Porovnanie dvoch metód stanovenia celkovej alfa aktivity vo vodách

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Table 3 Approved Methods - Gross Alpha and Beta

Method	Reference	Methodology	Minimum Detectable Level[a] (pCi/L)	Sample Size (mL)	Counting Time (min)	Noteworthy Features
1- Method 900.0	EPA 1980	Evaporation; count by gas-flow internal proportional counter or scintillation detector.	1.0 alpha, 0.5 beta	1000	100	Uses Am-241 as alpha and Sr-90 + Y-90 as beta calibration standards.
2	EPA 1976	Evaporation; count for alpha and beta activity.	0.1-1.8 alpha, 0.3-4 beta	500 - 100	60 - 1,000	Uses U-238 as alpha & Cs-137 as beta calibration standards.
3 - Method 00-01	EPA 1984	Evaporation; count for alpha and beta activity in internal gas-flow type proportional counter.	na[b]	na	na	Uses natural uranium and Pu-239 as alpha and Sr-89 and Sr-90 + Y-90 as beta calibration standards.
4	EPA 1979	Evaporation, count by low-background internal gas flow type proportional counter.	na	na	na	Uses Am-241 as alpha and Cs-137 as beta calibration standard.
5 Method 302	APHA 1971	Evaporation/filtration; count by internal proportional counter, thin window proportional counter, or Geiger counter.	na	na	na	Uses natural uranium as alpha and Cs-137 as beta calibration standard
6 - Method 7110B	APHA 1995	Evaporation; count by thin-window heavily shielded, gas-flow type, anticoincidence circuitry proportional counter; internal proportional counter; or Geiger counter.	na	na	na	Uses natural uranium, Th-230, Pu-239, and Am-241 as alpha and Cs-137, Sr-90 + Y-90 as beta calibration standard.
7 - Residue method R-1120-76	CSI 1977	Evaporation; count by low-background proportional counter.	na	na	na	Uses natural uranium as alpha and Sr-90+Y-90 or Cs-137 as beta calibration standard.

