists can compare infectious microbes by the microbes' **ID50**: the minimum number of cells that a person must come into contact with to have a 50-percent chance of becoming infected.

normally do no harm. These microbes lack characteristics of **virulence**. Virulent bacteria may be able to invade specific host cells, produce toxins, produce enzymes, or have other effects that can damage host cells. Some pathogenic strains of *E. coli*, for example, produce toxins.

### Some Current Issues in Microbiology

**Identifying bacteria:** Traditionally (and still often today), microbiologists identified bacteria by physical and chemical features. Newer methods use **DNA typing** to detect, identify, and help determine the source of a given organism. Recently in Arlington, DNA typing was used to determine whether bacteria found in local streams were species from humans or from dogs.

**Bacterial ecology:** Scientists do not have all the answers about how bacteria interact with their environment. For example, some pathogenic bacteria cannot survive for long outside of a host, but others can; the traits that allow these pathogens to survive in water bodies are not completely understood.

**Coliform bacteria as indicators of possible pathogens:** Some microbiologists question the value today of using coliform bacteria to indicate possible pathogens in water. Their arguments include the following (among others): some bacteria that do not live in the colon will give a false positive result in the fecal coliform test, while perhaps 10-15 percent of *E. coli* may give a false negative result; and modern techniques allow more direct detection of pathogens.

## Benefits of Bacteria

There are many kinds of bacteria, and only a small number of species cause human disease, waterborne or otherwise. In fact, bacteria as a group perform functions that range in importance from merely convenient for humans to essential for all living things. Here are a few examples.

- Bacteria that get nutrition by decomposing leaves, dead animals, and organic material help recycle essential materials (such as nitrogen) upon which all living things depend.
- Bacteria living in the roots of legumes (some of the world's most important crops, such as soybeans, are legumes) can convert nitrogen in the air to a form that can be taken up by

plants, allowing such plants to grow in nitrogen-poor soils.<sup>7</sup>

- Bacteria and other microbes living in the stomach of ruminants (sheep, cows, etc.) help break down cellulose in the plants the animals eat, thereby making grasses and other plants better feed sources.
- Silage is formed by bacterial fermentation of grass. In partially decomposing the grass, the bacteria produce lactic acid; the acidic conditions help preserve the grass from spoilage organisms.
- In the human intestines, the normal resident bacteria help prevent establishment and infection by pathogenic bacteria.
- Bacteria are involved in the production of cheese, butter, yogurt, sauerkraut, coffee, cocoa, and other food products.
- Bacteria break down organic matter during sewage treatment, and they can also can take up nitrogen and convert it to a form that releases to the air.<sup>8</sup> This conversion of nitrogen is part of **biological nutrient removal**, which many Virginia localities are adding to their sewage treatment processes to reduce nutrients going to Bay.
- In **recombinant DNA technology**, bacterial DNA can be changed so that the bacterium can do something people want, such as produce insulin.

## What We Don't Know About Bacteria Might Help Us

Even though the Virginia colonists in 1610 knew about the disease-causing potential of wastewater, what they and other people didn't know about bacteria and other microbes would harm them for centuries. Almost 400 years later, we know a lot more about those billions of bacteria that are all around us, as well as on and in us. One important lesson is that not all "germs" are bacteria, nor are all bacteria "germs."

But we don't know all there is to know about bacteria, harmful or otherwise. An illustration of this is a recent news story that

<sup>7</sup>This process is called **nitrogen-fixation**.

<sup>8</sup> This process, called **nitrification**, is in effect the reverse of nitrogen-fixation, mentioned in the previous note.

described discoveries of bacteria living and growing year-round in Antarctica ("Under Antarctic Ice, Bacteria Redefine Life on the Edge," *Washington Post*, July 13, 1998). Their existence provides evidence that similar life could exist on Mars, for example, where frozen water occurs. As a scientist quoted in that article said, "The world is full of bacteria we know virtually nothing about."

