AUSTRALIAN FACILITY FOR NOBLE-GAS RADIO ISOTOPE MEASUREMENTS USING ATOM TRAP TRACE ANALYSIS (ATTA)

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We are constructing a facility, funded through an Australian Research Council LIEF Grant, to measure ratios of noble-gas radio-isotopes.

The facility will accurately date water and ice core samples using the natural radio-isotopes incorporated within the samples. This will allow a detailed understanding of water and gas movement in underground reservoirs, provide analysis of changes in atmospheric composition over the long-term, and assess the impact of unconventional gas extraction on water systems.

The facility will also be capable of detection of manmade emissions of such radio-isotopes, in particular Kr-85, which can aid in determination of compliance with nuclear non-proliferations treaties. The presence of Kr-85 in the atmosphere is primary due to nuclear-bomb tests, nuclear reactors, and as a result of the reprocessing of fuel rods from such reactors; the atmospheric concentration has increased a million-fold since the 1950s. There are excellent time records of the atmospheric Kr-85 concentration, measured using low-level counting (decay counting) techniques requiring large sample volumes and long measurement times.

The measurement facility will use the Atom Trap Trace Analysis (ATTA) technique, which allows measurements to be performed using gas extracted from small water samples, orders of magnitude smaller than measurements performed using existing techniques such as low-level counting (LLC) or accelerator mass spectrometry (AMS). The facility will be able to measure three target isotopes: Kr-81, Kr-85 and Ar-39.