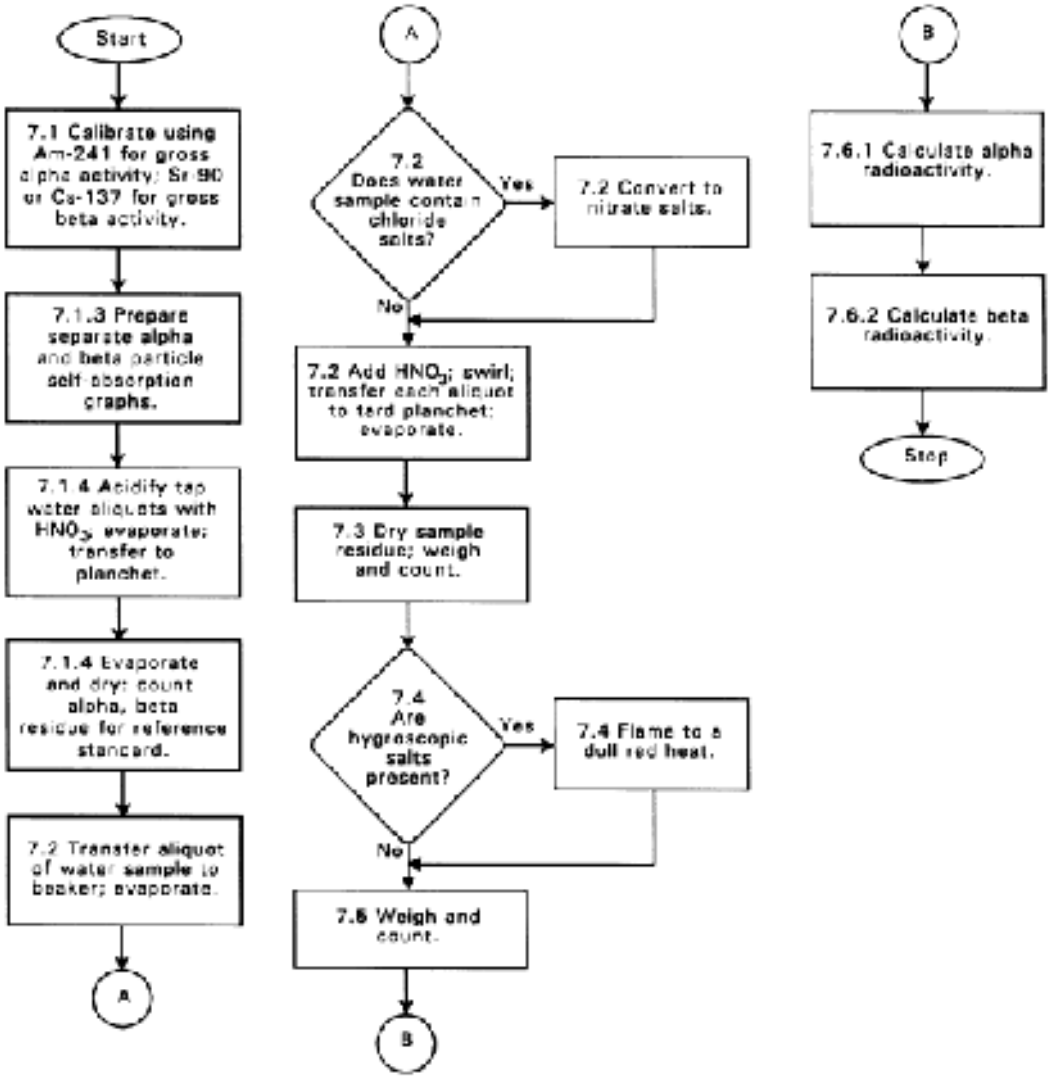
[a] Minimum detectable level is defined as the minimum detectable concentration reported for the method at the 99% confidence level (EPA 1980) or at the 95% confidence level (EPA 1976).

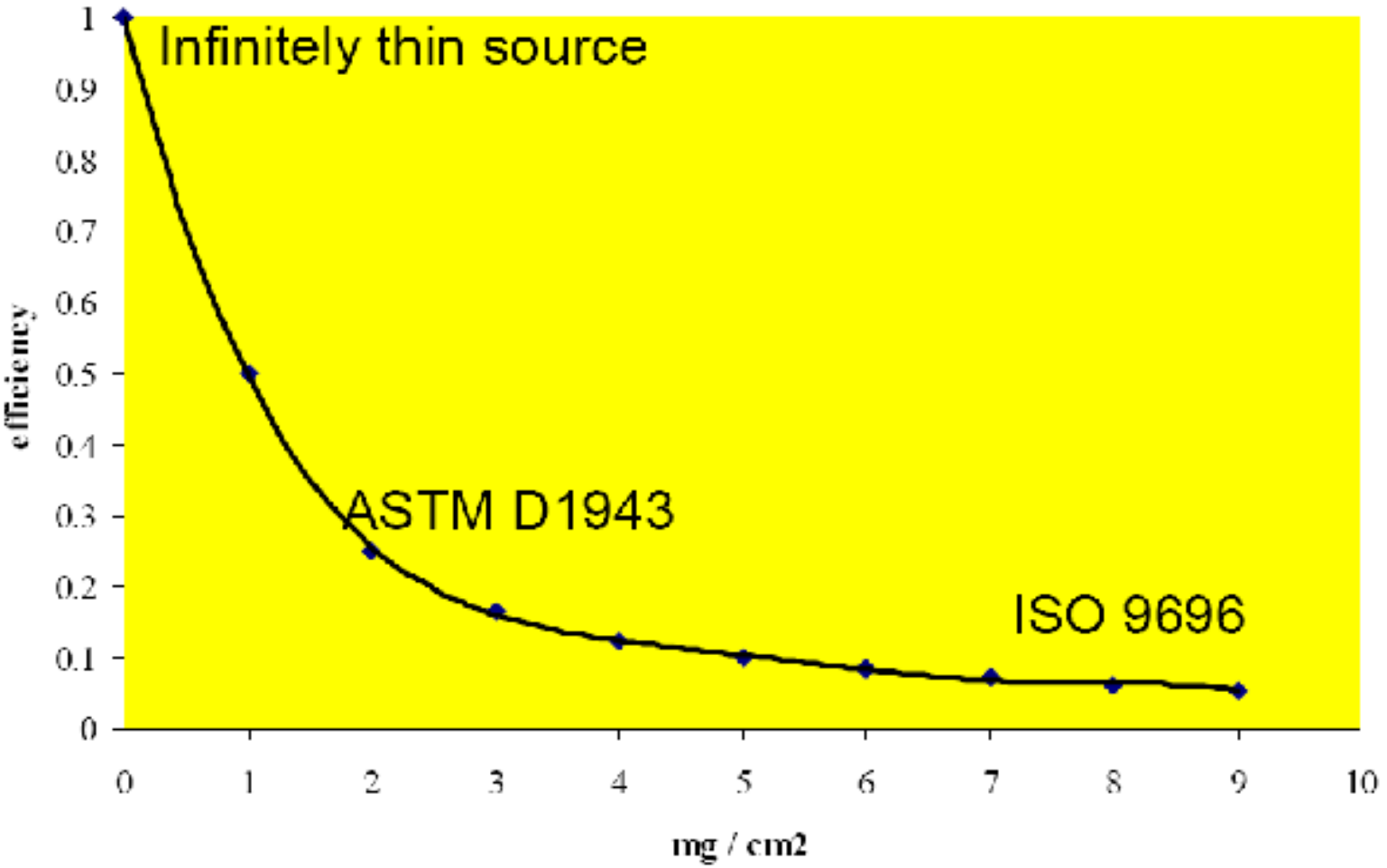
[b] na - information not available.