## References and Further Reading

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- Singleton, P. 1995. *Bacteria in Biology, Biotechnology, and Medicine*. 3<sup>rd</sup> ed. Chichester, England: John Wiley & Sons.

## Further Reading on the World Wide Web

The *E. coli* Reference Center, operated by Penn State University, has an informative Web site at [www.ecoli.cas.psu.edu/](http://www.ecoli.cas.psu.edu/).

For information on microbial research, try the Web site of the Microbial Ecology lab at the Virginia Institute of Marine Science (VIMS), at [www.vims.edu/bio/microbial/](http://www.vims.edu/bio/microbial/).

The "First Sanitation Law in Virginia," is on the Virginia Department of Health's Web site at [www.vdh.state.va.us/ochs/gifs/1st-law.gif](http://www.vdh.state.va.us/ochs/gifs/1st-law.gif).

## IN AND OUT OF THE NEWS

*Newsworthy items you may have missed*

•**Occoquan Bay National Wildlife Refuge** was officially established on June 26, when the Army transferred title to 586 acres to the U. S. Fish and Wildlife Service. The site, located near Woodbridge in Prince William County, joins Mason Neck and Featherstone National Wildlife Refuges to form the Potomac River National Wildlife Refuge Complex. (To visit the area, call the Fish and Wildlife Service at [703] 690-1297.) (*Virginia Native Plant Society Bulletin*, August 1998)

•In the wake of a report in June that Tyson Food, Inc. had “dumped excessive amounts” of **poultry waste** at a site on Maryland’s Eastern Shore, the regional U. S. EPA administrator called on Maryland to tighten their regulations for applying poultry waste to agricultural lands. Tyson stopped applying waste to the site on June 23. In early July, the deputy director for Maryland’s Waste Management Administration stated that Maryland would “definitely” make changes in how it regulated the poultry industry. Later in July, the state was considering a lawsuit against Tyson. The company maintains that the application was allowed under Maryland Department of Agriculture guidelines. (*Washington Post*, 6/20 and 7/1/98; Associated Press article in *Montgomery Journal*, 7/24/98)

•The Gilmore administration announced a reorganization of the **Virginia Department of Environmental Quality (DEQ)**. The agency’s main divisions now are air, water, and waste, environmental enhancement, and pollution prevention and compliance. (*Washington Post*, 7/8/98, and DEQ Web site)

•**Water-quality strategic plans** have been developed for the James River and York River. An initial plan for the Rappahannock River is expected by January 1999. “Final” strategic plans for each river, incorporating numerical pollution-reduction goals, are to be developed later this year, once computer-

based models for each river are completed by the U. S. EPA. The plans are available from the Department of Conservation/Recreation, the DEQ, and the Chesapeake Bay Local Assistance Department. (*Rappahannock Record*, 7/9/98)

•The Marine Environmental Education Foundation has begun a **national campaign to urge boaters to help prevent pollution** of waterways and marinas by sewage, gasoline, or oil. An estimated 70 million U. S. boaters operate 17 million boats. Some 45 states now have laws requiring sewage-pumping facilities at marinas, with 2,800 stations now in operation. But another 3,200 stations are still needed, according to a U. S. Fish and Wildlife Service official. (Associated Press article in *Washington Post*, 7/11/98)

•Sixty scientists from several Atlantic Coast states, meeting at Solomon’s Island, Maryland, identified **three disturbing Chesapeake Bay trends** that have developed over the last 10-15 years: bacterial sores on as much as 10 percent of rockfish (striped bass); declining stocks of menhaden (an important food source for rockfish); and decreased populations of zooplankton, small-to-microscopic animals that are food sources for many fish. The scientists are currently unable to explain the causes of the trends. (*Baltimore Sun*, 7/12/98)

•Rappahannock County is making use of the U. S. EPA’s **brownfields program** to determine whether chemicals from an abandoned textile plant threaten nearby domestic wells. The brownfields program assists in restoring to use “abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.” (*Rappahannock News*, 7/15/98; and EPA

Office of Solid Waste and Emergency Response Web site)

