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Diffusion of Am, Pu, U, Np, Cs, I and Tc in compacted sand-bentonite mixture

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ABSTRACT

In order to predict the diffusion of actinides and fission products through a backfill mixture of sand and clay from a high-lewel waste repository, the diffusion of the actinides ^{241}Am, ^{239}Pu, ^{237}Np and ^{233}U and the fission products ^{134}Cs, ^{131}I and ^{99m}Tc have been measured in a mixture of 90% silica sand-10% bentonite (MX-80, Wyoming bentonite). The sand-bentonite mixture was compacted to a density of 2000 kg/m^3. The water phase used was an artificial groundwater representative of Swedish deep granitic groundwater (pH≈8, I≈0.01). The apparent diffusivity is in all cases slightly higher than in pure clay.

1 INTRODUCTION

The Swedish concept for disposal of high-level waste has concentrated on a multiple barrier system in cristalline rock at a depth of about 500 m (KBS83). In the near vincinity of the copper canisters with burnt-out fuel elements, pure bentonite is proposed as a second barrier, and when the dumping of the fuel is finished, the drifts will be filled with a mixture of 90% sand and 10% bentonite. This may also find a wider use as a backfill in future radioactive waste disposal concepts.

To be able to predict the transport of radionuclides in present and future applications of sand-bentonite as repository backfill an investigation of the migration/sorption of some actinides and fission products in a mixture of sand-bentonite have been performed. The nuclides used are neptunium, uranium, plutonium, americium, cesium, iodine and technetium. The method has been described previosly, and will only be briefly presented in this report.

2. DIFFUSION THEORY

Diffusion of a trace element through a porous media is mainly dependent on molecular diffusion in the aqueous phase, on sorption phenomena, and on the pore constrictivity and the tortuosity due to the solid. The general transport equation, which accounts for both advection and dispersion can be reduced to a diffusion equation which, if the relationship between the concentration of the solute on the solide phase and the concentration of the solute in the solution is linear and reversible, can be written (CAR59)

$$\frac{dC}{dt} = D_a \frac{d^2C}{dx^2} \qquad (1)$$

where D_a is the apparent diffusivity of a reactive solute in the medium. The relation between D_a and the diffusion coefficient of solute in free solution (D_o) is, if the sorption is independent of concentration,

$$D_a = \frac{D_o\ \Gamma}{1+K_d*(\sigma/\eta)} \qquad (2)$$

where σ = density

η = porosity of the solid

Γ = tortuosity factor

K_d = distribution coefficient for trace element between solid and aqueous phase.

The tortuosity factor for the solid can be calculated if a nonreactive solute is used, in that case the denominator in Eq. (2) is equal to 1.

The solution of Eq. (1), in one dimension, when D_a is constant and independent of concentration, is (CRA75)

$$\frac{C}{M} = \frac{\exp(-x^2/(4D_a t_c))}{2\sqrt{\pi D_a t_c}} \qquad (3a)$$

where C = concentration

M = total amount of diffusing species per unit area

x = distance from initial source

t_c = contact time

Eq. 3a can be rewritten as

$$\ln C = \ln(0.5\ M/\sqrt{\pi D_a t_c}) - (1/(4D_a t_c))x^2 \qquad (3b)$$

which plotted as ln C versus x^2 yields a straight line giving D_a from the slope (TOR86).

In the case of diffusion in water the diffusivity can be estimated from the ionic radius,

$$D_o = \frac{kT}{6\pi\delta r} \qquad (4)$$

where k = Boltzmanns constant

T = absolute temperature

δ = viscosity

r = ionic radius.

Eq.(2) gives the K_d-value as

$$K_d = \eta(D_o\Gamma - D_a)/(\sigma D_a) \qquad (5)$$

which can compared with the traditionally obtained K_d-values using batch technique.

3. EXPERIMENTAL

3.1 RADIONUCLIDES

The elements investigated are representatives of valence -1 (TcO_4, I), +1 (Cs, NpO_2), +2 (UO_2), +3 (Am) and +4 (Pu). The nuclides used are also of interest for the longtime hazard in a final disposal of radioactive waste (^{99}Tc $t_{½}=2.1 \cdot 10^5$ y, ^{129}I $t_{½}=1.6 \cdot 10^7$ y, ^{135}Cs $t_{½}=2 \cdot 10^6$ y and the actinides listed below). Data for the radionuclides used and the total amount added for each experiment are listed in Table 1.

Table 1. Decay data and total amount added in each experiment for the radionuclides used.

Nuclid	Decay	Detection method	$T_{½}$	Total amount added (moles)
^{99}Tc	ß	Liq. Scint.	$2.1 \cdot 10^5$y	$2 \cdot 10^{-7}$
^{99m}Tc	γ	NaI(Tl)	6.0 h	$2 \cdot 10^{-15}$
^{131}I	ß, γ	NaI(Tl)	8.0 d	$3 \cdot 10^{-14}$
^{134}Cs	ß, γ	NaI(Tl)	2.1 y	$3 \cdot 10^{-10}$
^{233}U	α	Liq. Scint.	$1.6 \cdot 10^5$ y	$4 \cdot 10^{-9}$
^{237}Np	α	Liq. Scint.	$2.1 \cdot 10^6$ y	$5 \cdot 10^{-8}$
^{239}Pu	α	Liq. Scint.	$2.4 \cdot 10^4$ y	$1 \cdot 10^{-9}$
^{241}Am	α	Liq. Scint.	433 y	$1 \cdot 10^{-8}$

3.2 MATERIALS AND METHODS

3.2.1 Materials

The sand used in the experiments was pure silica sand. Two different size fractions of sand were used, the first with a size distribution between 0.045-0.350 mm (one fifth of: i) 0.045-0.063, ii) 0.063-0.090, iii) 0.090-0.125, iv) 0.125-0.250 and v) 0.250-0.350 mm) and the other with a more narrow size distribution between 0.125-0.250 mm. The clay used was a sodium bentonite (MX-80, Wyoming bentonite). The clay was preequilibrated for more than two weeks with an artificial groundwater, after which it was centrifugated with an avarage centrifugal field of 22000 g. The clay was then dried in an oven at 105 °C and finally ground in an agar mortar. Then the clay was mixed with the appropriate amount and fraction of silica sand (90% by weight), the mixture loaded into the diffusion cell described below and compacted to a density of 2000 kg/m^3. The entire cells were submerged in the artificial groundwater for more than one month, in order to wet/homogenize the sand-clay mixture completely.

The water used was an artificial groundwater representative of Swedish deep granitic groundwater (TOR82, TOR86).

The porosity, η, of the sand-clay mixture was calculated from the water content (equilibrated cell and dried at 105°C) to be 13%. The K_d measurements were performed by conventional batch technique, using 2 g of sand-clay mixture and 8 mL of groundwater and a contact time of two weeks.

3.2.2 Apparatus and measurement technique

The technique used is described in detail in TOR85. Fig. 1 gives a drawing of the main parts of the diffusion cell. To introduce the activity into the diffusion cell, a slurry of the clay was placed on a glass plate and was allowed to dry. This gave a thin plate (≈0.2-0.5 mm thick) of dried fine-grained clay. The solution containing the activity (usually 0.1 mL) was then dropped onto the clay-plate under an IR-lamp and slowly evaporated. The radioactive clay-plate was then placed on an eqilibrated clay cylinder in the diffusion cell and another clay cylinder was pressed on top of it, see fig. 1.

After an appropriate time, the diffusion cell was opened, the clay cylinder was pressed through a cutting device, which peeled off the outer part of the clay cylinder (diameter before = 25 mm, after = 20 mm) to take care of wall effects. The remaining clay cylinder was then cut into slices of between 0.2 - 0.4 mm into preweighed bottles. The slices were air dried and the dry weight of each sample measured. The weight of the samples were then used to calculate a more precise thickness of each slice.

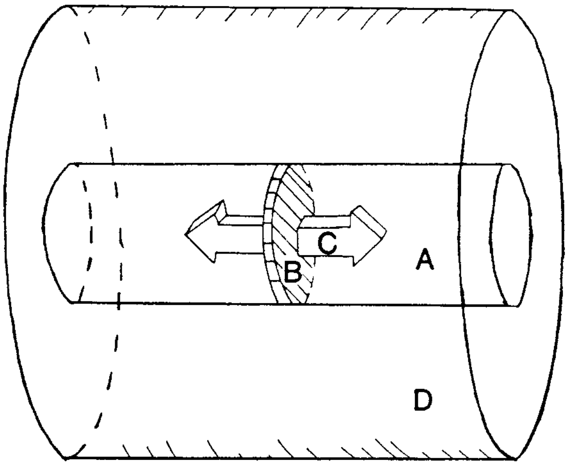

Figure 1. Schematic drawing of the diffusion cell. A Compacted bentonite, B Thin clay-plate originally containing all radioactivity , C Diffusion direction, D Sample holder of stainless steel.

The activity of gamma emitting nuclides (see Table 1) was directly measured in a well-type NaI(Tl)-detector (Intertechnique CG 4000, France). For the alpha decaying nuclides (see Table 1), first 1 mL of 1 M HCl, and thereafter 15 ml of liquid scintillation cocktail (Pico-Fluor 30, Packard Instruments AB) was added to the slices. The activity was then measured in an liquid scintillation detector (Intertechnique SL-30, France). The background activity was measured using exactly the same method, with about the same amount of clay, in order to correct for naturally occuring ^{40}K content in the clay. In the case of Np the samples containing sample and liquid scintillation cocktail was stored cold and remeasured after 1 month and after 3 months in order to detect the influence of the neptunium daughter protactinium

$$^{237}Np \xrightarrow{2.1E6\ y} {}^{233}Pa \xrightarrow{27\ d} {}^{233}U$$

on the measured diffusion.

^{99}Tc was extracted from the weighed clay-slices with 2 mL of 1 M HCl + 0.06 M $NaBrO_3$ standing overnight. The tubes were centrifuged with a centrifugal field of about 300 g. 1 mL of the supernatant was mixed with 15 mL of liguid scintillation cocktail and measured on a liquid scintillation detector.

3.2.3 Possible experimental limitations

In order to evaluate the apparent diffusion coefficient, D_a, ln C was plotted against x^2 (cf. Eq. 3b), where x is the distance from the place where the activity originally was placed, taken as the clay-slice which gave the highest specific activity. This resulted, however, in an unexpected shape of the concentration profile in the near vincinity of x=0, often giving a high and sharp peak, cf. Fig. 2. This effect has also been observed by Torstenfelt et. al. (TOR86). Some of the possible courses for this devation can be

a) hydrolysis
b) solubility problems
c) a change in valence state
d) diffusion in two media.

It was considered that diffusion in two media was a plausible explanation since the activity was added on a thin clay-plate consisting of very fine grained clay material, thus possibly giving a more dense materia with lower D_a. This hypothesis was tested by numerically solving Eq. 1 with a finite element method, giving

$$C(x,t+\ t)=\frac{D(x)\ t}{x^2}(C(x-\ x,t)+C(x+\ x,t))+(1-\frac{2D(x)\ t}{(\ x)^2})C(x,t) \quad (6)$$

The resulting diffusion profile, using a small inner layer (half thickness = 0.4 mm) with a diffusivity 2 orders of magnitude lower than in the bulk layer, see Fig. 3, shows the same tendency as the experimental measured profiles. Thus, the narrow peak in the middle of the experimental profiles can be explained by this theory.

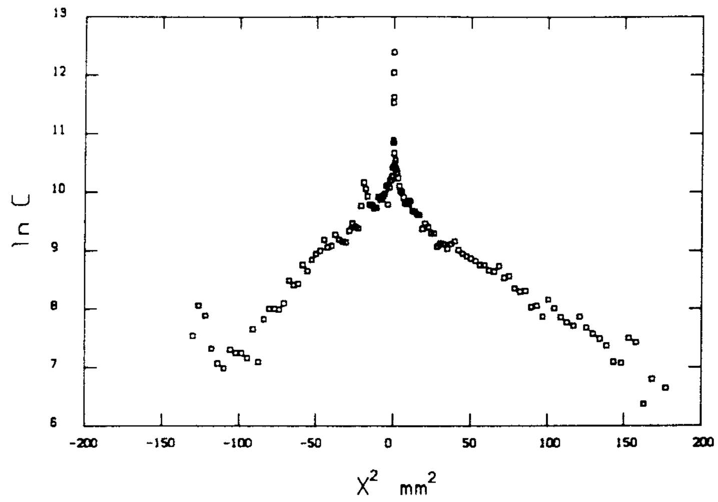

Figure 2. Concentration profile for Np in sand-bentonite mixture. x is the distance from the end of the diffusion cell where the slicing began. Right hand side of the peak is not used in the evaluation because of tailing, depending on contamination from the center of the cell due to the way of slicing the sand-clay mixture.

