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"Emissions Trading of Sulfur Dioxide: The U.S. Experience"

U.S. Environmental Protection Agency, Acid Rain Program, 1997, pp. 1–5. Reprinted by permission.

Introduction

The overall goal of the United States' Acid Rain Program is to achieve significant environmental and public health benefits through reductions in emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), the primary causes of acid rain. To achieve this goal at the lowest cost to society, the program employs both traditional and innovative, market-based approaches for controlling air pollution.

At the core of the SO_2 program is a cap, or mandatory ceiling, on total SO_2 emissions from utilities. After full implementation of the program, annual emissions will be capped at 8.95 million tons, which represents a 50 percent decrease in SO_2 emissions from electric utilities from 1980 levels. Enforcing this cap is a rigorous monitoring system that allows EPA to ensure accuracy and verifiable emissions reductions.

In a dramatic departure from traditional command and control regulatory structures, this program utilizes a market-based system of tradable emissions allowances. The system allows regulated utilities flexibility in how they attain compliance, so that they can select the most cost effective strategy for their particular facilities.

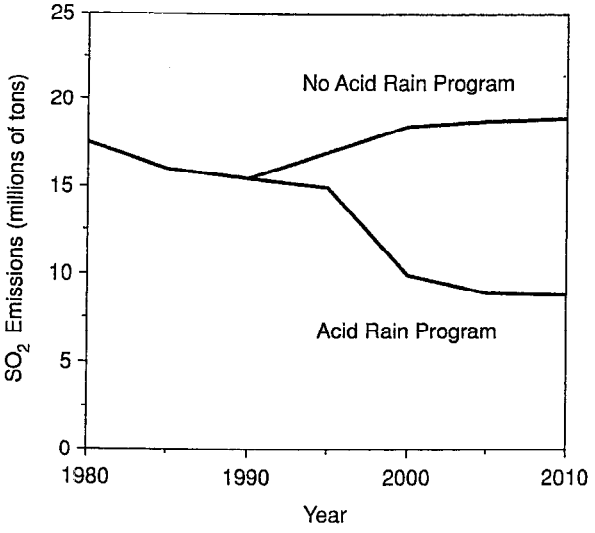
The program was established in the 1990 amendments to the Clean Air Act, the nation's air pollution control law. As stated in Title IV of the Clean Air Act, the primary goal of the Acid Rain Program is to reduce annual SO_2 emissions by 10 million tons below 1980 levels. To achieve these reductions, the law requires a two-phase tightening of restrictions placed on fossil fuel-fired power plants, which accounted for two thirds of national SO_2 emissions in 1980.

Phase I began in 1995. It affects 263 boilers, or "units," at 110 mostly coal-burning electric utility plants that were identified in the law as the largest SO_2 emitters. An additional 182 units voluntarily joined Phase I of the program early as substitution or compensating units, bringing the total of Phase I affected units to 445.

Phase II, which begins in the year 2000, tightens the annual emissions limits imposed on these large, higher emitting plants. In addition, restrictions come into effect on smaller, cleaner plants fired by coal, oil, and gas. This phase affects existing utility units serving generators with an output capacity of greater than 25 megawatts and all new utility units.

The Clean Air Act also calls for a 2 million ton reduction in NO_x emissions by the year 2000 through a more conventional regulatory program. A significant portion of this reduction will be achieved by coal-fired utility boilers that will be required to install low NO_x burner technologies and to meet new emissions standards.

Utility SO_2 Emissions



The Acid Rain Program will result in a 10 million ton reduction in SO_2 emissions from 1980 levels by the year 2010.

The Allowance System

Allowance trading is the innovative tool for achieving SO_2 emissions reductions required by the cap. Allowances are the currency with which compliance with the SO_2 emissions requirements is achieved; one allowance authorizes a regulated unit to emit one ton of SO_2 during a specific year or any year thereafter. At the end of each year, the unit must hold an equal or greater number of allowances as the tons of SO_2 emitted that year, i.e., a unit that emits 5,000 tons of SO_2 must hold at least 5,000 allowances that are eligible to be used that year.

The allowance trading system gives utilities flexibility in devising compliance strategies. This flexibility is a result of the fact that a regulated unit need only to hold enough allowances at year end to account for its emissions. Unlike traditional regulatory programs, EPA does not dictate the compliance options. Options might include employing energy conservation measures, increasing reliance on renewable energy, reducing usage, employing pollution control technologies, switching to lower sulfur fuel, or developing other alternate strategies to reduce emissions.

Because allowances have a value and can be purchased and owned, they are sometimes misconstrued as "rights" to a certain amount of pollution. However, the law makes clear that allowances are merely authorizations to emit, since at all times the government retains the

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authority to require affected sources to comply with the Clean Air Act limits. The concept of authorizing sources to emit is common to all air pollution regulations; no regulations dictate zero air emissions. With more traditional forms of regulations, sources are authorized to emit through emissions limits or through requirements to install specific technologies.

