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A COMPILATION OF SORPTION COEFFICIENTS FOR RADIONUCLIDES ON GRANITES AND GRANITIC ROCKS

by

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ABSTRACT

Radionuclide sorption coefficients, or partition ratios, for granites and granitic rocks, obtained experimentally in our laboratory and from the literature, have been tabulated and critically evaluated.

Sorption coefficients are defined as:

$$k_a \text{ (in cm)} = \frac{\text{activity sorbed/cm}^2 \text{ surface area}}{\text{activity in solution/mL of solution}}$$

when determined on machined or fracture surfaces, and as:

$$k_d \text{ (in mL/g)} = \frac{\text{activity sorbed/gram of material}}{\text{activity in solution/mL of solution}}$$

when particulate material is used.

The relationship between k_d and k_a and parameters affecting sorption coefficients are discussed.

Because of the wide spread in reported sorption coefficients for many radionuclides, ranges and "recommended" values for use in assessments are given.

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COMPILATION DES COEFFICIENTS D'ADSORPTION DES RADIONUCLEIDES POUR LES GRANITES ET LES ROCHES GRANITIQUES

par

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RESUME

Les coefficients d'adsorption ou les taux de séparation des radionucléides pour les granites et les roches granitiques obtenus au cours d'expériences en laboratoire ou à partir des données existantes, ont été tabulés et soumis à une évaluation critique.

Les coefficients d'adsorption correspondent à:

$$k_a \text{ (en cm)} = \frac{\text{activité adsorbée/cm}^2 \text{ de surface}}{\text{activité dans la solution/mL de solution}}$$

s'ils sont établis sur des surface usinées ou de fracture; ils correspondent à:

$$k_d \text{ (en mL/g)} = \frac{\text{activité adsorbée/gramme de matière}}{\text{activité dans la solution/mL de solution}}$$

si l'on se sert d'un matériau particulaire.

L'auteur traite du rapport entre k_d et k_a et des paramètres affectant les coefficients d'adsorption.

Etant donné le grand écart existant entre les coefficients d'adsorption cités pour bien des radionucléides, des gammes et des valeurs "recommendées" pour utilisation aux fins d'évaluation sont données.

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1. INTRODUCTION

Environmental assessments of nuclear fuel waste disposal methods must consider the possibility that groundwater will eventually enter the vault, corrode the waste container, and dissolve some or all of the waste material. The extent of radionuclide transport to the biosphere, and the rate at which this will occur, must be considered.

The effective velocity at which a radionuclide moves through a fractured or porous medium, depends on the rate of groundwater flow and on the affinity of that particular radionuclide for the solid surface in contact with the groundwater. If the radionuclide has no affinity for the surface, it will move at the same velocity as the groundwater. However, if it has a high affinity and is sorbed, it will be removed - at least temporarily - from the groundwater and its velocity will be equal to zero during the time it remains sorbed. When it is desorbed, its velocity will again, equal that of the groundwater, but its movement relative to that of the groundwater will have been retarded.

The retardation of a radionuclide in a flowing system can be determined by techniques analogous to chromatography, where the difference between the transfer time of the transport medium (i.e., the groundwater) and of the radionuclide is measured. This technique is only practical when the retardation is not too great and transfer times for the radionuclides are not too long. However, the long-term nature of these experiments makes it difficult to study the effect of various parameters such as groundwater composition. Further, hydraulic parameters such as diffusion and dispersion are often difficult to quantify and may affect the movement of the radionuclide through the system.

It is usually simpler and more rapid to determine the distribution ratio of a radionuclide between an aqueous solution and sorbing surfaces under static conditions, and to determine the effects of various

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parameters on this ratio. From this distribution ratio - which is commonly called the radionuclide sorption coefficient - the degree of retardation of a radionuclide in a flowing system can be estimated in some cases.

2. DETERMINATION OF SORPTION COEFFICIENTS

Most sorption coefficients for geological material are obtained experimentally by equilibrating the material with a radionuclide-containing aqueous solution for a specified period of time. Sorption of the radionuclide on the geological material is usually determined by measuring the decrease in the radionuclide concentration (i.e., activity in the solution) over this period of time. Corrections for removal of the radionuclides from solution by processes other than sorption on the geological surface - either by sorption on the walls of the container or by precipitation or colloid formation - may or may not be made, depending on the sophistication of the experimental approach.

Sorption coefficients can be determined during the desorption as well as during the sorption step. In the desorption step the geological material with the sorbed radionuclide is contacted with a solution containing no radionuclide, and the degree of desorption determined from the increase in the activity of the solution.

The coefficients obtained during the sorption and desorption steps are not necessarily the same. Irreversible processes such as precipitation and incorporation of radionuclides into the crystal lattice of the minerals during the "sorption" step may make new nuclides unavailable for subsequent desorption.

When particulate matter, such as crushed and sieved rocks or minerals, is used in the sorption experiments, the sorption coefficient

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is usually called k_d, and is defined as:

$$k_d \text{ (in mL/g)} = \frac{\text{activity sorbed/gram material}}{\text{activity in solution/mL solution}}$$

This coefficient does not include a surface area term and is thus not directly applicable to fracture surfaces of the type that may be expected to form in a hard rock body. In that case, it is advisable to determine the sorption coefficient directly on machined or fracture surfaces, and to define this sorption coefficient:

$$k_a \text{ (in cm)} = \frac{\text{activity sorbed/cm}^2\text{ surface}}{\text{activity in solution/mL solution}}$$

where the surface area is normally taken to mean the geometrical surface area, i.e., the roughness factor is considered to be unity.

3. RELATIONSHIP BETWEEN k_a AND k_d

k_a and k_d are theoretically related through a specific surface area term, SSA, defined as the surface area per gram of particulate material:

$$k_a = k_d/\text{SSA}$$

This relationship holds when the particulate material has the same chemical and mineral composition as the bulk rock. However, fracturing and sieving steps tend to concentrate certain minerals, such as magnetite and illite, in fractions with smaller particle size. As a result, the various size fractions cease to be representative of the bulk rock, and a valid comparison between k_a and k_d becomes highly questionable, even if the specific surface area is known.

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4. DETERMINATION OF SURFACE AREAS

Surface areas can be determined by a number of methods. The B.E.T.* method[1] is based on nitrogen physisorbed on a surface at 77 K. It is widely used to determine surface areas greater than 0.1 to 1 m^2/g. When krypton is used instead of nitrogen, the limit of detection is somewhat lower. The ethylene glycol (EG) method[2] involves equilibrating the sample with an anhydrous calcium chloride - ethylene glycol solvate, until a monolayer of EG remains sorbed on the surface. Phyllosilicates such as micas and clays, which swell in aqueous media, present a higher surface area to the ethylene glycol sorbate than to nitrogen and, consequently, surface areas obtained by this method tend to be higher - and more realistic - than those obtained using the B.E.T. method.

Both techniques are of marginal use for the crushed and sieved rock particles commonly used in radionuclide sorption studies because of their poor sensitivity for low surface areas. A third technique, using methylene blue as a sorbate in aqueous systems[3] is showing more promise. Its use for low surface areas is being investigated by A. Baweja of Environment Canada.

In principle, surface areas can be calculated from the geometrical shape of the rock particles. If one assumes spherical particles, with no micropores or microcracks, the specific surface area is given by the equation:

$$SSA = \frac{6}{d\rho}\ cm^2/g$$

where d = particle diameter in cm

ρ = particle density in g/cm^3.

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* Brunauer, Emmett, Teller

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Thus, a particle with a diameter of 150 μm (0.015 cm) would have a specific surface area of 151 cm^2/g.

The different methods give widely ranging results, as shown in Table 1. Measured surface areas[4] for Climax Stock granite used at the Los Alamos Scientific Laboratory (LASL) are orders of magnitude greater than those calculated using the above equation.

This is not an isolated case, and should not be construed as casting doubt on the LASL results. It is simply indicative of the problems occurring in sorption studies. It is likely that the granite surface in an ethylene glycol/water medium is very much different from that in nitrogen at 77 K, and both sets of experimental results suggest that to assume that crushed rock consists of hard spherical particles gives erroneous results.

At the Whiteshell Nuclear Research Establishment (WNRE), machined rock surfaces are used when possible and sorption coefficients are expressed as k_a, in units of cm. The results are based on the geometrical surface area, i.e., no allowance is made for surface roughness or for the possible presence of micropores or microfractures in the rock. Some work has been done to compare the sorptive capacity of a machined rock surface to that of a fresh fracture with a known projected surface area. For ^{90}Sr and ^{137}Cs the sorptive capacity of the fresh fractures was about five times that of a machined surface of the same geometrical area. It appears possible, therefore, to relate sorption coefficients obtained on machined surfaces to actual rock fractures, providing of course that the mineral composition in the fracture has not been altered by weathering.

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5. EFFECTS OF VARIOUS PARAMETERS ON SORPTION COEFFICIENTS

In addition to the vagaries in sorption coefficient measurements for particulate material introduced by uncertainties in surface area measurements and by the possible segregation of certain minerals during the crushing and sieving steps, there are a number of parameters that may affect the experimentally obtained sorption coefficients on both bulk rock and particulate material. They fall into a number of categories, which are discussed below.

5.1 CHEMICAL AND MINERAL COMPOSITION OF THE GEOLOGICAL MATERIAL

Geochemical terms such as "granite", "gabbro", etc., cover a relatively wide range of mineral compositions (Figure 1) and a particular granite can thus not be construed *a priori* to be representative of all granites. This is especially the case when sorption takes place primarily on accessory minerals. Similarly, many minerals form series exhibiting a wide range of chemical composition. For example, the plagioclase feldspars - one of the most common rock forming minerals - exist as a solid solution series ranging from pure albite ($NaAlSi_3O_8$) through anorthite ($CaAl_2Si_2O_8$). In the pyroxene group a solid solution series of enstatite ($MgSiO_3$) - hypersthene ($(MgFe)SiO_3$) - ferrosilite ($FeSiO_3$) exists, each with a potentially different sorptive behaviour towards radionuclides in solution. It is thus important that both the chemical and mineral composition of the geological material be fully documented.

5.2 PHYSICAL CHARACTERISTICS OF THE GEOLOGICAL MATERIAL

The main physical characteristics that may affect the sorption coefficient are porosity and pore size distribution of whole rock[5], and particle size distribution of crushed material. A porous rock sample will have a much higher accessible surface area than a "tight" rock,

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and diffusion of a radionuclide into the rock body will be correspondly of greater importance. However, porosity alone is not enough: the pore size must be large enough to allow ions to diffuse into them.