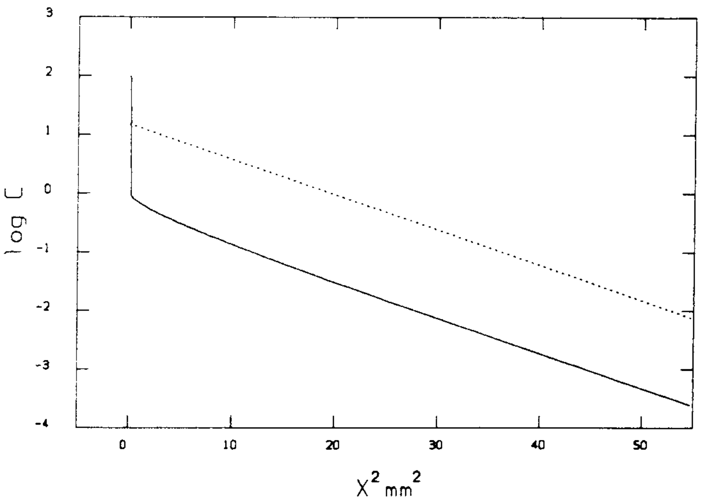

Figure 3. Theoretical concentration profile (cf Eq. (6)) for a nuclide with $D_a=3 \cdot 10^{-10}$ m^2/s in the inner, more dense, clay-plate (0.4 mm thick) and $D_a=3 \cdot 10^{-8}$ m^2/s in outer bulk material (continuous line) and for a nuclide with D_a=3·10-8 m^2/s in the whole cylinder (dotted line).

From the theoretical diffusion profiles it is also evident that the slope of the curves are the same beyond a small distance from x=0, thus giving the same calculated diffusivity for the two cases when the central peak is excluded. However, some care must be taken in evaluating diffusion experiments done with this technique in the case of almost immobile nuclides, eg. plutonium. Another problem occuring in the case of nearly immobile nuclides is the angle of the clay-plate originally containing all activity. Near the center (x=0), the slices will contain fractions of the initial radioactive plate and this will give a positive bias to the measured radioactivity, (cf. Fig. 1 and cf. Fig. 4).

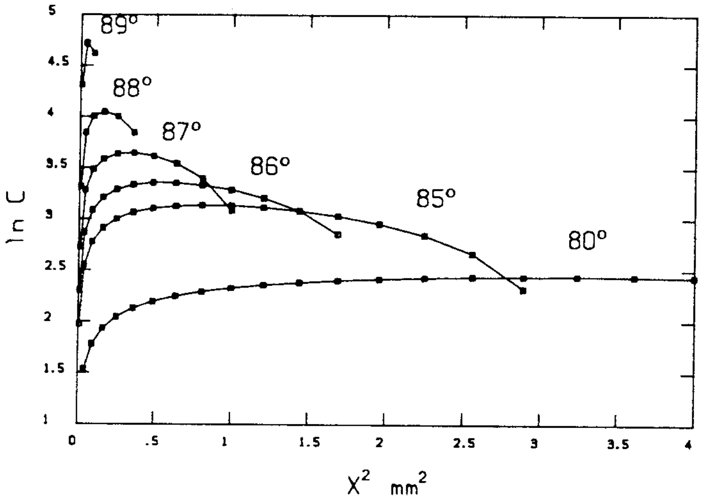

Figure 4. Theoretical concentration profile without any diffusion as a function of the angle of the clay-plate originally containing all the radioactivity.

The above considerations are reasons enough to be careful in evaluating the validity of the D_a-values obtained for the almost immobile ions, especially plutonium.

4 RESULTS AND DISCUSSION

The different size fractions of sand used (see Sect 3.2.1) gave no significant difference in apparent diffusivity, why a mean value of D_a for the two measurements for each nuclide is used. The maximum deviation is less then 0.5 in log-value, see Table 2 Sect. 5.

4.1 FISSION PRODUCTS

4.1.1 Technetium

Technetium is under oxidizing conditions negatively charged (TcO_4^-) wich makes it mobile under the conditions used here.

Several experiments using ^{99}Tc and contact times from 22 to 8 days were performed. The scattering in the concentration profiles was high, probably due to end effects in the finite size of the diffusion cell. In order to avoid end effects, shorter contact times were used (2 days). The apparent diffusivity, D_a(Tc), obtained from Eq. (3b) is $3 \cdot 10^{-10}$ m^2/s, see Fig. 5. This is a high value, compared to the one obtained in pure bentonite, $1 \cdot 10^{-12}$ m^2/s (TOR86).

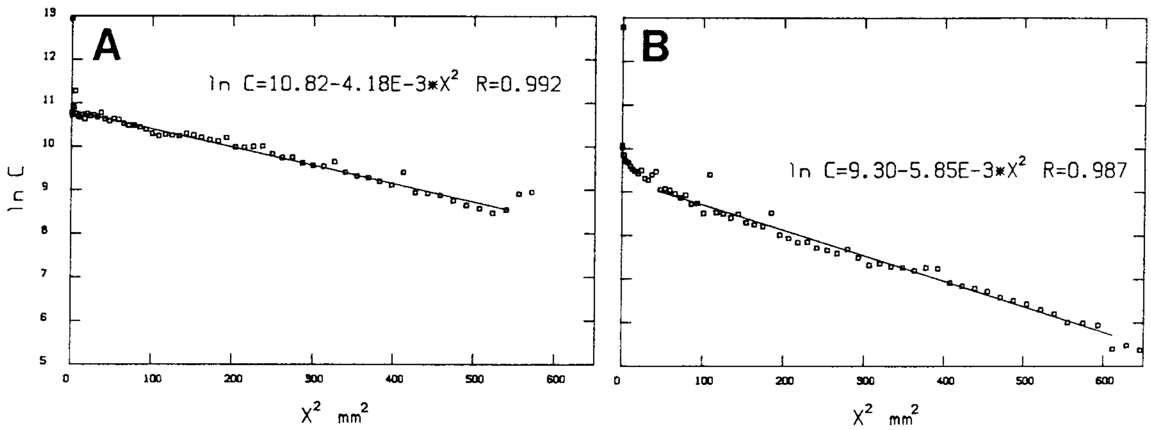

Figure 5. Concentration profile for Tc in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration expressed as cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 2 days; Fig. B sand size 0.045-0.350 mm, contact time 2 days.

Additional experiments with pure clay were performed, and the results indicate that the value give by Torstenfelt is too low due to too long contact time (69 days). The D_a-value obtained in this investigation (7 days contact time, ^{99}Tc, pure benonite, compactation 2000 kg/m^3) is $8.5 \cdot 10^{-11}$ m^2/s, see Fig. 6.

The D_a for Tc measured in this investigation ($3 \cdot 10^{-10}$ m^2/s) is in good agreement with the one measured under approximately the same conditions (90% sand-10% bentonite, ≈2000 kg/m^3) for Cl by Johnston et al. (JOH85, $D_a(Cl)=2 \cdot 10^{-10}$ m^2/s), knowing that D_o is $4 \cdot 10^{-9}$ for Tc resp. $2 \cdot 10^{-9}$ m^2/s for Cl (see Eq. (4)).

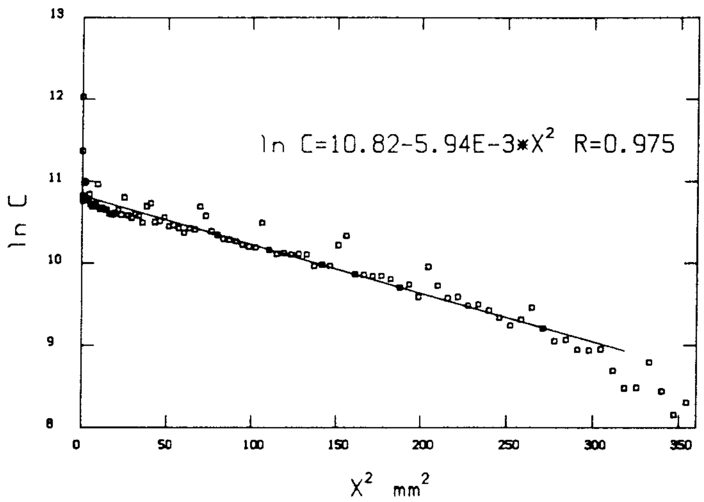

Figure 6. Concentration profile for Tc in compacted (2000 kg/m^3) bentonite. C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Contact time 6 days.

4.1.2 Iodine

For iodine two diffusivities have been measured, one faster fraction with a $D_a = 2 \cdot 10^{-10}$ m^2/s and a slower fraction with a D_a-value of $2 \cdot 10^{-11}$ m^2/s, see Fig. 7. The faster D_a-value is in agreement with what is expected for negatively charged ions, cf. pertechnetate and chloride in Sect 4.1.1 above. A possible explanation for the second slower D_a-value as being the result of the formation of hypoiodus acid, HIO, has been proposed by Torstenfelt (TOR86). This seems to be a reasonable explanation, since i) HIO could probably be stable under these conditions, ii) HIO would be associated in the pH-range of this investigation (8.0-9.0), pKa=10.6 (FUR85), iii) the measured slower D_a-value for iodine ($2 \cdot 10^{-11}$ m^2/s) is somewhere between those for Tc and Cl (valency -1, $D_a \approx 2 \cdot 10^{-10}$ m^2/s) and those for Cs and Np (valency +1, $D_a \approx 4 \cdot 10^{-12}$ m^2/s).

Also for iodine the measured fast diffusivity is high compared to the ones given by Torstenfelt. Possibly the same explanation as for Tc is valid (see Sect. 4.1.1, contact time, this investigation =4 days, TOR86 >157 days).

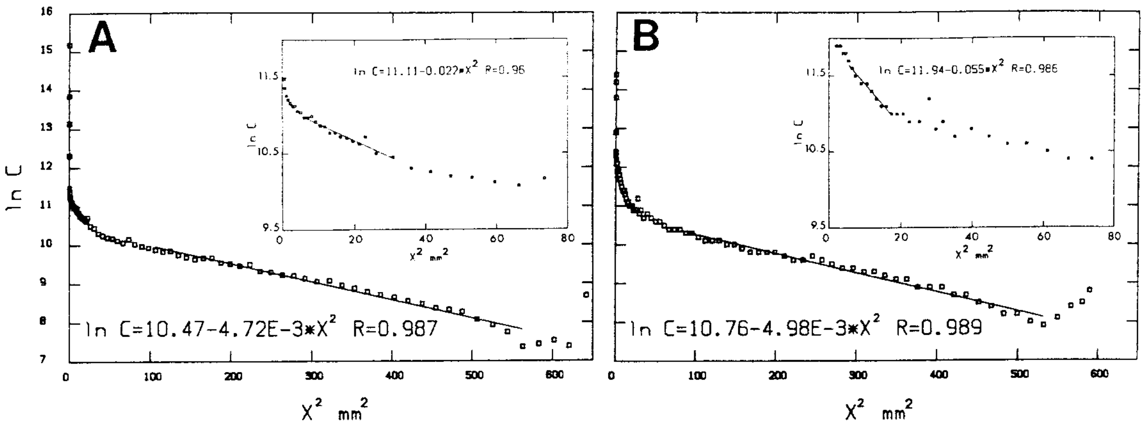

Figure 7. Concentration profile for I in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 4 days ; Fig. B sand size 0.045-0.350 mm, contact time 4 days.

4.1.3 <u>Cesium</u>

Cesium exists as Cs^+. The measured D_a-value is $5 \cdot 10^{-12}$ m^2/s, see Fig. 8. Cesium sorbs mostly by ion exchange, and the D_a-value is about 2 orders of magnitude lower then for the non-sorbing, negatively charged ions (Tc, I and Cl).

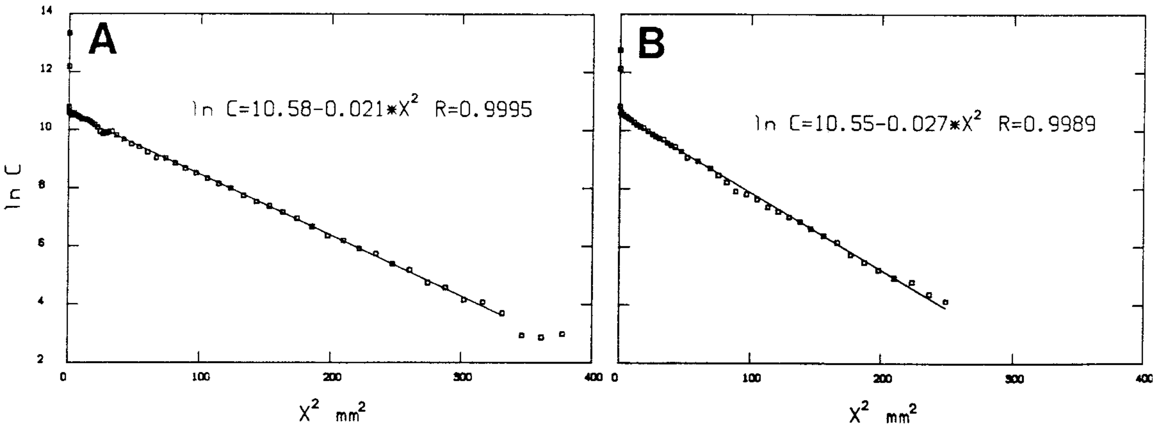

Figure 8. Concentration profile for Cs in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 24 days; Fig. B sand size 0.045-0.350 mm, contact time 24 days.

4.2 ACTINIDES

The actinides have a more complex speciation in the environment used here (oxidizing conditions, pH 8-9). All information below about the speciation of the actinides in groundwater is taken from Allard et. al. (ALL84).

4.2.1 Neptunium

The pentavalent state dominates under oxidizing conditions, NpO_2^+. The D_a-value for Np is in the same order as for Cs, $D_a(Np) = 4 \cdot 10^{-12}$ m^2/s, which also indicates that Np is in its pentavalent state. As can bee seen from Fig. 9, the concentration profile is somewhat scattered, having a peak around $x^2=20$ mm^2 in Fig. 9B. This can be due to small impurities in the sand-clay mixture of iron, which gives local reducing conditions, resulting in formation of Np(IV) which is strongly sorbed.