- The Lake Barcroft Watershed Improvement District in Fairfax County recently tested a **new kind of street sweeper** that could reduce urban nonpoint source pollution. In the test, the machine, which uses no water, picked up twice as much dirt—with its attached potential water pollutants, such as phosphorus—as a traditional sweeper. The new sweeper costs, however, up to \$80,000 more. (*Fairfax Journal*, 7/1/798)

- The New River and Potomac River are among 14 rivers nationwide designated **American Heritage Rivers** by President Clinton on July 30. The announcement of the first group of rivers was made from the North Carolina headwaters of the New, which subsequently flows through southwestern Virginia. East Heritage river is assigned a “river navigator,” a federal employee who will help river communities find existing federal resources for community projects with environmental, cultural, or economic value. River communities choose whether or not to participate in the program. (*Roanoke Times*, 7/31/98)

- Underground storage tanks** in Virginia may soon come under state regulation, rather than that of the U. S. EPA. The EPA tentatively approved the state’s application to regulate the tanks. The Virginia DEQ has been requiring tank owners and operators to comply with federal law since 1993, so no changes are expected to existing requirements for documentation or for financial responsibility. Virginia has some 36,000 active underground storage tanks, with another 32,000 inactive ones; possibly 7,500 of these have leaks.

EPA’s approval would authorize Virginia to use the Petroleum Storage Tank Fund to help meet the federal financial-responsibility requirements. Federal rules require that a tank owner or operator document their ability to pay up to \$1 million in cleanup costs in the event of a petroleum leak from an underground tank.

The DEQ contact for questions or more information (including a copy of the regulations) is Mary-ellen Kendall at (804) 698-4298. (*Roanoke Times*, 8/5/98; and the DEQ)

Meanwhile, According to a report from the Virginia DEQ, **petroleum-based contaminants in public wells in Purcellville** (Loudoun County) may have come from one or more of 20 public and private properties that have, or once had, underground storage tanks. Finding the exact source of contaminants will be difficult because of fractured bedrock underlying this area. (*Washington Post*, 8/13/98)

- In the context of a national dam-removal campaign by U. S. Interior Secretary Bruce Babbitt, the Chesapeake Bay Program has slated **30 dams in Virginia, Maryland, and Pennsylvania** for removal or alteration to allow passage of migratory fish. Some 2,500 dams and other stream blockages exist in the Bay region. About 272 stream miles have been reopened since 1993; the Bay Program has a goal of reopening 1356 miles by 2003. Work is underway to provide passage over Boshers’ Dam near Richmond (see the June, 1998, issue of *Water Central*); in November 1998, work will begin on a passage over Little Falls Dam on the Potomac River. (*Baltimore Sun*, 8/5/98; and *Montgomery Journal*, 8/19/98)

- Pfiesteria update—In June:** Virginia Institute of Marine Science researchers were continuing monitoring of fish at some 100 sites around the Chesapeake Bay; state environmental workers in Virginia started collecting water samples from Northern Neck streams and from the Rappahannock River to test for *Pfiesteria*; and Virginia, Maryland, and other coastal states were conducting federally funded medical tests on volunteers to clarify human health effects. (*Richmond Times-Dispatch*, 6/22/98)

**In July:** Since April, 69 Virginians had had medical and neurological exams as part of the health study. Virginia Commonwealth University, in charge of Virginia’s part of the multi-state study, hopes ultimately to test

100 people who work on the water and another 100 who do not. Testing will be repeated in October and February. (*Richmond Times-Dispatch*, 7/19/98)

**In August:** *Pfiesteria* was believed to have been responsible for a late-July kill of a half-million fish in the Neuse River, located in North Carolina. By August 6, Maryland officials had seen *Pfiesteria*-like symptoms on 31 out of 151 fish caught in an Eastern Shore tributary to the Wicomico River; preliminary tests identified “traces” of *Pfiesteria* in the Wicomico River. (*Washington Post*, 8/6 and 8/8/98)

•**Dominion Semiconductor**, a computer chip manufacturer in the city of Manassas, is seeking a permit to construct a 26-mile **pipeline for increased wastewater discharge** to a tributary of the Potomac River. The pipeline would allow Dominion’s discharge to increase from its current 2.3 million gallons per day to as much as 7 million gallons per day. The pipeline and increased discharge would give Dominion the capacity to add two more plants, which reportedly could provide 1,800 new jobs.