Particle size distribution of crushed material is important, as it determines the effective surface area of the material. Dry sieving after crushing into a narrow range of particle sizes is not enough as very small particles often adhere to larger ones and are only removed by thorough washing. Thus, wet sieving is the only acceptable procedure to isolate particulate material of a certain size fraction, and should be followed by a particle size distribution analysis to describe the material properly.

5.3 COMPOSITION OF THE AQUEOUS SOLUTION

The composition of the solution containing the radionuclide may dramatically affect the degree of radionuclide sorption. In cases where sorption occurs via a cation exchange or cation substitution mechanism, the presence of competing cations will depress the sorption of the radionuclide. For example, ^{90}Sr sorption is depressed in the presence of alkali and alkaline earth cations, ^{137}Cs sorption is decreased by Rb^+ and Cs^+ ions but not by Na^+ unless large amounts (> 0.1 mol/L) are present. The concentration of the radionuclide itself in solution has an effect on the sorption coefficient: where competition for sorption sites exists, the sorption coefficient decreases with increasing radionuclide concentration. For radionuclides with a low solubility, precipitation may occur where the radionuclide-containing solution is brought into contact with the geological material. This decrease in radionuclide concentration due to precipitation may then be assigned erroneously to sorption and an unrealistically high sorption coefficient obtained.

For multivalent radionuclides, the compositon of the aqueous solution may dictate the oxidation state of the radionuclide and this

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will affect the extent of sorption: higher oxidation states favour the formation of anionic - and hence poorly sorbed - species.

Thus, the composition of the aqueous solution must also be documented fully, preferably at the end of the equilibration period as well as at the beginning. It is recognized that the former may present difficulties, as facilities for wet chemical analysis on radioactive solutions may not be readily available.

5.4 TIME

The term "sorption coefficient" implies that an equilibrium has been reached in the partitioning of the radionuclide between the solid and liquid phases, and implies that the solid phase is also in equilibrium with the aqueous phase. This is not necessarily the case in the experimental determination of sorption coefficients: the reaction between the geological material and the aqueous solution is slow and has most likely not reached a steady state after the limited time over which sorption is determined[6]. Alteration of the surface affects the number and nature of the sorption sites and has thus an effect on the sorption coefficient.

The presence of microcracks and micropores in the geological material may lead to diffusion of the radionuclide into these confined areas. This is also a time-dependent process, and its effect on measurements will depend on the number and the dimensions of these pores and fractures[7].

5.5 EXPERIMENTAL PROCEDURES

The experimental procedures used in the determination of sorption coefficients may affect the results. If the mixture of geological material and the aqueous solution is not agitated, concentration gradients may form in the solution and deplete the radionuclide in solution

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close to the sorbing surfaces. Vigorous agitation, on the other hand, must be avoided (especially with particulate matter) as attrition may occur. This could increase the surface area of the material and present fresh sorbing areas to the solution, resulting in sorption coefficients up to an order of magnitude higher than obtained under more quiescent conditions[8].

Radionuclide sorption on the walls of the containers was mentioned earlier. It is not sufficient to include a "blank" in the experiment, as the degree of sorption in the container walls may be affected by the presence of geological material in the container[9]. The actual amount of radionuclide sorbed on the container walls in the presence of the rock must be measured.

Colloid formation in solution may affect the concentration of the radionuclides in solution, and centrifuging or filtration may have to be used to distinguish between colloids and ionic species[10].

6. DATA COMPILATION

Because of the potentially significant effects of the various parameters on the sorption coefficients, as described in the previous section, they should be reported together. Therefore, a data bank for sorption coefficients on granites and granitic rocks has been set up at WNRE, based on a model suggested by Battelle's Pacific Northwest Laboratory[11]. Details of the data bank are described in a report by Nuernberger et al.[12], which also contains a user's guide.

The data bank stores the following information:

1. Geological material

Chemical composition	major elements
	minor elements

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	Mineral composition	
	Rock properties	Cation and anion exchange capacities, including ions used and pH at which measurement was made.
		Surface area, method used
		Carbonates
		Hydrous oxides
2.	Aqueous phase	Cation and anion concentrations at the beginning and at the end of the equilibration period
		pH and Eh at the beginning and at the end of the equilibration period
3.	Experimental details	Method used
		State of geological material
		Solid/liquid ratio
		Temperature
		Equilibrating atmosphere
		Procedure used to separate liquid from solid after equilibrating
		Phase analyzed
		Combination of radionuclides used, if any
4.	Reference	
5.	For each radionuclide	Contact time
		Initial and final concentration

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Sorption coefficient obtained in the 'forward' (sorption) or 'reverse' (desorption) direction with percentage error at the 1σ level in brackets

Appendix A contains the data presently available for radionuclide sorption on granites and granitic rocks. It will be updated periodically as new information becomes available.

The sorption coefficients for a particular nuclide can be extracted and tabulated separately. This is done for all nuclides in Appendix B. It will also be updated periodically.

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7. CRITICAL EVALUATION OF SORPTION COEFFICIENTS

Practically all sorption coefficients reported for the individual radionuclides cover a wide range of values. Reasons for this include:

1. The geological material used by the various experiments is usually obtained from different sources and is by nature not homogeneous.

2. The procedures used to determine sorption coefficients differ between the various laboratories and are often still in a stage of development.

3. The effect of various parameters on the sorption coefficient can be large, as was pointed out in Section 5, above, and may account for much of the spread in sorption coefficient values.

There is good communication among workers in this field. The U.S. WISAP* staff organized an international two-phase round robin program[13] which has already[14] shown that, even with a prescribed procedure and with standard samples supplied from the same source, large variations in sorption coefficients are obtained. Work is now underway to determine the cause of these variations.

We expect to see improved agreement as time goes on. In the meantime, based on the quality of the reported data and on a general knowledge of the chemistry involved, a range of sorption coefficients and "recommended" (most reasonable) values can be suggested. It is emphasized that the range of values and the "recommended values" given here are tentative, and subject to revision.

Appendix C lists the recommended ranges and "best" values for sorption coefficients by increasing atomic numbers. These are dated and will also be updated as appropriate.

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* Waste Isolation Safety Assessment Program, now WRIT (Waste/Rock Interactions Technology).

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TABLE 1

COMPARISON BETWEEN CALCULATED AND MEASURED[4] SURFACE AREAS

Sample	Range of Particle Size (μm)	Median (μm)	Surface Area m^2/g^1			Ratio $\frac{BET}{Calc}$	Ratio $\frac{EG}{Calc}$	Ratio $\frac{EG}{BET}$
			Calculated*	BET++	EG**			
CS5	106-210	132	0.017	0.95	8.0	56	470	8.4
CS5	180-500	300	0.008	0.16	4.0	20	500	25
CS5	425-1000	688	0.003	0.10	7.0+	33	-	-
CS7	106-250	133	0.017	0.80	9.0	47	530	11
CS7	180-500	293	0.008	0.16	3.3	20	410	21
CS7	425-1000	690	0.003	0.12	3.0	40	1000	25

* Based on median particle size, $\rho = 2.65\ g/cm^3$.

** Ethylene glycol.

\+ Most likely in error.

++ Brunauer, Emmett, Teller.

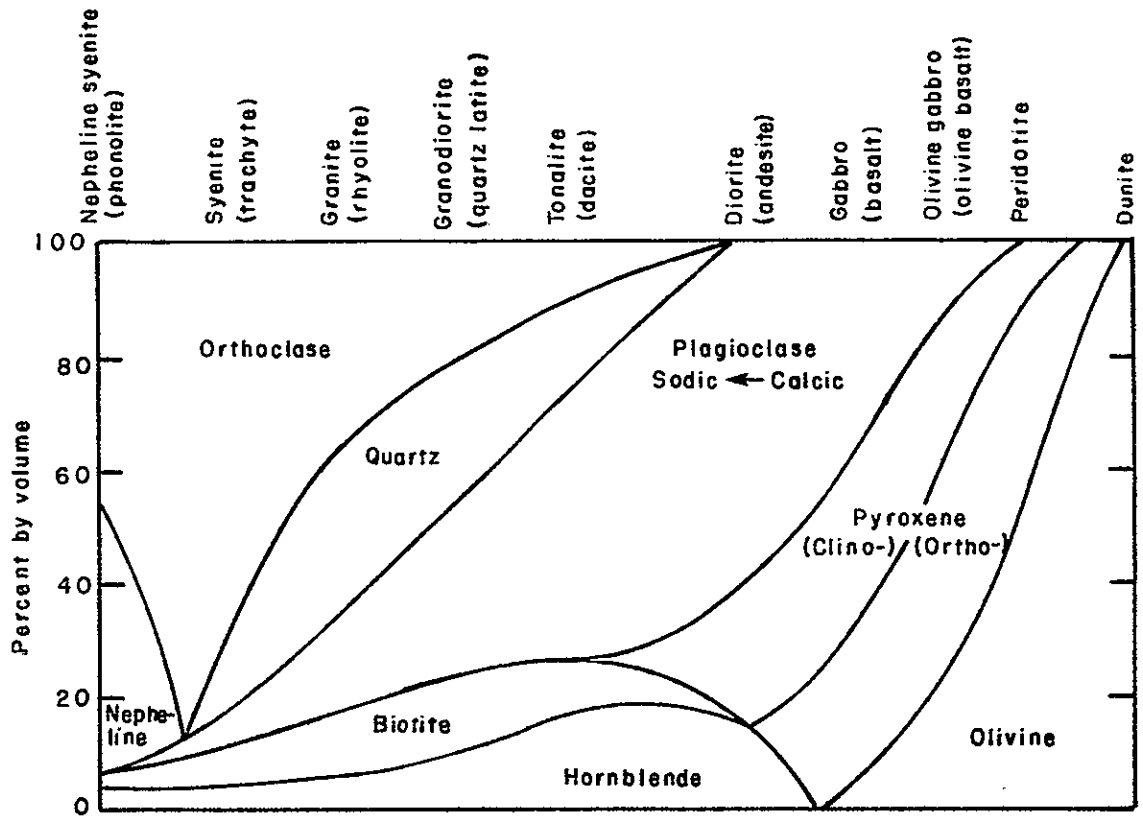

FIGURE 1: Range of Mineral Compositions of Major Rock Types from H.W. Kirby, Geochemistry of the Naturally Occurring Radioactive Series, Mound Laboratory, Miamisburg, Ohio, Report MLM 2111, p. 26 (1974).