The financial value and enduring validity of excess allowances encourage SO_2 reductions beyond what is required by the present year's allotment. Allowances are fully marketable commodities: units that reduce their emissions below the number of allowances they hold may trade their excess allowances with other units in their system, sell them on the open market to other utilities or through EPA auctions, or bank them to cover emissions in future years.

Banking

Banking encourages early emissions reductions by allowing participants to store their excess allowances and by assuring that those allowances will retain their compliance value in future years. Utilities may use banked allowances to help comply in later years, or they may sell them. In the first year of the Program's implementation, Phase I affected units collectively achieved 40 percent greater emissions reductions than was required by law. This dramatic result demonstrates that banking leads to SO_2 reductions earlier than if banking were not permitted. These extra reductions result in environmental and health benefits that begin sooner.

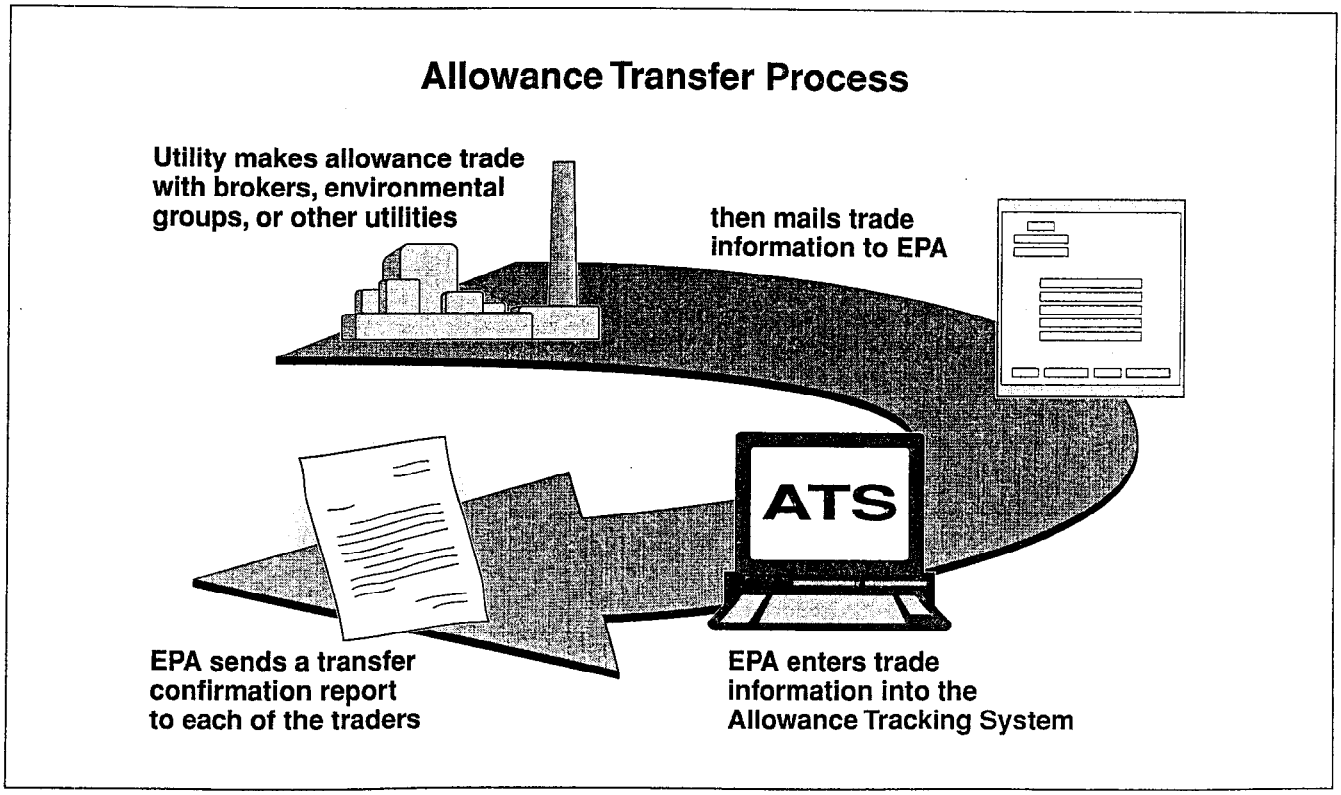
Banking also reduces compliance costs by allowing utilities more flexibility in the timing of their pollution control investments.

Phase I affected sources are likely to be banking allowances in anticipation of the more stringent emission limits and higher costs in Phase II. It is expected that rather than a sharp drop in emissions at the start of Phase II, reductions will move toward the ultimate cap more gradually as banked allowances from previous years are used for compliance. Although the reduction rate may slow down after Phase II, the environmental and health benefits sparked by the initial overcompliance will have been accruing for several years.

Regardless of how many allowances a unit holds, it is never entitled to exceed the source-specific limits set under Title I of the Clean Air Act to protect public health.