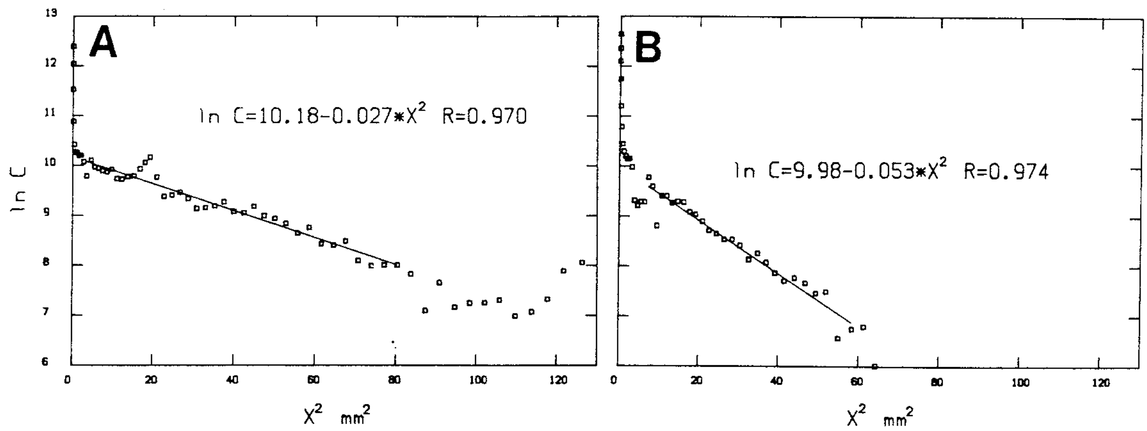

Figure 9. Concentration profile for Np in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 28 days ; Fig. B sand size 0.045-0.350 mm, contact time 12 days.

4.2.2 Uranium

Uranium is hexavalent, UO_2^{2+}, in slightly oxidizing conditions. From the evaluation of the concentration profile (cf. Fig. 10) a D_a-value of $1 \cdot 10^{-12}$ m^2/s was measured.

This value is about one order of magnitude lower than the experimental D_a-value given by Johnston et. al. (JOH 84) for Sr^{2+} in the same experimental setup. This is, however, in good accordance with their predicted D_a-value for Sr^{2+}.
The D_a for UO_2^{2+} is, as expected, lower than for Cs^+ and NpO_2^+ by a factor of three.

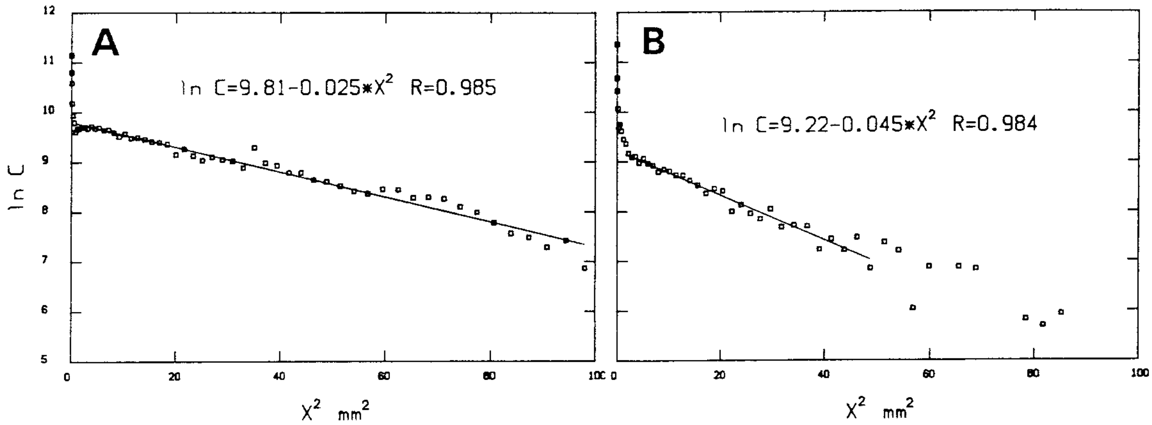

Figure 10. Concentration profile for U in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 81 days ; Fig. B sand size 0.045-0.350 mm, contact time 45 days.

4.2.3 Americium

Americium is trivalent in both oxidizing and reducing conditions. The concentration curves, Fig. 11, can be explained as a combination of two diffusion rates, one faster with $D_a=3\cdot10^{-13}$ m^2/s and one slower with $D_a\approx1\cdot10^{-13}$ m^2/s. The lower D_a-values may however be an artifact depending on the high concentration used in this experiment that possibly gave precipitation of $Am(OH)_3(s)$ ($pK_s\approx23.5$, pH≈8.8, $[Am]=6\cdot10^{-9}$ M at $x^2=180$ mm^2, $[Am]=6\cdot10^{-5}$ at M $x^2=0$ mm^2, cf. fig. 11). The D_a-value for Am is about one order of magnitude lower than for U.

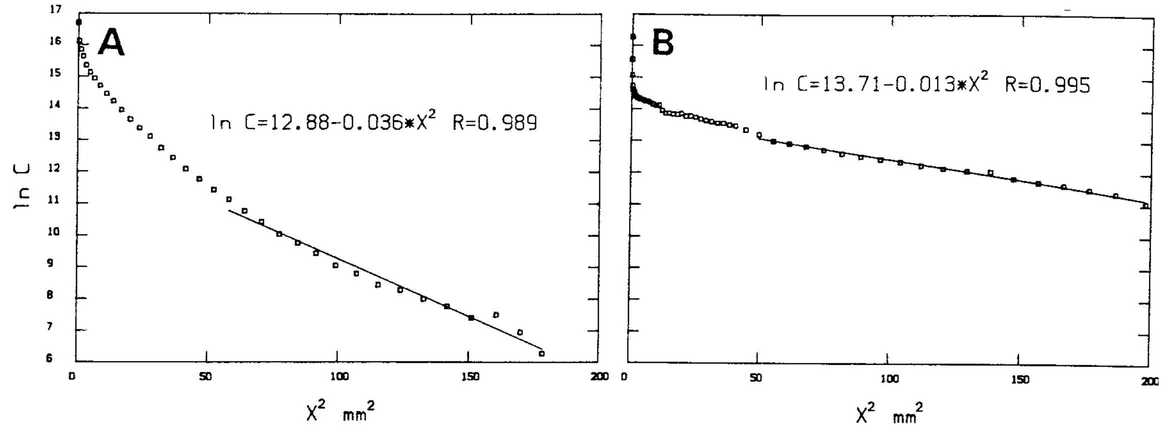

Figure 11. Concentration profile for Am in compacted (2000 kg/m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 379 days ; Fig. B sand size 0.045-0.350 mm, contact time 378 days.

4.2.4 <u>Plutonium</u>

Plutonium is in the tetravalent state under oxidizing conditions. In the tetravalent state, plutonium is almost totally sorbed, and only a maximum D_a-value can be estimated, based on the minimum diffusivity that could be detected after 391 days, $D_a(max)=1 \cdot 10^{-15}$ m^2/s. The measured points for Pu is given in Fig. 12.

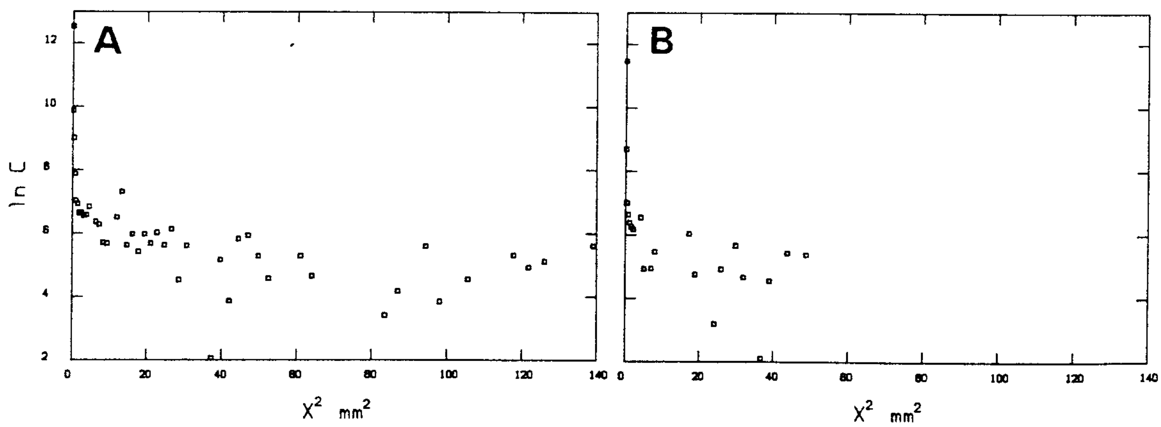

Figure 12. Concentration profile for Pu in compacted (2000 kg/ m^3) sand-bentonite (90/10). C is the concentration in cpm/g and x is the distance from the clay-plate originally containing all radioactivity. Fig. A sand size 0.125-0.250 mm, contact time 391 days ; Fig. B sand size 0.045-0.350 mm, contact time 211 days.

5 CONCLUSIONS

The apparent diffusivities for all the nuclides measured are listed in Table 2, both in a mixture of 90% silica sand-10% bentonite and in pure bentonite. The log D_a values are plotted for the different nuclides in Fig. 13, also including D_a-values measured in loosely compacted bentonite (CHR88).

Table 2. Apparent diffusivity, Da (m^2/s), for Tc, I, Cs, U, Np, Pu och Am in sand-bentonite mixture (90/10). Two different size composition of sand (A=0.125-0.250 resp. B=0.045-0.350 mm).

		Log D_a			
Nuclide	Ion	A	B	Mean value	Pure bentonite
^{99m}Tc	TcO_4^-	-9.46	-9.61	-9.5	-10.1,(-11.9)*
^{131}I	I^-	-9.82	-9.84	-9.8	-11.7*
		-10.48	-10.88	-10.7	-12.8*
^{134}Cs	Cs^+	-11.24	-11.31	-11.3	-11.6*
^{237}Np	NpO_2^+	-11.42	-11.34	-11.4	-12.4*
^{233}U	UO_2^{2+}	-11.84	-11.84	-11.8	-12.2*
^{241}Am	Am^{3+}	-12.67	-12.23	-12.5	<-13.9*
^{239}Pu	Pu^{4+}	<-14.8	<-15.0	<-14.8	<-14.7*

*From (TOR86).

As can be seen from Table 2 and Fig. 13, the D_a-values are in average 4 times higher in the sand/bentonit mixture (ranging from 2 to 10 times) than in pure bentonite. For plutonium no diffusion can be detected in any of the investigations, and no comparison can be made.

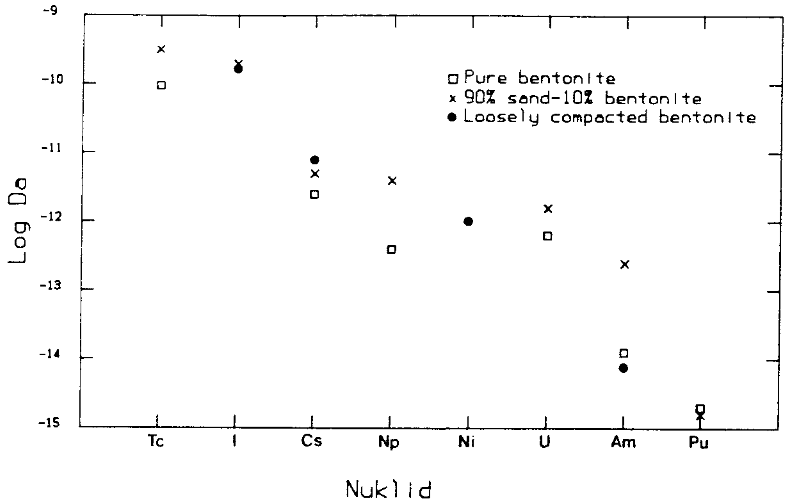

Figure 13. Apparent diffusivity for different elements.

Table 3. Calculation of K_d-values using the apparent diffusivity and ionic radius (SHA76), cf. Eq. (5), and measured K_d-values in a sand-bentonite (90/10) mixture.

Ion	Ionic radius	D_o	D_a	K_d (calc)	K_d(meas.)*
	nm	m^2/s	m^2/s	m^3/kg	m^3/kg
TcO_4^-	0.056	$3.9 \cdot 10^{-9}$	$3 \cdot 10^{-10}$	0	0
Cs^+	0.167	$1.3 \cdot 10^{-9}$	$5 \cdot 10^{-12}$	0.0013	0.1
NpO_2^+	0.075	$2.9 \cdot 10^{-9}$	$4 \cdot 10^{-12}$	0.0037	-
UO_2^{2+}	0.073	$3.0 \cdot 10^{-9}$	$2 \cdot 10^{-12}$	0.0077	0.0005
Am^{3+}	0.097	$2.2 \cdot 10^{-9}$	$3 \cdot 10^{-13}$	0.038	0.2
Pu^{4+}	0.086	$3.6 \cdot 10^{-9}$	$<1 \cdot 10^{-15}$	>19	0.3

*Probably conc. dependent, $[U] \approx 10^{-6}$, $[Am] \approx 10^{-9}$, $[Pu] \approx 10^{-7}$ M.