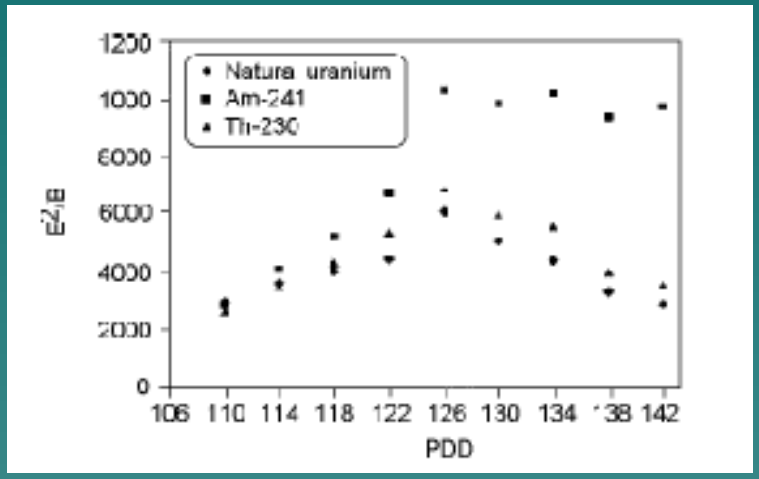
Method	Reference	Methodology	Noteworthy Features
1- Method 00-02	EPA 1984	Coprecipitation; count by alpha scintillation or low background proportional counter.	Determine counter efficiency by coprecipitating standardized aliquots of alpha emitting actinide solutions.
2- Method 7100 C	APHA 1995	Coprecipitation; count by alpha scintillation or low background proportional counter.	This method can be used for drinking water samples with high dissolved solid content, e.g., 500 mg/L or higher. Preferably use thorium-230 (a pure alpha emitter) for gross alpha efficiency calibration. Allow at least 3 hours for decay of radon progeny before beginning the alpha counting.

