Coastwatch

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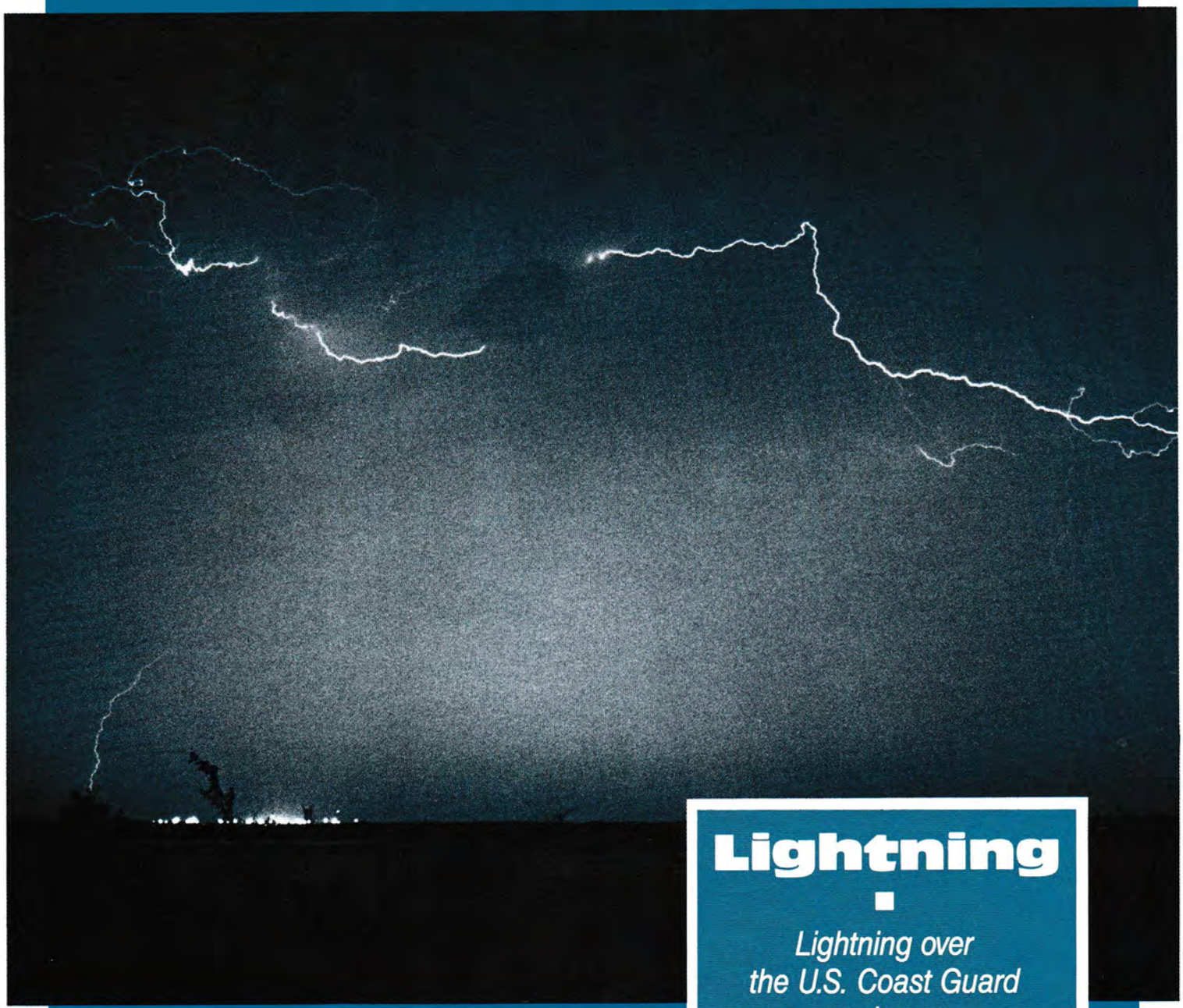

Photo by Scott Taylor

Lightning

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Lightning over the U.S. Coast Guard station at Fort Macon.

