RADIOANALYSIS SERVICES

Bubble Technology Industries is primary supplier of radioanalysis services to the Canadian Department of National Defence. Our fully equipped radioanalytical laboratory is approved by the CNSC and can provide the following accurate, fast analyses for any sample type:

Alpha Spectrometry

Using solid state silicon detectors. Two types of analyses available:
Option 1: All isotopes are counted using a single source.
Option 2: Alpha emitters are isolated and chemical interferences are removed using extensive radiochemistry. Actinide separation techniques are employed to produce sources free of spectral overlap and tracer additions are used to determine yields.

Beta Spectrometry

Using either plastic or liquid scintillation spectrometry. Analysis options depend on the nature of the sample and the level of sophistication required. For solids a minimum 5g sample is required; for liquids, a minimum volume of 500 ml.
Option A – High Energy Beta (150 keV - 2.5 MeV) Analysis by Plastic Scintillator
Radionuclides include ^{144}Ce and ^{90}Sr
Solids: a thin (5 mg/cm^2) sample is prepared for counting. For a single beta emitter, detection limits of 1 Bq/g are typical. (Caution: activity may be underestimated due to sample absorption). Optional acid digestion produces a thin source to alleviate absorption and reduce minimum detectable activity to typically 0.1 Bq/g.
Liquids: 500 mL aliquots are evaporated and then counted using the plastic scintillator. Detection limits of 0.2 Bq/L are typical.
Option B – Low Energy Beta Analysis (<200 keV) by Liquid Scintillator
Maximum of three radionuclides can be determined simultaneously for any given sample. If more than three beta emitters are present, radiochemical separation techniques must be employed at additional cost.
Solids: Sample is acid digested to dissolve the beta emitter(s), then acidic medium is used to prepare a counting sample. For ^{63}Ni, a detection limit of 10 Bq/g is typical. Volatile species, such as $^{3}H_2O$, H^{36}Cl and $^{14}CO_2$ are also collected and analysed simultaneously. Detection limits of 20 Bq/g are achievable for ^{36}Cl and ^{14}C, 30 Bq/g for Tritium. Limits may be lowered to typical values of 1 Bq/g if isotope separation techniques are employed.
Liquids: Pre-concentration techniques reduce typical minimum detection limits to 0.2 Bq/L. **Option C -** Tritium Analysis
Aliquots from liquid samples are counted using liquid scintillation spectrometry. In the absence of other emitters, a detectable limit of 75 Bq/L can be obtained.

Gamma Spectrometry

Services include activity measurements of various long-lived natural and man-made radioisotopes using a Ge(Li) spectrometer. For solids, a 10g dry particulate sample is counted directly. For water and aqueous solutions, elements are pre-concentrated from a 500 mL sample. The detection limits as shown in Table 1 (see over) assume low total activity.

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Table 1: Gamma Spectrometry Detection Limits

RADIOISOTOPE	DETECTION LIMIT	
	SOLIDS (Bq/g)	LIQUIDS (Bq/L)
^{238}U Series		
^{234}Th	0.30	6.0
^{226}Ra	0.30	6.0
^{214}Pb	0.05	1.0
^{214}Bi	0.05	1.0
^{232}Th Series		
^{228}Ac	0.10	2.0
^{228}Th	2.00	40.0
^{212}Pb	0.04	0.8
^{212}Bi	0.20	4.0
^{208}Tl	0.04	0.8
Actinium Series		
^{235}U	0.04	0.8
^{227}Th	0.10	2.0
^{223}Ra	0.10	2.0
^{211}Pb	0.50	10.0
^{211}Bi	0.60	12.0
^{40}K	0.25	5.0
Man-Made Gamma Emitters		
^{241}Am	0.1	2.0
^{207}Bi	0.03	0.6
^{141}Ce	0.03	0.6
^{144}Ce	0.10	2.0
^{60}Co	0.03	0.6
^{134}Cs	0.03	0.6
^{137}Cs	0.03	0.6
^{152}Eu	0.04	0.8
^{154}Eu	0.04	0.8
^{131}I	0.03	0.6
^{54}Mn	0.03	0.6
^{102}Rh	0.03	0.6
^{65}Zn	0.03	0.6

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