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Environmental Benefits

On November 15, 1990, President Bush signed into law the Clean Air Act Amendments of 1990. Title IV of the Act, which deals with acid rain control, contains provisions for a 10-million-ton reduction in sulfur dioxide emissions and for controls on nitrogen oxide emissions from electric utility plants. This fact sheet discusses the environmental effects of acid rain and the benefits that will accrue as a result of the required emissions reductions.

Acidic deposition, or acid rain as it is commonly known, occurs when chemically laden emissions react in the atmosphere with water, oxygen, and oxidants to form various acidic compounds. These compounds then fall to the earth in either dry form (such as gas and particles) or wet form (such as rain, snow, and fog).

Sulfur dioxide, which is emitted primarily by coal-burning electric power plants, is the dominant precursor of acid rain in the United States. Nitrogen oxide emissions also play a role in the formation of acid rain and are significant in the formation of ground-level ozone.

Electric utility plants account for about 70 percent of annual sulfur dioxide emissions and 30 percent of nitrogen oxide emissions in the United States. Over 20 million tons of each of these two pollutants are emitted into the atmosphere each year.

Acid rain causes surface water acidification and damages trees at high elevations (for example, red spruce trees above 2,000 feet in elevation). Air concentrations of sulfur and nitrogen species degrade visibility in large parts of the country, including our national parks.

In addition, acid rain accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures that are part of our nation's cultural heritage. Finally, air concentrations of acid aerosols (tiny droplets of sulfuric acid derived from sulfur dioxide emissions) may pose a risk to public health.

Implementation of the acid rain provisions will confer significant benefits on the nation. Acid rain control will allow acidified lakes and streams to recover so that they can once again support fish life. Visibility will improve, allowing for increased enjoyment of scenic vistas across our country. Acid rain control will improve the health of forests, particularly red spruce forests that populate the ridges of mountains, from Maine to Georgia. It will provide new safeguards for our nation's cultural heritage through protection of historic buildings and monuments and it will provide an insurance policy against the potential threat to public health posed by acid aerosols.

Surface Waters

Acid rain primarily affects sensitive bodies of waters, that is, those that rest atop soil with a limited ability to neutralize acidic compounds (called "buffering capacity"). Many lakes and streams examined in a National Surface Water Survey (NSWS) suffer from chronic acidity, a condition in which water has a constant low pH level. The NSWS investigated the effects of acidic deposition in over 1,000 lakes larger than 10 acres and in thousands of miles of streams thought especially sensitive to acidification. Of the lakes and streams surveyed in the NSWS, acid rain has been determined to cause acidity in 75 percent of the acidic lakes and about 50 percent of the acidic streams.

In some sensitive lakes and streams, acidification has completely eradicated fish species, such as the brook trout, leaving the bodies of water barren. In fact, hundreds of the lakes in the Adirondacks surveyed in the NSWS have acidity levels indicative of chemical conditions unsuitable for the survival of sensitive fish species.

The soil in Eastern Canada is very similar to the soil of the Adirondack Mountains and lakes in that area are consequently extremely vulnerable to chronic acidification problems. The Canadian government has estimated that 14,000 lakes in Eastern Canada are acidic.

Streams flowing over soil with low buffering capacity are equally as susceptible to damage from acid rain as lakes are. Approximately 580 of the streams in the Mid-Atlantic Coastal Plain are acidic primarily due to acidic deposition. The New Jersey Pine Barrens area endures the highest rate of acidic streams in the nation (about 60 percent) of which over 90 percent is attributed to acidic deposition. Over 1,350 of the streams in the Mid-Atlantic Highlands are acidic primarily due to acidic deposition while streams in the Mid-Appalachians are also undergoing increasing acidification. Many streams in that area have already experienced trout losses due to the rising acidity.

Acidification is also a problem in areas that were not surveyed in federal research projects. For example, lakes smaller than 10 acres

*The Mid-Atlantic Coastal Plain encompasses parts of the Piedmont and coastal plain in New Jersey, Delaware, Pennsylvania, Maryland, Virginia, and North Carolina. The Mid-Atlantic Highlands extend from southeastern New York through most of Pennsylvania and include portions of Maryland, West Virginia, and Virginia. The Mid-Appalachians include Southern Virginia, North Carolina, and Georgia.

were not included in the NSWS, and there are from one to four times as many of these small lakes as there are larger lakes. In the Adirondacks, the percent of acidic lakes is significantly higher when it includes smaller lakes (26 percent) than when it includes only the NSWS target size lakes (14 percent).