APPENDIX A

COMPILATION OF RADIONUCLIDE SORPTION DATA

LIST OF ABBREVIATIONS USED

Geological Material

PPM	Parts per million or μg/g.

Rock Properties

CEC	Cation exchange capacity.
AEC	Anion exchange capacity.
ME/100G	Milliequivalents per 100 grams.
BET	Surface area determination using a procedure developed by Brunauer, Emmett, and Teller (see Section 4).
EG	Surface area determination using ethylene glycol.

Experimental Details

BATCH	Static experiment.
COLUMN	Column or dynamic experiment.
NW	N cold washes i.e., number of contact periods using non-radioactive solutions.
BC	Blank corrected i.e., corrections made for vial wall sorption.
STATE	Physical state of the geological material.
RATIO	Solid-to-liquid ratio for static experiments or pore volume (PV) and flow velocity for dynamic experiments.

ATM	Atmosphere in contact with mixture.
SEP'N	Procedure used to separate liquid from solid after equilibration, e.g., GRAVITY (i.e., settling) CEN (XXG, YYM): centrifuge at XXG for YY minutes, or FIL(0.4) filtered through 0.4 μm filter.
ANAL	Analysis of specifed material: L: liquid W: wall, S: solid.
COMB	Combination of radionuclides used.

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Sorption Results

TIME (D)	Contact time in degrees.
INITIAL [RN] (M/L)	Initial radionuclide concentration in moles per litre.
FINAL [RN] (M/L)	Radionuclide concentration at time of analysis.
KAS, KDS	k_a, k_d as defined in the text (section 2) in the forward (sorption) direction.
KAD, KDD	k_a, k_d in the reverse (desorption) direction. The experimental notation is used for k_a, k_d, i.e., 2.2×10^3 is expressed as 2.2E + 3. The relative error at the 1σ level is given in brackets behind k_a or k_d.

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 1
NAME : GRANITE (WEATHERED ROCK SURF.) 31A
ORIGIN : GOETHEBORG, SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :COUPONS - 31 CM-2 GSA
RATIO :
TEMP. :25 C
ATM. :AIR
SEP'N. :NONE
ANAL. :L
COMB. :NONE

REFERENCES : 1) B. ALLARD ET.AL
CHALMERS INST. TECH.
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 1

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KAS	KAD
AM 241	.5			7.9E+0(--)	
	1			5.0E+0(--)	
	1				1.1E+2(--)
CS 134	.5			6.3E+0(--)	
	1			5.0E+0(--)	
	1				2.0E+1(--)
SR 89	.5			3.2E-1(--)	
	1			2.0E-1(--)	
	1				2.0E-1(--)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 2
NAME : GRANITE USWISAP RR-1-1A
ORIGIN : CLIMAX STOCK (L.D.RAMPSPOTT LLL)

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	
SIO2	68.41	ANDESINE	47
AL2O3	16.35	QUARTZ	28
TIO2	.37	MICROCLINE	15
FE2O3	0	BIOTITE	10
FEO	2.45	APATITE	
MNO	.06	HEMATITE	
MGO	1.05	MAGNETITE	
CAO	3.72	SPHENE	
NA2O	3.55	HASTINGSITE	
K2O	3.91		
P2O5	.1		
CO2	0		
H2O	0		
TOTAL	99.97		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G) 0.85
@ PH
CATION SR

SURFACE AREA (M2/G) 0.08 349
METHOD BET EG

AQUEOUS PHASE

	START	END
PH(LOG)	6.9	7.9
NA	8.3	
K	3.5	
CA	13	
MG	3.9	
HCO3	61.6	
CL	5	
SO4	8.6	
F	.2	
NO3	.6	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :CRUSHED,-20+50 MESH
RATIO :1 G/ 10 ML
TEMP. :23 C
ATM. :AIR
SEP'N. :GRAVITY
ANAL. :L
COMB. :NONE

REFERENCES :
1) L.L. AMES
PNL-2797
2) T.T. VANDERGRAAF
WNRE
PR-WWM-1, P 79-84

SORPTION RESULTS

FOR MATERIAL NUMBER--- 2

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	14			6.6E+2(1.4)	
	28			5.8E+2(2.2)	
	14				1.6E+2(6.1)
	28				1.4E+2(21)
PU 237	14			1.9E+2(28)	
	28			3.6E+2(26)	
	14				9.4E+2(1.4)
	28				5.3E+2(22)
SR 90	14			1.1E+1(27)	
	28			1.1E+1(28)	
	14				2.1E+1(24)
	28				2.0E+1(19)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 3
NAME : GRANITE USWISAP RR-1-13
ORIGIN : CLIMAX STOCK(L.O.RAMPSPOTT LLL)

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	
SIO2	68.41	ANDESINE	47
AL2O3	16.35	QUARTZ	28
TIO2	.37	MICROCLINE	15
FE2O3	2	BIOTITE	13
FEO	2.45	APATITE	
MNO	.06	HEMATITE	
MGO	1.25	MAGNETITE	
CAO	3.72	SPHENE	
NA2O	3.55	HASTINGSITE	
K2O	3.91		
P2O5	.1		
CO2	0		
H2O	0		
TOTAL	99.97		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G) 0.85
@ PH
CATION SR

SURFACE AREA (M2/G) 0.08 3.9
METHOD BET EG

AQUEOUS PHASE

	START	END
PH(LOG)	6.9	8.1
NA	8.3	
K	3.5	
CA	13	
MG	3.9	
HCO3	61.6	
CL	5	
SO4	8.6	
F	.2	
NO3	.6	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,8C)

STATE :CRUSHED,20-50 MESH,WET SIEV

RATIO :1 G/10 ML

TEMP. :23 C

ATM. :AIR

SEP'N. :GRAVITY

ANAL. :L

COMB. :NONE

REFERENCES :
1) L.L. AMES
PNL-2797
2) T.T. VANDERGRAAF
WNRE
PR-WWM-1 P. 79-84

SORPTION RESULTS

FOR MATERIAL NUMBER--- 3

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	14			5.0E+2(20)	
	14			4.8E+2(17)	
	28				1.3E+2(25)
	28				1.2E+2(14)
PU 237	14			2.4E+2(45)	
	14			3.3E+2(16)	
	28				7.2E+2(8.6)
	28				5.6E+2(7.5)
SR 90	14			7.7E+0(13)	
	14			8.0E+0(15)	
	28				1.4E+1(10)
	28				1.4E+1(23)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 4
NAME : GRANITE USWISAP RR-1-1C
ORIGIN : CLIMAX STOCK(L.O. RAMPSPOTT LLL)

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	68.41	ANDESINE	47	
AL2O3	16.35	QUARTZ	28	
TIO2	.37	MICROCLINE	15	
FE2O3	0	BIOTITE	10	
FEO	2.45	APATITE		
MNO	.06	HEMATITE		
MGO	1.25	MAGNETITE		
CAO	3.72	SPHENE		
NA2O	3.55	HASTINGSITE		
K2O	3.91			
P2O5	.1			
CO2	0			
H2O	0			
TOTAL	99.97			

ROCK PROPERTIES

CEC (MEQ/100 G) 0.85
@ PH
CATION SR

SURFACE AREA (M2/G) 3.08 3.9
METHOD BET EG

AQUEOUS PHASE

	START	END
PH(LOG)	6.8	7
NA+	115	
K	17.2	
CA	900	
MG	10.4	
HCO3	10.3	
CL+	174.9	
SO4	4198	
BO3	9.8	
SR	1.3	
CS	1	

* PPT

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)

STATE :CRUSHED,20-50 MESH

RATIO :1 G/10 ML

TEMP. :23 C

ATM. :AIR

SEP'N. :GRAVITY

ANAL. :L

COMB. :NONE

REFERENCES :
1) L.L. AMES
PNL-2797
2) T.T. VANDERGRAAF
WNRE
PR-WWM-1 P. 79-84

SORPTION RESULTS

FOR MATERIAL NUMBER---> 4

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	14	7.4E-6		3.9E-1(18)	
	28	7.4E-6		1.2E-1(130)	
	14	7.4E-6			0.0E+0(0)
	28	7.4E-6			0.0E+0(0)
PU 237	14			3.0E+0(30)	
	28			2.1E+0(83)	
	14				4.0E+1(15)
	28				2.9E+1(44)
SR 90	14	1.4E-5		1.8E-1(110)	
	28	1.4E-5		2.8E-1(122)	
	14	1.4E-5			2.4E+0(143)
	28	1.4E-5			2.9E+0(124)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 5
NAME : GRANITE USGISAP RR-1-10
ORIGIN : CLIMAX STOCK(L.O.RAMPSPOTT LLL)

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	
SIO2	68.41	ANDESINE	47
AL2O3	16.35	QUARTZ	28
TIO2	.37	MICROCLINE	15
FE2O3	2	BIOTITE	10
FEO	2.45	APATITE	
MNO	.06	HEMATITE	
MGO	1.25	MAGNETITE	
CAO	3.72	SPHENE	
NA2O	3.55	HASTINGSITE	
K2O	3.91		
P2O5	.1		
CO2	2		
H2O	2		
TOTAL	99.97		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G) 0.85
@ PH
CATION SR

SURFACE AREA (M2/G) 0.08 3.9
METHOD BET EG

AQUEOUS PHASE

	START	END
PH(LOG)	6.8	7
NA+	115	
K	17.2	
CA	900	
MG	10.4	
HCO3	10.3	
CL+	174.9	
SO4	4198	
BO3	9.8	
SR	1.2	
CS	1	

* PPT

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,8C)
STATE :CRUSHED,20-50 MESH,WET SIEVED
RATIO :1 G/10 ML
TEMP. :23 C
ATM. :AIR
SEP'N. :GRAVITY
ANAL. :L
COMB. :NONE

REFERENCES :
1) L.L. AMES
PNL-2797
2) T.T. VANDERGRAAF
WNRE
PR-WMM-1 P.79-84

SORPTION RESULTS

FOR MATERIAL NUMBER--- 5

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	14	7.4E-6		6.3E-1(7.2)	
	28	7.4E-6		3.3E-1(64)	
	14	7.4E-6			0.0E+0(0)
	28	7.4E-6			0.0E+0(0)
PU 237	14			4.1E+0(22)	
	28			4.3E+0(26)	
	14				4.0E+1(37)
	28				3.7E+1(28)
SR 90	14	1.4E-5		9.0E-2(150)	
	28	1.4E-5		3.8E-1(120)	
	14	1.4E-5			3.1E+0(110)
	23	1.4E-5			4.4E+0(100)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 6
NAME : QUARTZ MONZONITE PORPHYRY-1A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	31
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT/CHLOR	13
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	8
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1	NONE
@ PH	8.2	8.3	
CATION	CS	SR	
SURFACE AREA (M2/G)	2.95	8.0	1.3
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH(LOG)	7.7	8.2
K	4.8	
CA	9.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.3	
SO4	5.1	
F	.3	
BA	.3	
LI	0	
SR	.1	
NA	7.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 6

