corded the respect and gratitude of their fellow citizens.

In the past few years, Congress has repeatedly turned to Federal retirees to ask that they tighten their belts to help us balance the Federal budget. Laws have been enacted to reduce the full effect of cost-of-living formula in their annuities, to reduce or eliminate their spouse and survivor income under social security, and to reduce or eliminate tax benefits intended to provide them some tax relief roughly comparable to that accorded social security recipients. This year alone, increases in premiums in the Federal employees health benefit program have increased 31 percent for both active and retired Federal workers. While I do not believe that all these cuts have necessarily been in the country's best interests, I must say that the Federal retirees in my State have been willing to accept these cuts as their share of the burden in the fight to stabilize our national economy. They have endured these budget cutbacks in the spirit of cooperation and patriotism which has been a hallmark of the American character.

In Tennessee, there are 16,908 retired employees with average annuities of $904 a month. There are 6,410 persons receiving survivor annuities on the average of $404 a month. Nationwide, only 9 percent of all Federal annuities exceed $20,000 per year and like social security income, Federal retirement is fully taxable at all levels of government.

In Tennessee, Gov. Lamar Alexander has proclaimed the week of April 25, as retired Federal employees week to honor these Americans to whom we owe a great deal of gratitude for their past services, and their continuing efforts as retirees to make our communities better places to live.

Mr. President, I ask that a copy of this proclamation be included in the RECORD, following my remarks.

The proclamation follows:

PROCLAMATION

Whereas the U.S. Civil Service Act of 1883 was signed into law by then President Chester A. Arthur, thereby creating the U.S. Civil Service System; and

Whereas the U.S. Civil Service Retirement System was created in 1920 and signed into law by then President Woodrow Wilson; and

Whereas virtually all State, county and municipal civil service systems have derived from the U.S. Civil Service Act; and

Whereas untold thousands of U.S. Civil Service employees have worked diligently, patriotically, silently and with little notice to uphold the highest traditions and ideals of our country; and

Whereas thousands of Federal employees are retired in Tennessee and continue to devote inestimable time and effort toward the betterment of our communities and State;

Now, therefore, I, Lamar Alexander, as Governor of the State of Tennessee, do hereby proclaim the week of April 25-30, 1982, as "Retired Federal Employees Week" in Tennessee and do urge our citizens to join me in this worthy observance.●

ACID RAIN

● Mr. MITCHELL. Mr. President, the issue of acid rain has been debated extensively in the Congress and throughout the country in the past year. One reason that the national awareness of this problem has grown so dramatically is its coverage by the press. Numerous articles and television and radio shows have discussed the nature of this environmental threat to our water resources, vegetation, architecture, and possibly forests.

One particularly informative feature article appeared in the National Geographic magazine in November last year. This article, and a feature story on energy, have just earned for National Geographic the Pulitzer Prize for Public Service in Magazine Journalism. I congratulate National Geographic and Dr. Anne LaBastille, the author of "Acid Rain—How Great a Menace?", for a significant contribution to the further understanding of this issue.

I commend Dr. LaBastille's article to my colleagues and I ask unanimous consent that it be printed in the RECORD at this point.

The article follows:

[From the National Geographic, November 1981]

ACID RAIN HOW GREAT A MENACE?

(By Anne La Bastille)

Evenings, I often stroll out on my cabin dock to enjoy the view of an Adirondack lake. But the scene is not as I remember it. No trout rise to the water's surface, swirling sunset colors. No ospreys quest along the shoreline, scanning for fish. No otters sprawl on my rocky point, crunching bullheads for dinner.

North and south of where I live are at least 180 fishless ponds, about 6 percent of all the ponds and lakes in the Adirondack Mountains of New York.

Four thousand miles away I recently overlooked a silent lake in Sweden. Gnarled pines framed its sparkling, too blue waters. Dr. William Dickson, an aquatic chemist with the Swedish National Environment Protection Board, pointed to an ancient rock wall skirting the steep shore.

"The Vikings built this defense line a thousand years ago," he said, "and survived a long siege here. They had wood, water, and all the trout they could eat. But now, for the first time since the Ice Age, Stone Lake doesn't hold a single trout. I estimate that 20,000 lakes of the 100,000 in our country are fishless or about to become so."

