Monitoring and analysis of natural radioactivity resulting from radon, thoron and their progeny

The Radon Analytical Laboratory operates a comprehensive suite of instrumentation for the monitoring and analysis of an extended range of radon (^{222}Rn) and radon progeny concentrations in air, as well as radon emanation and exhalation rates from gaseous, liquid, solid and mixed phase samples (including indoor, industrial or environmental water samples).

Our laboratory-based instrumentation includes a radon rig, liquid scintillation counter and a gamma spectrometer. A range of field instrumentation is also available for *in situ* continuous, or spot measurement of radon concentration in air: the lower limits of detection range from 0.03 to 2 Bq m^{-3}, depending on the chosen instrument. A flux chamber ('emanometer') is also available for simultaneously determining radon and thoron (^{220}Rn) flux density at environmental levels.

Field instrumentation is a very important component of the Radon Analytical Laboratory's facilities: many of the detectors have been designed and built at ANSTO, including a series of dual flow loop, two-filter radon detectors, a charcoal trap sampler, and a radon/thoron emanometer.

The ANSTO-built detectors for continuous operation have been designed to monitor hourly radon concentration in air in harsh environments, with little maintenance, for prolonged periods. The highest sensitivity portable model of these detectors has a lower limit of detection of ~30 mBq m^{-3}.

The single-trap sampler is designed for spot measurements of radon in air, or performing radon assays on process gas. The emanometer (or flux chamber) is designed to determine the radon and thoron flux density directly from soil and rock surfaces.

Capability selection

- Continuous *in situ* radon measurements in indoor or outdoor air (portable Alphaguard detectors)
- Continuous *in situ* radon measurements in outdoor air (dual flow loop two-filter detectors)
- In situ spot measurements of radon/thoron emanation from rocks and soils (radon/thoron emanometer-flux chamber)
- Sample-based *in situ* radon measurements in air and process gases (single-trap sampler)
- Sample-based radon in water via mineral oil extraction and liquid scintillation counting (liquid scintillometer)
- Sample-based radon/radium direct liquid scintillation for small gas/liquid/mixed phase samples (liquid scintillometer)
- Sample-based radon/radium gamma-spectrometry measurements of rocks and soils (by gamma spectrometry)

Please discuss your proposal with the appropriate ANSTO Contact Scientist before submitting your proposal as they will assist you in making the correct capability selection.

For further information please contact:

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Instrument	Measurement	Medium	Analysis rate	Notes
Liquid scintillation (small samples)	Concentration (sample)	Gas/liquid/ mixed	30 min per run	20mL samples; LLD 200 mBq m^{-3}; up to 300 samples per run
Liquid scintillation (Rn in water)	Concentration (sample)	Water only (via oil extraction)	30 per day	Quantification limit of ≤0.5Bq/L for 600mL samples
Single-trap sampler	Concentration (*in situ*)	Gas	20 per day	1L min^{-1} sampling; 60 traps available; analysis performed on radon rig
AlphaGuard	Concentration (*in situ*)	Gas	10 - 60 min per measurement	LLD 2Bq m^{-3}
700/1500L Rn	Concentration	Gas	Hourly	LLD 0.03 - 0.04Bq m^{-3}
Radon rig	Concentration emanation (sample)	Solid/liquid/ gas	20 per day	Instrumental BG <0.5cpm; LLD depends on volume sampled
Gamma spectrometer	Emanation (*in situ*)	Solid	30 days per analysis*	0.5kg sample, grain size <5mm
Rn emanometer	Emanation (*in situ*)	Solid	30 min per measurement	LLD = 4mBq m^{-2}s^{-1}; typically 10% measurement error