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.92	2.4E-8		2.6E+2(4)	
	16.98	2.4E-8		2.0E+2(4)	
	27.91	2.4E-8		2.7E+2(4)	
	62.04	2.4E-8		4.2E+2(4)	
	13.67				2.6E+2(6)
	27.66				2.5E+2(6)
	55.72				3.9E+2(9)
CE 141	9.92	1.3E-6		1.3E+2(5)	
	16.98	1.3E-6		9.8E+1(4)	
	27.91	1.3E-6		1.4E+2(5)	
	62.04	1.3E-6		1.3E+3(4)	
	13.67				7.5E+2(6)
	27.66				1.6E+3(8)
	55.72				5.2E+3(13)
CS 137	9.92	1.4E-9		4.6E+2(3)	
	16.98	1.4E-9		4.2E+2(3)	
	27.91	1.4E-9		4.5E+2(3)	
	62.04	1.4E-9		5.2E+2(2)	
	13.67				5.8E+2(7)
	27.66				6.2E+2(7)
	55.72				7.6E+2(7)
EU 152	9.92	8.0E-8		3.5E+2(4)	
	16.98	8.0E-8		2.7E+2(4)	
	27.91	8.0E-8		3.5E+2(4)	
	62.04	8.0E-8		3.6E+3(4)	
	13.67				1.1E+3(6)
	27.66				1.9E+3(6)
	55.72				4.6E+3(8)
SR 85	9.92	1.2E-6		2.2E+1(4)	
	16.98	1.2E-6		1.6E+1(4)	
	27.91	1.2E-6		1.7E+1(5)	
	62.04	1.2E-6		1.9E+1(9)	
	13.67				2.3E+1(7)
	27.66				2.2E+1(8)
	55.72				2.8E+1(10)
U 237	6.95	5.4E-8		9.9E+0(22)	
	13.95	5.4E-8		1.0E+1(22)	
	20.95	5.4E-8		1.0E+1(21)	
	7.89				2.9E+1(31)
	13.64				2.7E+1(33)
	19.76				2.0E+1(40)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV. 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 7
NAME : QUARTZ MONZONITE PORPHYRY-2A
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	29
AL2O3	PLAGIO+KFLD	58
TIO2	ALT.FELDSPAR	4
FE2O3	BIOT/CHLOR	7
FEO	SPHENE	1
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	<1
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.16	4.0	4.4
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH(LOG)	7.7	8.2
NA	7.5	
K	4.8	
CA	9.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.5	
SO4	5.1	
F	.3	
NO3	0	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 7

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.91	2.4E-8		7.5E+1(4.1)	
	16.98	2.4E-8		9.6E+1(4.0)	
	27.91	2.4E-8		8.0E+1(4.3)	
	62.03	2.4E-8		1.5E+2(3.3)	
	13.67				8.4E+1(6.7)
	27.66				7.9E+1(5.2)
	55.72				8.1E+1(5.5)
CE 141	9.91	1.3E-6		1.0E+2(4.3)	
	16.98	1.3E-6		9.0E+1(4.3)	
	27.91	1.3E-6		8.6E+1(4.6)	
	62.03	1.3E-6		3.7E+2(3.6)	
	13.67				6.6E+2(7.1)
	27.66				6.1E+2(5.8)
	55.72				1.0E+3(7.7)
CS 137	9.91	1.4E-9		2.2E+2(2.6)	
	16.98	1.4E-9		2.5E+2(2.6)	
	27.91	1.4E-9		2.8E+2(2.9)	
	62.03	1.4E-9		2.8E+2(2.3)	
	13.67				4.0E+2(7.3)
	27.66				3.8E+2(7.4)
	55.72				4.1E+2(7.3)
EU 152	9.91	8.0E-8		1.9E+2(4.0)	
	16.98	8.0E-8		2.0E+2(4.0)	
	27.91	8.0E-8		1.8E+2(4.3)	
	62.03	8.0E-8		1.0E+3(3.4)	
	13.67				8.1E+2(6.7)
	27.66				7.2E+2(5.2)
	55.72				1.1E+3(5.6)
SR 85	9.91	1.2E-6		1.3E+1(5.2)	
	16.98	1.2E-6		1.2E+1(5.8)	
	27.91	1.2E-6		1.1E+1(6.0)	
	62.03	1.2E-6		1.3E+1(3.1)	
	13.67				1.7E+1(9.5)
	27.66				1.3E+1(7.7)
	55.72				1.3E+1(8.5)
U 237	6.95	5.4E-8		2.2E+0(72)	
	13.95	5.4E-8		2.0E+0(80)	
	20.95	5.4E-8		3.1E+0(52)	
	7.89				2.0E+1(87)
	13.64				1.5E+1(149)
	7.69				1.1E+1(169)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV-11, 1981

GEOLOGICAL MATERIAL

NUMBER : 8
NAME : QUARTZ MONZONITE PORPHYRY-3A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE, CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	24
AL2O3	PLAGIO+KFLD	61
TIO2	ALT,FELDSPAR	5
FE2O3	BIOT/CHLOR	7
FEO	SPHENE	1
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.18	7.2	2.9
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8.2
NA	7.5	
K	4.8	
CA	9.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.5	
SO4	5.1	
F	.3	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTR.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 8

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.91	2.4E-8		7.3E+1(4.0)	
	16.97	2.4E-8		7.8E+1(4.0)	
	29.97	2.4E-8		7.7E+1(3.9)	
	62.03	2.4E-8		7.8E+1(3.4)	
	13.67				7.7E+1(6.4)
	27.66				9.1E+1(6.3)
	55.72				7.9E+1(5.9)
CE 141	9.91	1.3E-6		1.8E+2(4.2)	
	16.97	1.3E-6		1.2E+2(4.4)	
	29.97	1.3E-6		1.2E+2(4.0)	
	62.03	1.3E-6		1.9E+2(3.6)	
	13.67				9.4E+2(6.8)
	27.66				9.1E+2(7.0)
	55.72				1.1E+3(8.4)
CS 137	9.91	1.4E-9		2.7E+2(2.6)	
	16.97	1.4E-9		3.1E+2(2.6)	
	29.97	1.4E-9		3.0E+2(2.6)	
	62.03	1.4E-9		4.1E+2(2.4)	
	13.67				5.2E+2(7.3)
	27.66				4.7E+2(7.3)
	55.72				6.6E+2(7.3)
EU 152	9.91	8.0E-8		2.5E+2(3.9)	
	16.97	8.0E-8		2.2E+2(4.0)	
	29.97	8.0E-8		2.1E+2(3.9)	
	62.03	8.0E-8		3.7E+2(3.4)	
	13.67				9.0E+2(5.9)
	27.66				8.8E+2(6.3)
	55.72				9.4E+2(6.3)
SR 85	9.91	1.2E-6		1.3E+1(5.4)	
	16.97	1.2E-6		1.2E+1(5.7)	
	29.97	1.2E-6		1.2E+1(5.8)	
	62.03	1.2E-6		1.1E+1(5.8)	
	13.67				1.8E+1(8.4)
	27.66				1.6E+1(9.2)
	55.72				1.7E+1(8.8)
U 237	6.95	5.4E-8		3.3E+0(50)	
	13.95	5.4E-8		4.0E-1(360)	
	20.95	5.4E-8		1.3E+0(117)	
	7.89				1.3E+1(218)
	13.64				-3.6E+0(731)
	19.76				3.9E+1(65)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV-11, 1981

GEOLOGICAL MATERIAL

NUMBER : 9
NAME : QUARTZ MONZONITE PORPHYRY-1C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	31
AL2O3	PLAGIO+KFLD	48
TIO2	ALT,FELDSPAR	2
FE2O3	BIOT/CHLOR	10
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	8
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.95	8.0	1.3
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	7.9
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF., 12000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 9

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		1.2E+3(--)	
	14.7	1.0E-6		3.9E+3(7.0)	
	28.7	1.0E-6		5.3E+3(--)	
	56.7	1.0E-6		7.8E+3(17)	
	15.7				2.9E+3(--)
	16.8				7.7E+2(3.7)
	19.7				4.7E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		1.4E+3(--)	
	28.7	1.0E-12		1.2E+3(--)	
	56.7	1.0E-12		2.3E+3(--)	
	15.7				
	16.8				
	19.7				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV-11, 1981

GEOLOGICAL MATERIAL

NUMBER : 10
NAME : QUARTZ MONZONITE PORPHYRY-2C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	29
AL2O3	PLAGIO+KFLD	58
TIO2	ALT,FELDSPAR	4
FE2O3	BIOT/CHLOR	7
FEO	SPHENE	1
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	<1
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.16	4.2	4.4
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.1
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH (1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :
ATM. :AIR
SEP'N. :CENTRIF.,12000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 18

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		7.6E+2(--)	
	14.7	1.0E-6		1.3E+3(--)	
	28.7	1.0E-6		1.7E+3(--)	
	56.7	1.0E-6		3.0E+3(--)	
	16.8				4.4E+2(--)
	19.7				3.2E+2(--)
	29.7				3.3E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		9.8E+2(--)	
	28.7	1.0E-12		7.1E+2(--)	
	56.7	1.0E-12		2.5E+3(--)	
	16.8				
	19.7				
	29.7				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV-11, 1981

GEOLOGICAL MATERIAL

NUMBER : 11
NAME : QUARTZ MONZONITE PORPHYRY-3C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	24
AL2O3	PLAGIO+KFLD	61
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT/CHLOR	7
FEO	SPHENE	1
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1
@ PH	8.1	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	2.1	7.0	2.9
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8	8.2
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :
ATM. :AIR
SEP'N. :CENTRIF., 12000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 11

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		3.6E+2(--)	
	14.7	1.0E-6		4.8E+2(--)	
	28.7	1.0E-6		1.6E+3(83)	
	56.7	1.0E-6		4.1E+3(--)	
	15.7				3.0E+3(--)
	16.8				
	19.7				4.0E+2(7.1)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		4.0E+2(--)	
	28.7	1.0E-12		5.2E+2(--)	
	56.7	1.0E-12		8.4E+2(--)	
	15.7				
	16.8				
	19.7				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 12
NAME : QUARTZ MONZONITE PORPHYRY-4C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	31
AL2O3	PLAGIO+KFLD	48
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT/CHLOR	10
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	8
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1	
@ PH	3.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	2.95	8.0	1.3
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8	8.1
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF., 12000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 12