DEQ will publish two notices seeking comment from the public, and may schedule a public hearing. (*Prince William Journal*, 8/21/98)

•In late July, the Virginia Department of Health (VDH) issued an **advisory against eating fish** (more than two 8-ounce portions per month of striped bass, white bass, or carp) caught from a 50-mile stretch of the **Staunton River** in southern Virginia. (The Staunton River is the section of the Roanoke River above Leesville Lake in Campbell and Pittsylvania counties and below Buggs Island Lake in Mecklenburg County.) Fish in that stretch may be contaminated with PCB’s (polychlorinated biphenyls, a class of suspected carcinogens). The advisory is based on tests done in 1993; the source or sources of the contamination has not been identified. VDH officials stated that “there is no imminent danger to human health at this time.” Local residents, however, complained about the five-year delay in being told of the test results. (*Lynchburg News & Advance*, 8/21/98).

—Helen Counts assisted in compiling these accounts.

## N O T I C E S

### At the Water Center

•The Water Center is sponsoring the **Southwest Virginia Water Symposium** on October 29-30, 1998, in Abingdon. For more information, see page 15.

•Three **new special reports** are available: *Batie Springs: Assessment and Restoration* [Lee County, Virginia], (SR4-1998); *Economic Analysis of Water Hauling for Southwest Virginia*, (SR5-1998); and *Wetland Restoration for Science Education—Glade Spring, Virginia* [Washington County], (SR6-1998).

Virginia residents may receive one free copy of these publications, while supplies last, by contacting the Water Center at the phone, address, or e-mail address listed on page 16.

•Four new **small-community drinking water projects** are underway with support from the Water Center: “Developing Guidelines for Sustainable Small Drinking Water Systems in Virginia”; “A Study of Cost-effectiveness and Risk Assessment of Integrating Telemetry Technology into Small Drinking Water Systems”; “The Potential for Developing Mine Cavity Water for Drinking Water Supplies”; and “Testing Coal-seam Water in Dickenson County.”

For more information on these projects, please contact Tamim Younos at the Water Center, (540) 231-8039, or e-mail: tyounos@vt.edu.

## Selected Virginia Regulatory Actions

- The State Water Control Board intends to consider amending **water quality regulations** regarding four issues: numerical criteria for metals; protection of endangered or threatened species in the "mixing zone"; updates to the listing of endangered species; and application of the antidegradation policy to all state activities (including nonpoint-source-related activities). The notice of intended regulation was published July 20. For more information, contact Elleanore Daub at (804) 698-4111.

- The Waste Management Board intends to develop regulations for **transportation of solid and medical wastes on state waters**. This is a result of legislation passed in the 1998 General Assembly (HB816), noted in the feature article of this issue of *Water Central*. The notice of intended regulation was published July 6; a public meeting was held August 11. For more information, contact Lily Choi at (804) 698-4054.

## Miscellaneous Notices

- The **Rivanna River Basin Roundtable** has published its 1998 **State of the Basin** report (the Rivanna River is a tributary of the James River). The report includes sections on history, hydrology, water quality, and land use, along with the group's recommendations for water-quality improvements. A copy of the report may be purchased for \$25 from the Thomas Jefferson Planning District Commission, P. O. Box 1505, Charlottesville, VA 22902; (804) 979-7310.

- The **Virginia Department of Conservation and Recreation (DCR)** recently reorganized to increase its emphasis on **watershed-based approaches to nonpoint-source pollution (NPS) prevention**. DCR hopes to expand local and regional participation in NPS prevention programs. New assistant directors have been appointed to manage NPS operations within the Chesapeake Bay region (offices in Henrico, Staunton, Tappahannock, and

Warrenton) and the Southern Rivers region (offices in Abingdon, Chase City, Dublin, and Suffolk). For more information or to communicate with DCR on NPS issues, contact Moira Croghan at the VA DCR, 203 Governor Street, Richmond 23219-2094; (804) 786-3958; e-mail: mbc@DCR.state.va.us.