Allocations

EPA allots allowances to each affected unit for each year, beginning with Phase I units in 1995. These allocations were determined prior to the start of the trading program, based on selected emission rates and each unit's representative fuel utilization level. In Phase I, the specified emission rate was 2.5 pounds of SO_2/mmBtu (million British thermal units). This rate was applied to units with existing rates greater than 2.5 pounds/mmBtu and was multiplied by the unit's average fuel use from 1985 through 1987. These allocations are listed in the Clean Air Act and codified in the Allowance System Regulations.



In Phase II, the limits imposed on Phase I plants will be tightened, and emissions limits will be imposed on smaller, cleaner units that were not included in Phase I. EPA allocated allowances to each unit at the lesser of its existing emission rate or 1.2 pounds of SO_2/mmBtu, multiplied by the unit's baseline fuel consumption.

Equity Issues in Allowance Allocations

In addition to the standard formulas for allocating emission allowances, the Clean Air Act Amendments set forth special provisions to address equity concerns raised by some states. For example, in some cases, states that had already reduced the emissions of their electric utilities to levels well below the national average were given extra allowances. Similarly, a state with high population growth in the 1980s was given bonus allowances for its electric utilities to compensate for this growth. In all cases, these redistributions of allowances were done without increasing the overall level of national emissions. In other words, increases in allowance allocations in certain states or at certain electric utilities were offset by decreases in the allowance allocations to other states or emissions sources.

Permits

Permitting under the Acid Rain Program is simple and flexible. For example, the Phase II permitting form consists primarily of a statement of standard legal requirements in the Clean Air Act that companies certify they will meet. Utilities may select from several compliance options, devise the most cost-effective compliance plan, and revise plans easily without needing government review or approval. The standard permit forms ensure consistency on a nationwide basis.

Allowance Transfers

EPA is responsible for recording the transfer of allowances that are used for compliance and for confirming that utilities hold at least as many allowances as tons of SO_2 emitted by the end of the year.

To fulfill this role, EPA designed and maintains the Allowance Tracking System (ATS), a computer program that is the official record of allowance holdings and transfers. Every utility unit, corporation, group, or individual holding allowances has an account with ATS, held in the name of a designated individual. EPA established accounts for utility units affected by both Phase I and Phase II. In addition, any person or group wishing to purchase allowances may open an ATS account.

The structure of the Acid Rain Program simplifies the transfer of allowances, thereby lowering the cost of transactions. The transfer process is comprised of four steps for utilities. A utility makes an allowance trade with another utility, a broker, or environmental group. They enter information about the trade on a one-page form and mail it to EPA. Next, EPA enters this information into ATS and then sends a transfer confirmation report to each of the traders. Because there is no need for case-by-case approval of trades, allowance transfers are straightforward and fast. Only transfers of allowances to be used for compliance require EPA notification; notification of other transfers is voluntary.

ATS also makes the movement of allowances easy to track. ATS records the issuance of all allowances, the holdings of allowances in accounts, the deduction of allowances for compliance purposes, the transfer of allowances between accounts, and the number of allowances held in EPA reserves. Information on the ATS accounts is available to the public via the Internet.

Determining Compliance

At the end of the year, units must hold in that year's compliance subaccount an amount of allowances equal to or greater than the amount of SO_2 emitted during that year. By January 30 following the compliance year, units must finalize and report to EPA allowance transactions that were used in attaining quantities of allowances necessary for compliance. The amount of emissions is contained in the Emission Tracking System (ETS), which is operated by the Acid Rain Program and records each hour of each unit's hourly emissions throughout the year.

After the January 30 deadline, EPA deducts allowances from each unit's compliance subaccount in an amount equal to its SO_2 emissions for that year. If the unit's emissions do not exceed its allowances, the remaining allowances are carried forward, or banked, into the next year's subaccount.

Ensuring Environmental and Health Benefits through Stringent Monitoring

Tradable allowances are intended to achieve environmental goals at the lowest cost to society. However, even if no trades were to occur, these environmental goals would still be met by the Acid Rain Program. The Program uses several mechanisms to ensure that its environmental and health goals are met. During Phase II, the Clean Air Act places a cap of 8.95 million on the total number of allowances issued to units each year. This effectively caps emissions of 8.95 million tons annually and ensures that the mandated emissions reductions are maintained over time. This reduction represents a 50 percent decrease in SO_2 emissions from 1980 levels.

To enforce the integrity of the emissions limit, EPA tracks on a continuous basis each unit's emissions of SO_2, NO_x and CO_2, as well as volumetric flow and opacity. In most cases, a continuous emission monitoring (CEM) system must be installed. Through the CEM system, units report their hourly emissions data to EPA on a quarterly basis. The reporting process is evolving from the submittal of diskettes to the use of modems, which has greatly increased the efficiency of reporting. The data is then recorded in the Emissions Tracking System, which serves as a repository of emissions data for the utility industry.