It wasn't always this way. Earlier in this century Adirondack lakes and those of Scandinavia produced prime trout, and wildlife was plentiful. Then, as if a curtain were drawing slowly across a stage, aquatic organisms began to die in some of them, and other animals dependent on them declined.

Why? An energy-related problem called acid rain (or, more correctly, acid deposition, which encompasses dry as well as wet acidic substances). How great this menace is, no one is certain. But it now engages the efforts of hundreds of scientists from a range of disciplines, and a broad-brush picture of the problem is emerging.

Certainly, acid rain is affecting surface waters in the eastern United States, Canada, and Scandinavia. Probably it is affecting surface waters elsewhere, across wide areas of the Northern Hemisphere, and also corroding buildings; it may be threatening forests and croplands, the soils and ground-water that support them, even human health itself.

Despite these many qualifiers, the fact is irrefutable that fish in sensitive lakes are being destroyed by acid rain (as measured on a pH scale of 0 to 14). Thus the feisty brook trout of troubled Adirondack waters plays the role of the proverbial canary in the coal mine, warning us of impending peril.

CULPRIT: BREATH OF THE MACHINE AGE

The problem of acid deposition starts, most experts agree, with the worldwide burning of coal, oil, and natural gas Despite general adherence to existing environmental controls, the smokestacks of electrical generating plants, industrial boilers, and smelters release sulfur dioxide and nitrogen oxides, the chief precursors of acid rain. Nitrogen oxides also puff from the exhaust pipes of motor vehicles and slowly escape from chemical fertilizers.

Other contaminants also are discharged; of particular concern are acidic soots and specks of toxic metals such as lead and cadmium. But it is the oxides of sulfur and nitrogen that are the major culprits in forming acid deposition, both wet and dry.

Some of these pollutants hover above the city or industrial plant that spawned them, creating clouds that sometimes settle on the local landscape. Moistened by dew or a local shower, these emissions may transform into acids and damage vegetation and wildlife, etch car finishes, and corrode buildings and bridges. This short-range fallout leaves the blight and tarnish that we associate with the smoky cities of an earlier industrial era.

HIGH-FLYING POLLUTION AIDS ACID RAIN

More sulfur dioxide (SO_2) and nitrogen oxides (NO_x), along with other combustion products, climb skyward, especially when vented upward by tall stacks. There they circulate with the great air masses that form our weather systems. It is these venturesome travelers that become the chief contributors to acid precipitation.

Their flights may last for days and take them hundreds, even thousands of miles. En route, the pollutant molecules interact chemically with sunlight, moisture, oxidants, and catalysts to change into other compounds of sulfur and nitrogen. Eventually some of the compounds are captured within clouds or by raindrops and snowflakes to form acid rain and snow—which in reality are dilute solutions of nitric and sulfuric acids.

The remaining sulfur and nitrogen compounds sift down as gases and dry particles, awaiting the first rainstorm or dewfall to transform them into droplets of acid.

Because of these long journeys, acid deposition is no respecter of state or national boundaries. Dr. Anthony Knap of the Bermuda Biological Station for Research has reported acid rain on that mid-ocean, nonindustrial island, as has Dr. John M. Miller of the National Oceanic and Atomospheric Administration (NOAA) atop Mauna Loa volcano in Hawaii.

Perplexingly, certain sites in the less industrialized Southern Hemisphere receive rains as acidic as those of Hawaii and Bermuda. This suggests that the sulfur compounds are also released by biologic activity occurring in the oceans or that they are carried long distances.

Despite the insidious ease with which acid rain precursors can travel, regions where its impacts are noticable are, as yet, relatively few and predictable. They lie mainly in the industrialized belt of the Northern Hemisphere, downwind from dense concentrations of power plants, smelters, and urban sprawls. Often they are mountainous, and as such they frequently bathe in rains and snows. Well watered, these areas are typically clothed in forests and laced with lakes and streams. Their soils often are thin—a fragile flesh spread over a skeleton of glaciated bedrock.