- Volunteer Stream Monitoring: A Methods Manual** (1997, 200 pages) is a tool for people who want to start or enhance a volunteer monitoring program, whether for a single stream or a large area. The document includes methods for assessing instream physical, chemical, and biological characteristics, as well as watershed land uses. Two other manuals in this series are also available: *Volunteer Lake Monitoring* (1991) and *Volunteer Estuary Monitoring* (1993). To obtain these documents, contact U. S. EPA/Office of Wetlands, Oceans and Watersheds Volunteer Monitoring (4503F), 410 M Street NW, Washington, DC 20460.

- A Handbook on Water Supply Planning and Resource Management** (1996; 240 pages) is based on U. S. Army Corps of Engineers regulations, manuals, etc., as well as on private-sector literature. Topics include water supply data bases; water supply modeling; conservation and planning for drought; and others. Copies (\$44 paper; \$19 microfiche) can be ordered from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; (800) 553-6847; e-mail: orders@ntis.fedworld.gov.

- Water in the West: The Challenge for the Next Century** was released in June by the Western Water Policy Review Advisory Commission. The Commission was instructed by Congress in 1995 to review of federal activities affecting water resources in the western United States. The Commission also produced 22 research reports on specific western water issues. The full report and the 22 research reports are available at the Commission's Web site, [www.den.doi.gov/wwprac/](http://www.den.doi.gov/wwprac/). For printed copies, contact the Commission at P. O. Box 25007, D-5010, Denver Federal Center, Denver, CO 80225; (303) 445-2100.

## THE LEARNING RESOURCES PAGE

### For the Record

*Sources for selected public-interest topics*

#### Finding Drinking Water Information

The U. S. EPA's Safe Drinking Water Hotline—**(800) 426-4791**—can answer general questions, direct you to other sources for more specific questions, and provide publications. The Hotline operates from 9 a.m.-5:30 p.m. (Eastern Time). For those with Internet access, similar information is available from the EPA's Office of Ground Water and Drinking Water:

**[www.epa.gov/OGWDW/](http://www.epa.gov/OGWDW/)**.

Public water systems in Virginia (a public water system serves 15 or more connections, or 25 or more people) are regulated by the Department of Health's (VDH) Office of Water Programs, specifically the Division of Water Supply Engineering. This Division can be reached at Room 109, 1500 E. Main Street, Richmond 23219; (804) 371-2883. The Office of Water Program's web site is at **[www.vdh.state.va.us/owp/](http://www.vdh.state.va.us/owp/)**. The site includes information on regulations, waterworks, certified testing labs, and other topics. **For information on private wells, start by contacting your local VDH office (listed in the phone book).**

By October 1999, public water suppliers will begin providing annual "**Consumer Confidence Reports**" to their customers. These reports will note and explain any contaminants detected. For general information about this new requirement, contact the EPA sources listed above. For information on Virginia's implementation of this requirement, contact the VDH's Consumer Information Team at the Lexington field office, (540) 463-7136.

***A Guide to National Drinking Water Standards and Private Water Systems*** (1996, 71 pages), available from the Water Center, is an excellent introduction to drinking water regulation, testing, and information sources.

#### **FOR THE RECORD SCHEDULE**

**1998**

#### **This issue - Finding Drinking Water Information**

October - Finding Water Quality Information

December - Finding Hydrologic, Weather, and Climate Information

**1999**

February - Tracking Virginia General Assembly Legislation

April - Following State Water Regulatory Processes

June - Tracking Federal Legislation and EPA Regulations

*Schedule subject to change*

### Teaching Water

*Especially for Virginia's K-12 teachers*

*Water Central* will use this space to list the Virginia Standards of Learning (SOLs) in science and social studies for which articles in the issue have relevant information. We will also include, when we can, other information particularly for teachers or students.