Since Tc is non-sorbing the D_a(Tc)-value was used to calculate the tortosity of the sand/clay mixture (see Eq. (4)), which gave a tortosity value, Γ, of 0.08, using $D_o(Tc)=3.9 \cdot 10^{-9}$ m^2/s. This is in good agreement with Γ-value obtained by Johnston et. al. using ^{36}Cl as a nonsorbing nuclide, obtaining Γ=0.07-0.12 at the same conditions as in this investigation.

As can be seen from Table 3 the measured and calculated K_d values are not in accordance. This can be due to different concentrations, especially for the actinides. A better understanding of the sorption process, especially at low concentrations, is needed to be able to explain the deviations in the measured and, from diffusion experiments, calculated K_d-values.

6 ACKNOWLEDGEMENTS

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Nuclide: Tc-99m
No.fract.:1
Cont.time:2 days
Backgr.: 349 cpm
Meas.time:4 min

Samp.no.	cpm	Weight g	mm in	X^2 mm	LN(C)
1	2120	0.2622	0.20	572	8.96
2	1401	0.1785	0.53	556	8.91
3	1429	0.2639	0.86	541	8.55
4	1164	0.2294	1.23	523	8.48
5	1376	0.2509	1.59	507	8.57
6	1406	0.2388	1.96	491	8.66
7	1578	0.2449	2.32	475	8.76
8	1828	0.2555	2.70	458	8.88
9	1748	0.2364	3.07	443	8.92
10	1908	0.2552	3.44	427	8.94
11	2746	0.235	3.81	412	9.41
12	2160	0.2475	4.17	398	9.12
13	2343	0.2502	4.54	383	9.20
14	2443	0.2427	4.91	368	9.28
15	2604	0.2506	5.28	354	9.32
16	2876	0.256	5.67	340	9.41
17	3423	0.2435	6.04	327	9.65
18	3192	0.2546	6.41	313	9.54
19	3164	0.2477	6.79	300	9.57
20	3504	0.2626	7.18	287	9.62
21	3688	0.245	7.56	274	9.75
22	2742	0.2633	7.94	261	9.74
23	4196	0.2585	8.33	249	9.84
24	4806	0.2525	8.72	237	10.01
25	4693	0.2515	9.09	225	9.99
26	4578	0.2494	9.47	214	9.98
27	4738	0.2589	9.85	203	9.99
28	5867	0.2622	10.24	192	10.20
29	5029	0.2449	10.62	182	10.12
30	5662	0.27	11.01	172	10.15
31	5600	0.2548	11.41	161	10.21
32	5801	0.2516	11.79	152	10.26
33	6003	0.2533	12.17	143	10.30
34	5582	0.25	12.54	134	10.24
35	5599	0.2504	12.92	125	10.25
36	5882	0.26	13.30	117	10.27
37	5833	0.2682	13.70	108	10.24
38	5968	0.2616	14.10	100	10.30
39	6438	0.26	14.49	93	10.39
40	6735	0.26	14.88	85	10.44
41	7033	0.2619	15.27	78	10.49
42	6836	0.2573	15.66	71	10.48
43	7392	0.2683	16.06	65	10.53
44	8257	0.2774	16.47	58	10.61
45	7560	0.2513	16.87	52	10.63
46	7353	0.2592	17.25	47	10.58
47	7963	0.2684	17.65	42	10.63
48	8839	0.2614	18.04	37	10.77
49	8294	0.2707	18.44	32	10.68
50	8344	0.2614	18.84	28	10.73
51	8448	0.2717	19.24	24	10.71
52	8360	0.2586	19.64	20	10.76
53	8176	0.2887	20.05	16	10.63
54	8157	0.2629	20.47	13	10.73

55	7740	0.2678	20.87	11	10.67
56	7809	0.2661	21.27	8	10.69
57	7992	0.2575	21.66	6	10.76
58	13826	0.2674	22.06	4	11.28
59	9268	0.2637	22.46	3	10.90
60	9401	0.2599	22.85	2	10.93
61	5457	0.2594	23.24	1	10.72
62	7953	0.2567	23.63	0	10.78
63	65410	0.2475	24.01	0	12.95
64	31489	0.2743	24.40	0	12.12
65	9018	0.2531	24.79	0	10.95
66	7887	0.2607	25.18	1	10.79
67	6807	0.2646	25.57	2	10.64
68	6352	0.2638	25.97	3	10.58
69	6055	0.2547	26.36	5	10.57
70	5717	0.2656	26.75	7	10.48
71	5399	0.2633	27.15	9	10.47
72	5356	0.2711	27.55	12	10.44
73	4728	0.2404	27.94	15	10.44
74	4910	0.259	28.31	18	10.41
75	4841	0.2829	28.72	21	10.31
76	9288	0.5563	29.35	27	10.31
77	7640	0.5326	30.17	37	10.16
78	9379	0.5199	30.96	47	10.40
79	15571	0.5022	31.73	58	10.95
80	23399	0.6152	32.57	71	11.17
81	24699	0.555	33.44	87	11.33
82	15595	0.5621	34.28	104	10.86
83	11058	0.5536	35.12	121	10.54
84	7341	0.5443	35.95	140	10.15
85	6882	0.5671	36.78	161	10.05
86	4790	0.5499	37.62	183	9.72
87	3930	0.5754	38.47	206	9.48
88	2977	0.5498	39.31	231	9.25
89	2198	0.5502	40.14	193	8.95
90	3618	0.5581	40.97	216	9.45
91	1166	0.5039	41.77	241	8.38
92	1068	0.5938	42.60	267	8.13
93	762	0.5539	43.46	296	7.83
94	609	0.5209	44.27	324	7.64
95	493	0.5358	45.06	353	7.37
96	462	0.5889	45.90	386	7.20
97	352	0.5448	46.76	420	6.94
98	308	0.5472	47.58	454	6.76
99	259	0.5309	48.39	490	6.55
100	218	0.808	49.39	535	5.86

Nuclide: Tc-99m
No.fract.:5
Cont.time:2 days
Backgr.: 338 cpm
Meas.time:4 min

Samp.no.	cpm	Weight g	mm in	X^2 mm	LN C
1	127.50	0.1726	0.13	661	5.52
2	132.20	0.2222	0.43	646	5.38
3	135.50	0.2156	0.76	629	5.48
4	138.20	0.2478	1.11	612	5.40
5	177.50	0.2513	1.49	593	5.94
6	186.70	0.2657	1.88	574	5.99
7	184.50	0.2572	2.28	555	6.01
8	186.50	0.2175	2.64	539	6.20
9	219.00	0.2622	3.01	522	6.30
10	231.70	0.2550	3.40	504	6.43
11	238.00	0.2465	3.78	487	6.51
12	252.00	0.2510	4.16	471	6.59
13	269.00	0.2435	4.53	455	6.72
14	287.00	0.2524	4.91	439	6.79
15	295.70	0.2512	5.29	423	6.84
16	308.70	0.2490	5.67	407	6.92
17	397.00	0.2524	6.05	392	7.24
18	394.50	0.2483	6.43	377	7.26
19	378.20	0.2533	6.81	363	7.19
20	399.20	0.2547	7.19	348	7.27
21	413.00	0.2634	7.59	334	7.28
22	416.50	0.2492	7.98	319	7.36
23	407.20	0.2528	8.36	306	7.32
24	477.20	0.2610	8.75	293	7.49
25	557.20	0.2602	9.14	279	7.69
26	501.70	0.2557	9.53	266	7.59
27	532.00	0.2564	9.92	254	7.66
28	571.70	0.2663	10.32	241	7.72
29	587.50	0.2434	10.71	229	7.85
30	646.00	0.2767	11.10	218	7.84
31	645.20	0.2525	11.50	206	7.94
32	677.70	0.2491	11.88	195	8.01
33	1082.70	0.2534	12.26	185	8.53
34	848.20	0.2682	12.66	174	8.21
35	877.50	0.2694	13.07	163	8.25
36	875.00	0.2571	13.47	153	8.30
37	1087.70	0.2711	13.87	144	8.49
38	941.00	0.2556	14.27	134	8.40
39	1064.50	0.2667	14.66	125	8.50
40	1055.50	0.2598	15.06	116	8.53
41	2186.70	0.2383	15.44	108	9.39
42	971.20	0.2443	15.81	101	8.51
43	1273.70	0.2631	16.19	93	8.74
44	1235.00	0.2598	16.59	86	8.73
45	1424.00	0.2478	16.97	79	8.93
46	1418.00	0.2636	17.36	72	8.88
47	1495.50	0.2575	17.76	66	8.96
48	1681.70	0.2714	18.16	59	9.04
49	1688.50	0.2637	18.56	53	9.08
50	1719.20	0.2779	18.97	47	9.06
51	2415.20	0.2649	19.39	42	9.47
52	2234.50	0.2645	19.79	37	9.40
53	1985.00	0.2658	20.19	32	9.28
54	2010.20	0.2622	20.59	28	9.31

55	2456.50	0.2699	20.99	24	9.50
56	2297.00	0.2714	21.40	20	9.43
57	2372.70	0.2701	21.81	16	9.48
58	2440.70	0.2654	22.22	13	9.53
59	2575.00	0.2662	22.62	10	9.59
60	2745.00	0.2640	23.03	8	9.67
61	2911.00	0.2741	23.43	6	9.70
62	2575.70	0.2376	23.82	4	9.72
63	3546.70	0.2963	24.23	3	9.84
64	3223.50	0.2643	24.65	1	9.86
65	3739.70	0.2630	25.05	1	10.02
66	4054.70	0.2758	25.46	0	10.07
67	51140.70	0.2366	25.85	0	12.78
68	31317.20	0.2936	26.25	0	12.08
69	7962.70	0.2646	26.68	1	10.82
68	5495.20	0.2633	27.08	2	10.45
71	5062.00	0.2672	27.48	3	10.36
72	3907.00	0.2654	27.88	4	10.11
73	3997.70	0.2680	28.29	6	10.14
74	3746.20	0.2569	28.69	8	10.12
75	3599.00	0.2606	29.08	10	10.07
76	7212.50	0.5263	29.68	15	10.08
77	6177.50	0.5229	30.47	21	9.94
78	5784.00	0.5317	31.27	29	9.87
79	7210.50	0.5254	32.07	39	10.11
80	4988.70	0.5272	32.87	49	9.74
81	4760.00	0.5386	33.68	61	9.69
82	4225.00	0.5146	34.48	74	9.62
83	3996.70	0.5374	35.28	89	9.52
84	3504.70	0.5042	36.07	104	9.46
85	3414.70	0.5343	36.86	121	9.38
86	3037.70	0.5229	37.66	139	9.29
87	2824.70	0.5335	38.46	159	9.21
88	2592.00	0.5189	39.26	180	9.15
89	2341.70	0.5172	40.04	201	9.06
90	2108.20	0.5299	40.84	225	8.93
91	1936.00	0.5137	41.63	249	8.88
92	1734.00	0.5315	42.42	275	8.74
93	1521.00	0.5253	43.22	302	8.62
94	1367.00	0.5319	44.03	330	8.50
95	1176.70	0.5310	44.83	360	8.35
96	992.70	0.5279	45.64	391	8.18
97	880.20	0.5289	46.44	424	8.06
98	715.70	0.5360	47.24	458	7.82
99	552.20	0.5085	48.04	492	7.58
100	443.20	0.5277	48.82	528	7.28
101	446.00	0.5119	49.61	565	7.33

Nuclide: I-131
No.fract.:1
Cont.time:4 days
Backgr.: 330 cpm
Meas.time:4 min

Samp.no.	cpm	Weight	mm in	X^2 mm	LN C
1	1394.50	0.0679	0.06	657	9.66
2	1929.70	0.2688	0.33	643	8.69
3	739.20	0.2546	0.76	621	7.38
4	735.00	0.2173	1.14	602	7.53
5	776.70	0.2632	1.54	583	7.44
6	713.20	0.2421	1.95	563	7.37
7	899.20	0.2448	2.35	544	7.75
8	1038.70	0.2539	2.76	525	7.94
9	1217.00	0.2757	3.19	506	8.08
10	1236.00	0.2299	3.60	487	8.28
11	1266.00	0.2266	3.98	471	8.33
12	1365.00	0.2393	4.36	455	8.37
13	1603.70	0.2629	4.77	437	8.49
14	1651.00	0.2539	5.19	420	8.56
15	1820.50	0.2611	5.61	403	8.65
16	1953.00	0.2667	6.04	386	8.71
17	2017.00	0.2561	6.47	369	8.79
18	2170.20	0.2556	6.89	353	8.88
19	2337.50	0.2578	7.31	337	8.96
20	2613.50	0.2616	7.74	322	9.07
21	2705.00	0.2772	8.18	306	9.06
22	2649.50	0.2491	8.61	291	9.14
23	2908.20	0.2582	9.02	278	9.21
24	3045.50	0.2665	9.45	263	9.23
25	3152.50	0.2572	9.88	250	9.30
26	3377.20	0.2710	10.31	236	9.33
27	3627.70	0.2458	10.73	223	9.50
28	3817.20	0.2688	11.15	211	9.47
29	3698.20	0.2479	11.58	199	9.52
30	3957.00	0.2579	11.99	187	9.55
31	4252.50	0.2485	12.41	176	9.67
32	4262.68	0.2491	12.81	166	9.67
33	4247.00	0.2550	13.22	155	9.64
34	4594.20	0.2641	13.65	145	9.69
35	4784.50	0.2603	14.08	135	9.75
36	5173.50	0.2543	14.50	125	9.85
37	5471.00	0.2744	14.93	116	9.84
38	5500.20	0.2642	15.37	106	9.88
39	5550.00	0.2530	15.79	98	9.93
40	6180.20	0.2715	16.22	89	9.98
41	6634.00	0.2757	16.67	81	10.04
42	6988.00	0.2567	17.11	74	10.16
43	6736.70	0.2705	17.54	66	10.07
44	6512.70	0.2487	17.96	60	10.12
45	7469.00	0.2699	18.39	53	10.18
46	7311.50	0.2589	18.82	47	10.20
47	7978.50	0.2679	19.25	41	10.26
48	8283.20	0.2652	19.69	36	10.31
49	9839.70	0.2744	20.13	31	10.45
50	10017.00	0.2660	20.57	26	10.50
51	5134.50	0.1061	20.87	23	10.72
52	5550.70	0.1265	21.06	21	10.63
53	5312.20	0.1164	21.26	20	10.66
54	5744.50	0.1209	21.46	18	10.71