This describes the Adirondack Mountains almost perfectly. It also fits other acid rain hot spots, such as rock-ribbed Nova Scotia, where nine acidified rivers no longer support salmon reproduction, and the Canadian shield country of southern Ontario and Quebec.

Other vulnerable areas include the Great Smoky Mountains, hundreds of sensitive lakes in Wisconsin and Minnesota, the Pacific Northwest, the Colorado Rockies, and the Pine Barrens of New Jersey. A striking parallel to New York's Adirondacks exists in Scandinavia, where galaxies of lakes glint among low mountains watered by acid precipitation drifting northward from Europe's industrial belt.

Conversely, certain areas can tolerate acid fallout because of the neutralizing effect of their alkaline soils—a natural resistance known as buffering. Limestone regions such as the Allegheny Mountains enjoy this immunity. A similar buffering takes place in much of the Midwest, where alkaline dust-blown from the West can also neutralize acid rain before it falls to the ground.

NATURE FAR OUTDONE BY MAN

How long have we had acidic rain? Probably since the first rains fell on a newformed planet. Volcanic eruptions, forest fires, and even the slow bacterial decomposition of organic matter produce sulfur or nitrogen compounds. Lightning bolts form NO_x from the nitrogen in earth's atmosphere.

When administered in nature's measured doses, this atmospheric "pollution" can serve as a wholesome, gentle way of fertilizing the landscape. In good faith could Shakespeare extol the "gentle rain from heaven" in *The Merchant of Venice*, and Robert Frost write of downy flakes in his "Stopping by Woods on a Snowy Evening."

But this natural cycle began to give way about two centuries ago, when man intruded with the cloud of coal smoke that signaled the start of the industrial revolution. Suddenly, sulfur and nitrogen that had accumulated in fossil fuels for millions of years were released as rapidly as coal could be burned. Swiftly the volume of man-made pollutants gained on nature's. Today, a large coal-fired power plant can emit in a single year as much sulfur dioxide as was blown out by the May 18, 1980, eruption of Mount St. Helens in Washington State—some 400,000 tons.

The total amounts of SO_2 and NO_x that mankind releases are staggering. In 1980 the U.S. ejected more than 26 million tons of sulfur dioxide into the air in addition to nearly 22 million tons of nitrogen oxides. For Canada the figures were five million and two million tons. Last year the two nations, along with Europe, pumped almost 100 million tons of SO_2 into the atmosphere.

As early as 1852 an observant English chemist, Robert Angus Smith, discovered a relationship between the increasingly sooty skies of industrial Manchester and the acidity he found in precipitation. Twenty years later he used the term acid rain in a 600-page book on the subject.

This remarkable work was neglected until Dr. Eville Gorham, a Canadian ecologist now at the University of Minnesota, elaborated on Smith's work in the later 1950s. He too was initially ignored.

SCIENTIFIC INTEREST PIQUED BY SWEDE

Acid rain's deserved notoriety finally came in 1967 when a Swedish soil scientist named Svante Odén reported a pattern of increasingly acid precipitation over time and geographic area. From his studies, he prohesied serious impacts on soils, waters, forest, and structures.

Employing colorful language that characterized acid rain as "chemical war," Dr. Odén provoked a fallout of concern that sparked the intense interest found among today's scientists. His findings established him as the father of acid rain research. In all fairness, however, Dr. Gorham must be considered the grandfather and Robert Angus Smith the great-grandfather.

Acid precipitation in North America found an early student in Dr. Gene Likens, an ecology professor at Cornell University. In 1963 Dr. Likens and Dr. F. Herbert Bormann of Yale had begun a multidisciplinary study of forest productivity in a small watershed of the Hubbard Brook Experimental Forest in New Hampshire. Their initial precipitation records revealed surprisingly strong acid content, considering the remoteness of the site.

The Hubbard Brook study provides the longest continuous record of acid precipitation chemistry in North America—a record that accurately shows annual fluctuations in acidity but no clear trend as to worsening or improving conditions through 1981.

TROUBLE FROM TALL STACKS

Until a few decades ago, air pollution was largely an urban concern. The economic surge that began with World War II brought increasing use of fossil fuels, and a corresponding increase in pollutants.