When lightning strikes

If Ben Franklin had known the risk he was taking when he sent his famous kite aloft in a thunderstorm, we might still be wondering about lightning.

The fact is, old Ben is lucky he didn't get fried in that experiment.

And lucky for us, he survived the shock to tell us that lightning is, in fact, electricity. In the process, he also invented the lightning rod.

BY NANCY DAVIS

Benjamin Franklin's bravery in the face of a storm eludes most of us. Nearly 250 years later, we're still awestruck by the clap of thunder and the flash of a jagged finger of lightning against a black sky.

And with good reason.

Lightning kills.

Nationwide as many as 100 to 125 people will die this year when they are struck by lightning. That makes it the second most deadly weather phenomenon after flash floods, killing even more people than hurricanes or tornadoes.

In North Carolina, about four people are killed and another 10 to 15 injured each year by lightning, making this the second most dangerous state for lightning. Only Florida records more lightning deaths.

In a single flash, lightning can kill people and livestock, smash a hole through a boat hull, destroy property and create fires that sweep through millions of acres of wilderness.

One bolt of lightning can pack as much as 10 million to 100 million volts of electricity. For comparison, an electrical outlet usually contains about 120 volts.

But lightning is also credited with creating life on Earth some 3 billion years ago. Scientists believe that electrical charges passing through gases in the atmosphere created amino acids that formed the building blocks of proteins, the basis for life.

As many as 16 million thunderstorms form around the world each year. And at any one time, about 2,000 of the storms are brewing.

In the United States, thunderstorms occur most frequently in the South Atlantic and Gulf states and in the Southwestern mountains, says Dave Eichorn, a forecaster with WRAL-TV in Raleigh.

North Carolina cities regularly record more than 40 days with thunderstorms each year. Raleigh, for example, averages about 45 thunderstorms a year. Wilmington records about 46 and Cape Hatteras, 47.

When hot and cold air masses mix, a thunderstorm forms. The top of the cloud becomes positively charged, and the bottom negatively charged. The Earth's surface is positively charged. The air acts as an insulator until the voltage difference reaches 3 million volts per meter. Then lightning occurs.

Our prime months for thunderstorms are March through October, with June and July being the most active months, says Dennis Decker, a meteorologist with the National Weather Service at the Raleigh-Durham International Airport.

So far, recording thunderstorms has proved easier than explaining them. When the sky blackens, and a dark, ominous cloud looms overhead, there's

Photo from National Oceanic and Atmospheric Administration

a lot more going on than meets the eye, scientists say.

Inside that cloud, a complicated chain of events is in the works. And it's about to create the first bolt of lightning.

Vin Saxena, a physical meteorologist at North Carolina State University, explains how lightning forms.

Even in fair weather, there is an electrical field spread over the Earth, Saxena says.

For example, from your waist down, you are continually being bombarded with about 120 volts per meter of electricity—an amount similar to that in an electrical outlet. In industrial areas, the electrical field can be as much as 360 volts per meter, Saxena says.

But in a thunderstorm, the electrical field becomes exaggerated.

When hot and cold air masses mix, a thunderstorm starts brewing. The top of the thunderstorm cloud becomes positively charged, and the bottom negatively charged.

Down below, the positively charged surface of the Earth reacts to that law of nature that says opposites attract. The more negative the base of the cloud becomes, the more positive the Earth's surface becomes.

The air between the two acts as an insulator until the voltage difference reaches 3 million volts per meter.

At this point, the insulation breaks and lightning begins to form.

A line of current races from the base of the cloud toward the Earth, searching for the quickest way to the ground. It finds the tallest point—a tree, a radio tower, a church steeple.

The positive charge of the target leaps up to meet the negative charge from the cloud, creating a connection between the two and a blinding flash of light.