Strong enforcement measures deter noncompliance. If annual emissions exceed the number of allowances held, the owners or operators of delinquent units must pay a penalty of $2,000 (adjusted for inflation) per excess ton of SO_2 or NO_x emissions. this fee is substantially higher than the cost of compliance, e.g., an allowance. In addition, the number of exceeded allowances is deducted from the violating utility's account for the next year to fully offset the environmental impact.

The emissions monitoring and reporting systems are critical to the program. Monitoring ensures, through stringent accounting, that the SO_2 and NO_x emissions reduction goals are met. They also instill confidence in allowance transactions by certifying the existence and quantity of the commodity being traded.

Emissions data is available to the public in several formats, including over the Internet. Such public access provides the program transparency that assures integrity and public trust in the system.

Results

The Acid Rain Program's environmental goals are already starting to be met. After the first year of implementation, the Acid Rain Program has witnessed large reductions in SO_2 emissions. In 1995, all 445 Phase I affected units were in compliance, and utilities reduced emissions 40 percent more than required by the cap. Annual emissions from these Phase I units dropped by more than half between 1980 and 1995, from 10.9 million tons to 5.3 million tons.

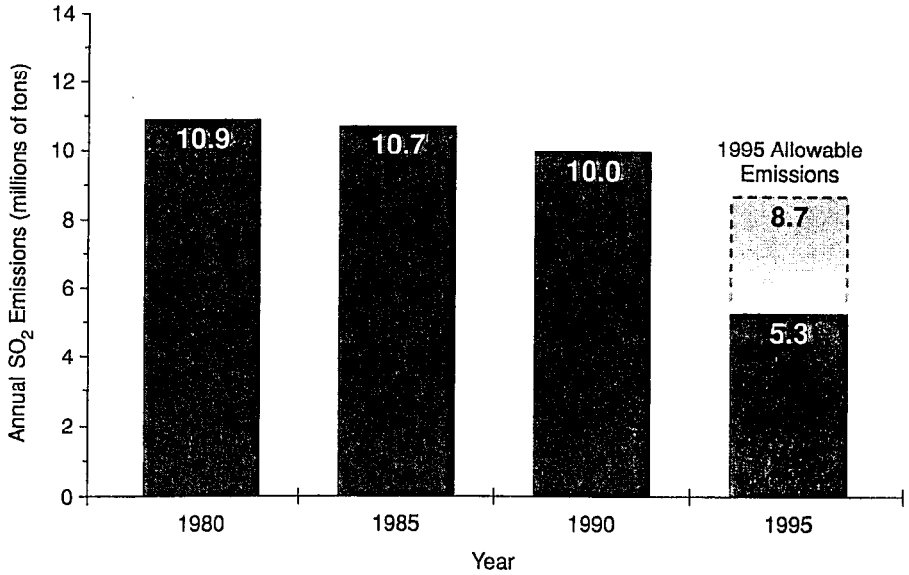
Environmental effects corresponding to these early reductions are starting to emerge. A United States Geological Survey study determined that 1995 wet sulfate deposition declined in the eastern United States by 10 to 25 percent. Other anticipated benefits include avoided health costs of $12 to $40 billion per year by 2010; improvements invisibility amounting to $3.5 billion by 2010; fewer acidic lakes and streams; and reduced damage to buildings and outdoor cultural artifacts.

At the same time, the Acid Rain program has cost significantly less than the benefits, and estimates for the program's long term costs continue to drop. As of 1994, the estimated cost of the program was $2 to $2.5 billion per year by 2010. The cost is half of what a command and control regulatory program would cost.

The cost of reducing a ton of SO_2 from the utility sector has been much lower than expected; scrubber costs have dropped, removal efficiencies have improved, and expected increases in costs associated with the increased use of low sulfur coal have not materialized.

SO_2 Emissions

445 Phase I Affected Utility Units



Emissions at Phase I affected utility units were 3.4 million tons below their required level in 1995.

These reductions in cost are reflected in allowance prices. In just two years, allowance prices have dropped from $150/ton to less than $100/ton.

Important Roles Played by Participants

Successful implementation of the Acid Rain Program hinges on straightforward and well-defined roles for each participant. EPA monitors utilities' emissions to ensure compliance, and measures the environmental effects of the program. Industry's role is to reduce emissions in the most cost effective manner. Brokers provide information on the market and facilitate allowance transfers for utilities and other parties, thus reducing transaction costs. Finally, environmental organizations monitor the overall performance through access to emissions and allowance data. In addition, these groups may purchase and retire allowances, a small but direct action individuals can take to reduce pollution.

