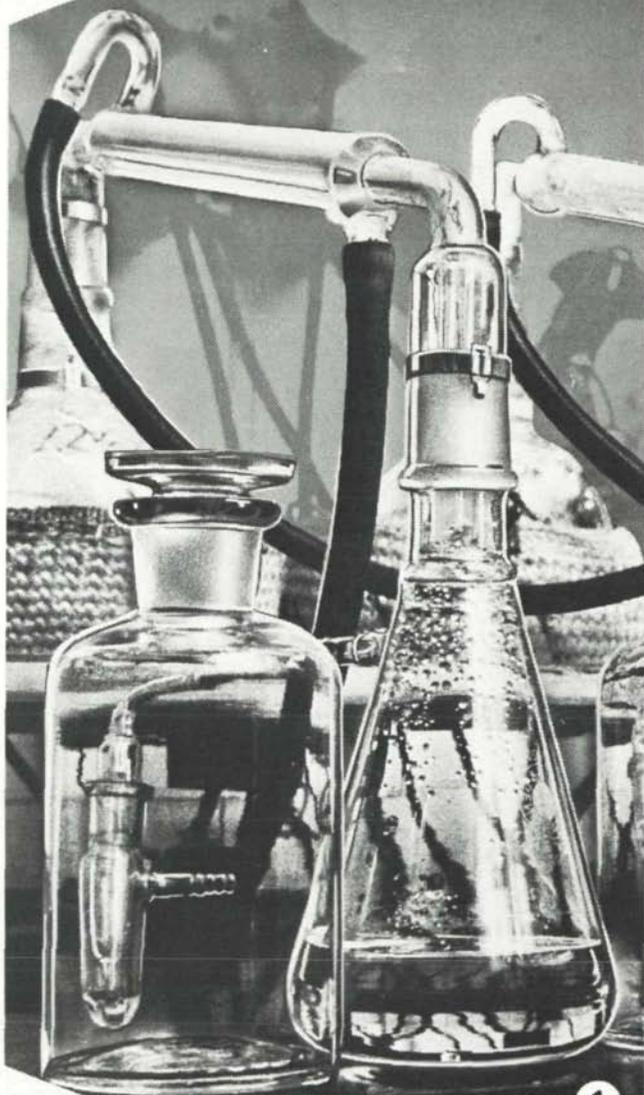
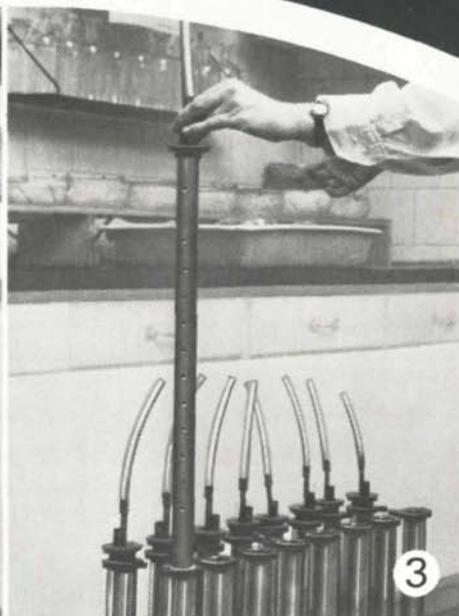


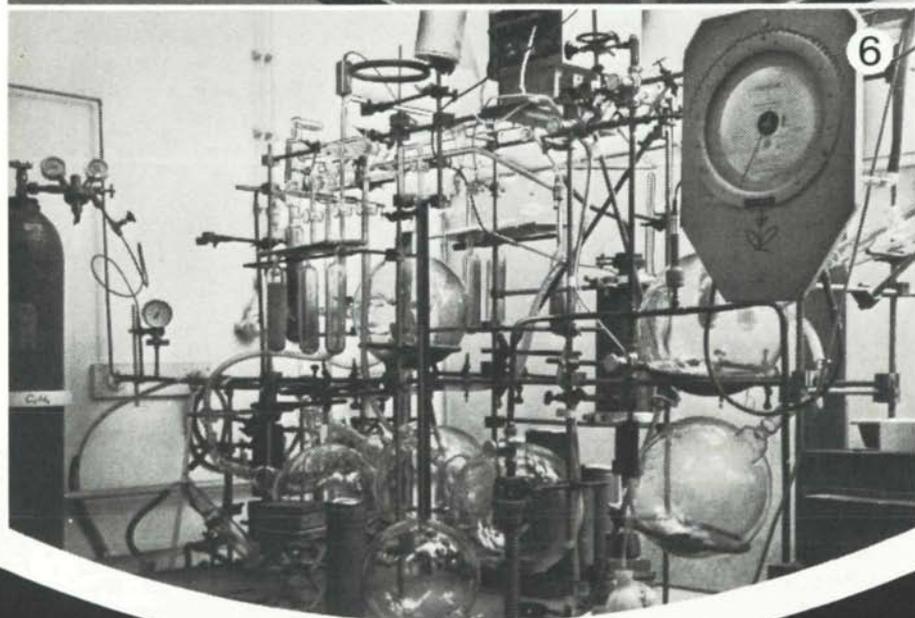
Measurement of Environmental Tritium for Isotope Hydrology Studies