This is called the return stroke. And contrary to the popular belief that the flash moves from cloud to ground, it's the return stroke that's actually visible.

With the return stroke, the air becomes super heated, raising the temperature instantly to 30,000 degrees. By comparison, the sun's outer disk is 5,800 degrees. "That flash increases the temperature to five times the sun's outer disk," Saxena says.

The violent shock that the temperature creates results in the sound we hear and feel as thunder.

So far, that's just one bolt of lightning. Now the process starts again, and will happen over and over until the cloud and the Earth have neutralized their opposite charges.

"Lightning is nature's magnificent process of organizing all this energy," Saxena says. "In one thunderstorm

continued on next page

When lightning strikes

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spread over the size of the city of Raleigh, the energy of lightning could be as much as the atomic bombs of Hiroshima and Nagasaki."

Lightning comes in several forms, and it's named according to where the discharge takes place.

We're probably most familiar with the type that occurs between the cloud and Earth. But the discharge may also take place within a cloud or between clouds, without making contact with the ground.

Heat lightning is the term used loosely to describe lightning that is so far away that we can't hear its thunder.

"To somebody under that lightning, it sure wasn't heat lightning," Eichorn says.

With thunderstorm season upon us, you can be your own forecaster simply by observing a storm, Eichorn says.

The more intense it is, the more cloud-to-Earth lightning you will see, he says. If the cloud-to-Earth lightning begins to lessen and you see lightning only in the clouds, the storm is probably weakening, Eichorn says.

"Generally, the more lightning you have, the worse the storm," Eichorn says.

You can estimate the distance between you and a lightning flash by counting the seconds between seeing the flash and hearing the thunder, Eichorn says.

For every second you count, add 1,000 feet. For example, if it takes five seconds for the sound of the thunder to reach you, the lightning is about a mile away.

Studying lightning remains a difficult task for meteorologists. Lightning detection systems have been developed to help predict storms and pinpoint hot spots of lightning activity.

And Saxena says scientists know how to "seed" clouds so that they don't produce hail or electricity. But generally, the cost of such a process is prohibitive, he says.

So far, no one has figured out how to harness the potential energy in a thunderstorm.

"Maybe another Ben Franklin can put lightning to something useful," Saxena says.

Photo by Dave Eichorn

Chasing lightning

Dave Eichorn, a forecaster with a Raleigh television station, has a fascination for thunderstorms and especially lightning.

Before coming to Raleigh, Eichorn worked in Oklahoma. "I saw some thunderstorms that were absolutely incredible out there," he says.

Nearby transmitting towers made a great target for lightning, Eichorn says. And a lightning detection system allowed him to know where the storms were going to be. And most important, lightning occurs most frequently there at night, when it makes a brilliant display against a black background.

He was so taken by the flashy electrical displays that he began trying to capture the sight on film.

"When my shift was over, I'd hop in the car and, with the help of the lightning detection system, I'd go where the storm was," Eichorn says.

"It was like fishing for bass. Once you find one storm, there are usually others in the area. We used to chase them, and I'd take pictures."

After experimenting with his camera and film, he learned that if he kept the shutter open for 60 to 90 seconds at a time, he would eventually capture the sight on film. Now, Eichorn has a large spiral notebook filled with plastic sleeves of color slides of lightning.

At this point, Eichorn would warn folks not to try this experiment at home.

He knows lightning can kill, and he has a healthy respect for it.

"I'm pretty brave with lightning—braver than I should be," Eichorn says.

Photo from National Oceanic and Atmospheric Administration

Weatherwise or otherwise?

BY NANCY DAVIS

Outdoorsmen beware.

That includes all you golfers, boaters, swimmers, joggers and beachgoers.

You're more likely than most folks to get struck by lightning—particularly if you live or vacation in North Carolina during the summer months.

Although the Tar Heel state isn't a national leader in numbers of thunderstorms per year, it consistently ranks second in lightning deaths per year.