Well-intended regulations may unwittingly have aggravated the problem. New Environmental Protection Agency (EPA) rules in 1970 caused plants to increase the height of their stacks; thus winds carried pollutants far from local sources. Today in the U.S., 179 stacks tower 500 feet high or more, including 20 that reach 1,000 feet.

The record stack, a 1,250-foot giant at a nickel smelter in Sudbury, Ontario (right), also holds the record as the free world's single greatest source of SO_2 pollution—2,500 tons a day (albeit a welcome reduction from the 7,000 tons daily in earlier years). Such huge stacks, spewing contaminants into large weather systems, have helped make air pollution an international phenomenon.

Nevertheless, experts acknowledge that much remains to be learned about acid rain, even such basic questions as: Where, exactly, are the specific sources of acid-causing pollutants? The answer is disputed, for it could involve the expenditure of large sums of money, and possibly even redirect the nation's energy policy.

"One of the major issues," explains Dr. Fred Lipfert, a scientist at Brookhaven National Laboratory on Long Island, "is the mechanics by which air pollutants enter rain."

"It's natural to assume that the fossil fuelburning regions of the eastern United States are responsible for their own acid rain. But the Ohio River Valley is a huge industrial user of coal, and because it has prevailing winds that carry its emissions eastward, it may, under certain conditions, be more important than eastern industry to such sensitive areas as the Adirondacks.

"Also," Dr. Lipfert continued, "the EPA in the 1970s permitted widely varying emission amounts from pre-existing smokestacks, with the tighter standards being applied in the heavily populated East. Some Midwest sources were allowed to disperse as much as 200 pounds of SO_2 per ton of coal. Because new sources are now allowed only 15 pounds per ton, the older plants remain the biggest contributors."

Not everyone believes the blame can be so handily pinpointed. Those who argue the point represent, in large measure, the nation's energy companies and power utilities.

Says John M. Wooten, environmental director for the giant Peabody Coal Company: "Nobody has yet proved a direct relationship between the level of sulfur emissions in the Midwest and the amount of acid rain that falls in the northeastern U.S. and Canada. And until we have this proof, we should go slowly in order to develop the most prudent control scheme. Before being required to retrofit expensive scrubbers to reduce emissions, we want assurance they will do some good—say, that a 20 percent reduction in sulfur emissions in the Ohio River Valley will bring a 10 percent decrease in acid rain back East."

DETECTIVES OF DIRTY SKIES

How do you prove that a specific Ohio power plant is sending out the emissions that are killing trout in my Adirondack lake, hundreds of miles downwind? How do you trace a molecule of sulfur dioxide on its long journey through dark and turbulent clouds?

To track pollutants, scientists engage in aerobatics that do credit to the flying circuses of old. Ducking in and out of drifting pollution plumes from urban areas and power plants, they take air and water samples in attempts to identify and track the flow. Computer-generated models then predict the pollutants' trajectories.

One of the most valuable tools in this sleuthing is a growing nationwide network of 84 acid rain monitoring stations, set up in the late 1970s under the guiding hand of Dr. Ellis B. Cowling of the School of Forest Resources at North Carolina State University. A private organization known as the National Atomospheric Deposition Program (NADP), it analyzes samples of rain, snow, and dry fallout from 32 states. A companion survey, the Canadian Network for Sampling Precipitation (CANSAP), covers 55 locales in Canada.

These monitors reveal that virtually all the eastern U.S. and much of southeastern Canada are receiving highly acidic precipitation. Measured on the pH scale, where 7.0 equals a perfect balance between acidity and alkalinity (diagram, page 660), the rains range from 4.1 to 4.6—ten to thirty times as acid as uncontaminated rain. Specific storms have dumped pH 2.7 precipitation—as acid as vinegar—on Wheeling, West Virginia.

THREE LAKES, THREE RESULTS

I can visit, conveniently close to my cabin, a lake acidification study (one of 20 separate research projects in the Adirondacks) that is taking a five-million-dollar look at the chemistry of wild lakes as a result of acid deposition. Sponsored by the Electric Power Research Institute, a nonprofit research arm for 600 electrical utility companies, the study traces what happens to three lakes and their watersheds from the moment acid rain and snow hit the treetops to their final flow from the outlets.