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		6.2E+3(--)	
	14.7	1.0E-6		4.5E+3(--)	
	18.7	1.0E-6		1.7E+4(--)	
	56.7	1.0E-6		1.8E+4(--)	
	16.8	1.0E-6			4.6E+2(--)
	19.7	1.0E-6			3.8E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		3.5E+2(--)	
	18.7	1.0E-12		4.3E+2(--)	
	56.7	1.0E-12		9.4E+2(--)	
	16.8	1.0E-12			
	19.7	1.0E-12			

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV-11, 1981

GEOLOGICAL MATERIAL

NUMBER : 13
NAME : QUARTZ MONZONITE PORPHYRY-6C
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS5

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	24
AL2O3	PLAGIO+KFLD	61
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT/CHLOR	7
FEO	SPHENE	1
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	1
@ PH	8.1	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	3.10	7.0	2.9
METHOD	BET	EG/GA	EG

AQUEOUS PHASE

	START	END
PH	8	8.1
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,12000 RPM,1 HR.
ANAL. :L
COMB. :NONE

REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 13

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		1.0E+3(--)	
	14.7	1.0E-6		1.8E+3(--)	
	28.7	1.0E-6		2.4E+3(--)	
	56.7	1.0E-6		2.0E+3(--)	
	15.7	1.0E-6			1.9E+3(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		2.8E+2(--)	
	28.7	1.0E-12		5.0E+2(--)	
	56.7	1.0E-12		7.0E+2(--)	
	15.7	1.0E-12			

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 14
NAME : QUARTZ MONZONITE PORPHYRY 7A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	40
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT + CHLOR	5
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	5
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.80	9.0	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8.3
NA	7.5	
K	4.8	
CA	9.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.5	
SO4	5.1	
F	.3	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 14

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.9	2.4E-8		2.3E+2(4.2)	
	16.99	2.4E-8		2.9E+2(4.3)	
	27.96	2.4E-8		3.8E+2(4.3)	
	62.02	2.4E-8		4.7E+2(3.8)	
	13.67				3.6E+2(6.4)
	27.66				3.6E+2(5.9)
	55.72				3.2E+2(5.5)
CE 141	9.9	1.3E-6		7.7E+1(4.3)	
	16.99	1.3E-6		1.8E+2(4.5)	
	27.96	1.3E-6		3.5E+2(4.6)	
	62.02	1.3E-6		6.8E+2(7.8)	
	13.67				1.4E+3(6.9)
	27.66				2.2E+3(6.9)
	55.72				3.2E+3(8.4)
CS 137	9.9	1.4E-9		3.5E+2(2.6)	
	16.99	1.4E-9		4.0E+2(2.7)	
	27.96	1.4E-9		5.5E+2(2.8)	
	62.02	1.4E-9		7.2E+2(2.5)	
	13.67				6.3E+2(7.3)
	27.66				6.4E+2(7.3)
	55.72				6.8E+2(7.2)
EU 152	9.9	8.0E-8		2.1E+2(4.1)	
	16.99	8.0E-8		4.6E+2(4.3)	
	27.96	8.0E-8		7.8E+2(4.4)	
	62.02	6.0E-8		2.0E+3(8.1)	
	13.67				2.0E+3(6.4)
	27.66				2.7E+3(6.0)
	55.72				3.4E+3(5.6)
SR 85	9.9	1.2E-6		2.3E+1(4.1)	
	16.99	1.2E-6		2.3E+1(4.2)	
	27.96	1.2E-6		2.4E+1(4.0)	
	62.02	1.2E-6		2.6E+1(3.6)	
	13.67				5.0E+1(7.8)
	27.66				2.7E+1(7.5)
	55.72				2.7E+1(7.2)
U 237	6.95	5.4E-8		1.1E+1(21)	
	13.95	5.4E-8		8.2E+0(24)	
	20.95	5.4E-8		8.8E+0(23)	
	7.69				2.4E+1(37)
	13.64				2.2E+1(39)
	19.76				1.7E+1(39)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 15
NAME : QUARTZ MONZONITE PORPHYRY 7B
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	43
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT+CHLOR	5
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	5
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.80	940	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.6	8.1
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :CS,TC
REFERENCES : 1) B.R. ERDAL ET.AL
LASL-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 15

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.49	1.44E-9		1.4E+2(1.2)	
	13.53	1.44E-9		1.6E+2(1.2)	
	27.6	1.44E-9		1.7E+2(1.7)	
	55.58	1.44E-9		1.9E+2(1.6)	
	14.01				3.9E+2(11)
	27.7				4.5E+2(11)
	56.78				5.8E+2(11)
TC 95M	6.49	1.92E-12		3.2E+1(3.4)	
	13.53	1.92E-12		4.4E+1(3.3)	
	27.6	1.92E-12		1.6E+2(2.9)	
	55.58	1.92E-12		8.0E+1(2.5)	
	14.01				6.0E+2(30)
	27.7				2.1E+2(20)
	56.78				2.0E+2(21)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 16
NAME : QUARTZ MONZONITE PORPHYRY 7C
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	40
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT+CHLOR	5
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	5
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.80	9.2	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.2
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LASL-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 16

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		2.2E+3(--)	
	14.7	1.0E-6		2.3E+3(--)	
	28.7	1.0E-6		8.5E+3(--)	
	56.7	1.0E-6		3.9E+3(22)	
	15.7				1.8E+4(--)
	16.8				5.4E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		1.1E+3(--)	
	28.7	1.0E-12		1.5E+3(--)	
	56.7	1.0E-12		2.9E+3(--)	
	15.7				
	16.8				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 17
NAME : QUARTZ MONZONITE PORPHYRY 6A
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	32
AL2O3	PLAGIO+KFLD	54
TIO2	ALT,FELDSPAR	7
FE2O3	BIOT+CHLOR	6
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.16	3.3	3.6
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8.2
NA	7.5	
K	4.8	
CA	4.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.5	
SO4	5.1	
F	.3	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF., 16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 17

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.9	2.4E-8		6.8E+1(4.0)	
	16.98	2.4E-8		8.4E+1(4.0)	
	27.96	2.4E-8		1.0E+2(4.0)	
	62.02	2.4E-8		9.7E+1(3.6)	
	13.67				8.3E+1(6.0)
	27.66				1.1E+2(6.1)
	55.72				7.5E+1(5.5)
CE 141	9.9	1.3E-6		5.7E+1(4.3)	
	16.98	1.3E-6		8.6E+1(4.3)	
	27.96	1.3E-6		1.1E+2(4.3)	
	62.02	1.3E-6		2.5E+2(3.8)	
	13.67				5.5E+2(6.4)
	27.66				6.0E+2(7.3)
	55.72				1.1E+3(8.6)
CS 137	9.9	1.4E-9		2.5E+2(2.6)	
	16.98	1.4E-9		3.4E+2(2.6)	
	27.96	1.4E-9		3.4E+2(2.6)	
	62.02	1.4E-9		5.3E+2(2.4)	
	13.67				4.5E+2(7.3)
	27.66				7.3E+2(7.3)
	55.72				6.1E+2(7.3)
EU 152	9.9	8.0E-8		1.2E+2(4.0)	
	16.98	8.0E-8		1.7E+2(4.0)	
	27.96	8.0E-8		2.4E+2(4.0)	
	62.02	8.0E-8		6.0E+2(3.6)	
	13.67				7.0E+2(6.0)
	27.66				9.5E+2(6.1)
	55.72				1.0E+3(5.6)
SR 85	9.9	1.2E-6		1.4E+1(5.2)	
	16.98	1.2E-6		1.6E+1(5.0)	
	27.96	1.2E-6		1.4E+1(5.3)	
	62.02	1.2E-6		1.4E+1(5.0)	
	13.67				1.6E+1(8.1)
	27.66				2.3E+1(8.4)
	55.72				1.4E+1(8.6)
U 237	6.95	5.4E-8		2.3E+0(70)	
	13.95	5.4E-8		2.8E+0(55)	
	20.95	5.4E-8		1.9E+0(80)	
	7.89				1.2E+1(163)
	13.64				2.3E+1(85)
	19.76				1.2E+1(158)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 18
NAME : QUARTZ MONZONITE PORPHYRY 6B
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	32
AL2O3	PLAGIO+KFLD	54
TIO2	ALT,FELDSPAR	7
FE2O3	BIOT+CHLOR	6
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.16	3.3	3.6
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.6	8
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :CS,TC
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 16

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.58	1.44E-9		8.3E+1(1.1)	
	13.52	1.44E-9		1.0E+2(0.8)	
	27.59	1.44E-9		1.1E+2(1.8)	
	55.58	1.44E-9		1.3E+2(1.7)	
	14.01				2.9E+2(11)
	27.7				3.4E+2(10)
	56.78				3.4E+2(10)
TC 95M	6.58	1.92E-12		-7.0E-1(51)	
	13.52	1.92E-12		-3.0E-1(114)	
	27.59	1.92E-12		-9.0E-1(38)	
	55.58	1.92E-12		-9.0E-1(36)	
	14.01				-2.3E+1(9.1)
	27.7				-4.2E+1(16)
	56.78				-3.0E+1(12)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 19
NAME : QUARTZ MONZONITE PORPHYRY BC
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	32
AL2O3	PLAGIO+KFLD	54
TIO2	ALT.FELDSPAR	7
FE2O3	BIOT+CHLOR	6
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.16	3.3	3.6
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.2
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 19

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.2E-6		7.8E+2(--)	
	14.7	1.0E-6		1.1E+3(--)	
	28.7	1.0E-6		1.7E+3(--)	
	56.7	1.0E-6		2.4E+3(--)	
	15.7				2.4E+3(81)
	16.8				2.2E+2(--)
	19.7				6.2E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		5.1E+2(--)	
	28.7	1.0E-12		6.0E+2(--)	
	56.7	1.0E-12		9.7E+2(--)	
	15.7				
	16.8				
	19.7				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 20
NAME : QUARTZ HORNBLENDE PORPHYRY 9A
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	26
AL2O3	PLAGIO+KFLD	60
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT+CHLOR	8
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	<1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	3	
@ PH	6.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.12	3.2	2.8
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8.2
NA	7.5	
K	4.6	
CA	9.6	
MG	2	
FE	.4	
SI	7.9	
HCO3	55	
CL	2.5	
SO4	5.1	
F	.3	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE

REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FCN MATERIAL NUMBER---- 20

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	9.89	2.4E-8		9.1E+1(4.3)	
	16.98	2.4E-8		9.5E+1(4.5)	
	27.96	2.4E-8		9.3E+1(4.2)	
	62.02	2.4E-8		9.6E+1(3.7)	
	13.67				9.6E+1(6.0)
	27.66				9.9E+1(5.7)
	55.72				9.7E+1(5.9)
CE 141	9.89	1.3E-6		1.7E+2(4.5)	
	16.98	1.3E-6		2.7E+2(4.7)	
	27.96	1.3E-6		1.3E+2(4.5)	
	62.02	1.3E-6		4.2E+2(4.0)	
	13.67				1.0E+3(6.5)
	27.66				1.1E+3(7.2)
	55.72				1.4E+3(7.7)
CS 137	9.89	1.4E-9		4.6E+2(2.7)	
	16.98	1.4E-9		6.1E+2(2.9)	
	27.96	1.4E-9		4.8E+2(2.7)	
	62.02	1.4E-9		7.8E+2(2.5)	
	13.67				8.2E+2(7.2)
	27.66				1.0E+3(7.3)
	55.72				1.0E+3(7.2)
EU 152	9.89	8.0E-8		2.8E+2(4.3)	
	16.98	8.0E-8		4.4E+2(4.4)	
	27.96	8.0E-8		2.6E+2(4.2)	
	62.02	8.0E-8		8.4E+2(3.8)	
	13.67				1.1E+3(6.0)
	27.66				1.2E+3(5.7)
	55.72				1.2E+3(5.9)
SR 85	9.89	1.2E-6		1.7E+1(4.7)	
	16.98	1.2E-6		1.7E+1(4.7)	
	27.96	1.2E-6		1.6E+1(5.0)	
	62.02	1.2E-6		1.5E+1(4.7)	
	13.67				2.0E+1(7.6)
	27.66				2.2E+1(7.2)
	55.72				2.0E+1(8.3)
U 237	6.95	5.4E-8		6.0E-1(260)	
	13.95	5.4E-8		1.0E+0(147)	
	20.95	5.4E-8		1.1E+0(143)	
	7.89				7.4E+0(367)
	13.64				1.2E+1(280)
	19.76				1.7E+0(600)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 21
NAME : QUARTZ MONZONITE PORPHYRY SR
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	26
AL2O3	PLAGIO+KFLD	62
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT+CHLOR	8
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	<1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	5	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	2.12	3.0	2.8
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.6	6.1
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :CS,TC

REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 21

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.58	1.44E-9		7.7E+1(1.1)	
	13.52	1.44E-9		1.0E+2(1.1)	
	27.59	1.44E-9		1.2E+2(1.8)	
	55.57	1.44E-9		1.2E+2(1.6)	
	14.21				3.2E+2(10)
	27.7				3.7E+2(11)
	56.77				3.4E+2(10)
TC 95M	6.58	1.92E-12		-8.0E-1(42)	
	13.52	1.92E-12		-9.0E-1(38)	
	27.59	1.92E-12		-7.0E-1(49)	
	55.57	1.92E-12		-1.1E+0(29)	
	14.21				-3.3E+1(14)
	27.7				-3.4E+1(13)
	56.77				-3.7E+1(15)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 22
NAME : QUARTZ MONZONITE PORPHYRY 9C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	26	
AL2O3	PLAGIO+KFLD	60	
TIO2	ALT,FELDSPAR	5	
FE2O3	BIOT+CHLOR	8	
FEO	SPHENE	<1	
MNO	APATITE	<1	
MGO	MAGN+ILM	<1	
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	3
@ PH	3.2	8.5
CATION	CS	SR
SURFACE AREA (M2/G)	2.12	3.6	2.8
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.2
NA	7.7	
K	2.9	
CA	11	
MG	2	
FE	.1	
SI	10	
HCO3	57	
CL	2.3	
SO4	3.9	
F	.1	
BA	.3	
LI	0	
SR	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :22 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R, ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 22

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		5.4E+2(1.3)	
	14.7	1.0E-6		1.0E+3(23)	
	28.7	1.0E-6		1.7E+3(18)	
	56.7	1.0E-6		3.7E+3(49)	
	16.8				5.0E+2(--)
	19.7				1.5E+2(--)
	29.7				3.4E+2(42)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		6.9E+2(--)	
	28.7	1.0E-12		1.2E+3(--)	
	56.7	1.0E-12		2.5E+3(--)	
	16.8				
	19.7				
	29.7				

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 23
NAME : QUARTZ MONZONITE PORPHYRY 10 A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	43
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT+CHLOR	5
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	5
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	8	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.88	9.0	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 23

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	7.08	2.4E-8		7.2E+2(4.4)	
	17.05	2.4E-8		1.3E+3(4.6)	
	27.93	2.4E-8		1.3E+3(4.8)	
	66.12	2.4E-8		2.9E+3(15)	
	13.69				1.2E+3(6.2)
	27.72				1.8E+3(6.2)
	55.75				1.8E+3(5.7)
CE 141	9.08	1.3E-6		5.5E+1(4.3)	
	17.05	1.3E-6		5.0E+1(4.3)	
	27.93	1.3E-6		5.5E+1(4.7)	
	66.12	1.3E-6		7.7E+1(15)	
	13.69				6.6E+2(6.9)
	27.72				1.4E+3(7.9)
	55.75				1.3E+3(8.3)
CS 137	7.08	1.4E-9		3.2E+2(2.6)	
	17.05	1.4E-9		4.4E+2(2.6)	
	27.93	1.4E-9		6.7E+2(2.8)	
	66.12	1.4E-9		2.8E+4(11)	
	13.69				1.1E+3(7.2)
	27.72				8.0E+2(7.3)
	55.75				9.9E+2(7.2)
EU 152	7.08	8.0E-8		1.0E+2(4.1)	
	17.05	8.0E-8		8.8E+1(3.8)	
	37.93	8.0E-8		1.0E+2(4.3)	
	06.12	8.0E-8		1.6E+2(15)	
	13.69				8.1E+2(6.2)
	27.72				1.6E+3(6.3)
	55.75				1.4E+3(5.7)
SR 85	7.08	1.2E-6		4.7E+1(3.0)	
	17.05	1.2E-6		6.2E+1(2.9)	
	27.93	1.2E-6		5.7E+1(2.9)	
	66.12	1.2E-6		1.5E+2(15)	
	13.69				5.4E+1(6.7)
	27.72				6.2E+1(6.9)
	55.75				5.9E+1(6.3)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 24
NAME : QUARTZ MONZONITE PORPHYRY 12B
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	43
AL2O3	PLAGIO+KFLD	46
TIO2	ALT.FELDSPAR	2
FE2O3	BIOT+CHLOR	5
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	5
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.86	9.0	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.1
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :CS,TC
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 24

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.83	1.44E-9		2.2E+2(1.3)	
	13.84	1.44E-9		5.0E+2(1.7)	
	27.84	1.44E-9		1.6E+3(2.2)	
	55.83	1.44E-9		3.6E+3(2.0)	
	14.04				2.0E+3(14)
	27.71				8.6E+2(11)
	56.76				8.6E+2(11)
TC 95M	6.83	1.92E-12		2.3E+1(4.0)	
	13.84	1.92E-12		6.1E+1(3.1)	
	27.84	1.92E-12		2.7E+1(3.5)	
	55.83	1.92E-12		1.3E+0(29)	
	14.04				4.2E+2(30)
	27.71				2.4E+2(21)
	56.76				1.0E+2(19)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 25
NAME : QUARTZ MONZONITE PORPHYRY 13C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	40	
AL2O3	PLAGIO+KFLD	46	
TIO2	ALT.FELDSPAR	2	
FE2O3	BIOT+CHLOR	5	
FEO	SPHENE	2	
MNO	APATITE	<1	
MGO	MAGN+ILM	5	
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.80	9.0	4.5
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8	7.7
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-100+140 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM, 1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 25

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	7.7	1.0E-6		2.3E+3(--)	
	14.7	1.0E-6		4.4E+3(--)	
	28.7	1.0E-6		1.1E+4(--)	
	56.7	1.0E-6		6.3E+4(--)	
	16.8	1.0E-6			4.0E+2(--)
PU 237	7.7	1.0E-12			
	14.7	1.0E-12		3.6E+3(--)	
	28.7	1.0E-12		4.4E+3(--)	
	56.7	1.0E-12		2.5E+4(--)	
	16.8	1.0E-12			

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 26
NAME : QUARTZ MONZONITE PORPHYRY 11A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	32	
AL2O3	PLAGIO+KFLD	54	
TIO2	ALT.FELDSPAR	7	
FE2O3	BIOT+CHLOR	6	
FEO	SPHENE	2	
MNO	APATITE	<1	
MGO	MAGN+ILM	1	
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.16	3.3	3.6
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,8C)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 26

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	7.07	2.4E-8		1.7E+2(3.7)	
	17.04	2.4E-8		3.2E+2(3.9)	
	27.93	2.4E-8		4.7E+2(4.3)	
	66.11	2.4E-8		5.7E+2(11)	
	13.69				4.7E+2(5.6)
	27.72				3.8E+2(6.3)
	55.75				3.8E+2(5.6)
CE 141	7.07	1.3E-6		3.5E+1(4.1)	
	17.04	1.3E-6		2.5E+1(4.2)	
	27.93	1.3E-6		2.3E+1(4.5)	
	66.11	1.3E-6		3.4E+1(11)	
	13.69				9.5E+2(6.9)
	27.72				9.2E+2(8.8)
	55.75				7.7E+2(10)
CS 137	7.07	1.4E-9		1.8E+2(2.4)	
	17.04	1.4E-9		2.3E+2(2.5)	
	27.93	1.4E-9		4.5E+2(2.7)	
	66.11	1.4E-9		1.4E+4(7.4)	
	13.69				7.8E+2(7.2)
	27.72				5.7E+2(7.3)
	55.75				1.4E+3(7.2)
EU 152	7.07	8.0E-8		4.9E+1(3.8)	
	17.04	8.0E-8		3.9E+1(3.9)	
	27.93	8.0E-8		3.9E+1(4.1)	
	66.11	8.0E-8		5.4E+1(11)	
	13.69				1.2E+3(5.9)
	27.72				1.2E+3(6.6)
	55.75				9.7E+2(5.7)
SR 85	7.07	1.2E-6		2.2E+2(4.0)	
	17.04	1.2E-6		2.9E+1(3.6)	
	27.93	1.2E-6		3.4E+1(3.3)	
	66.11	1.2E-6		8.7E+1(11)	
	13.69				3.3E+1(6.3)
	27.72				3.4E+1(7.7)
	55.75				3.2E+1(7.1)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 27
NAME : QUARTZ MONZONITE PORPHYRY 11B
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	32
AL2O3	PLAGIO+KFLD	54
TIO2	ALT.FELDSPAR	7
FE2O3	BIOT+CHLOR	6
FEO	SPHENE	2
MNO	APATITE	<1
MGO	MAGN+ILM	1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	2
@ PH	8.2	8.5
CATION	CS	SR