The reason?

Dennis Decker, a meteorologist with the National Weather Service in Raleigh, suspects the explanation is twofold.

First, with the long warm season, there are plenty of recreational opportunities here. That means more people are out on the golf course, in a boat or around a swimming pool during lightning season.

Second, since North Carolina is an agricultural state, more people are likely to be in open fields when a storm hits.

But if you spend a lot of time outside in the summer, take heart. Meteorological data tells us the odds of anyone being hit by lightning are about 1 million to one.

And if you are struck, there's a good chance you'll survive. Experts estimate two-thirds of those struck by lightning survive. Many of the victims that are assumed dead could actually be revived through cardiopulmonary resuscitation.

You can avoid becoming a lightning statistic by exercising a little common sense, Decker says.

As Ben Franklin once said, "Some people are weatherwise, but most are otherwise."

Because lightning often strikes without warning, the best advice is to take cover immediately. Don't wait to see if the storm is going to blow over.

If you're outside when a storm approaches, seek shelter in a building. If you're in a rural area and there's no building nearby, get in your vehicle.

"Make yourself as poor a target as possible," Decker says.

Don't take shelter near potential lightning targets such as fences or tall trees.

In many cases, nature will provide you with a warning that you're a lightning target. If you suddenly feel charged, your hair feels as though it's standing on end or your skin feels tingly, drop to your knees and bend over immediately.

Stay away from open doors and windows and out of the shower.

If you're in a boat on the water, your risk may be magnified. Not only does

continued on next page

Weatherwise or otherwise

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water conduct electricity well, but you will probably be the highest point around.

Whether you own a sailboat or a motorboat, the most important thing is to give lightning a ground.

Steel boats are automatically grounded by their hulls. But fiberglass or wooden boats need to be grounded to minimize the risk of lightning damage.

Some new boats will already be grounded when you buy them. Sea Grant marine agent Jim Bahen recommends you ask the dealer if the boat has been grounded.

If your boat hasn't been grounded, you can obtain instructions by writing Maryland Sea Grant, H.J. Patterson Hall, University of Maryland, College Park, Md. 20742. Ask for *Lightning: Grounding Your Boat*, Leaflet 138.

The next rule is to be weatherwise.

Obviously the best way to survive a storm is to stay out of it. Listen to weather reports before you leave the dock, says Bob Byrne, commander of the Morehead City Coast Guard Auxiliary Flotilla.

"If you know something is brewing, stay home," Byrne says.

But in some cases, stormy weather forms too quickly for warnings. If a storm takes you by surprise, Byrne recommends these steps.

Immediately secure any loose items on your boat. Most important, be sure everyone is wearing a personal flotation device.

"Don't leave them in the plastic or neatly tied up somewhere," Byrne says. "They won't do anybody any good there."

If your boat has a cabin, get inside. Then steer your boat toward the dock. Travel at a moderate speed, Byrne says.

If the storm overtakes you, drop back to minimum speed to avoid swamping your boat.

Zig-zag toward port, crossing the waves at 45-degree angles, Byrne says.

If lightning strikes your boat, the first rule is to recover, Byrne says. "Take two to three deep breaths first. You're going to be more scared than hurt. And if your boat has been properly grounded, your chances of getting hurt will be minimal," he says.

If someone is struck and appears dead, immediately give him mouth-to-mouth resuscitation and heart massage.

And even if a person seems merely stunned by lightning, he should see a doctor as soon as possible.

Lightning Safety Tips

Inside . . .

1. Stay away from open doors and windows.
2. Stay off the telephone and avoid using hand-held electrical appliances such as hair dryers, electric toothbrushes and electric razors.
3. Don't take a shower or bath during thunderstorms.

Outside . . .

1. If you're traveling, stay in your car. Automobiles offer good lightning protection.
2. If you don't have a car, take cover in a low area. Don't make yourself the highest point around.
3. Don't stand near tall, isolated trees, fences or other objects that might attract lightning.
4. Get out of and stay away from the water.
5. If you feel your hair stand on end, drop to your knees and bend forward.