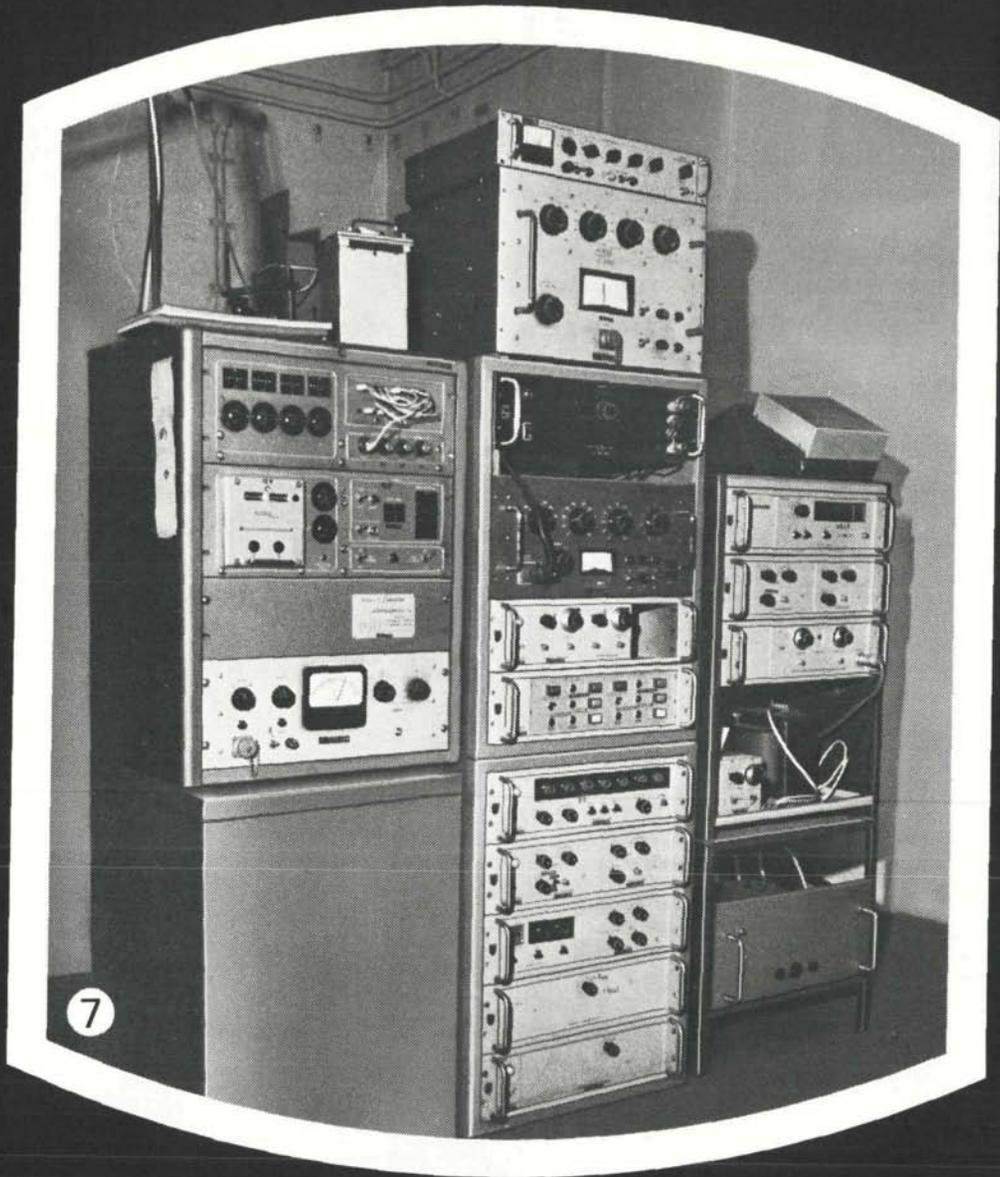
The Section of Isotope Hydrology of the IAEA Division of Research and Laboratories gains valuable hydrological information from studies of the concentration of environmental tritium in precipitation, surface and groundwater samples from various sites around the world. This photo story shows the steps in the measurement of these very low levels of tritium in water as performed in the Isotope Hydrology Laboratory of the Agency.



An electrolysis procedure is used to enrich the tritium of a water sample isotopically and its radioactivity is then measured by liquid scintillation or low level gas counting. Care must be taken to minimize exposure of the sample during processing to avoid contamination by exchange with atmospheric water vapour. The water samples are distilled (1) and 250 ml portions, made alkaline with sodium peroxide, filled into electrolysis cells (2) consisting of an outer stainless steel anode and a central mild steel cathode (3).



The cells are assembled (3) and placed in a cooling bath (4). Bubblers placed on the gas discharge tube of each cell (5) prevent contamination from adjacent cells or from the atmosphere during electrolysis. Current passed through the series of cells (5) decomposes the water to hydrogen and oxygen. Hydrogen of mass 1 is discharged in preference to the heavier isotopes, deuterium and tritium, so the latter are concentrated in the liquid remaining in the cells. After four days of electrolysis, the water samples are reduced to 12 ml containing 80% of the original tritium.



The tritium content of these concentrates may be measured by long counting in a liquid scintillation counter having a low background and stable operation or, for greater sensitivity, in a low background gas counter. In the latter case, the water concentrate converted to hydrogen and then ethane in a vacuum preparation system (6) and filled into a 2l. counter within a low background shield assembly shown in the right of the above photo. Electronic equipment (7) registers the radioactivity of the sample measured during 12 to 24 hours.

The Isotope Hydrology Laboratory performs about 1200 such analyses per year in addition to measuring the stable isotopes, ^2H and ^{18}O , of water samples by mass spectrometry and the ^{13}C and ^{14}C content of groundwater carbonates. The various isotope data complement each other and together provide information on the history of the water samples.