SURFACE AREA (M2/G)	0.16	3.3	3.6
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.1
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-45+60 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :CS TC
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 27

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.83	1.44E-9		1.4E+2(1.7)	
	13.83	1.44E-9		3.3E+2(1.4)	
	27.84	1.44E-9		1.4E+3(2.4)	
	55.82	1.44E-9		2.5E+3(1.9)	
	14.04				2.7E+3(15)
	27.7				1.3E+3(13)
	56.76				1.6E+3(13)
TC 95M	6.83	1.92E-12		7.0E-1(60)	
	13.83	1.92E-12		4.0E-1(97)	
	27.84	1.92E-12		3.0E-1(108)	
	55.82	1.92E-12		-1.3E+0(24)	
	14.04				-8.9E+0(6.7)
	27.7				-8.0E+0(17)
	56.76				-8.0E-1(415)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 28
NAME : QUARTZ MONZONITE PORPHYRY 12A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	26
AL2O3	PLAGIO+KFLD	60
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT+CHLOR	8
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	<1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	3	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.12	3.0	2.8
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	7.7	8.1
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER--- 28

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
BA 133	7.28	2.4E-8		1.3E+2(3.9)	
	17.04	2.4E-8		1.8E+2(3.9)	
	27.92	2.4E-8		1.9E+2(4.1)	
	66.11	2.4E-8		3.7E+2(5.9)	
	13.69				1.6E+2(5.6)
	27.72				2.3E+2(5.9)
	55.75				3.1E+2(6.1)
CE 141	7.28	1.3E-6		2.3E+1(4.3)	
	17.04	1.3E-6		2.2E+1(4.3)	
	27.92	1.3E-6		2.8E+1(4.4)	
	66.11	1.3E-6		6.5E+1(6.1)	
	13.69				4.6E+2(6.6)
	27.72				6.6E+2(8.0)
	55.75				2.3E+3(19)
CS 137	7.28	1.4E-9		1.4E+2(2.5)	
	17.04	1.4E-9		1.9E+2(2.5)	
	27.92	1.4E-9		2.1E+2(2.6)	
	66.11	1.4E-9		4.3E+3(4.1)	
	13.69				4.9E+2(7.3)
	27.72				4.5E+2(7.4)
	55.75				4.8E+3(7.4)
EU 152	7.28	8.0E-8		3.2E+1(4.0)	
	17.04	8.0E-8		3.2E+1(3.9)	
	27.92	8.0E-8		4.5E+1(4.0)	
	66.11	8.0E-8		1.1E+2(5.9)	
	13.69				5.9E+2(5.8)
	27.72				7.5E+2(6.1)
	55.75				1.9E+3(6.4)
SR 85	7.28	1.2E-6		2.1E+1(4.0)	
	17.04	1.2E-6		2.5E+1(3.8)	
	27.92	1.2E-6		2.5E+1(3.9)	
	66.11	1.2E-6		8.6E+1(6.2)	
	13.69				2.1E+1(6.6)
	27.72				3.1E+1(7.5)
	55.75				3.0E+1(7.1)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 29
NAME : QUARTZ MONZONITE PORPHYRY 12B
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE CS7

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	26
AL2O3	PLAGIO+KFLD	60
TIO2	ALT.FELDSPAR	5
FE2O3	BIOT+CHLOR	8
FEO	SPHENE	<1
MNO	APATITE	<1
MGO	MAGN+ILM	<1
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G)	<1	3	
@ PH	8.2	8.5	
CATION	CS	SR	
SURFACE AREA (M2/G)	0.12	3.0	2.8
METHOD	BET	EG/CA	EG

AQUEOUS PHASE

	START	END
PH	8.1	8.2
NA	8.6	
K	3.7	
CA	11	
MG	.2	
FE	.1	
SI	12	
HCO3	49	
CL	2.5	
SO4	6.5	
F	.1	
BA	.3	
LI	0	
SR	.1	

EXPERIMENTAL DETAILS

METHOD :BATCH(1W,BC)
STATE :-20+35 MESH
RATIO :1 G/20 ML
TEMP. :70 C
ATM. :AIR
SEP'N. :CENTRIF.,16000 RPM,1 HR.
ANAL. :L
COMB. :CS TC

REFERENCES : 1) B.R. ERDAL ET.AL
LA-7456-MS

SORPTION RESULTS

FOR MATERIAL NUMBER---- 29

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	6.82	1.44E-9		1.0E+2(1.1)	
	13.83	1.44E-9		3.0E+2(1.4)	
	27.84	1.44E-9		4.8E+2(1.9)	
	55.81	1.44E-9		2.8E+3(1.9)	
	14.04				1.6E+3(13)
	27.7				1.3E+3(13)
	56.76				1.1E+3(7.2)
TC 95M	6.82	1.92E-12		3.1E+0(15)	
	13.83	1.92E-12		-3.0E-1(107)	
	27.84	1.92E-12		-2.0E-1(190)	
	55.81	1.92E-12		2.5E+1(3.3)	
	14.04				-1.9E+1(6.7)
	27.7				-2.4E+1(9.9)
	56.76				1.0E+2(41)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 30
NAME : QUARTZ MONZONITE PORPHYRY 144
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE SPL UE15E7

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)	
SIO2	68.4	ANORTHITE	BA	900
AL2O3	15.9	QUARTZ		
TIO2	.29	BIOTITE		
FE2O3	0	ALBITE		
FEO	2.62	BROOKITE		
MNO	0	PLAGIOCLASE		
MGO	.86	ORTHOCLASE		
CAO	3.37	MAGNETITE		
NA2O	3.37	TITANITE		
K2O	3.61	APATITE		
P2O5	.23			
CO2	0			
H2O	0			
TOTAL	98.65			

ROCK PROPERTIES

SURFACE AREA (M2/G) 0.9
METHOD BET

AQUEOUS PHASE

	START	END
NA	83	
CA	144	
HCO3	219	
SO4	345	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W)
STATE :CRUSHED
RATIO :5 G/30 ML
TEMP. :23 C
ATM. :AIR
SEP'N. :FILTER 0.3 UM MILLIPORE
ANAL. :L
COMB. :NONE
REFERENCES : 1) G. SCOTT BARNEY
PNL-SA-7352 VOL2P1

SORPTION RESULTS

FOR MATERIAL NUMBER--- 39

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
NP 241		1.5E-1		6.1E+3(--)	
		1.6E-9		1.8E+4(--)	
		1.1E-8		2.7E+4(--)	
		1.5E-7		5.9E+4(--)	
CS 137		1.1E-8		1.4E+3(--)	
		1.1E-7		9.1E+2(--)	
		1.1E-6		2.3E+2(--)	
		1.1E-5		1.1E+2(--)	
NP 237		9.2E-7		2.6E+2(--)	
		7.8E-6		3.2E+1(--)	
		9.0E-5		1.5E+2(--)	
		7.0E-4		1.5E+2(--)	
PU		1.0E-8		6.4E+2(--)	
		1.0E-7		8.3E+3(--)	
		1.0E-6		7.7E+2(--)	
		1.0E-5		1.7E+5(--)	
SR 85		1.1E-7		6.1E+2(--)	
		1.1E-6		7.0E+0(--)	
		1.1E-5		6.3E+0(--)	
		1.1E-4		7.9E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 31
NAME : QUARTZ MONZONITE PORPHYRY 148
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE SPL UE15E7

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)	
SIO2	68.4	ANORTHITE	BA	900
AL2O3	15.9	QUARTZ		
TIO2	.29	BIOTITE		
FE2O3	0	ALBITE		
FEO	2.62	BROOKITE		
MNO	0	PLAGIOCLASE		
MGO	.86	ORTHOCLASE		
CAO	3.37	MAGNETITE		
NA2O	3.37	TITANITE		
K2O	3.61	APATITE		
P2O5	.23			
CO2	0			
H2O	0			
TOTAL	98.65			

ROCK PROPERTIES

SURFACE AREA (M2/G) 3.9
METHOD BET

AQUEOUS PHASE

	START	END
PH	8	
NA	83	
CA	144	
HCO3	219	
SO4	345	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W)

STATE :CRUSHED

RATIO :5 G/30 ML

TEMP. :23 C

ATM. :AIR

SEP'N. :FILTER 0.3 UM MILLIPORE

ANAL. :L

COMB. :NONE

REFERENCES : 1) G. SCOTT BARNEY
PNL-SA-7352-VOL2P161

SORPTION RESULTS

FOR MATERIAL NUMBER--- 31

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	14			2.7E+4(44)	
CS 137	14			1.1E+3(18)	
NP 237	14			4.5E+1(4.4)	
PU 239	14			1.2E+4(83)	
SR 85	14			6.2E+0(8.1)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 32
NAME : QUARTZ MONZONITE PORPHYRY 14C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE SPL WE15E7

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)	
SIO2	68.4	ANORTHITE	BA	900
AL2O3	15.9	QUARTZ		
TIO2	.29	BIOTITE		
FE2O3	0	ALBITE		
FEO	2.62	BROOKITE		
MNO	0	PLAGIOCLASE		
MGO	.86	ORTHOCLASE		
CAO	3.37	MAGNETITE		
NA2O	3.37	TITANITE		
K2O	3.61	APATITE		
P2O5	.23			
CO2	0			
H2O	0			
TOTAL	98.65			

ROCK PROPERTIES

SURFACE AREA (M2/G) 6.9
METHOD BET

AQUEOUS PHASE

	START	END
PH	6	
NA	83	
CA	144	
HCO3	219	
SO4	345	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W)
STATE :CRUSHED
RATIO :5 G/30 ML
TEMP. :R T
ATM. :AIR
SEP'N. :ND
ANAL. :L
COMB. :NONE