If someone is struck by lightning . . .

1. Administer mouth-to-mouth resuscitation and heart massage, even if a victim appears dead.
2. Lightning victims should always see a doctor, even if they seem unhurt. The physical effects of a lightning strike aren't always obvious.

Fulgurites

When a bolt of lightning strikes a sandy beach, something amazing happens.

It creates glass.

The intense heat of the lightning instantly melts the surrounding sand, forming finger-like, hollow tubes of cemented sand.

They're called fulgurites, from the Latin word fulgur, meaning lightning.

Fulgurites are rough on the outside, smooth on the inside. They can be from a half inch to 2 inches in diameter and as long as 10 feet. But because they're so fragile, fulgurites are usually found in smaller pieces.

Most sand on North Carolina beaches is composed of two minerals—quartzite and feldspar. And quartzite contains silica, which is used to make glass.

Fulgurites are rare finds on North Carolina beaches, says Sea Grant educational specialist Lundie Spence. You're most likely to find them on high dunes after a rain. The rain washes away the loose surrounding sand, uncovering the fulgurites.

If you find one, handle it carefully, Spence says. Fulgurites are collector's items.

The Back Page

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

Show everyone you're serious about clean waterways. Get a Big Sweep '89 T-shirt. The Big Sweep '89 is the successor to Beach Sweep. Because of the success of the coastal cleanup, we expanded it to include all of North Carolina's inland lakes and rivers. And to reflect that, we've changed the name to The Big Sweep.

The statewide cleanup is slated for Sept. 23. But show your support early by buying a T-shirt. The white T-shirts carry the blue and yellow sweeping logo across the front. The shirts are top quality and 100 percent cotton.

If you want a T-shirt, write Sea Grant, Box 8605, North Carolina State University, Raleigh, N.C. 27695. Or call 919/737-2454. The cost is $5, plus $1 for postage and handling. Makes checks payable to KNCCB/The Big Sweep.

The T-shirts are available in medium, large and extra large. Be sure to specify the quantities and sizes you want.

The money raised by selling the shirts will be used to produce educational materials such as posters, brochures and curriculum materials for teachers. Support The Big Sweep, and help clean up our waterways.

Lots of organizations and state agencies are hard at work on The Big Sweep '89.

This year, four groups join Sea Grant, the N.C. Division of Coastal Management, the N.C. Office of Marine Affairs/N.C. Aquariums, the N.C. Division of Parks and Recreation and N.C. 4-H in coordinating The Big Sweep.

They are the N.C. Division of Wildlife Resources, WRAL-TV in Raleigh, Keep North Carolina Clean and Beautiful, and Keep America Beautiful/Carteret County.

All this extra help should make The Big Sweep '89 a more successful and publicized event.

It took only four hours on a couple of Saturdays for America's beaches to come clean. But it also took more than 47,000 volunteers in 25 states and territories to make the difference.

The volunteers showed up for coastal cleanups from the Atlantic to the Pacific. In all they covered 3,518 miles of beaches. And they recorded each item they found for a national database compiled by the Center for Marine Conservation.

North Carolina's tallies from Beach Sweep '88 were included in more than 1 million items counted.

Altogether, 977 tons of trash were collected during beach cleanups last year. About 65 percent of it was plastic. Eleven percent was metal, and about 10 percent paper and glass. Plastic foam pieces ranked number one on the list.

The national database proved so successful that CMC will continue it annually. And they're considering expanding it to an international level.

For every snapper, grouper and king mackerel a recreational fisherman has reeled in, you can bet he's probably cast aside an amberjack, triggerfish or shark.

The reason? Well, more than likely, he just doesn't realize that amberjack can be just as tasty as king mackerel.