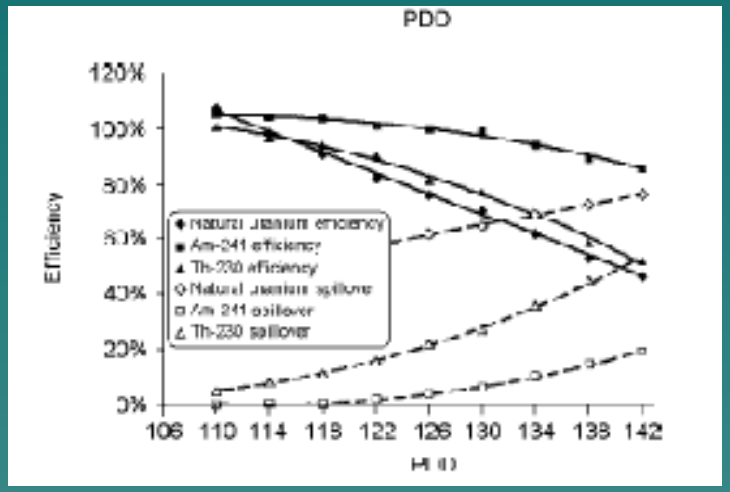
Method, Reference	Technique	Detection Limit	Application
International Organization for Standardization (ISO) 9695 and 9696 [ISO, 1991 & 1991a]	Evaporation	0.02 – 0.1 Bq/L	Groundwater with total dissolved solid content (TDS)greater than 0.1 g/L
American Public Health Association [APHA, 1998]	Co-precipitation	0.02 Bq/L	Surface and groundwater (TDS is not a factor)

METHOD 9310
GROSS ALPHA AND GROSS BETA




Infinitely thin source
ASTM D1943
ISO 9696
efficiency
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
8
9
10
mg / cm2