Just as each participant has a role in ensuring the integrity of the Program, each element of the Program works in concert to bring about efficient emissions reductions. The allowance trading system capitalizes on the power of the marketplace to reduce SO_2 emissions in the most cost effective manner possible. The permitting program allows sources the flexibility to tailor and update their compliance strategy based on their individual circumstances. The continuous emissions monitoring and reporting systems provide the accurate and standardized accounting of emissions necessary to make the program work, and the excess emissions penalties provide strong incentives for compliance. Each of these separate components contributes to the effective working of an integrated program that harnesses market incentives for the benefit of the environment.

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"Acid Rain: A Continuing National Tragedy"

"We still have a very major problem with acid rain. That is scientific fact. In that regard, the 1990 Clean Air Act Amendments have not worked very well."
Acid rain scientist Dr. Gene Likens, *Boston Globe*, February 8, 1998

Despite the Clean Air Act Amendments of 1990, acid rain continues to degrade ecosystems in high-elevation forests and waters from New York's Adirondack Park, Taconic Ridge, Catskill Park and Hudson Highlands; through New England's Green and White Mountains and the mid-Appalachian range in the Carolinas and Tennessee. Associated nitrogen-based air pollution is ruining aquatic habitat in Long Island Sound and the Chesapeake Bay and even Colorado's Rocky Mountains are now showing air-pollution-related damage.

The air pollution that causes acid rain has been falling on some areas of the United States for nearly a century. But the damage acid rain causes can take a long time to develop. In many of the most heavily damaged regions—such as the forests of New York and New England—scientists have been documenting ecological damage since the 1970s. Now, other regions are discovering that their health and environment are suffering too.

In 1990, Congress amended the Clean Air Act and instructed the U.S. Environmental Protection Agency to create the nation's first acid rain control program. In 1992, the Bush Administration boasted that the new program would "end acidity in Adirondack lakes and streams." But many recognized right away that the program would be inadequate to stop the destruction in the Adirondack Park and the nation's other most sensitive ecosystems.

In 1993, the NYS Dept. of Environmental Conservation, the Natural Resources Defense Council and the Adirondack Council sued the EPA over the new program. In a partial settlement of the suit, the EPA agreed to complete a 1996 report to Congress on whether the new program would have the desired effect. The report confirmed our fears.

The EPA noted that the current federal acid rain program could only slow the rate of damage done to the Adirondack Park. More lakes would die. Meanwhile, acid rain and the air pollution that causes it are damaging other areas of the nation at an alarming rate.

Acid rain has been harming the ecosystems of the Catskill Mountains for as long as the Adirondacks. While the Catskill Park is one-tenth the size of the Adirondack Park and has far fewer lakes, its legendary rivers and trout streams have lost much of their vitality.

Farther south, the mid-Appalachian Mountains are being devastated. Spruce forests are dying, streams are losing their fish. Insect infestations in forests threaten to wipe out entire species.

In New England, studies by acid rain research scientist Dr. Gene Likens showed that the hardwood forest of New Hampshire's Hubbard Brook area has stopped growing. Sugar maples are at a particular risk—bad news indeed for furniture and syrup makers.

Up north, the Canadian government estimates that by 2010, even with full implementation of the Canadian and American acid rain programs, an area the size of France and Britain in southern Canada will continue to receive harmful levels of acid rain. As many as 95,000 lakes will remain damaged, they stated in 1997.

Out west, scientists in the Rocky Mountains are finding that power plant emissions are saturating high-elevation watersheds in Colorado with acid-causing nitrogen. Evergreen forests are losing their needles and tree health is declining throughout the Front Range.

Acid rain damage is not limited to forests and aquatic ecosystems. In Pennsylvania, the monuments at the Civil War battlefield in Gettysburg are deteriorating far more quickly than similar structures in places not affected by acid rain. Throughout the Northeast, stone, brick and block buildings, as well as automobile finishes, show signs of more extensive and rapid weathering than counterparts in other regions of the country.

In the Chesapeake Bay and Long Island Sound, nitrogen-based pollution is overloading the water with nutrients. This contributes to an overabundance of algae, which when they die and decay, deplete the water of precious oxygen needed by all aquatic animals. The condition is known as hypoxia.

Closer to our homes, acidity in water supplies is leaching poisonous metals such as lead into the drinking water. Copper is killing the beneficial bacteria that make septic systems function. Airborne particles of sulfur—the chief component of acid rain—also cause and worsen lung diseases.

The few fish species that can survive in acidic waters are accumulating mercury in their body tissue. Now, mammals and birds that live on those fish are showing signs of mercury contamination. More than 500 lakes and ponds (out of 2,800) in the Adirondack Park are already too acidic to support the plants and aquatic wildlife that once existed in them. Each spring, an entire winter's acidic snowpack melts into the Park's

waters, jolting them with a huge jump in acidity known as "acid shock." It could not happen at a worse time. Many of the Park's plants, animals and insects are at their most vulnerable at the beginning of the growing season.

Red spruce forests on the western-facing slopes of the Park's High Peaks region are stunted and dying at a rapid pace. Those forests receive extremely high levels of polluted precipitation that blows in from the coal-fired smokestacks of the Ohio Valley and beyond. Day after day, even when it doesn't rain or snow, the pollution hangs in acid clouds that shroud the mountains in a caustic fog.