"What we're finding," explained Dr. James N. Galloway, an environmental chemist from the University of Virginia, "is that each lake is personalized in its reaction to acid rain. For example, no one has caught any brook trout at Woods Lake, which has had a pH of 4.7, for years—this is too acid for fish. But brookies thrive at Sagamore—pH 5.8—and at Panther—pH 7.0. Yet all three lie at roughly the same elevation within 20 miles of one another and receive the same kind of acid deposition.

"Many factors control this reaction: size and shape of the watersheds, type of vegetation, bedrock, and soils, and the residence time of precipitation in the soil. Fishless Woods Lake, with its shallow soil and steep slopes, provides little residence time and thus little buffering of the acid rain."

An important breakthrough in acid rain research came in 1977 from Adirondack studies by Dr. Carl Schoffield of Cornell. Investigating how acidity actually killed lake fish, he observed that aluminum compounds were collecting in the gills of fry. To combat the pollutant, the fry exuded a mucus in such amounts it finally strangled them. Acid precipitation, Dr. Schofield concluded, was leaching aluminum from surrounding soils—a process known as mobilization—and bearing it into the lake water. Today soil scientists recognize that acid rain mobilizes many toxic metals, including mercury and lead.

Acid rain and its companion heavy metals produce a long laundry list of suspected threats to the environment. These extend far beyond aquatic ecosystems, to forests, crops, soils, wildlife, groundwater, manmade materials, and perhaps human health.

Many of these ills beset Scandinavia, where I went to see them firsthand. Aquatic chemist Dr. Arne Henriksen guided me on an hour's hike around the rocky shores of Norway's Hovatn Lake. The surface stretched mercury smooth, ebony black to a stony mountain.

"It's 60 miles to the sea," gestured Dr. Henriksen, "and hundreds more miles to the nearest pollution sources. But watch." He took my pH meter, a small gauge resembling a battery tester, and dipped its probe into the water. It read 4.4. "That acidity has come from somewhere!" he claimed, looking southward toward industrial Europe.

FOR FISH, SPRING CAN BE DEADLY

Quietly we rowed to a lone cabin on a peninsula, on loan for use as a field station for a massive acid rain research program known by its initials, SNSF. It was launched in 1972 following the disappearance of fish in southern Norway. As I stepped inside the shadowy building, outlines of two enormous brown trout on the wall caught my eye. Both were longer than my forearm with fingers outstretched.

Dr. Henriksen said, "Those were caught in the early 1930s. Not a fish has been taken by any method from Hovatn since 1945."

He started a fire in the corner hearth and picked up a worn cabin journal. "Here it tells that the owners often tried restocking the lake, introducing thousands of fish, but none survived. By 1967 they suspected acid rain. Discouraged, they offered their cabin and lake to the research project."

Dr. Henriksen explained how the most severe fish kills occur in early spring. All winter, the pollutant load from storms accumulates in the snowpack as if in a great white sponge. When mild weather gives the sponge a "squeeze," acids concentrated on the surface of the snow are released with the first melt. Thus, the first meltwater can be five to ten times more acid than the remaining snowpack. This acid shock, acting in concert with mobilized aluminum, produces the drastic changes in water chemistry that destroy fish life.

With predaceous fish gone, aquatic insects can flourish, unless they too are sensitive to acidity. Acid-tolerant species, such as water boatmen, thrive. All other aquatic fauna decline in variety, as do the species of phytoplankton. A reduction in the sheer numbers of these tiny plants may allow light to penetrate farther through the water. That's why acid-impacted lakes are often described as being unnaturally clear or bluish.

Larger plant life too is affected. Water lilies decline, while the sphagnum mosses and filamentous algae grow prodigiously. These can form impenetrable mats, sealing off oxygen and retarding decay of lake-floor litter. Looking into the crystal water of a lake in Sweden, I saw leaves on the lake bottom that had not rotted in three years.

No acid lake therefore is really dead. Instead its population structure reverts to fewer species, radically altering the food web.