Gross alpha/beta analyses in water by liquid scintillation counting

C. T. Wong,[1,2]- V. M. Soliman,[1] S. K. Perera[1]

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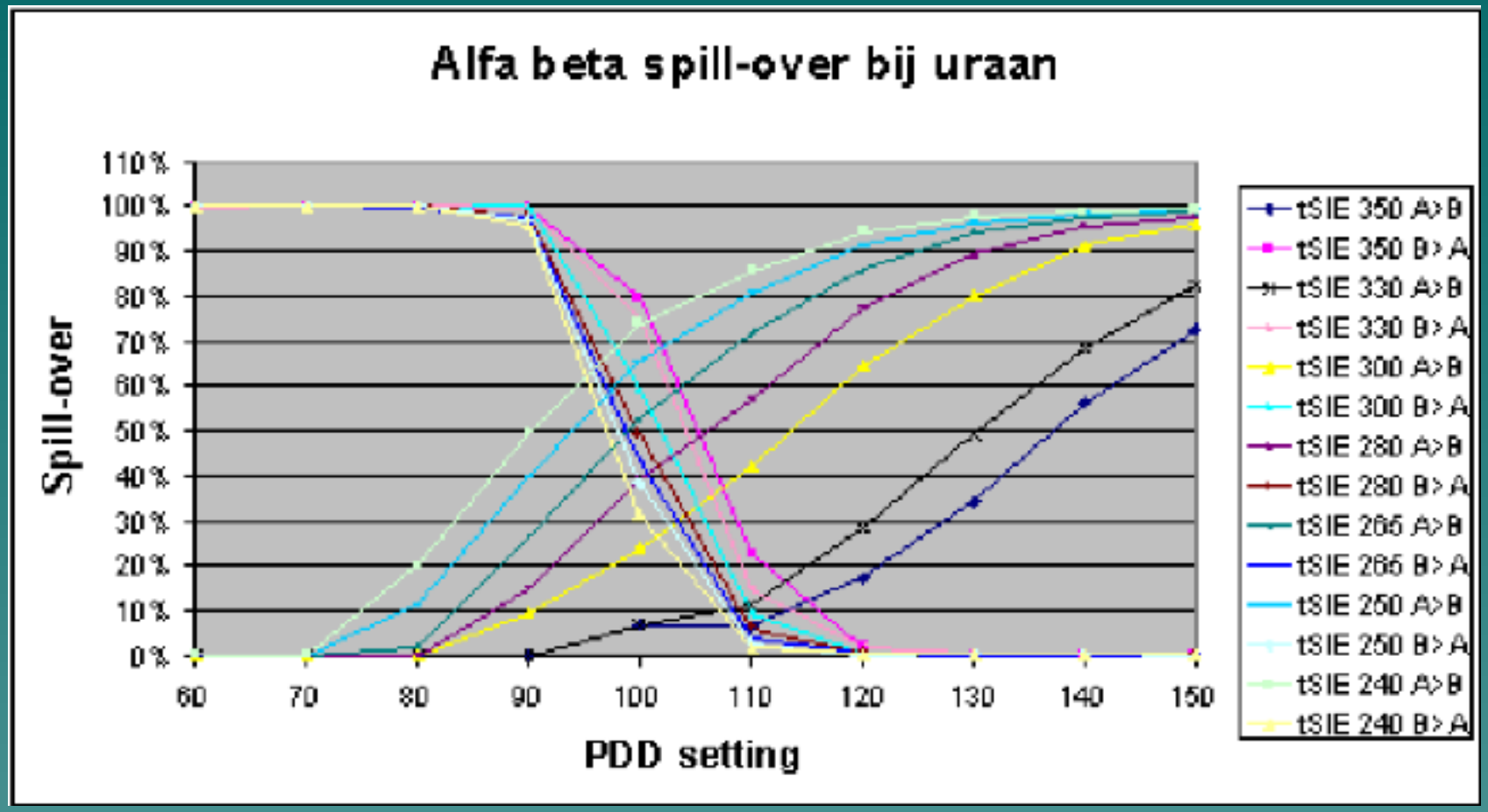
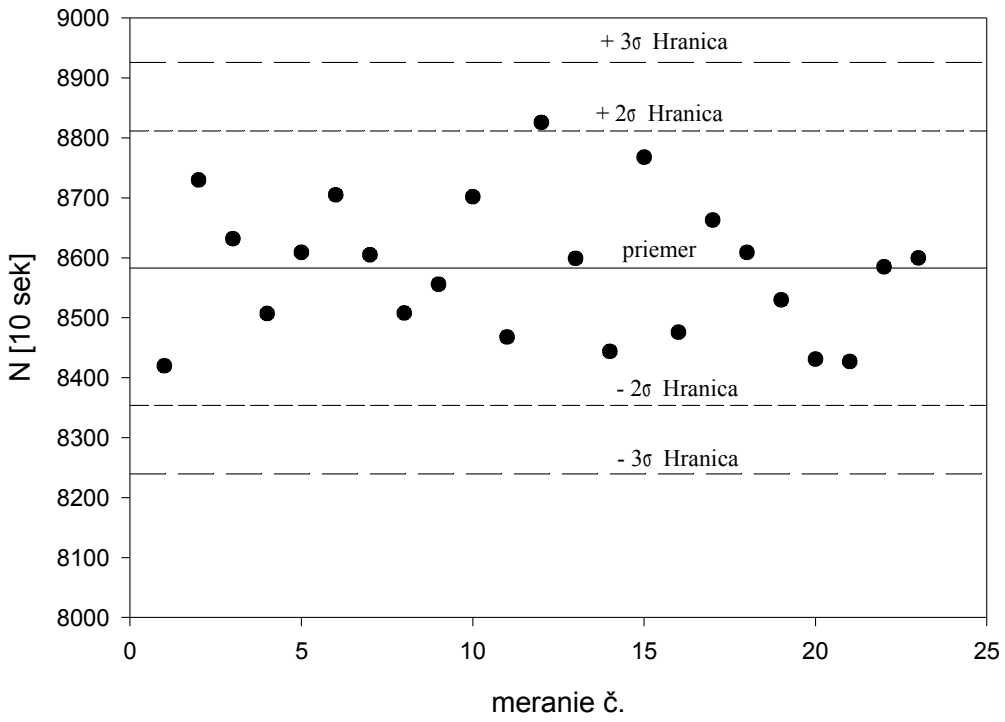