The acidification problem in both the United States and Canada grows in magnitude if "episodic" acidification—brief periods of low pH levels from snowmelt or heavy downpours, which can result in fish kills—is taken into account. Lakes and streams throughout the United States, including western lakes, are sensitive to episodic acidification. In the Mid-Atlantic Highlands, the Mid-Atlantic Coastal Plain, and the Adirondack Mountains, about three times as many lakes and streams become temporarily acidic during storms and snowmelt.

Acid rain control will produce significant benefits in terms of lowered surface water acidity. If acidic deposition levels were to remain constant over the next 50 years (the timeframe used for projection models), the acidification rate of lakes in the Adirondacks that are larger than 10 acres would rise by 50 percent or more. Scientists predict, however, that the decrease in sulfur dioxide emissions required by the acid rain provisions will virtually eliminate emission-caused acidification in that area.

Forests

Acid rain contributes to forest degradation, especially in high-elevation spruce trees that populate the ridges of the Appalachian Mountains from Maine to Georgia, including national park areas such as the Shenandoah and Great Smokey Mountains national parks. Acidic deposition seems to impair the trees' growth in several ways; for example, acidic cloudwater at high elevations increases the susceptibility of the red spruce to winter injury.

There also is a concern about the impact of acid rain on forest soils. There is good reason to believe that long-term changes in the chemistry of some sensitive soils may have already occurred as a result of acid rain. As acid rain moves through the soils, it can strip away vital plant nutrients through chemical reactions, thus posing a threat to future forest productivity.

Visibility

Sulfur dioxide emissions lead to the formation of sulfate particles in the atmosphere. Sulfate particles account for more than 50 percent of the visibility reduction in the eastern part of the United States, affecting enjoyment at many of our national parks. The legislated reduction in sulfur dioxide emissions is expected to result in a 30-percent increase in visual range in the eastern part of the country. In the western part of the United States, nitrogen and carbon also play roles, but sulfur has been implicated as an important source of visibility impairment in many of the Colorado River Plateau national parks, including the Grand Canyon, Canyonlands, and Bryce Canyon.

Building Materials

Acid Rain is known to contribute to the corrosion of metals and deterioration of stone and paint in buildings, statues, and other structures of cultural significance. The damage inflicted on cultural objects, such as statues or historic monuments, proves especially costly since a loss of detail caused by the corrosive potential of acid rain seriously depreciates the objects' value to society. Dry deposition of acidic compounds can also dirty buildings and other structures, leading to increased maintenance costs. Given the very large number of buildings affected by wet and dry deposition, even a small impact on maintenance costs could translate into a very large savings to society.

Health

High levels of sulfur dioxide have been proven to cause or aggravate various types of lung disorders. These lung disorders, which affect a person's ability to breathe, have led to both increased morbidity (sickness) and mortality. Based on these concerns, sulfur dioxide has historically been regulated under the Clean Air Act.

Additionally, studies at Harvard University have suggested a relationship between acidic sulfate (a type of acid aerosol) levels and increased levels of morbidity and mortality. While EPA continues to study the problem, sulfur dioxide emission reductions called for under the acid rain provisions reduce sulfate levels in the atmosphere, thereby providing an insurance policy against the threat to public health.

Clean Air for a Better Life

By reducing sulfur dioxide emissions by such a significant amount, the Clean Air Act promises to confer numerous benefits on the nation. Scientists project that the 10-million-ton decrease in sulfur dioxide emissions should stop the worsening acidification of water bodies and damage to forests and even allow these processes to be reversed. In addition, visibility will be significantly improved due to the cutbacks, and the lifespan of building materials and structures of cultural importance should lengthen. Finally, the reduction in emissions will provide the additional assurance that the public's health will not be put at risk.

For More Information, Write to:

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If you would like to receive other fact sheets in this series, call the Acid Rain Hotline at (617) 641-5377 or the EPA Public Information Center (PIC) at 202-260-2080.

Fact sheets are available on the following subjects:

- Allowance System
- Continuous Emission Monitoring
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