58	6365.00	0.1166	22.25	12	10.85
59	6565.20	0.1190	22.45	10	10.87
60	7316.70	0.1263	22.65	9	10.92
61	6967.00	0.1117	22.84	8	10.99
62	7197.20	0.1173	23.03	7	10.98
63	7803.00	0.1279	23.23	6	10.98
64	7409.50	0.1135	23.43	5	11.04
65	8488.00	0.1284	23.62	4	11.06
66	7506.70	0.1055	23.82	3	11.13
67	8649.70	0.1224	24.00	3	11.13
68	8822.70	0.1203	24.20	2	11.16
69	8843.00	0.1153	24.39	2	11.21
70	10180.70	0.1265	24.59	1	11.26
71	9247.70	0.1035	24.78	1	11.36
72	11540.70	0.1157	24.96	1	11.48
73	25948.00	0.1141	25.15	0	12.32
74	45880.00	0.0887	25.31	0	13.15
75	121757.50	0.1165	25.48	0	13.86
76	496812.30	0.1266	25.68	0	15.18
77	51429.50	0.1145	25.88	0	13.01
78	21620.50	0.1198	26.07	0	12.09
79	15026.50	0.1170	26.26	0	11.74
80	12970.20	0.1244	26.46	1	11.53
81	11039.20	0.1147	26.65	1	11.44
82	10177.00	0.1215	26.85	1	11.30
83	9310.25	0.1209	27.05	2	11.22
84	8443.50	0.1204	27.24	2	11.12
85	8074.00	0.1229	27.44	3	11.05
86	7421.70	0.1176	27.64	4	11.01
87	7713.20	0.1278	27.84	5	10.96
88	7135.50	0.1235	28.04	6	10.92
89	6744.70	0.1190	28.24	7	10.90
90	6504.50	0.1160	28.44	8	10.88
91	6503.00	0.1178	28.63	9	10.87
92	5848.00	0.1126	28.81	10	10.80
93	5843.70	0.1168	29.00	11	10.76
94	5761.50	0.1234	29.20	12	10.69
95	5702.00	0.1265	29.40	14	10.66
96	5435.50	0.1180	29.60	15	10.68
97	5272.00	0.1213	29.80	17	10.62
98	5014.00	0.1199	30.00	19	10.57
99	5029.70	0.1240	30.20	20	10.54
100	5161.50	0.1291	30.40	22	10.53
101	1182.50	0.2547	30.72	25	8.12
102	8886.00	0.2561	31.13	30	10.42
103	8726.50	0.2536	31.55	34	10.41
104	8803.00	0.2659	31.98	40	10.37
105	8413.50	0.2626	32.41	45	10.33
106	7941.20	0.2578	32.83	51	10.29
107	7715.50	0.2617	33.26	57	10.25
108	7439.20	0.2581	33.68	64	10.22
109	7106.00	0.2504	34.10	71	10.21
110	6996.00	0.2639	34.52	78	10.14
111	6923.20	0.2720	34.96	86	10.10
112	6174.70	0.2544	35.39	94	10.04
113	5965.50	0.2563	35.81	103	10.00
114	5846.50	0.2627	36.23	111	9.95
115	5925.70	0.2712	36.67	121	9.93
116	5387.20	0.2607	37.10	130	9.87
117	5021.70	0.2516	37.52	140	9.83
118	5089.00	0.2605	37.94	150	9.81
119	5089.50	0.2709	38.38	161	9.77
120	4960.70	0.2698	38.82	173	9.75
121	4647.20	0.2545	39.25	184	9.74
122	4722.70	0.2718	39.68	196	9.69
123	4353.20	0.2639	40.12	208	9.63
124	4363.00	0.2658	40.55	221	9.63

128	4003.00	0.2760	42.26	275	9.50
129	3548.20	0.2510	42.69	289	9.46
130	3672.50	0.2667	43.11	304	9.44
131	3638.00	0.2512	43.53	319	9.49
132	3263.20	0.2566	43.95	334	9.34
133	3368.70	0.2651	44.38	350	9.35
134	3119.20	0.2576	44.80	366	9.29
135	3171.70	0.2518	45.22	382	9.33
136	3075.20	0.2707	45.65	399	9.22
137	2917.70	0.2602	46.08	416	9.21
138	2762.00	0.2582	46.51	434	9.15
139	2523.00	0.2546	46.93	451	9.06
140	2420.70	0.2649	47.35	470	8.97
141	2180.20	0.2585	47.78	488	8.88
142	1849.00	0.2539	48.20	507	8.70
143	1600.70	0.2488	48.61	526	8.54
144	2037.70	0.2812	49.04	546	8.71
145	23366.70	0.4447	49.64	574	10.86

Nuclide: I-131
No.fract.:5
Cont.time:4 days
Backgr.: 332 cpm
Meas.time:4 min

Samp.no.	cpm	Weight	mm in	X^2 mm	LN C
1	754.7	0.0665	0.05	589	8.76
2	1254	0.1839	0.24	580	8.52
3	1239.5	0.2109	0.54	566	8.37
4	1135.2	0.2523	0.89	549	8.07
5	976.2	0.2407	1.27	532	7.89
6	1046	0.2346	1.63	515	8.02
7	1167	0.2391	1.99	499	8.16
8	1282	0.2551	2.36	483	8.22
9	1291.2	0.2188	2.72	467	8.39
10	1583.5	0.2520	3.08	452	8.51
11	1726.2	0.2367	3.45	436	8.68
12	1837.2	0.2431	3.81	421	8.73
13	2136.5	0.2426	4.18	406	8.91
14	2161	0.2487	4.56	391	8.90
15	2146.5	0.2403	4.93	376	8.93
16	2332.7	0.2276	5.28	363	9.08
17	2494.2	0.2373	5.63	350	9.12
18	2852.5	0.2565	6.01	336	9.19
19	2773.2	0.2271	6.38	322	9.28
20	3195.2	0.2493	6.74	309	9.35
21	3467.2	0.2655	7.13	296	9.38
22	3443.2	0.2468	7.52	283	9.44
23	3766.7	0.2669	7.91	270	9.46
24	3830	0.2377	8.29	257	9.60
25	4245	0.2437	8.66	246	9.68
26	4327.7	0.2668	9.04	234	9.61
27	3911.2	0.2485	9.43	222	9.58
28	4574	0.2681	9.83	210	9.67
29	4908	0.2544	10.22	199	9.80
30	4396	0.2311	10.59	189	9.77
31	5525.7	0.2753	10.98	178	9.85
32	5070.5	0.2530	11.38	168	9.84
33	5576	0.2576	11.76	158	9.92
34	5820.2	0.2603	12.16	148	9.96
35	6150.7	0.2607	12.55	139	10.01
36	6826	0.2646	12.95	129	10.11
37	6514.2	0.2514	13.34	121	10.11
38	7264.7	0.2748	13.74	112	10.14
39	7297.7	0.2649	14.15	104	10.18
40	7616.7	0.2574	14.55	96	10.25
41	7794	0.2527	14.94	88	10.29
42	8930.2	0.2712	15.33	81	10.36
43	9532.2	0.2729	15.75	74	10.43
44	8410.2	0.2426	16.14	67	10.41
45	9797.7	0.2547	16.52	61	10.52
46	10728.7	0.2534	16.90	55	10.62
47	10161.7	0.2349	17.27	50	10.64
48	11502.2	0.2535	17.64	45	10.69
49	13063.2	0.2486	18.02	40	10.84
50	11967.7	0.2523	18.40	35	10.74
51	6939.2	0.1219	18.69	32	10.90
52	6598	0.1217	18.87	30	10.85
53	8169.7	0.1040	19.04	28	11.23
54	13463.7	0.2493	19.31	25	10.87
55	7309.7	0.1236	19.60	22	10.94
56	7758.5	0.1199	19.78	21	11.03
57	8101	0.1236	19.97	19	11.05
58	7945.2	0.1219	20.15	17	11.04

62	10648.2	0.1291	20.88	12	11.29
63	10497.2	0.1196	21.07	11	11.35
64	21990.2	0.2490	21.35	9	11.37
65	12187	0.1169	21.63	7	11.53
66	12805.2	0.1170	21.81	6	11.58
67	15703.2	0.1256	21.99	5	11.71
68	15787.7	0.1197	22.18	5	11.77
69	15124.7	0.1119	22.35	4	11.79
70	19638	0.1284	22.54	3	11.92
71	16265.7	0.1134	22.72	3	11.85
72	17325.7	0.1175	22.89	2	11.88
73	19915.7	0.1114	23.07	2	12.08
74	23811.5	0.1327	23.25	1	12.08
75	23781	0.1160	23.44	1	12.22
76	27499.5	0.1189	23.62	1	12.34
77	30045.5	0.1194	23.80	0	12.42
78	47514.2	0.1162	23.98	0	12.91
79	172248	0.1201	24.16	0	14.17
80	208879	0.1121	24.34	0	14.44
81	93784.5	0.0985	24.50	0	13.76
82	25107	0.1372	24.67	0	12.10
83	17707.6	0.1321	24.88	0	11.79
84	10308.2	0.1336	25.08	1	11.22
85	7892.7	0.1296	25.28	1	10.97
86	7160	0.1297	25.48	1	10.87
87	6738.7	0.1346	25.68	2	10.77
88	11519.5	0.2715	25.99	3	10.63
89	5461.225	0.1326	26.29	4	10.56
90	5162.7	0.1330	26.49	5	10.50
91	12246	0.1336	26.70	6	11.40
92	3608	0.1243	26.89	7	10.18
93	3560.6	0.1213	27.08	8	10.19
94	3513.2	0.1297	27.27	9	10.11
95	3971.5	0.1341	27.47	10	10.21
96	3833.5	0.1274	27.67	11	10.22
97	3844	0.1234	27.86	12	10.26
98	4304.5	0.1426	28.06	14	10.24
99	4090.2	0.1385	28.27	15	10.21
100	3673.2	0.1215	28.47	17	10.22
101	7440.2	0.2656	28.77	20	10.19
102	7226.5	0.2785	29.18	23	10.12
103	7056.2	0.2742	29.60	28	10.11
104	6956.7	0.2807	30.02	32	10.07
105	6886.7	0.2749	30.44	37	10.08
106	6101.5	0.2518	30.84	42	10.04
107	6616.5	0.2799	31.24	48	10.02
108	6487.2	0.2917	31.68	54	9.96
109	6034	0.2712	32.11	60	9.95
110	5833	0.2760	32.52	67	9.90
111	5701.2	0.2685	32.93	74	9.90

Nuclide: Cs-134
No.fract.:1
Cont.time:24 days
Backgr.: 112 cpm
Meas.time:4 min

Samp.no.	cpm	Weight	mm in	X^2 mm	LN C
1	118.00	0.1223	0.10	682	3.89
2	114.40	0.2	0.37	668	2.48
3	115.00	0.2289	0.73	650	2.57
4	106.10	0.2436	1.13	630	#NUM!
5	106.90	0.2288	1.52	610	#NUM!
6	111.30	0.2417	1.92	591	#NUM!
7	117.00	0.2437	2.33	571	3.02
8	109.70	0.2335	2.73	552	#NUM!
9	104.60	0.2378	3.12	534	#NUM!
10	106.60	0.2461	3.53	515	#NUM!
11	109.10	0.2357	3.93	497	#NUM!
12	114.20	0.2435	4.33	479	2.20
13	107.70	0.2393	4.74	462	#NUM!
14	114.70	0.2489	5.15	444	2.38
15	108.00	0.2361	5.55	427	#NUM!
16	110.60	0.2499	5.96	410	#NUM!
17	110.30	0.2438	6.37	394	#NUM!
18	117.10	0.2568	6.79	377	2.99
19	116.20	0.2377	7.21	361	2.87
20	116.40	0.2324	7.60	347	2.94
21	122.40	0.2566	8.01	332	3.70
22	125.80	0.2354	8.42	317	4.07
23	128.50	0.2563	8.84	302	4.16
24	135.20	0.2366	9.25	288	4.59
25	140.90	0.2496	9.66	274	4.75
26	157.90	0.2566	10.08	260	5.19
27	165.70	0.2419	10.50	247	5.40
28	190.90	0.2524	10.91	234	5.74
29	205.20	0.2501	11.34	222	5.92
30	131.60	0.2433	11.75	209	6.20
31	262.50	0.2594	12.17	197	6.36
32	312.90	0.2512	12.60	186	6.68
33	379.80	0.2539	13.02	174	6.96
34	434.40	0.2473	13.44	163	7.17
35	489.20	0.2344	13.85	153	7.38
36	587.10	0.255	14.26	143	7.53
37	690.20	0.253	14.68	133	7.73
38	852.50	0.2494	15.10	124	8.00
39	968.10	0.2491	15.52	114	8.14
40	1177.50	0.2541	15.94	106	8.34
41	1383.40	0.2528	16.37	97	8.52
42	1590.20	0.2505	16.79	89	8.68
43	1883.10	0.2525	17.21	81	8.86
44	2207.50	0.2524	17.64	74	9.02
45	2248.40	0.2512	18.06	67	9.05
46	2771.00	0.2572	18.48	60	9.24
47	3149.20	0.2474	18.91	53	9.42
48	3479.70	0.2457	19.32	48	9.53
49	4427.60	0.2711	19.75	42	9.68
50	4481.40	0.2384	20.18	36	9.82
51	2937.80	0.1347	20.49	33	9.95
52	2577.70	0.12	20.71	30	9.93
53	2474.40	0.1204	20.91	28	9.88