Adding insult to a long list of injuries, Canadian studies show that the larvae of black flies—the bane of spring outdoor activities in the Northeast and southern Canada—seem to thrive in acidic waters. Consequently, their populations are exploding as pollution changes the chemistry of the waters from which they hatch.

The Adirondack Park is suffering the worst damage in the nation from acid rain. And because nearly all of the utility plant pollution that causes acid rain in the Adirondacks comes from outside the state, New Yorkers alone can do little to prevent the onslaught.

The good news is that the current acid rain program is costing utility companies far less than they predicted when Congress was contemplating the Clean Air Act Amendments of 1990. As a result, the total costs of finishing the job Congress intended to do in 1990 would still be less than original estimates.

Appalachian Damage

Often, a tree weakened over time by acid rain will die from what—on the surface—appears to be an unrelated disease or other stress factor. Species such as spruce and fir, for example, can succumb to severe cold, drought, insect infestations or diseases that may have caused little damage to a tree located where acid rain is less severe.

Reports by the U.S. Forest Service indicate that death rates for many tree species have doubled or tripled in parts of the greater Appalachian range since the 1960s and 1970s. The greatest proportion of dead trees are located in areas that receive the highest doses of sulfur- and nitrogen-based air pollution.

The Mechanics of Acid Rain

Acid-rain-causing pollution is carried on prevailing winds and can drift for hundreds of miles before it is deposited by precipitation. Adirondack, Catskill and Appalachian mountain regions are the hardest hit because prevailing winds carry the pollution from several other states onto those mountain ranges. As the winds rise over the mountains, the moisture they contain cools and condenses into clouds, which reach the point of saturation. The resulting rain, snow, sleet and/or fog has high concentrations of sulfur and nitrogen pollution. The sulfur-dioxide becomes sulfuric acid. The nitrogen becomes nitric acid. Alkaline minerals such as calcium and magnesium in soil and the air (a.k.a. base cations) help buffer acidity. But acid rain washes those minerals out of the soil faster than weathering can replace them by breaking down rock.

[Editor's Note: See Figure 20-14 in Raven/Berg *Envrionment* 3e for an illustration of the mechanics of acid deposition.]

Mercury Kills

Loons require pristine shorelines and seclusion to successfully nest and breed. They find vast areas of suitable habitat within the Adirondack Park. But their habitat is shrinking in most other areas of the Northeast due to human encroachments. As a result, the loon has become a symbol of the health and solitude of the Adirondack wilderness.

Unfortunately, the fish that loons eat are becoming increasingly contaminated with mercury—one of the deadliest toxic metals associated with acid rain.

Cranberry Lake and Stillwater Reservoir are two of the largest and most popular water bodies in the western Adirondack Park. They lie at the northern and southern boundaries of the Five Ponds Wilderness Area, which contains the largest contiguous virgin forest remaining in the Northeastern United States. In the mid-1990s, both lakes were found to have substantial mercury contamination. Like aluminum, mercury can be leached out of soil by acidity, but it is also found in the same smokestack pollution that causes acid rain.

In 1996, something new and alarming happened. New York State officials advised women of child-bearing age, the elderly, and young children to avoid eating yellow perch and smallmouth bass from either lake. Both fish are less susceptible to aluminum-related gill damage than most species of trout and salmon. But that resistance allows them to live longer in acidic waters, where they slowly accumulate mercury in their fatty tissues.

The NYS Health Department has now issued similar mercury warnings for more than a dozen Adirondack lakes. Every single Northeastern state now has mercury consumption warnings for fish taken from its waters.

The poisoning of these valuable game fish is a tragic blow to the Park's tourism industry. And the contamination is growing deadly for bird and mammal species that rely on fish for food, since the accumulated mercury in fish is transferred to whomever, or whatever, eats the fish.

An Adirondack Case Study

Fifty years ago, Big Moose Lake was teeming with life. For a half-century, tourists flocked to the lake from near and far to escape city life and relax on the shore of a pristine lake, fifty miles from the bustle and pollution of the nearest urban center.

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Trophy-sized brook trout, white fish, landlocked salmon and lake trout abounded, beckoning anglers from throughout the world to ply its remote, chilly waters. Acid rain has exterminated those fish species. Former natives such as crayfish, freshwater shrimp, frogs, hooded mergansers and otters are rarely seen anymore.

By 1980, the tourist hotel operators had given up on Big Moose Lake's fishing as a means of attracting tourists. They watched helplessly as millions of dollars in potential revenues slipped from their collective fingers. Worse yet, one lakeside business was about to discover that acid rain can make people sick, too.

Covewood Lodge owners Diane and C.V. "Major" Bowes were dumbfounded when their children began complaining about the taste of their drinking water, which was drawn from a well next to the lake. When one of their young daughters developed stomach cramps and diarrhea, the Boweses had their water tested.