LAND SHOWS MIXED EFFECTS

Unlike these dramatic effects on aquatic life, the influence of acid rain on crops and forest is difficult to measure. No conclusive evidence of actual crop damage by acid rain has yet been shown. This could stem in part from the fact that sulfur and nitrogen, even when administered in the form of mild acids, serve as plant nutrients.

Laboratory tests, in which crops are grown in simulated acid rain conditions, produce a mixed bag of results. Some show a reduction in crop yield, others no effect, and yet others showed actual yield increases.

Yet many scientists fear that long-term exposure to acid rain inevitably must cause plant stress.

Is acid rain curtailing forest growth? The answer to this vital question too remains an ambiguous yes and no. It is complicated by the fact that forest systems are biologically more complex than croplands, and have a longer response time to acid stress.

"During six years of field experiments, growth of Scotch pine has actually been stimulated by acid rain, at least on poor soils," I heard from Dr. Folke Andersson of the Swedish University of Agricultural Sciences. "This change may be explained by the fertilization effect of the nitrogen that comes with polluted rain."

But Dr. Andersson was quick to add: "This fertilization probably cannot compensate for the delay in decomposition of forest-floor litter caused by acid rain, and the accumulation of heavy metals in soils over long time spans. And, in fact, another extended study has shown decreases in growth rate on both poor and good soils.

"We need another 25 years," he said, "to determine if acid rain is seriously impairing tree growth, or causing other bad effects."

However, a West German study recently linked acid deposition with the death of trees' feeder roots and the subsequent decline in forest growth.

DOES WILDLIFE SUFFER TOO?

Uncertainty also surrounds the effects of acid rain on wildlife. Unquestionably it is harmful to amphibians such as salamanders, spring peepers, and frogs—creatures that lay their eggs in acidified ponds and meltwater pools.

Dr. Erik Nyholm of the University of Lund in Sweden, studying the breeding biology of small songbirds along lakes in Lapland, found fewer eggs, less hatching success, and soft or missing shell material.

He theorizes that the birds were poisoned by aluminum from feeding on contaminated insects. "The aluminum probably was leached from the soil by the acid snow and rain," he said. "High aluminum content found in the bone marrow of the birds counteracted calcium deposition, resulting in defective eggshells. Other birds, feeding deep in the forest or around buffered lakes, showed no such problems."

A few mammals also may be showing biological reaction to acid deposition. In Poland, a large group of roe deer living in a forest directly downwind from Krakow's steel mills demonstrates definite declines in antler size and trophy value during the past 25 years. Polish biologists believe that the deer's habitat has been contaminated by acid and heavy-metal deposition.

The reaction of soils to acid deposition understandably stirs wide concern, for these are critical ecosystems, supporting the plants and animals that give us food, fiber, and forest products. They represent our long-term bank account. Is acid rain starting to eat up the principal?

Naturally acidic soils, common to many regions of the U.S., possess little built-in buffering capacity. Laboratory and field experiments with simulated acid rain show that acidifying soils may undergo a host of undesirable changes: increased leaching of trace elements such as aluminum and manganese, a slowdown of the organisms that break down forest-floor litter, and reduced nitrogen.

HOW DIM THE FUTURE?

These laboratory results leave many scientists with a haunting fear. If acid deposition continues unabated, vast tracts of sensitive soils may slowly decline in fertility until their productivity fails. When, or if, this might occur, no one can calculate, but it's effects could be difficult to reverse.

And what of corrosion—the eating away of man-made materials by acids? Engineers have despaired for decades as airborne pollutants have attacked structures ranging from steel bridges to tombstones. The list of the wounded includes many famous names: The caryatids of the Acropolis, Egypt's temples at Karnak, the U.S. Capitol. Even that glorious copper lady—the Statue of Liberty—is under the onslaught of acid rain and corrosive gases and particles.

If acid rain, with its associated gases and metals, can be detrimental to animals and structures, what might it be doing to people? No immediate, direct health problems, such as getting "burned" by acid rain, have been observed or reported. Indirect effects have been noted, however, both from dry and wet acid deposition.