54	2453.70	0.1222	21.11	26	9.86
55	2818.40	0.1303	21.32	24	9.94
56	3247.30	0.1282	21.54	22	10.10
57	3448.50	0.1262	21.75	20	10.18
58	3945.00	0.1361	21.97	18	10.25
59	3856.60	0.1263	22.19	16	10.30
60	4190.90	0.1302	22.41	15	10.35
61	4504.60	0.1379	22.63	13	10.37
62	4166.40	0.1264	22.85	11	10.38
63	3937.60	0.1204	23.06	10	10.37
64	4381.60	0.1252	23.27	9	10.44
65	4728.40	0.1328	23.48	7	10.46
66	5075.50	0.1347	23.71	6	10.51
67	4806.80	0.1277	23.93	5	10.51
68	5151.60	0.1292	24.14	4	10.57
69	4802.00	0.1284	24.36	3	10.51
70	4713.30	0.1269	24.57	3	10.50
71	5336.60	0.1383	24.80	2	10.54
72	5098.90	0.1269	25.02	1	10.58
73	4942.80	0.1229	25.23	1	10.58
74	5336.70	0.1285	25.44	1	10.61
75	5092.80	0.1214	25.65	0	10.62
76	6325.70	0.128	25.86	0	10.79
77	22090.30	0.1116	26.06	0	12.19
78	54347.70	0.0884	26.22	0	13.33
79	35050.70	0.1053	26.39	0	12.71
80	11394.30	0.1398	26.59	0	11.30
81	5517.30	0.1097	26.80	0	10.81
82	5007.30	0.1081	26.98	1	10.72
83	5782.90	0.1252	27.18	1	10.72
84	5197.60	0.1179	27.38	1	10.67
85	4826.80	0.1147	27.58	2	10.62
86	5000.60	0.1215	27.78	2	10.60
87	4787.90	0.1168	27.98	3	10.60
88	4419.20	0.1118	28.17	4	10.56
89	4597.10	0.1178	28.36	5	10.55
90	4311.20	0.1126	28.55	5	10.53
91	4388.00	0.1181	28.75	6	10.50
92	4080.70	0.1134	28.94	7	10.46
93	4279.10	0.1205	29.14	9	10.45
94	4182.50	0.1218	29.34	10	10.42
95	3969.20	0.1149	29.54	11	10.42
96	4044.90	0.1209	29.74	12	10.39
97	3768.90	0.1153	29.93	14	10.36
98	3628.30	0.1135	30.13	15	10.34
99	3737.90	0.1178	30.32	17	10.33
100	3569.10	0.1184	30.52	18	10.28
101	6430.10	0.2315	30.81	21	10.21
102	6057.10	0.2459	31.21	25	10.09
103	5623.90	0.2439	31.62	29	10.03
104	4871.40	0.2347	32.02	34	9.92
105	4220.80	0.2307	32.41	38	9.79
106	3928.70	0.2366	32.81	43	9.69
107	3468.00	0.2422	33.21	49	9.54
108	2969.00	0.2409	33.61	55	9.38
109	2598.50	0.2313	34.01	61	9.28
110	2396.70	0.2364	34.40	67	9.18
111	2218.70	0.2569	34.81	74	9.01
112	1696.70	0.2341	35.23	81	8.82
113	1498.90	0.2385	35.62	88	8.67
114	1297.40	0.246	36.03	96	8.48
115	1062.80	0.2351	36.43	104	8.31
116	944.10	0.2461	36.83	113	8.13
117	797.60	0.2389	37.24	121	7.96
118	743.10	0.2575	37.66	131	7.80
119	581.10	0.2262	38.06	140	7.64
120	555.20	0.2464	38.46	150	7.49

124	347.10	0.247	40.08	192	6.86
125	209.20	0.1191	40.39	201	6.70
126	308.60	0.2373	40.69	209	6.72
127	293.00	0.249	41.10	221	6.59
128	262.00	0.232	41.50	233	6.47
129	240.00	0.2385	41.89	246	6.29
130	250.70	0.2592	42.31	259	6.28
131	220.30	0.2268	42.72	272	6.17
132	226.00	0.2411	43.11	285	6.16
133	216.90	0.2421	43.52	299	6.07
134	197.70	0.2301	43.91	313	5.92
135	204.80	0.2476	44.31	327	5.93
136	190.80	0.2308	44.71	342	5.83
137	184.80	0.2396	45.11	357	5.72
138	184.00	0.238	45.51	372	5.71
139	201.00	0.2259	45.90	387	5.98
140	174.50	0.2298	46.28	402	5.61
141	189.60	0.2309	46.66	418	5.82
142	173.00	0.2352	47.05	434	5.56
143	178.80	0.2221	47.44	450	5.71
144	174.50	0.2223	47.81	466	5.64
145	166.70	0.2194	48.18	482	5.52
146	164.10	0.2091	48.54	498	5.52
147	167.30	0.2253	48.90	515	5.50
148	169.20	0.3886	49.42	538	4.99

Nuclide: Cs-134
No.fract.:5
Cont.time:22 days
Backgr.: 113.75
Meas.time:4 min

Samp.no.	cpm	Weight	mm in	X^2 mm	LN C
1	109.00	0.1715	0.14	585	#NUM!
2	115.40	0.2	0.46	570	2.11
3	111.00	0.1965	0.79	554	#NUM!
4	110.50	0.2128	1.13	538	#NUM!
5	108.00	0.2073	1.49	522	#NUM!
6	113.70	0.2004	1.83	506	#NUM!
7	108.20	0.2169	2.18	491	#NUM!
8	107.60	0.2054	2.54	475	#NUM!
9	111.20	0.212	2.89	460	#NUM!
10	113.50	0.2034	3.24	445	#NUM!
11	115.30	0.218	3.59	430	1.96
12	111.80	0.2234	3.96	415	#NUM!
13	116.70	0.2174	4.34	400	2.61
14	120.30	0.2193	4.70	385	3.40
15	112.30	0.2262	5.08	371	#NUM!
16	106.60	0.2297	5.46	356	#NUM!
17	115.80	0.2115	5.83	342	2.27
18	112.60	0.2235	6.20	329	#NUM!
19	117.70	0.2291	6.58	315	2.85
20	115.30	0.2306	6.97	302	1.91
21	113.80	0.2307	7.35	288	-1.53
22	120.90	0.2316	7.74	275	3.43
23	112.80	0.241	8.14	262	#NUM!
24	128.60	0.2353	8.54	249	4.14
25	133.00	0.2385	8.94	237	4.39
26	147.30	0.276	9.37	224	4.80
27	152.80	0.274	9.84	210	4.96
28	155.20	0.2231	10.25	198	5.22
29	171.50	0.2415	10.64	187	5.48
30	185.40	0.2298	11.04	177	5.74
31	228.90	0.2397	11.44	166	6.17
32	260.00	0.2434	11.84	156	6.40
33	288.80	0.2303	12.24	146	6.63
34	289.30	0.182	12.59	138	6.87
35	384.50	0.2376	12.94	130	7.04
36	400.00	0.2081	13.32	121	7.23
37	487.80	0.2352	13.69	113	7.37
38	589.10	0.2267	14.08	105	7.65
39	763.20	0.2617	14.49	97	7.82
40	771.70	0.2393	14.91	89	7.92
41	870.40	0.2023	15.28	82	8.23
42	1208.60	0.2283	15.64	75	8.48
43	1320.70	0.2004	16.00	69	8.70
44	3959.90	0.495	16.59	60	8.96
45	1451.10	0.1531	17.13	52	9.08
46	2634.60	0.2315	17.46	47	9.30
47	2589.50	0.1955	17.82	42	9.45
48	1642.50	0.1133	18.08	39	9.51
49	2166.10	0.1411	18.29	36	9.59
50	3164.40	0.1867	18.57	33	9.70
51	2819.90	0.1589	18.86	30	9.74
52	2163.60	0.1127	19.09	27	9.81
53	3613.00	0.1783	19.33	25	9.88
54	5343.20	0.2407	19.68	22	9.99

55	6062.20	0.2449	20.09	18	10.10
56	3901.10	0.1489	20.42	15	10.14
57	5607.60	0.202	20.72	13	10.21
58	5834.00	0.1954	21.05	11	10.28
59	6928.10	0.2117	21.40	9	10.38
60	6433.70	0.1882	21.73	7	10.42
61	5981.80	0.1642	22.03	5	10.48
62	6612.40	0.1793	22.32	4	10.50
63	11005.30	0.281	22.71	3	10.57
64	11871.40	0.2791	23.18	1	10.65
65	6557.90	0.1565	23.54	1	10.63
66	13511.50	0.2619	23.89	0	10.84
67	15964.40	0.0854	24.19	0	12.13
68	28713.90	0.0818	24.33	0	12.76
69	95774.20	0.2383	24.60	0	12.90
70	9528.20	0.2184	24.98	0	10.67
71	6051.00	0.136	25.28	1	10.68
72	6110.70	0.1387	25.51	1	10.67
73	9422.80	0.2346	25.82	2	10.59
74	8479.40	0.2098	26.20	3	10.59
75	10534.70	0.2792	26.61	5	10.53
76	4342.30	0.1218	26.95	7	10.45
77	6160.90	0.1827	27.20	8	10.41
78	7568.90	0.2438	27.56	10	10.33
79	4564.10	0.1537	27.90	13	10.27
80	3617.80	0.1299	28.14	14	10.20
81	5782.20	0.2069	28.42	17	10.22
82	6469.10	0.2571	28.81	20	10.12
83	4779.90	0.2176	29.21	24	9.97
84	5521.30	0.2628	29.61	28	9.93
85	3327.60	0.1815	29.99	32	9.78
86	3327.90	0.1926	30.30	36	9.72
87	3429.80	0.2128	30.64	40	9.65
88	2182.70	0.1479	30.95	44	9.55
89	2901.60	0.2195	31.26	48	9.45
90	2020.00	0.1625	31.58	53	9.37
91	1803.60	0.1591	31.85	57	9.27
92	2038.50	0.1998	32.15	61	9.17
93	1727.40	0.1989	32.48	66	9.00
94	1481.30	0.1859	32.81	72	8.90
95	1102.90	0.1436	33.09	77	8.84
96	1352.40	0.1955	33.37	82	8.75
97	1097.90	0.1824	33.69	88	8.59
98	1723.90	0.3704	34.15	97	8.38
99	971.40	0.2477	34.67	107	8.15
100	682.70	0.1816	35.04	115	8.05
101	687.10	0.2294	35.38	122	7.82
102	616.00	0.2223	35.76	131	7.72
103	522.40	0.2212	36.13	139	7.52
104	417.70	0.1956	36.48	148	7.35
105	421.70	0.2146	36.83	156	7.27
106	528.80	0.3327	37.29	168	7.13
107	430.30	0.3363	37.85	183	6.85
108	486.90	0.5473	38.60	204	6.52
109	198.10	0.1668	39.20	221	6.23
110	246.50	0.2447	39.54	231	6.30
111	222.50	0.2932	40.00	245	5.92
112	172.60	0.2015	40.41	259	5.68
113	185.30	0.2437	40.79	271	5.68
114	173.90	0.2406	41.19	284	5.52
115	141.20	0.0958	41.48	294	5.66
116	162.40	0.172	41.70	302	5.64
117	137.50	0.1205	41.95	310	5.28
118	151.70	0.1979	42.22	320	5.26
119	164.20	0.2365	42.58	333	5.36
120	149.30	0.1841	42.94	346	5.26

124	123.80	0.0582	44.31	399	5.15
125	152.30	0.3971	44.69	415	4.58
126	135.50	0.1958	45.19	435	4.71
127	147.70	0.279	45.59	452	4.80
128	127.50	0.1914	45.99	469	4.27
129	148.70	0.3227	46.42	488	4.68
130	144.20	0.3789	47.01	514	4.39
131	127.10	0.1945	47.49	537	4.23
132	150.00	0.4171	48.01	561	4.46
133	130.70	0.2069	48.53	586	4.41
134	188.60	0.7688	49.35	626	4.58

Nuclide: Np-237
No.fract.:1
Cont.time:28 days
Backgr.: 631 cp10m
Meas.time:10 min