Test results showed the water contained five times as much lead as is deemed safe for human consumption. The water contained copper as well. Both metals were being leached out of the inside of their pipes and plumbing fixtures due to the corrosive water. Lead is highly toxic to humans. But copper also kills the beneficial bacteria that allow septic systems to break down wastes and purify wastewater. The Boweses now treat their water to make it safe for drinking.

In 1996, the NYS Dept. of Health began conducting tests of water supplies throughout the state. Health officials reported that nearly all of the lakes, ponds and reservoirs they tested for toxins in the Adirondacks and Catskills were at least slightly acidic. Often, the tests showed no chemical contamination in the source of the water; but high levels of lead and copper coming out of the taps in people's homes.

How Do We Solve This Problem?

Given all of the damage done to our health and environment by acid rain and the toxic chemicals associated with it, it is unconscionable that this destruction is allowed to continue. But utility companies that burn coal and produce the most acid rain also produce the cheapest electricity in the country. That is a strong incentive to keep doing what they are doing. In 1992, the U.S. Environmental Protection Agency created an acid rain control program to reduce sulfur-dioxide emissions by 50 percent nationwide. We now know that this goal is too low. In addition, the federal government has done little to control nitrogen-oxide emissions from electric plants. Research has demonstrated that nitrogen-based air pollution is a main culprit in the destruction of many life forms in lakes, rivers and coastal estuaries. The good news is that there is a solution to the acid rain problem. Scientists in Northeastern states and southern Canada agree that sensitive areas of the country would have a fighting chance at recovering from decades of pollution if utility companies reduce their sulfur-dioxide and nitrogen-oxide emissions by 70 to 75 percent below 1990 levels. Better yet, the solution is simpler and less expensive than most people think.

1. **Make the existing program work.** Private industry has already grown accustomed to the current sulfur-dioxide control program. Making the program work better would be more practical than trying to tear it down and start over. The program sets a cap on the total amount of pollution allowed nationwide and allows individual companies to buy and sell the rights to that pollution. This allows those who can make the largest and least expensive cuts to do so right away. They are then free to sell the rights to the pollution they don't emit. Over time, the total number of pollution rights (a.k.a. allowances) issued by EPA will drop by 50 percent below 1990's pollution levels. **Action: Reduce the cap another 50 percent. This would bring the total reduction in pollution to 75 percent below 1990 levels.**
2. **Create a new pollution-trading program for nitrogen-oxides.** Creating a federal allowance-trading program similar to the sulfur-dioxide program would give utility companies a financial incentive to make deep cuts in emissions. **Action: Create a nitrogen-oxide pollution trading program that reduces nitrogen-based air pollution by 70 percent below 1990 levels.**
3. **Keep monitoring the results.** Cuts in smokestack emissions have caused a drop in the amount of acid rain chemicals hitting the ground, but some watersheds have been so hard-hit for so long, deeper cuts will be needed—nationwide or in a targeted geographic region—to ensure that they recover. In addition, any new cuts in sulfur, nitrogen and mercury should be coupled with monitoring of the effects of the cuts on the ground. **Action: Biological surveys and chemical tests should be performed on a regular basis at least through the year 2020 to ensure that the pollution cuts made in the meantime have the anticipated effect.**
4. **Give EPA the authority to keep making cuts.** Congress expected EPA to fix the nation's acid rain problems when it approved the Clean Air Act Amendments of 1990. That did not happen and EPA says it has no authority to order deeper cuts on its own. **Action: EPA's Administrator should have explicit authority to order new cuts to protect human health and sensitive ecosystems without further Congressional action.**

What Is All Of This Going To Cost?

In 1992, utility companies said it would cost them a total of $6 billion a year to comply with the federal acid rain program. A recent study by the Massachusetts

Institute of Technology showed that the actual cost of compliance is less than $800 million annually. That is less than one-seventh of the projected price. EPA predicted in 1990 that allowances would trade for $1,200 to $1,500 per ton by now. The average cost in 1998 was less than $120.

Creating an allowance trading program to control both sulfur-dioxide and nitrogen-oxide emissions would be very attractive to utility companies and securities brokers, who can help us convince Congress to act right away—before more lakes and forests die.

For the same amount that we expected to spend as a nation just on sulfur-dioxide, we can reduce both sulfur-dioxide and nitrogen-oxides by 70 to 75 percent below 1990 levels and continue monitoring the results.

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"A Washington, D.C. Press Conference"

The Adirondack Council Newsletter, August 1999, p. 4. Reprinted by permission.

