YORKSCIENCE

Richard Dubinsky

The earth's atmosphere contains millions of microscopic particles invisible to the naked eye, known to scientists as atmospheric aerosol.

Most are less than 10 microns in size or about one five thousandth of an inch. Some of these particles called cloud condensation nuclei are important because clouds, fog, and rain could not form without them.

Richard Leaitch of the Physics Department received his Ph.D. last week for an extensive study of the atmospheric aerosol in the Toronto area with particular concentration on cloud condensation nuclei.

The presence of large amounts of particles in the air leads to the hazes often seen in most large cities.

Leaitch's studies specifically dealt with the activation point at which particles will participate in cloud or fog formation.

The aerosol source is a combination of natural and anthropogenic (man-made) sources and can affect climatic conditions by acting as centres for water condensation.

The particles are made up of water soluble and insoluble parts. As Leaitch explains, "The soluble part is generally best represented by the chemical ammonium sulphate. The insoluble portion is much larger in size and is composed mainly of sand, dust, clay, etc."

The soluble aerosol is usually formed by combustion or as a result of gas to particle conversion. As an example, combustion in factories results in large amounts of sulphur dioxide which reacts with water vapour to form sulphuric acid. The sulphuric acid can remain suspended as small droplets but most likely combines with other particles in the atmosphere. These small particles can travel very long distances, Leaitch explains.

"The sulphur dioxide emissions certainly appear related to the problems of acid rain but there may be a lot of involved chemistry associated with this."

Leaitch, working under the direction of Dr. Jim Megaw, the head of York's Physics Department, developed an instrument for measuring the cloud condensation nuclei, called the Cloud Condensation Nuclei Counter or CCNC.

The particles are entered into air at humidities very slightly greater than 100 per cent. Under these conditions the particles condense water on them and become large droplets. Their size and number can then be determined.

"The design of our CCNC is very simple," states Dr. Leaitch. "However the interpretation is relatively complex."

The CCNC was tested last year at the University of Nevada's Desert Reserach Institute in Reno, Nevada and showed exceptionally good results when compared with other similar instruments.

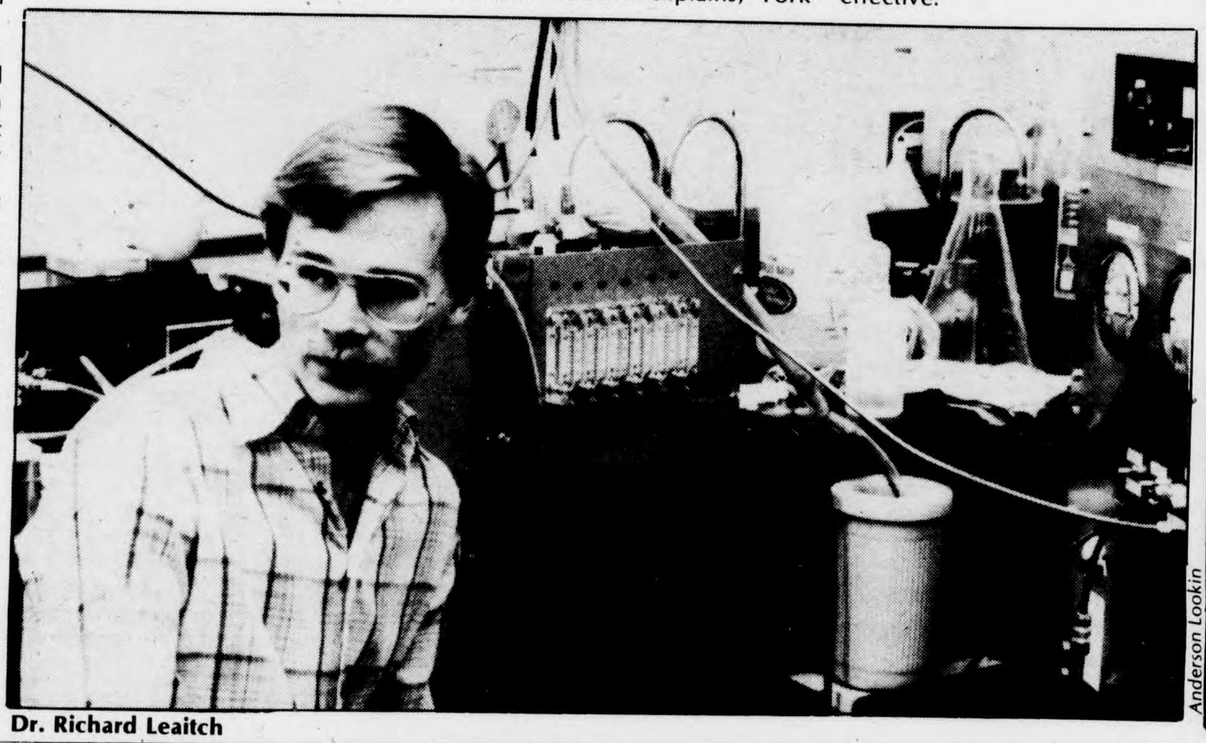
Dr. Leaitch has conducted his own measurments here at York, more than 220 during his six years of study.

Leaitch found a definite relationship between small particle concentration and the layout of Toronto.

High particle numbers were associated with Highways 401 and 400 and at the centre of Toronto, due mainly to automobile exhaust and industry. A high concentration of particles was also observed when winds came from the airport region, presumably as a result of jet exhaust. As Leaitch explains, "York is almost in line with a main runway at the airport and when a southwesterly wind blows it appears we receive a noticeable portion of the jets' emissions.

The number of particles found in the York University area normally varies between 10,000 to 50,000 per cubic centimeter of air, whereas in the downtown core the range might cover 25,000 to a few hundred thousand. The York University area is relatively clean due to the fact that the prevailing winds are frequently from the northerly regions."

Leaitch made his first series of measurements in 1976 and the most recent measurements occurred in 1980. He observed that "The average particle concentration did not change significantly during this period which suggests that emission controls are effective."



Anderson Lookin

Dr. Richard Leaitch