Gas chromatograph – mass spectrometer arrives at AES

Carefully pumping a syringe needle, Assistant Deputy Minister Jim Bruce injected a murky liquid containing four typical atmospheric impurities into a large metal box. This novel "ribbon-cutting ceremony", was laid on to inaugurate the spanking new $225,000 Gas Chromatograph Mass Spectrometer (GCMS), housed in the south wing of AES Downsview headquarters. The ceremony took place on December 16 in the GCMS operations room.

Also taking part in the ceremony were Dr. Warren Godson, director general of the Atmospheric Research Directorate, Preston Sanderson, chief of Atmospheric Chemistry and Standards Division and his assistant Dr. Kurt Anlauf. Howard Ferguson, director of Air Quality and Inter-Environmental Research branch acted as MC to the specially invited audience consisting mainly of department heads and atmospheric chemists.

"The GCMS is a major step forward in using chemistry to fight the chemical impurities in the atmosphere and is a landmark acquisition for AES services", commented Dr. Sanderson after the ceremony.

ADMA Jim Bruce (left) plunges in the needle to inaugurate the Gas Chromatograph Mass Spectrometer. Looking on, left to right, are Dr. Kurt Anlauf, Atmospheric Chemistry Criteria and Standards Division (ARQA); Dr. Warren Godson, Director General, Atmospheric Research Directorate; Howard Ferguson, Director, Air Quality and Inter-Environmental Research Branch; Dr. Preston Sanderson, Chief, ARQA, and Dr. Kar Wah Chan, post doctoral Fellow.

The background story to GCMS is that nitrogen and sulphur compounds, which are transported over long distances and deposited as acid rain, interact with other substances in the atmosphere. Similarly, hundreds of other compounds spewed into the atmosphere from thousands of emission sources may be reacting to form traces of various other compounds. Thus, as yet undetected molecules capable of causing unrealized environmental problems may be present in the atmosphere. Realizing this, atmospheric scientists of the AES Air Quality Research Branch in their search for atmospheric contaminants, use the GCMS, capable of detecting molecules at concentrations of one part per billion (ppb). Says Bill Schroeder of the Atmospheric Chemistry Criteria and Standards Divisions "A ppb can be pictured as one pinch of salt in 10 tons of potato chips or a very dry martini with one drop of vermouth in 500 barrels of gin."

A gas chromatograph works by sending an air sample on a stream of inert gas through a long narrow tube lined with an absorbant material. Since the various molecules are moved at different rates of speed by the inert gas, some soon lag behind and thus the various types of molecules separate into lumps or peaks as they are called. The various compounds thus separated are further identified by the use of a mass spectrometer.

The peaks coming from the gas chromatograph are bombarded with ionizing radiation until they are charged and torn apart. The parts are then moved through a magnetic field. However, the paths of charged molecules or parts moving through a magnetic field are bent in relation to the mass of the molecule: the heavier the molecules, the less the bending. Thus, subpeaks of the original peaks are formed. Since different compounds have different spectral characteristics, the molecules from the atmospheric sample can be identified. The simplied mixture used for the ceremony contained Dichloro benzene, Trichloro benzene, Trichloro phenol and Aldrin.

The machine acquired by AES has its own dedicated mini-computer and is capable of being upgraded as the state of the art improves. This instrument can generate in a matter of hours, solutions to problems which would take weeks using classical analytical techniques.