On June 16, the Adirondack Council hosted a press conference on acid rain at the U.S. Capitol, joining forces with a U.S. Senator and two Congressmen, as well as historic preservation organizations and groups striving to protect outdoor artworks. The message to the rest of Congress was simple: Pass the *Acid Deposition and Ozone Control Act.*

Joining the Council at the press conference were U.S. Sen. Charles Schumer and U.S. Reps. Sherwood Boehlert, R-Utica, and John Sweeney, R-Saratoga. Also at the press conference were representatives from the National Trust for Historic Preservation, the Save Outdoor Sculptures Project (Heritage Preservation), D.C. Preservation League, Potomac Heritage Partnership, Historical Society of Washington D.C., National Audubon Society, Trout Unlimited and Citizens Campaign for the Environment.

The press conference focused on the damage acid rain has done to historic buildings and monuments in the nation's capital. The Adirondack Council is attempting to broaden the coalition of organizations and politicians who are interested in stopping acid rain by showing people from various parts of the nation and various interest groups what they have at stake.

Susan Nichols of Save Outdoor Sculptures captured the attention of the media with her discussion of the damage done each year to priceless works of art, including the Statue of Liberty and any outdoor sculpture made of limestone, marble, copper or bronze.

"Acid rain is the leading cause of damage to outdoor statuary today," Ms. Nichols told reporters from the Associated Press, CNN, C-Span and NBC, who had gathered on the lawn overlooking the U.S. Senate at the Capital.

From the Capitol building itself to the Lincoln and Washington memorials, acid rain destroys the surface of carved limestone and marble by washing away the calcite. Pits develop on the smooth surfaces at the base of the columns. Anyone who brushes across the surface comes away covered with a chalky, white powder.

On copper and bronze objects, sulfur dioxide pollution combines with the copper to form copper-sulfate, which runs down the surface as a liquid. Holes and streaks develop in the metal, while smooth surfaces turn rough.

Whether the damage is done to stone or metal, the loss of fine details and intricate carvings happens much more quickly in acidic precipitation than in untainted rain. The damage is irreversible. Faces become smooth and amorphous. Names, dates and other inscriptions disappear.

The *Acid Deposition and Ozone Control Act* (S.172/H.R.25) is sponsored by Senators Daniel Patrick Moynihan, D-NY, Charles Schumer, D-NY, and James Jeffords, R-Vt., Jack Reed, D-R.I., Joseph Lieberman, D-Ct., John Kerry, D-Mass., Dianne Feinstein, D-Ca., and Barbara Boxer, D-Ca. House sponsors include Sherwood Boehlert, R-NY and John Sweeney, R-NY, and more than 40 of their colleagues.

The bill calls for an additional 50 percent cut in sulfur dioxide pollution—on top of the 50 percent cut ordered by Congress in 1990, for a total cut of 75 percent below 1990 levels. It also would require a 70 percent reduction in nitrogen oxide pollution (which causes both acid rain and smog) from electric power plants.

reading 5

"Public Service Announcement Campaign a Ringing Success"

The Adirondack Council Newsletter. August 1999, p. 5. Reprinted by permission.

In July, the Adirondack Council released nearly 1,000 copies of radio and television public service announcements on the need to stop acid rain. Calls have been streaming into the Council's Acid Rain Hotline from Florida, California, West Virginia, Rhode Island and the Carolinas, where stations appear to be giving the ads excellent air time.

The voices of musicians Bonnie Raitt and Natalie Merchant are featured in the national campaign.

"New York's Adirondack Park is the one place in the nation hardest-hit by acid rain, but we are by no means alone in suffering extensive damage. The Adirondack Council has been fighting acid rain in the Adirondacks for two decades. Now we are organizing and funding the national campaign to stop acid rain across America," said Adirondack Council Executive Director Timothy J. Burke. "We are pleased to have the assistance of the nation's most respected environmental and historic preservation organizations, who joined us in a *New York Times* ad calling on Congress for deeper pollution cuts. And we are grateful that Bonnie Raitt and Natalie Merchant are lending their well-known voices to this effort."

Questions for Discussion

For Readings 1 and 2

1. Basically, how does EPA's plan work to reduce SO_2 and NO_x? How are these emissions different?
2. How does the EPA measure success?
3. According to the EPA, how successful has the plan been in reducing SO_2 emissions?
4. According to the EPA how successful has the plan been in reducing NO_x emissions?

For Reading 3

1. According to this reading, how serious is the problem of acid precipitation in the Adirondacks and in other regions. What are the sources of acid precipitation?
2. In addition to reducing emissions of SO_2 and NO_x, what are some other possible solutions to the problem? Would they be short-term or long-term solutions?

For Readings 4 and 5

1. Describe how acid precipitation can adversely affect urban environments.
2. The more people are concerned with acid precipitation, the more likely it is that Congress will enact further legislation. What other citizen groups might join the Adirondack Council in voicing their concerns? Describe how the Adirondack Council is soliciting their cooperation.
3. In your opinion, has the plan been successful? How might it be improved?

Going Beyond the Readings

Visit our Web site at <www.harcourtcollege.com/lifesci/envicases2> to investigate acid precipitation issues in additional regions of the United States and Canada.