Dry airborne pollutants—usually sulfates—are largely associated with respiratory diseases—chronic bronchitis, asthma, and emphysema. Dr. Leonard Hamilton, a Brookhaven National Laboratory epidemiologist, estimated in 1975 that "acid sulfates from fossil fuel . . . emissions are responsible for 7,500 to 120,000 deaths a year." Few other scientists believe there is enough solid evidence to support such high figures.

Another health effect relates to acidified groundwater in Scandinavia. In western Sweden I drove through rural provinces with Dr. Hans Hultberg of the Swedish Water and Air Pollution Research Institute. We bounced over rough roads in farmland where severe groundwater acidification has begun, along with contamination by metals leached from the soil.

"See that farm over there?" Dr. Hultberg pointed. "The babies had diarrhea off and on for months until we found that high copper content in the drinking water was the cause. Their well was acid. The water leaches copper from the plumbing lines."

A HAIR-TINTING EXPERIENCE

We passed a small cottage. "The lady's hair there was tinted green," exclaimed Dr. Hultberg. "Green as a birch in spring. She washed it in well water turned green by copper sulfate."

Later I found an echo of this problem in the western Adirondacks as I guided Dr. G. Wolfgang Fuhs, an environmental scientist with New York's Department of Health, to isolated springs, wells, and small municipal water supplies. Owners in the area had been complaining of corroding plumbing systems and suspicious-tasting tap water. Dr. Fuhs found several home systems and springs with elevated levels of lead and copper. For each family he had the same advice: Let faucets run a few minutes after nonuse overnight to lower metal concentrations before drinking or cooking.

TIME BOMBS FOR TOMMORROW

Is it surprising, given this parcel of known and feared effects, that some scientists rank acid rain with toxic-chemical pollution and carbon dioxide buildup as the three worst "environmental time bombs?" They compare the connective evidence between fossil-fuel emissions and acid rain effects to that of cigarette smoking and lung cancer: Though in each case the cause-and-effect relationship is not proved, even doubters of acid rain must agree that the combustion of fossil fuels has increased in past decades, that lakes and streams do show a loss of life.

The dilemma of acid rain will ultimately be solved by politicians, economists, and the public, acting on the best information we scientists bring forth.

The principal tool we have to work with in this country is the Clean Air Act. This federal law, controlling adverse effects of air pollution on public health and welfare, requires that the emissions from fossil-fuel burning facilities and motor vehicles meet certain standards.

It does so essentially in two ways. One is through an EPA requirement making new pollution sources use the "best available" technology to control emissions.

The second approach relates to existing plants. Here, each state is expected to regulate itself. A result is that no state needs to heed another's standards. Thus the SO_2 emission Ohio allows are nearly 30 times higher than permitted in Connecticut.

Robert F. Flacke, commissioner of New York State's Department of Environmental Conservation, says firmly, "The Clean Air Act is really one of the chief reasons for the increase in acid rain. Not only did its earlier policy bring about the long-range transport of air pollution via tall stacks, it also permits New York and other clean-plant states to be dirtied by states with looser air standards."

Not surprisingly, these biases pit state against state, with at least half a dozen of them initiating legal actions. Another spate of litigation attacks EPA for allegedly failing to do its duty to provide protection under provisions of the Clean Air Act.

The act is up for reauthorization in Congress now, and swarms of lobbyists seek both to strengthen and to weaken it. Meanwhile, Congress allocated 12 million dollars under the Acid Precipitation Act of 1980 to spend on research in 1981, with more being recommended for 1982. A federal-level interagency task force directed by NOAA's Dr. Chris Bernabo is studying acid rain with a view toward developing a national strategy, and extensive research goes on at universities, national laboratories, and within the electric-power industry.

But the Reagan Administration is making no rush to judgment. In the words of A. Alan Hill, chairman of the Council on Environmental Quality: "Our scientific community is still unclear as to . . . what control methods should be used. In our opinion, we just don't know enough yet to impose control measures at great cost to the American people with questionable results."

NATIONS FALL OUT OVER RAIN

On the international scene, too, acid precipitation emerges as a politically poisonous brew—one that embitters that valued friendship between the U.S. and Canada.