#### **This issue and the VA SOLs**

(ES = earth science, LS = Life science, and BIO = biology)

##### "Virginia Water Legislation..."

Science: 6.11, LS.12, ES.9, BIO.9

Social Studies: 7.4, 10.10, 12.6, 12.8, 12.9, 12.10, 12.13

##### "...There's a Huge Crowd of Bacteria..."

Science: 6.9, LS.3, LS.4, LS.5, LS.7, LS.9, LS.12, LS.13, LS.14, ES.9, BIO.2, BIO.4, BIO.5, BIO.6, BIO.9

Social Studies: 10.13

##### In and Out of the News

Science: 6.11, LS.12, ES.7, ES.12, BIO.9

Social Studies: 10.15, 12.6, 12.98, 12.16

##### For the Record

Social Studies: 7.2, 7.4, 12.13, 12.16

<b>CONFERENCE ANNOUNCEMENT</b>
--------------------------------



***SOUTHWEST VIRGINIA  
WATER SYMPOSIUM'98***

**OCTOBER 29-30, 1998**

**Southwest Virginia Higher  
Education Center  
Abingdon, Virginia**

**Sponsored By**

Virginia Water Resources Research Center  
Virginia Tech  
Blacksburg, VA

**Cooperating Sponsors**

Emory & Henry College  
Mountain Empire Community College  
Southwest Virginia Community College  
Virginia Highlands Community College  
The Powell River Project  
Virginia Cooperative Extension

**Purpose**

The Southwest Virginia Water Symposium'98 and Workshop will be held on October 29-30, 1998 at the Southwest Virginia Higher Education Center in Abingdon, Virginia. The goal of the symposium is to highlight water related research, education, management, and outreach activities in Southwest Virginia, assess our progress in the 1990s, and discuss the strategies for the year 2000 and beyond.

**Conference Topics**

Drinking Water  
Household Water Use and Wastewater  
Surface Water and Groundwater Quality  
Nonpoint Source Pollution & BMPs  
Stream Protection and Restoration  
Watershed Protection  
Wetland Protection and Restoration  
Educational Programs

## Registration Form

Please complete the form below and mail with the registration fee by **October 14, 1998**, to:

LPSWCD  
Attn: Carolyn N. Baker  
Rt. 2, Box B  
Clintwood, VA 24228

### Registration Fee

Symposium:  General \$25  Student \$10

Workshops (October 30):  \$15  
(Check one)

1: Alternative Wastewater Techniques for Households

2: Home\*A\*Syst for In-house Water Use and Management

3: The Guest River—A Case Study in Watershed Action

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

Total enclosed: \$ \_\_\_\_\_

A block of rooms has been reserved at the Comfort Inn, Abingdon, under the Southwestern Virginia Water Symposium title. Contact the motel for reservations: (540) 676-2222 or (800) 221-2222. Cost is \$46+tax single, \$51+tax double. Rooms will be held until October 1, 1998. **For more information:** Contact Judy Poff at the Water Center, (540) 231-8030, e-mail: jupoff@vt.edu.

## Virginia Water Central

Published bimonthly by the Virginia Water Resources Research Center, Virginia Tech, 10 Sandy Hall (0444), Blacksburg, VA 24061; (540) 231-5624; fax (540) 231-6673; e-mail: water@vt.edu; Leonard Shabman, director.

*Water Central* staff: Alan Raflo, editor; George Wills, illustrator.

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1. Would you rate the **content** of this issue as good, fair, or poor?
2. Would you rate the **appearance** as good, fair, or poor?
3. Would you rate the **readability** of the articles as good, fair, or poor?
4. Do you approve of the newsletter **name**? If not, please suggest an alternative.
5. Please add any other **comments** you wish to make.

**Reminder!!** *Water Central* will be posted on the Water Center's web site. If you prefer to read the newsletter there, *instead of* receiving a paper copy, please send your e-mail address to water@vt.edu, and we will notify you whenever a new issue is posted.

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