P. Kwakman (RIVM, the Netherlands)

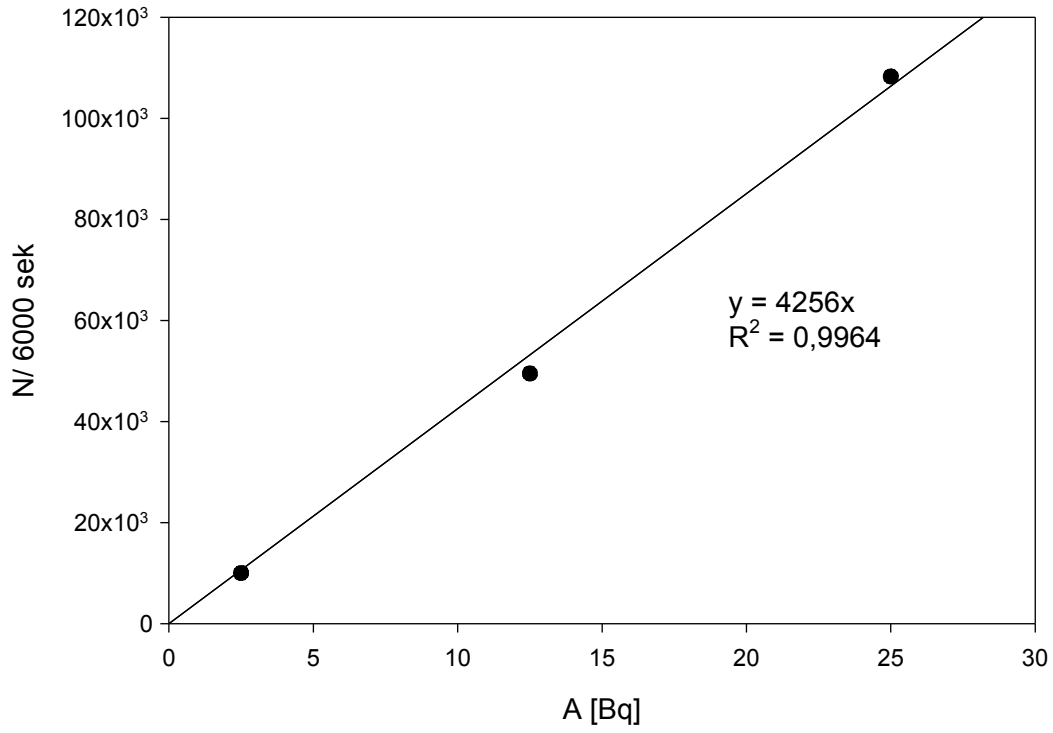
Parametre pre metódu LSC a STN 757611

Parametre	Metóda	
	LSC	STN 757611
FOM	11185	10293
MDA 0,25 L ; 3600 s LSC 6000 s STN 757600 [Bq/L]	0,044	0,053
Pozadie cpm	0,38	0,42
Účinnosť %	62,8	68,4

