# Advanced Analytical Facilities for determination of Low Level Radionuclides in environmental matrices

Nuclear energy is clean and green energy. The emission from nuclear facilities is well regulated and state-of-art engineering safety control measures ensured that insignificant amount of radioactivity is released to the surrounding environment. Therefore, it is an uphill task to measure very low level of radionuclides in environmental samples for scientific research purpose and to understand their geo-chemical behaviour in the terrestrial and marine ecosystem. In order to meet the challenges, advanced analytical techniques are required to quantify low level of radionuclides in environmental matrices.

> **High Resolution Gamma Spectrometer**: HPGe detectors of 50% relative efficiency and carbon fiber window are used for identification and quantification of natural and man-made gamma emitting radionuclides having gamma energies in the range of 40-3000 keV.

> **Alpha Spectrometer**: Passivated Ion Implanted Silicon (PIPS) detectors are used for measurement of alpha energy in range of 4 – 8 MeV for activity concentration of $^{210}$Po, $^{238}$U, $^{235}$U, $^{232}$Th, $^{230}$Th, $^{239}$Pu, $^{241}$Am, etc..

> **Liquid Scintillation Analyser**: Triple PMT based liquid scintillation analysers are used for measurement of low energy beta emitters like $^{3}$H, $^{14}$C, $^{228}$Ra and hard beta emitters like $^{90}$Sr.

> **Emanometry technique:** Used by the measurement of radon generated by radium present in groundwater, using scintillation of radon daughter products

> **Radium Delayed Coincidence Counter:** An alpha scintillation counter that distinguishes decay events of short-lived radium daughter products based on their contrasting half-lives is used for the quantification of $^{223}$Ra and $^{224}$Ra in water samples.
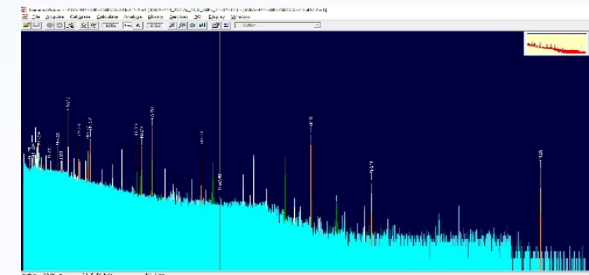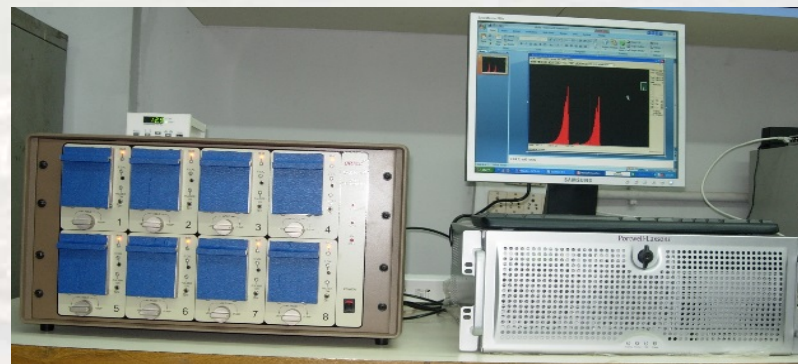


**Typical Gamma Spectrum**
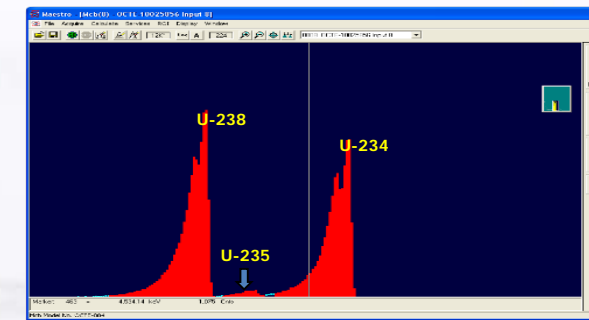


**Uranium Alpha Spectrum**



**High Resolution Gamma Spectrometer**



**Alpha Spectrometer**



**Liquid Scintillation Analyser**



**Scintillation counting set up of radon**