Samp.no.	cp10m	Weight	mm in	X^2 mm	LN C
1	729	0.0520	0.04	130	7.54
2	1085	0.1435	0.21	126	8.06
3	919	0.1077	0.41	122	7.89
4	798	0.1101	0.60	118	7.32
5	763	0.1122	0.78	114	7.07
6	762	0.1209	0.97	110	6.99
7	794	0.1092	1.17	106	7.31
8	786	0.1097	1.35	102	7.25
9	785	0.1094	1.53	98	7.25
10	791	0.1235	1.72	95	7.17
11	872	0.1138	1.92	91	7.66
12	765	0.1107	2.11	87	7.10
13	928	0.1183	2.30	84	7.83
14	962	0.1107	2.49	80	8.00
15	963	0.1110	2.67	77	8.00
16	956	0.1098	2.86	74	7.99
17	1007	0.1143	3.04	71	8.10
18	1186	0.1146	3.23	67	8.49
19	1109	0.1067	3.42	65	8.41
20	1164	0.1166	3.60	62	8.43
21	1352	0.1137	3.80	59	8.75
22	1289	0.1157	3.99	56	8.65
23	1454	0.1193	4.18	53	8.84
24	1492	0.1133	4.38	50	8.94
25	1545	0.1133	4.56	47	9.00
26	1714	0.1115	4.75	45	9.18
27	1601	0.1137	4.94	42	9.05
28	1675	0.1195	5.13	40	9.08
29	1801	0.1103	5.32	38	9.27
30	1805	0.1203	5.52	35	9.19
31	1717	0.1150	5.71	33	9.15
32	1742	0.1190	5.91	31	9.14
33	1910	0.1125	6.10	29	9.34
34	2098	0.1143	6.29	27	9.46
35	2133	0.1239	6.49	25	9.40
36	1952	0.1118	6.68	23	9.38
37	2679	0.1182	6.87	21	9.76
38	3534	0.1115	7.06	19	10.17
39	1968	0.0573	7.20	18	10.06
40	3073	0.1189	7.35	17	9.93
41	2707	0.1163	7.55	15	9.79
42	2680	0.1162	7.74	14	9.78
43	2575	0.1166	7.93	12	9.72
44	2580	0.1160	8.13	11	9.73
45	3078	0.1208	8.32	10	9.92
46	2930	0.1191	8.52	9	9.87
47	2884	0.1138	8.72	7	9.89
48	3141	0.1206	8.91	6	9.94
49	3130	0.1168	9.11	5	9.97
50	3746	0.1269	9.31	5	10.11
51	3783	0.1770	9.57	4	9.79
52	3494	0.1206	9.81	3	10.07
53	3755	0.1160	10.01	2	10.20
54	3882	0.1206	10.21	2	10.20

55	3903	0.1146	10.40	1	10.26
56	4172	0.1219	10.60	1	10.28
57	4193	0.1061	10.79	0	10.42
58	6666	0.1127	10.97	0	10.89
59	10820	0.1002	11.15	0	11.53
60	15244	0.0859	11.30	0	12.04
61	23138	0.0936	11.45	0	12.39
62	12821	0.1089	11.62	0	11.63
63	7150	0.1275	11.82	0	10.84
64	5617	0.1165	12.02	0	10.66
65	4491	0.1127	12.21	1	10.44
66	4861	0.1185	12.40	1	10.48
67	4974	0.1149	12.60	1	10.54
68	4725	0.1262	12.80	2	10.39
69	4076	0.1124	13.00	2	10.33
70	4196	0.1275	13.20	3	10.24
71	3582	0.1208	13.40	4	10.10
72	3203	0.1144	13.60	5	10.02
73	3236	0.1187	13.79	5	10.00
74	3083	0.1220	13.99	6	9.91
75	2795	0.1195	14.19	8	9.80
76	2720	0.1134	14.39	9	9.82
77	2750	0.1175	14.58	10	9.80
78	2945	0.1224	14.78	11	9.85
79	2486	0.1168	14.98	12	9.67
80	2490	0.1183	15.17	14	9.66
81	2466	0.1229	15.37	15	9.61
82	2279	0.1114	15.57	17	9.60
83	2076	0.1234	15.76	19	9.37
84	2220	0.1245	15.97	20	9.45
85	2111	0.1223	16.18	22	9.40
86	1874	0.1142	16.37	24	9.29
87	1935	0.1205	16.57	26	9.29
88	1695	0.1227	16.77	28	9.07
89	1665	0.1131	16.97	30	9.12
90	1630	0.1107	17.15	33	9.11
91	1667	0.1246	17.35	35	9.03
92	1653	0.1132	17.55	37	9.11
93	1789	0.1223	17.74	40	9.16
94	1535	0.1111	17.94	42	9.00
95	1577	0.1237	18.13	45	8.94
96	1477	0.1150	18.33	47	8.90
97	1485	0.1215	18.53	50	8.86
98	1507	0.1298	18.74	53	8.82
99	1314	0.1081	18.93	56	8.75
100	1405	0.1230	19.13	59	8.75
101	1314	0.1187	19.33	62	8.66
102	1317	0.1217	19.53	65	8.64
103	1349	0.1162	19.72	68	8.73
104	1229	0.1174	19.92	72	8.54
105	1249	0.1188	20.12	75	8.56
106	1142	0.1206	20.31	79	8.35
107	1072	0.1104	20.51	82	8.29
108	1144	0.1260	20.70	86	8.31
109	985	0.1150	20.90	89	8.03
110	998	0.1165	21.10	93	8.05
111	931	0.1146	21.29	97	7.87
112	1033	0.1147	21.48	101	8.16
113	986	0.1172	21.67	104	8.02
114	936	0.1175	21.87	109	7.86
115	920	0.1219	22.07	113	7.77
116	886	0.1140	22.26	117	7.71
117	932	0.1153	22.45	121	7.87
118	883	0.1159	22.65	125	7.68
119	857	0.1155	22.84	130	7.58
120	838	0.1152	23.03	134	7.49

124	830	0.1097	23.82	153	7.50
125	828	0.1169	24.01	158	7.43
126	707	0.1291	24.21	163	6.38
127	737	0.1176	24.42	168	6.80
128	855	0.2907	24.76	177	6.65

Nuclide: Np-237
No.fract.:5
Cont.time:12 days
Backgr.: 697 cp10m
Meas.time:10 min

Samp.no.	cp10m	Weight	mm in	X^2 mm	LN C
1	630	0.1438	0.12	131	#NUM!
2	710	0.0849	0.30	127	5.02
3	716	0.0947	0.45	123	5.29
4	692	0.1017	0.61	120	#NUM!
5	639	0.1012	0.78	116	#NUM!
6	652	0.1107	0.95	113	#NUM!
7	690	0.1160	1.14	109	#NUM!
8	752	0.1038	1.32	105	6.27
9	663	0.1132	1.49	101	#NUM!
10	648	0.1120	1.68	98	#NUM!
11	741	0.1143	1.86	94	5.95
12	728	0.1226	2.06	90	5.53
13	678	0.1031	2.24	87	#NUM!
14	708	0.1309	2.43	83	4.42
15	684	0.1128	2.63	80	#NUM!
16	691	0.1101	2.82	76	#NUM!
17	705	0.1126	3.00	73	4.25
18	714	0.1151	3.18	70	4.99
19	696	0.1071	3.37	67	#NUM!
20	744	0.1140	3.55	64	6.02
21	801	0.1153	3.73	61	6.80
22	796	0.1156	3.92	58	6.75
23	808	0.1556	4.15	55	6.57
24	885	0.1040	4.36	52	7.50
25	902	0.1166	4.54	49	7.47
26	949	0.1172	4.73	47	7.67
27	990	0.1231	4.93	44	7.77
28	957	0.1162	5.12	41	7.71
29	982	0.1086	5.31	39	7.87
30	1044	0.1080	5.48	37	8.07
31	1131	0.1116	5.66	35	8.27
32	1105	0.1190	5.85	33	8.14
33	1224	0.1162	6.04	30	8.42
34	1266	0.1112	6.23	28	8.54
35	1313	0.1204	6.42	26	8.54
36	1377	0.1181	6.61	24	8.66
37	1378	0.1110	6.80	23	8.72
38	1546	0.1158	6.99	21	8.90
39	1666	0.1153	7.18	19	9.04
40	1650	0.1078	7.36	18	9.09
41	1955	0.1169	7.54	16	9.28
42	1956	0.1159	7.73	15	9.29
43	1922	0.1157	7.92	13	9.27
44	2031	0.1099	8.11	12	9.40
45	2096	0.1150	8.29	11	9.41
46	1469	0.1152	8.48	9	8.81
47	2406	0.1163	8.67	8	9.60
48	2663	0.1119	8.86	7	9.77
49	1953	0.1168	9.04	6	9.28
50	1990	0.1191	9.24	5	9.29
51	1736	0.1039	9.42	5	9.21
52	1954	0.1132	9.60	4	9.31
53	3104	0.1116	9.78	3	9.98
54	3385	0.1052	9.96	3	10.15

55	3614	0.1145	10.14	2	10.15
56	3736	0.1124	10.32	2	10.20
57	3944	0.1094	10.51	1	10.30
58	4234	0.1030	10.68	1	10.44
59	5824	0.1059	10.85	1	10.79
60	7967	0.0989	11.02	0	11.21
61	12456	0.0933	11.17	0	11.74
62	14377	0.0757	11.31	0	12.10
63	17448	0.0717	11.43	0	12.36
64	27329	0.0858	11.56	0	12.65
65	20022	0.1033	11.72	0	12.14
66	10841	0.1050	11.89	0	11.48
67	6624	0.1068	12.06	0	10.92
68	6316	0.1260	12.25	0	10.71
69	5121	0.1146	12.45	1	10.56
70	4764	0.1133	12.63	1	10.49
71	4462	0.1184	12.82	2	10.37
72	4793	0.1237	13.02	2	10.41
73	4483	0.1211	13.22	3	10.35
74	4210	0.1200	13.42	3	10.28
75	4182	0.1206	13.62	4	10.27
76	3459	0.1113	13.81	5	10.12
77	3846	0.1295	14.00	6	10.10
78	3418	0.1185	14.21	7	10.04
79	3312	0.1212	14.40	8	9.98
80	3207	0.1227	14.60	9	9.93
81	2772	0.1169	14.80	10	9.78
82	2662	0.1183	14.99	12	9.72
83	2532	0.1163	15.18	13	9.67
84	2347	0.1204	15.38	15	9.53
85	2068	0.1168	15.57	16	9.37
86	2113	0.1184	15.76	18	9.39
87	1985	0.1235	15.96	19	9.25
88	1791	0.1187	16.16	21	9.13
89	1804	0.1164	16.35	23	9.16
90	1668	0.1256	16.55	25	8.95
91	1442	0.1170	16.75	27	8.76
92	1395	0.1260	16.95	29	8.62
93	1249	0.1109	17.14	31	8.51
94	1251	0.1143	17.32	33	8.49
95	1160	0.1142	17.51	35	8.31
96	1132	0.1209	17.70	38	8.19
97	1078	0.1195	17.90	40	8.07
98	1017	0.1100	18.09	43	7.98
99	1024	0.1160	18.27	45	7.94
100	966	0.1279	18.47	48	7.65
101	938	0.1215	18.68	51	7.59
102	866	0.1190	18.87	53	7.26
103	810	0.1205	19.07	56	6.84
104	809	0.1293	19.27	60	6.76
105	822	0.1145	19.47	63	6.99
106	771	0.1145	19.66	66	6.47
107	775	0.1168	19.85	69	6.50
108	751	0.1134	20.04	72	6.16
109	754	0.1134	20.22	75	6.22
110	723	0.1190	20.41	78	5.38
111	744	0.1130	20.60	82	6.03
112	753	0.1126	20.79	85	6.21
113	693	0.1170	20.98	89	#NUM!
114	751	0.1185	21.17	92	6.12
115	677	0.1184	21.36	96	#NUM!
116	713	0.1203	21.56	100	4.88
117	642	0.1103	21.75	104	#NUM!
118	642	0.1074	21.93	107	#NUM!
119	753	0.1166	22.11	111	6.17
120	694	0.1122	22.30	115	#NUM!

124	643	0.1122	23.05	132	#NUM!
125	657	0.1158	23.24	136	#NUM!
126	672	0.1159	23.43	141	#NUM!
127	638	0.1150	23.62	145	#NUM!