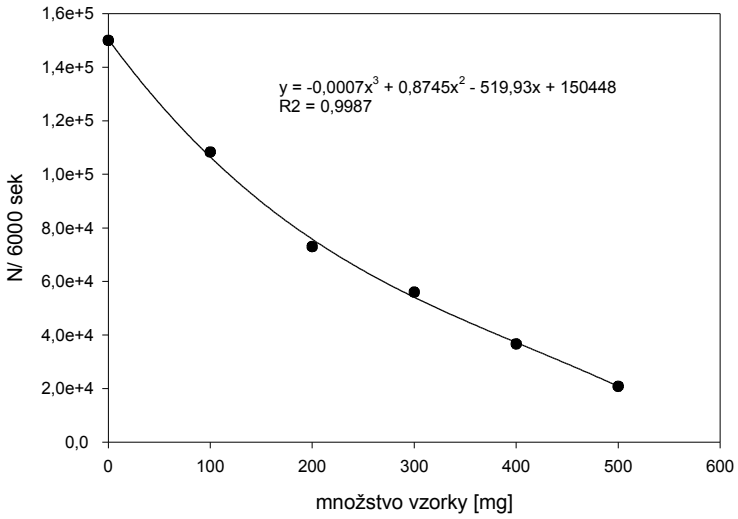
Regulačný diagram prístroja NV 3103 pre meranie celkovej alfa aktivity pomocou scintilačnej sondy 61 PK 413



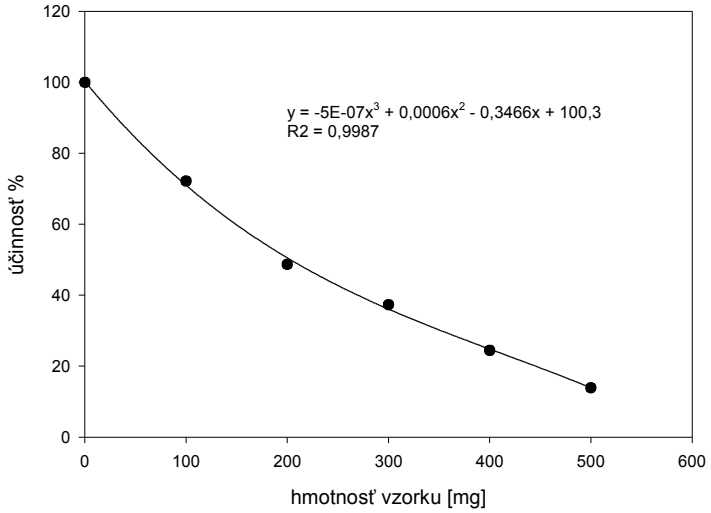
Kalibračná krivka pre detekciu uránu tuhým scintilátorom