To change that, Sea Grant, the National Marine Fisheries Service and North Carolina State University's Department of Agricultural Communications have produced a television documentary on underutilized species.

Fishing for a New Catch, a 30-minute show, will air on the University of North Carolina Center for Public Television Sunday, July 23 at 7:30 p.m. and Saturday, July 29 at 12:30 p.m.

The video is aimed at the more than 8 million saltwater sport fishermen in the Southeast.

NMFS estimates recreational fishermen discard as much as 60 percent of the fish they catch because they don't consider them table fare.

To increase the use of these so-called undesirables, NMFS funded a study. Researchers from NCSU and East Carolina University surveyed fishermen from North Carolina to Texas to find out why they preferred some fish over others.

They found that if a fish didn't look "normal," it usually didn't make it to the cooler.

Fishing for a New Catch will help change those attitudes, says NCSU video producer Mike Gray. It will introduce fishermen to some of these less-favored fish, explain how to handle and clean them, and offer preparation suggestions.

In addition to the video, Sea Grant has developed a series of brochures showing how to catch, clean and prepare 16 underutilized species. And a cookbook, *Recipes with a New Catch*, is chocked full of delicious recipes for the fish.

If you would like the brochures, write Sea Grant and ask for the underutilized species brochure series. The cost is $2. For a copy of the cookbook, ask for UNC-SG-86-06. The cost is $2.

The N.C. State Museum of Natural Sciences Society is sponsoring a whale watch trip to Boston, Mass., July 20–23. Naturalists from the New England Aquarium will accompany the group on a whale watch excursion and will teach participants how to identify different species of whales and other marine life in the area.

The trip will also include a behind-the-scenes tour of the New England Aquarium.

The cost of the four-day trip is $579 for Society members, $619 for nonmembers, and $389 for children 16 and under who are accompanied by an adult.

To register, contact the Natural Sciences Society at 919/733-7450.

From Massachusetts to Hawaii, letters came—hundreds of them. Each requested the UNC Sea Grant publication, *Design and Installation of Low-Pressure Waste Treatment Systems.*

What spurred the requests? *Popular Science*, a national science magazine for interested laymen.

In its April issue, the magazine described how the low-pressure pipe (LPP) system can be used in areas where conventional septic systems will not work.

Almost 10 years ago, North Carolina State University soil scientists Bobby Carlile and Dennis Osborne developed the LPP system as part of a Sea Grant project. Conventional systems frequently failed in porous coastal soils, spewing sewage into the estuaries and contaminating water sources.

Coastal residents needed an alternative waste treatment system.

Under pressure from a pump, the system uniformly distributes wastewater into the soil at intervals. The soil dries between cycles, retaining its ability to purify waste.

The LPP allowed hundreds of coastal property owners to build on soils that previously had been unacceptable. And it provided the same benefits to inland property owners trying to treat sewage in the clay soils of the Piedmont.

Now news of this unconventional system has spread nationwide. If your septic system is failing or you plan to build on marginal soils, send for a copy of the LPP manual. Ask for UNC-SG-82-03. The cost is $3.

The booklet includes information on site and soil requirements, design, layout, equipment specifications, installation procedures and maintenance.

Sea Grant also published two other septic manuals—*Design and Installation of Mound Systems for Waste Treatment* and *Pressure-Dosed Septic Systems: Electrical Components and Maintenance.*

The mound system is a modified septic system designed for use in shallow soils that are not deep enough to properly purify effluent. To overcome this problem, the mound system uniformly treats effluent in fill material, using the same pressure-dosed strategy as the LPP. The mound manual is $2.50, and its publication number is UNC-SG-82-04.

The electrical component manual describes dosing controls and accessories suitable for pressure-dosed septic systems. It describes how to select, install and maintain them.

This manual should be used as a supplement to the LPP and mound manuals. Its publication number is UNC-SG-85-06. The cost is $3.

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105 1911 Building
Box 8605
North Carolina State University
Raleigh, NC 27695-8605

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