Nuclide: U-233
No.fract.:1
Cont.time:81 days
Backgr.: 648 cp10m
Meas.time:10 min

Samp.no.	cp10m	Weight	mm in	X^2 mm	LN C
1	643	0.1595	0.12	219	#NUM!
2	671	0.1022	0.32	213	5.43
3	613	0.9680	1.15	190	#NUM!
4	667	0.1162	1.98	167	5.12
5	662	0.1096	2.16	163	4.88
6	611	0.1109	2.33	159	#NUM!
7	646	0.1168	2.50	154	#NUM!
8	668	0.1114	2.68	150	5.21
9	659	0.1242	2.86	145	4.52
10	658	0.1036	3.04	141	4.61
11	686	0.1200	3.21	137	5.77
12	642	0.1184	3.39	133	#NUM!
13	650	0.1206	3.58	129	2.98
14	691	0.1190	3.76	125	5.90
15	719	0.1171	3.94	121	6.41
16	724	0.1162	4.12	117	6.49
17	733	0.1116	4.30	113	6.64
18	783	0.1204	4.48	109	7.02
19	747	0.1224	4.66	105	6.70
20	762	0.1139	4.84	102	6.91
21	756	0.1124	5.02	98	6.87
22	857	0.1250	5.20	94	7.42
23	823	0.1199	5.39	91	7.29
24	861	0.1197	5.57	87	7.49
25	875	0.1181	5.76	84	7.56
26	932	0.1185	5.94	81	7.78
27	992	0.1166	6.12	77	7.99
28	1040	0.1194	6.30	74	8.10
29	1099	0.1165	6.48	71	8.26
30	1097	0.1123	6.66	68	8.29
31	1109	0.1166	6.84	65	8.28
32	1196	0.1178	7.02	62	8.45
33	1239	0.1256	7.20	60	8.46
34	1147	0.1159	7.39	57	8.37
35	1163	0.1144	7.57	54	8.41
36	1247	0.1196	7.75	51	8.52
37	1281	0.1160	7.93	49	8.61
38	1297	0.1148	8.11	46	8.64
39	1433	0.1202	8.29	44	8.78
40	1364	0.1093	8.47	42	8.79
41	1572	0.1227	8.64	39	8.93
42	1554	0.1139	8.83	37	8.98
43	1882	0.1137	9.00	35	9.29
44	1542	0.1235	9.18	33	8.89
45	1565	0.1107	9.36	31	9.02
46	1676	0.1205	9.54	29	9.05
47	1764	0.1241	9.73	27	9.10
48	1560	0.1083	9.91	25	9.04
49	1805	0.1254	10.09	23	9.13
50	1809	0.1102	10.27	22	9.26
51	1759	0.1181	10.45	20	9.15
52	2073	0.1224	10.63	18	9.36
53	2003	0.1122	10.81	17	9.40
54	2141	0.1220	10.99	15	9.41

55	2066	0.1106	11.17	14	9.46
56	2419	0.1332	11.36	13	9.50
57	2082	0.1090	11.55	11	9.48
58	2215	0.1100	11.72	10	9.56
59	2289	0.1211	11.89	9	9.51
60	2278	0.1110	12.07	8	9.59
61	2454	0.1164	12.25	7	9.65
62	2531	0.1220	12.43	6	9.64
63	2411	0.1084	12.61	5	9.70
64	2553	0.1191	12.78	5	9.68
65	2612	0.1177	12.97	4	9.72
66	2537	0.1180	13.15	3	9.68
67	2503	0.1130	13.33	3	9.71
68	2544	0.1153	13.50	2	9.71
69	2538	0.1190	13.68	2	9.67
70	2266	0.1027	13.85	1	9.67
71	2474	0.1231	14.03	1	9.60
72	2515	0.1037	14.20	1	9.80
73	2841	0.1056	14.36	0	9.94
74	3468	0.1068	14.53	0	10.18
75	4472	0.0962	14.68	0	10.59
76	3975	0.0674	14.81	0	10.81
77	6477	0.0841	14.92	0	11.15
78	6490	0.0874	15.06	0	11.11
79	4959	0.1089	15.21	0	10.59
80	3645	0.1096	15.38	0	10.22
81	2849	0.1203	15.55	0	9.81
82	2574	0.1145	15.73	1	9.73
83	2652	0.1234	15.92	1	9.70
84	2633	0.1272	16.11	1	9.66
85	2546	0.1242	16.30	2	9.63
86	2266	0.1138	16.49	2	9.56
87	2401	0.1187	16.67	3	9.60
88	2304	0.1229	16.85	4	9.51
89	2311	0.1250	17.04	5	9.50
90	2226	0.1163	17.23	5	9.52
91	2355	0.1273	17.42	6	9.50
92	2227	0.1180	17.61	7	9.50
93	2073	0.1233	17.79	8	9.36
94	2232	0.1346	17.99	9	9.37
95	2111	0.1124	18.18	11	9.47
96	2169	0.1195	18.36	12	9.45
97	2308	0.1352	18.55	13	9.42
98	1907	0.1133	18.75	15	9.32
99	2020	0.1235	18.93	16	9.32
100	1834	0.1130	19.11	18	9.26
101	1997	0.1275	19.30	19	9.27
102	1946	0.1268	19.49	21	9.23
103	1815	0.1224	19.68	23	9.16
104	1762	0.1197	19.87	25	9.14
105	1703	0.1272	20.06	26	9.02
106	1770	0.1291	20.26	28	9.07
107	1543	0.1151	20.45	31	8.96
108	1396	0.1312	20.64	33	8.65
109	1463	0.1212	20.83	35	8.81
110	1332	0.1177	21.01	37	8.67
111	1302	0.1291	21.20	39	8.53
112	1249	0.1270	21.40	42	8.46
113	1184	0.1108	21.58	44	8.48
114	1210	0.1203	21.76	47	8.45
115	1115	0.1276	21.95	49	8.21
116	1005	0.1292	22.15	52	7.93
117	1000	0.1275	22.35	55	7.92
118	950	0.1172	22.54	58	7.86
119	948	0.1269	22.73	61	7.77
120	902	0.1193	22.91	64	7.66

124	849	0.1135	23.65	76	7.48
125	757	0.1178	23.83	79	6.83
126	736	0.1228	24.01	83	6.58
127	738	0.1255	24.21	86	6.58
128	725	0.1513	24.42	90	6.24
129	880	0.3014	24.77	97	6.65

Nuclide: U-233
No.fract.:5
Cont.time:45 days
Backgr.: 707 cp10m
Meas.time:10 min

Samp.no.	cp10m	Weight	mm in	X^2 mm	LN C
1	786	0.2032	0.16	208	5.96
2	735	0.0984	0.40	201	5.65
3	730	0.0901	0.55	197	5.54
4	698	0.1077	0.71	192	#NUM!
5	689	0.1025	0.88	188	#NUM!
6	692	0.1095	1.04	183	#NUM!
7	689	0.1073	1.22	178	#NUM!
8	672	0.1157	1.39	174	#NUM!
9	694	0.1082	1.57	169	#NUM!
10	680	0.1154	1.75	164	#NUM!
11	705	0.1088	1.93	160	#NUM!
12	719	0.1075	2.10	155	4.72
13	667	0.1090	2.27	151	#NUM!
14	714	0.1133	2.45	147	4.12
15	652	0.1160	2.63	143	#NUM!
16	678	0.1215	2.82	138	#NUM!
17	725	0.1044	3.00	134	5.15
18	630	0.1228	3.18	130	#NUM!
19	678	0.1027	3.36	126	#NUM!
20	755	0.1180	3.54	122	6.01
21	755	0.1241	3.73	118	5.96
22	719	0.0961	3.90	114	4.83
23	690	0.1161	4.07	110	#NUM!
24	725	0.1069	4.25	106	5.13
25	704	0.1128	4.43	103	#NUM!
26	688	0.1132	4.61	99	#NUM!
27	700	0.1110	4.78	96	#NUM!
28	756	0.1182	4.97	92	6.03
29	678	0.1120	5.15	89	#NUM!
30	754	0.1244	5.34	85	5.93
31	742	0.1175	5.53	82	5.70
32	746	0.1152	5.72	78	5.82
33	723	0.1242	5.91	75	4.86
34	711	0.1065	6.09	72	3.63
35	824	0.1252	6.27	69	6.84
36	827	0.1243	6.47	66	6.87
37	722	0.1012	6.65	63	5.00
38	830	0.1271	6.83	60	6.87
39	757	0.1189	7.03	57	6.04
40	857	0.1120	7.21	54	7.20
41	901	0.1223	7.40	51	7.37
42	814	0.1136	7.59	49	6.85
43	903	0.1123	7.77	46	7.46
44	867	0.1176	7.95	44	7.22
45	913	0.1218	8.14	41	7.43
46	848	0.1022	8.32	39	7.23
47	1005	0.1359	8.51	37	7.69
48	1002	0.1319	8.72	34	7.71
49	978	0.1253	8.92	32	7.68
50	1050	0.1107	9.11	30	8.04
51	1015	0.1215	9.30	28	7.84
52	1031	0.1143	9.48	26	7.95
53	1090	0.1135	9.67	24	8.12
54	1060	0.1191	9.85	22	7.99

55	1240	0.1193	10.04	21	8.40
56	1262	0.1188	10.23	19	8.45
57	1201	0.1165	10.42	17	8.35
58	1358	0.1300	10.61	16	8.52
59	1360	0.1177	10.81	14	8.62
60	1419	0.1160	11.00	13	8.72
61	1480	0.1258	11.19	11	8.72
62	1494	0.1184	11.38	10	8.80
63	1449	0.1075	11.56	9	8.84
64	1524	0.1248	11.75	8	8.79
65	1607	0.1206	11.94	7	8.92
66	1668	0.1238	12.14	6	8.96
67	1689	0.1140	12.33	5	9.06
68	1632	0.1172	12.51	4	8.97
69	1812	0.1231	12.70	3	9.10
70	1797	0.1232	12.90	3	9.09
71	1873	0.1218	13.09	2	9.17
72	1984	0.1097	13.28	2	9.36
73	2225	0.1195	13.46	1	9.45
74	2418	0.1140	13.64	1	9.62
75	2949	0.1309	13.84	1	9.75
76	2342	0.1001	14.02	0	9.70
77	2802	0.0893	14.17	0	10.06
78	3547	0.0847	14.31	0	10.42
79	3978	0.0753	14.44	0	10.68
80	8513	0.0912	14.57	0	11.36
81	7492	0.1357	14.75	0	10.82
82	2801	0.1157	14.95	0	9.80
83	3242	0.1262	15.14	0	9.91
84	2880	0.1139	15.34	1	9.86
85	2927	0.1174	15.52	1	9.85
86	2830	0.1188	15.71	1	9.79
87	2594	0.1062	15.89	2	9.79
88	3002	0.1281	16.07	2	9.79
89	2672	0.1134	16.27	3	9.76
90	2873	0.1202	16.45	4	9.80
91	2840	0.1150	16.64	4	9.83
92	2796	0.1207	16.83	5	9.76
93	2606	0.1086	17.01	6	9.77
94	2798	0.1194	17.19	7	9.77
95	2767	0.1303	17.39	8	9.67
96	2908	0.1210	17.59	9	9.81
97	2549	0.1145	17.78	10	9.69
98	2608	0.1182	17.96	11	9.69
99	2718	0.1230	18.15	13	9.70
100	2584	0.1173	18.34	14	9.68
101	2755	0.1251	18.54	16	9.70
102	2500	0.1132	18.73	17	9.67
103	2426	0.1143	18.91	19	9.62
104	2506	0.1183	19.09	20	9.63
105	2404	0.1232	19.28	22	9.53
106	2374	0.1212	19.48	24	9.53
107	2156	0.1147	19.67	26	9.44
108	2338	0.1256	19.86	28	9.47
109	2195	0.1193	20.05	30	9.43
110	2252	0.1326	20.25	32	9.36
111	2128	0.1201	20.45	35	9.38
112	2102	0.1263	20.65	37	9.31
113	1937	0.1198	20.85	39	9.24
114	1739	0.1122	21.03	42	9.13
115	2041	0.1296	21.22	44	9.24
116	1868	0.1171	21.42	47	9.20
117	1921	0.1145	21.60	49	9.27
118	1856	0.1258	21.79	52	9.12
119	1728	0.1204	21.99	55	9.05
120	1830	0.1306	22.19	58	9.06

124	1537	0.1095	22.92	70	8.93
125	2567	0.2480	23.21	75	8.92
126	2108	0.2355	23.59	81	8.69
127	3351	0.7674	24.39	96	8.14

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Conny Holmqvist, Hans-Edy Mårtensson
Seismological Department, Uppsala University, Uppsala
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Kemakta Consultants Co, Stockholm
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Department of Chemical Engineering, Royal Institute of Technology, Stockholm, Sweden

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Luis Moreno, Ivars Neretnieks
Department of Chemical Engineering, Royal Institute of Technology, Stockholm, Sweden

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[1] The Royal Institute of Technology, Department of Chemical Engineering, Stockholm
[2] Studsvik Nuclear, Nyköping
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Swedish National Defence Research Establishment
Materials department, Stockholm
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Jan-Erik Andersson[1], Lennart Lindqvist[2]
[1] Swedish Geological Co, Uppsala
[2] EMX-system AB, Luleå
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Hanh-Meitner-Institut, Berlin
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Lars O Werme[1], Roy S Forsyth[2]
[1] SKB, Stockholm
[2] Studsvik AB, Nyköping
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[1] Abem AB, Uppsala, Sweden
[2] Bergab, Göteborg
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Editors: **K. Ahlbom, J.A.T. Smellie, Swedish Geological Co, Uppsala**
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K. Ahlbom and J.A.T. Smellie. Swedish Geological Company, Uppsala, Sweden.
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J-E. Andersson[1], L. Ekman[1], R. Nordqvist[1] and A. Winberg[2]
[1] Swedish Geological Company, Uppsala, Sweden
[2] Swedish Geological Company, Göteborg, Sweden
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[1] Swedish Geological Company, Uppsala, Sweden
[2] Swedish Nuclear Fuel and Waste Management Company, Stockholm, Sweden
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Hans Carlsson[1], Leif Carlsson[1], Roland Pusch[2]
[1] Swedish Geological Co, SGAB, Gothenburg, Sweden
[2] Clay Technology AB, Lund, Sweden
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