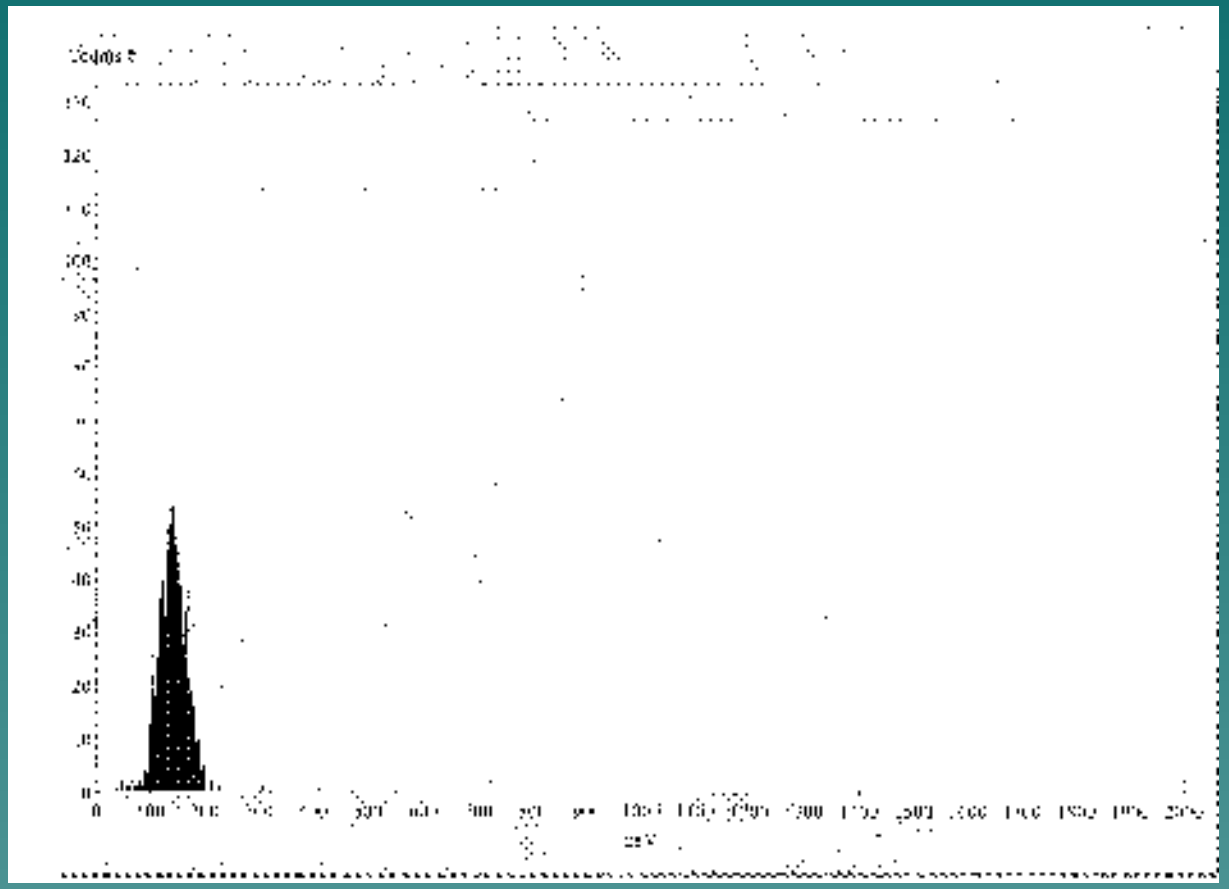


Závislosť početnosti 1 mg uránu merané tuhym scintilátorom od hmotnosti vzorku



Závislosť účinnosti detektora s tuhým scintilátorom od hmotnosti vzorku





Výsledky merania pomocou metódy STN 757611 , množstvo meranej vzorky 100 mg

Minerálna voda	hmotnosť odparku mg	objemová aktivita Bq/L	relatívna neistota
Budiš 1	2580,0	0,333	20,3
Budiš 2	2377,6	0,156	35,1
Budiš 3	2440,7	0,208	28,3
Budiš 4	2398,4	0,239	24,9
Budiš 5	2494,6	0,261	23,9
Mitická 1	1741,4	0,132	31,3
Mitická 2	1474,5	0,111	31,3
Mitická 3	1655,0	0,089	41,9
Mitická 4	1559,0	0,167	23,5
Mitická 5	1869,4	0,214	22,3
Čerinská 1	2074,8	0,571	11,7
Čerinská 1	2074,8	0,581	11,6
Čerinská 2	2025,1	0,592	11,3
Čerinská 3	1927,3	0,426	13,6
Čerinská 4	2016,4	0,661	10,4
Čerinská 5	2001,1	0,478	6,0
Baldovská 1	2241,4	0,120	41,9
Baldovská 2	2299,0	0,084	58,9
Baldovská 3	2139,5	0,047	94,3
Baldovská 4	2359,0	0,057	85,4
Baldovská 5	2323,8	0,079	62,7

Výsledky merania pomocou metódy LSC

Názov	hmotnosť odparku mg	hmot. Vzorky [mg]	[Bq/L]	sigma %
Baldovská 2	2299,0	505,7	0,048	33,7
Budiš 5	2494,6	514	0,208	11,3
Mitická 5	1869,4	537,9	< MDA	-
Čerinská 5	2001,1	499,7	0,356	7,0

Záver

- ZnS(Ag) účinnosť je závislá od množstva odparku, obmedzenie množstva návažky pre soľné roztoky, hygroskopické odparky
- LSC rozpustnosť odparkov, vznik dvoch fáz pri väčšom množstve návažky, zhášanie – závislosť nastavenia PDD, doriešiť kalibrácie (U_{nat}, Am^{241}, iné)