"We calculate that half the acid deposition striking Canada is imported from the U.S.," explained Dr. Hans Martin, Canada's coordinator for acid rain research. "Furthermore, it's falling on a million square miles of Ontario and Quebec that lack adequate buffering capacity. A million and a half lakes dot that region, and some are already giving way to acid deposition."

The meaning of this in terms of cold Canadian dollars came across in a statement by John Roberts, Canada's Minister of the Environment.

"Fifteen percent of our gross national product comes from forestry," he noted, "a higher percentage than the automobile industry contributes to the U.S. economy. Yet this resource is being threatened. The second largest industry in Canada is tourism. But how many tourists will want to spend their time at fishless lakes?

"Your country, the United States," he observed, "is dumping its garbage at the expense of our country."

U.S. spokesmen retort that American emission controls are more stringent than Canada's (although Canadian regulations are being rapidly tightened), and that Canadian pollution also drifts onto the United States (although not in nearly the volume that the U.S. exports to Canada).

Recognition of the problem led to the creation in 1980 of a massive binational program aimed at devising an agreement on transboundary air pollution.

EUROPEANS JOIN FORCES

An impressive team effort has arisen in Europe. In 1979, 31 of the 34 member govenments in the UN's Economic Commission for Europe signed the Convention on Long-Range Transboundary Air Pollution. Though it does not enforce controls, it morally commits each nation to respect the environment of other countries.

Erik Lykke of Norway's Ministry of Environment told me, "I'm praying this convention will bring a cleaner landscape 10 to 15 years from now."

Few scientists are so optimistic. Many see the year 2000 as the earliest that emissions can be stabilized, and then slowly reduced. Experts at EPA, for example, predict that under current controls SO_2 in the United States will stay constant or increase modestly to 29 million tons per year by the end of the century. NO_x, on the other hand, will near 28 million tons a year and possibly outstrip SO_2 as a contributor to acid fallout.

What can be done to lessen this impact, and how much will it cost? the most obvious step lies in conservation of energy—simply using less fuel. Another approach, more complicated and costly, is to apply new technology to reduce emissions—the object of intensive research by the EPA, universities, and utility groups.

The cost of cleaning up is high; equipping older U.S. plants with scrubbers would require an investment of billions of dollars, and even then might reduce emissions by only a third. These costs might be mitigated by positive side effects—the generating of useful by-products such as commercial sulfuric acid and road-fill material, and the creation of new jobs.

Meanwhile, hidden costs of acid rain may already be surpassing the expense of controlling it. Metal corrosion by SO_2 may cost each American at least seven dollars a year, and possibly many times that.

Proof that a solution exists comes from Japan. The government issued stringent sulfur oxide controls in 1968 and encouraged use of low-sulfur fuels and desulfurization; by 1975 emissions had plunged by 50 percent even as energy consumption doubled. Since then, even stricter limits have been set, and nearly 1,200 scrubbers installed, compared to about 200 in the United States.

Scientists in several countries are experimenting with so-called curative approaches to acid rain. These include the breeding of acid-tolerant fish and crops, liming lakes to reduce acidity, and coating valuable structures and artwork against corrosion. Yet such solutions are only short term.

WILL THE 21ST CENTURY BE SILENT?

What of the future? "It's only a matter of time before we are forcibly pressed to do something," says Norway's Dr. Lars Overrein, head of the Norwegian acid rain project. "Today's acid rain is just the beginning. We are already worried about heavy metals and organic pollutants that come with acid deposition."

When I stand looking out over my lake, what will I see and hear come the year 2000? Will peepers be trilling, fish jumping, trees leafing, deer drinking, baby birds chirping? Or will it be a silent spring? ●

TRIBUTE TO DAN J. BRADLEY—A DEDICATED AMERICAN

Mr. KENNEDY. Mr. President, I would like to take a few moments to commend a fine individual and a good friend, Dan J. Bradley. Until the last day of March, Dan was the President of the Legal Services Corporation. For the last 22 months, Dan has performed the often-thankless, always-difficult task associated with the Corporation's presidency—and performed it with constant enthusiasm and repeated success. His thoughts and advice have been invaluable. His dedication to the Corporation and its disadvantaged clients has been an inspiration to those of us who have fought for an expansion of legal services.