Acid rain poses serious problem

The Canadian government has a program in operation to make Canadians and American visitors to Canada more aware of the acid rain problem, considered to be one of the most serious environmental problems facing North America.

Acid rain is invisible. One cannot smell it, or even taste it. It feels like ordinary rain or snow. This airborne acid is threatening fish and plant life in thousands of lakes, injuring plant leaves and perhaps stunting the growth of trees. It may slowly damage metal on cars and eat away at stone statues, older limestone buildings and metal rooftops.

Acid rain can also eat away at leaves, leach nutrients from the soil and interfere with photo-synthesis. In Scandinavia, scientists suggest that an increase in acid rain may have reduced timber growth.

The effects of acid rain are slow but sure, and once an area is affected, there is no quick and easy way to bring it back to normal. The problem must be tackled before it is too late.

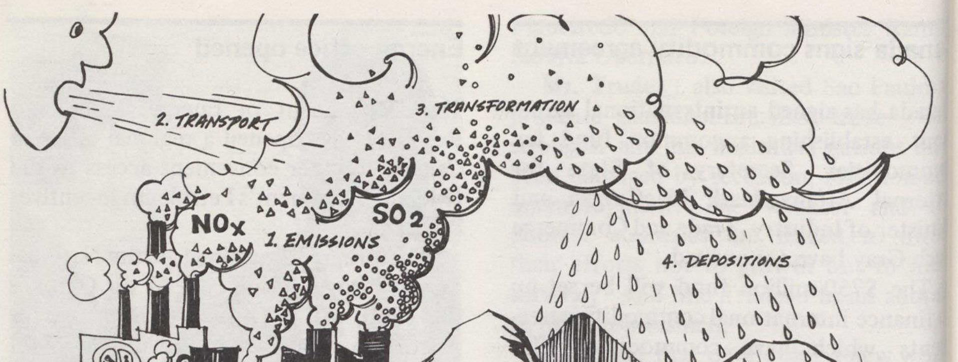
What is acid rain?

Even in an environment completely free of all pollution, rain and snow would still be slightly acidic. This is because carbon dioxide, which is a natural by-product on earth, reacts with moisture in the atmosphere to form a mild carbonic acid in rain and snow. This type of rain or snow is considered to be "clean".

But acid rain is not natural. It contains more acid than normally found in nature. Clean or normal rain has a pH of 5.6. Rain with a pH of less than 5.6 is considered to be acidic. It is now common, in parts of Canada, for rain to be ten times more acidic than "clean" or normal rain. In some areas it is even found to be up to 40 times more acidic than normal.

Acidic or alkaline

When trying to show how much acid is in any liquid, scientists use what they call a pH scale. This scale goes from 1 to 14. If the pH is 7, then that liquid is considered neutral, that is, neither an acid nor a base. As pH decreases from 7 down to 1, the acidity of the liquid increases. For example, vinegar has a pH of 2.2 and distilled water has a pH of 7. As the pH increases from 7 to 14 a liquid becomes more alkaline or basic. For example, baking soda in water has a pH of 8.



Winds carry pollutants over long distance, hundreds or even thousands of kilometres.

Because the pH scale is logarithmic (i.e., it is not linear), a change in one pH unit, (for example, a decrease in pH from 6 to 5) means a tenfold increase in acidity. A change in two pH units, such as a decrease in pH from 6 to 4 means the solution is 100 times more acidic.

The larger problem is long-range transport of airborne pollutants (LRTAP) and acid rain is only part of that problem. Scientists now know that pollutants are carried by the winds over long distances, hundreds and even thousands of kilometres. These pollutants do not disappear. Instead, while moving through the atmosphere, they are chemically changed and these new products then react further with water vapour in the atmosphere. The result is acidic water vapour. This transformation process, these chemical changes, are not yet fully understood – but the harmful results are becoming more and more apparent.

Over a period of time, pH levels change in lakes which receive these acids through rain or melted snow. That, in certain cases, impairs the egg-producing ability of fish. As well, organic matter in lakes decomposes more slowly. Scavenging micro-organisms also suffer. The number of plankton falls off and a vital link in the food chain is depleted.

Pollutants

Culprits include: oxides of sulfur and nitrogen; particles of heavy metal (from burning coal in thermal power plants, smelters, etc.); persistent organic chemicals (chemicals which get into the environment and accumulate); and also reactive organics that contribute to formation of photo-chemical oxidants (produced from nitrogen oxides and hydrocarbons in presence of sunlight).

Although they all contribute to the problems of LRTAP, sulfur dioxide and nitrogen oxides are the two main culprits responsible for the acid rain problem facing Canadians:

– sulfur dioxide is generally a by-product of industrial processes. Ore smelting in Canada and coal-fired power generation in the United States are the main sources in each country; and

– about half the nitrogen oxides emissions are a by-product of exhausts from cars, trucks and other forms of transportation, and the rest come from coal-fired power generation and other industrial processes.

Near the source the concentrations of these pollutants at ground level, as well as when these pollutants drift, are usually within air quality standards established by federal and provincial governments. Both industry and government have been working for years to try to reduce these pollutants at the source.

But these substances go through chemical changes while being carried by the winds through the atmosphere. They can be deposited as particles from the air (dry deposition) or be washed out from the air through rain or snow (wet deposition). In either case, delicate or sensitive ecosystems can be changed as they accumulate on the ground and in the water over the years. The problem is aggravated when the pollutants are carried by weather systems in the higher reaches of the atmosphere. These systems move over other industrialized areas and pick up even more pollutants. They can accumulate on the ground or in lakes and streams through either dry or wet deposition. If acid rain falls over a lake every year for 20 years, and if that lake has no way of neutralizing the extra acid, the lake will change. This accumulated deposition is known as loading.