Morrow measures minute molecules

Richard Dubinsky

The earth's atmosphere is an invisible mixture of gases and particles which plays an enormous part in shaping life on earth.

Bill and Molly Morrow, a unique team in York's Physics Department, are particularly interested in the atmosphere and are doing something about it. After a number of years working in private industry, Bill and Molly have returned to school as Ph.D. candidates, to gain a deeper understanding of the field.

Bill is researching Resonance Fluoresence Spectroscopy, a relatively new and very sensitive technique for measuring chemicals in the atmosphere. Resonance fluorescence occurs when a molecule or atom in the atmosphere absorbs a certain wavelength (or colour) of light from a lamp and becomes excited.

Under these conditions it re-emits this light in a very narrow wavelength as pure colour. Since each molecule emits at a different wavelength, it can be easily recognized and measured using this technique.

"This whole fluorescence technique has strong applications for environmental monitoring," explains Morrow. "Chlorine spills, for example, could be monitored with a detection system as small as a suitcase." At present, monitoring many atmospheric pollutants requires a large mobile laboratory.

PCB's (Poly Chlorinated Biphenyls) used throughout industry because of their stable properties are another problem of interest to the Morrows. These chemicals must also be carefully monitored because they were recently found to be highly toxic. PCB's are known to dissolve in animal (and human) fat and are associated with toxic mutagenic effects such as cancers, birth defects and genetic disorders.

No less dangerous is a compoud called Dioxin associated with the

PCB's as a contaminent. "Dioxin is an extremely poisonous chemical and no one has been able to determine a low level at which is it *not* toxic," explains Morrow. These compounds are difficult to monitor and the Resonance Fluorescence technique holds considerable promise in this field.

Bill Morrow is working under the direction of Dr. Schiff studying the photolysis (dissociation) of ozone. This is of critical importance to the atmosphere, especially at ground level. Near the earth's surface ozone splits to form an excited oxygen atom which reacts with other gases to form many more reactive compounds that "pump energy into other reactions related to photochemical smog, acid rain and many other atmospheric problems."

Molly Morrow is doing her Ph.D. work on the same technique applied to the measurement of metastable species of nitrogen in the atmosphere.

Metastable atoms are very long lived and highly exicted, and cause many reactions by the transfer of their energy.

The atmosphere is becoming better known as a result of research such as that being done by the Morrow's. Bill explains, "The troposphere (the part of the atmosphere closest to the surface) is a real soup...composed of large and small molecules, varied dynamics and lots of other stuff. It is incredibly complex and varies greatly in different areas."