REFERENCES : 1) G. SCOTT BARNEY
PNL-SA-6957

SORPTION RESULTS

FOR MATERIAL NUMBER--- 32

RADIONUCLIDE	TIME (D)	INITIAL CRNJ (M/L)	FINAL CRNJ (M/L)	KDS	KDD
AM 241	2	7.9E-6		6.0E+4(48)	
CS 137	2	4.4E-9		6.5E+2(7.1)	
PU	2			5.4E+3(21)	
RU 106	2	2.0E-1[illegible]		2.1E+2(8.2)	
SR 90	2	6.0E-8		5.5E+2(10)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 33
NAME : QUARTZ MONZONITE PORPHYRY-(A,W.) 140
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE SPL UE15E7

CHEMICAL COMPOSITION(%)	
SIO2	68.4
AL2O3	15.9
TIO2	.29
FE2O3	0
FEO	2.62
MNO	0
MGO	.86
CAO	3.37
NA2O	3.37
K2O	3.61
P2O5	.23
CO2	0
H2O	0
TOTAL	98.65

MINERAL COMPOSITION(%)	

TRACE ELEMENTS (PPM)	
BA	900

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	8	
NA	83	
CA	144	
HCO3	219	
SO4	345	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W)
STATE :CRUSHED
RATIO :5 G/30 ML
TEMP. :23 C
ATM. :AIR
SEP'N. :FILTER 0.3 UM MILLIPORE
ANAL. :L
COMB. :NONE
REFERENCES : 1) G. SCOTT BARNEY
PNL-SA-7352-VOL2P1

SORPTION RESULTS

FOR MATERIAL NUMBER--- 33

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	14			2.1E+4(24)	
CS 137	14			1.1E+3(27)	
NP 237	14			3.9E+1(7.7)	
PU 237	14			1.2E+4(58)	
SR 85	14			6.4E+0(13)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 34
NAME : QUARTZ MONZONITE PORPHYRY 15A
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE-SHEAR ZN 1

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	M	
AL2O3	K,NA FELDSPAR	M	
TIO2	MUSC - ILL	W	
FE2O3	CALCITE	10	
FEO	MONTMOR.	10	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

SURFACE AREA (M2/G) 4.37
METHOD BET

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	1.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-100+325 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 34

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			4.6E+2(4.6)	
SR 85	7			1.8E+2(2.0)	
TC 95M	7			-5.0E-1(14)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 35
NAME : QUARTZ MONZONITE PORPHYRY 16A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE-SHEAR ZN 2

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	MW	
AL2O3	K,NA FELDSPAR	W	
TIO2	MUSC. - ILL	T	
FE2O3	CALCITE	15-20	
FEO	MONTMOR.	>40	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	1.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-325 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TO CS

REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 35

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			1.0E+3(0.5)	
SR 85	7			6.0E+2(1.2)	
TC 95M	7			-6.0E+1(23)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 36
NAME : QUARTZ MONZONITE PORPHYRY 16B
ORIGIN : CLIMAX STOCK, NEVADA TEST SITE-SHEAR ZN 2

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	MW	
AL2O3	K,NA FELDSPAR	W	
TIO2	MUSC. - ILL	T	
FE2O3	CALCITE	15-20	
FEO	MONTMOR.	>40	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

SURFACE AREA (M2/G) 13.6
METHOD BET

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	1.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	
F	0	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-100+325 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 36

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			1.0E+3(1.5)	
SR 85	7			6.1E+2(1.6)	
ZC 95M	7			-7.0E-1(22)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 37
NAME : QUARTZ MONZONITE PORPHYRY 16C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE-SHEAR ZN 2

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	MW	
AL2O3	K,NA FELDSPAR	W	
TIO2	MUSC. - ILL	T	
FE2O3	CALCITE	15-20	
FEO	MONTMOR.	>40	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	1.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :-50+100 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS

REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 37

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			1.5E+3(47)	
SR 85	7			6.0E+2(3.8)	
TC 95M	7			-5.0E-1(21)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 38
NAME : QUARTZ MONZONITE PORPHYRY 17A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE SHEAR ZN 3

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	
SIO2	QUARTZ	MN
AL2O3	K,NA FELDSPAR	MN
TIO2	MUSC. - ILL	MN
FE2O3	CALCITE	5
FEO	MONTMOR.	30
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-325 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TO CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 36

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			1.4E+3(1.2)	
SR 85	7			4.4E+2(2.7)	
TC 95M	7			-2.0E-1(60)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 39
NAME : QUARTZ MONZONITE PORPHYRY 173
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE-SHEAR ZN 3

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	MW	
AL2O3	K,NA FELDSPAR	MW	
TIO2	MUSC. - ILL	MW	
FE2O3	CALCITE	5	
FEO	MONTMOR.	30	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

SURFACE AREA (M2/G) 7.081
METHOD BET

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-100+325 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 39

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			9.4E+2(2.8)	
SR 85	7			3.1E+2(2.9)	
TC 95M	7			-2.0E+1(137)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 40
NAME : QUARTZ MONZONITE PORPHYRY 17C
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE-SHEAR ZN 3

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)		TRACE ELEMENTS (PPM)
SIO2	QUARTZ	MW	
AL2O3	K,NA FELDSPAR	MW	
TIO2	MUSC. - ILL	MW	
FE2O3	CALCITE	5	
FEO	MONTMOR.	30	
MNO			
MGO			
CAO			
NA2O			
K2O			
P2O5			
CO2			
H2O			

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-50+100 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS

REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 40

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	7			1.1E+3(5.7)	
SR 85	7			3.2E+2(2.2)	
TC 95M	7			-4.0E-1(30)	

9 2 1 2 5 5 2 0 2 3 3

GEOLOGICAL MATERIAL

NUMBER : 41
NAME : QUARTZ MONZONITE PORPHYRY 18A
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE / USWISAP

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-20+50 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

9 2 1 2 5 6 2 0 2 3 4

SORPTION RESULTS

FOR MATERIAL NUMBER--- 41

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	8			3.8E+2(35)	
SR 85	8			1.7E+1(7.3)	
TC 95M	8			-8.0E-1(26)	

9 2 1 2 5 6 2 0 2 8 5

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 42
NAME : QUARTZ MONZONITE PORPHYRY 188
ORIGIN : CLIMAX STOCK,NEVADA TEST SITE / USWISAP

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,8C)
STATE :-20+50 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :NONE
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

9 2 1 2 5 6 2 0 2 8 6

SORPTION RESULTS

FOR MATERIAL NUMBER--- 42

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
PU 237	7			5.6E+2(27)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 43
NAME : WESTERLY GRANITE 19A
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)	
SIO2	69.5
AL2O3	16.7
TIO2	.37
FE2O3	2
FEO	.3
MNO	.04
MGO	1.12
CAO	2.25
NA2O	3.3
K2O	4.5
P2O5	.08
CO2	0
H2O	2
TOTAL	99.96

MINERAL COMPOSITION(%)

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G) @ PH 3.6

SURFACE AREA (M2/G) 6(3)

AQUEOUS PHASE

	START	END
PH	7	7.5
EH		324
NA+	118	
CL+	181	

+ PPT

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :CRUSHED -150 MESH

RATIO :0.5 G/15 ML

TEMP. :RT

ATM. :AIR

SEP'N. :CENTRIF.,7000 RPM,20 MIN.

ANAL. :L

COMB. :SR TO CS

REFERENCES :

1) J.F. RELYEA ET.AL
PNL-SA-6957 P.125

2) J.F. RELYEA ET.AL
PNL-SA-7352-VOL2P259

3) A.N. MUCCIARDI ET.AL
PNL-SA-7352-VOL2P333

4) L.L. AMES
PNL-2797

SORPTION RESULTS

FOR MATERIAL NUMBER--- 43

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS	3			8.2E+0(61)	
	10			5.5E-1(999)	
	30			1.2E+1(45)	
SR	3			6.9E+0(70)	
	10			-3.2E+0(239)	
	30			1.6E+0(57)	
TC	3			7.2E+0(60)	
	10			-4.3E+0(117)	
	30			9.4E+0(45)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 44
NAME : WESTERLY GRANITE 198
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)	
SIO2	69.5
AL2O3	16.7
TIO2	.37
FE2O3	2
FEO	.3
MNO	.04
MGO	1.12
CAO	2.25
NA2O	3.3
K2O	4.5
P2O5	.08
CO2	0
H2O	0
TOTAL	99.96

MINERAL COMPOSITION(%)

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

CEC (MEQ/100 G) @ PH 3.6

SURFACE AREA (M2/G) 6

AQUEOUS PHASE

	START	END
PH	7	7.9
EH		430
CA	600	
CL	1034	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :CRUSHED -150 MESH

RATIO :0.5 G/15 ML

TEMP. :RT

ATM. :AIR

SEP'N. :CENTRIF.,7000 RPM,20 MIN.

ANAL. :L

COMB. :SR TC CS

REFERENCES :

1) J.F. RELYEA ET.AL
PNL-SA-6957 P.125

2) J.F. RELYEA ET.AL
PNL-SA-7352-VOL2P259

3) A.N. MUCCIARDI ET.AL
PNL-SA-7352-VOL2P333

4) L.L. AMES
PNL-2797

SORPTION RESULTS

FOR MATERIAL NUMBER--- 44

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS	3			7.9E+2(8.7)	
	10			2.7E+3(12)	
	30			5.9E+3(27)	
SR	3			4.4E+0(31)	
	10			5.4E+0(73)	
	30			4.1E+0(13)	
TC	3			3.7E+0(30)	
	10			6.3E+0(80)	
	30			7.4E+1(9.5)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 45
NAME : WESTERLY GRANITE 19C
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)
SIO2	69.5	
AL2O3	16.7	
TIO2	.37	
FE2O3	2	
FEO	.3	
MNO	.04	
MGO	1.12	
CAO	2.25	
NA2O	3.3	
K2O	4.5	
P2O5	.08	
CO2	2	
H2O	2	
TOTAL	99.96	

ROCK PROPERTIES

CEC (MEQ/100 G) @ PH 3.6

SURFACE AREA (M2/G) 6

TRACE ELEMENTS (PPM)

AQUEOUS PHASE

	START	END
PH	7	8.3
EH		384
NA	690	
CL	1034	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :CRUSHED -150 MESH

RATIO :0.5 G/15 ML

TEMP. :RT

ATM. :AIR

SEP'N. :CENTRIF.,7000 RPM,20 MIN.

ANAL. :L

COMB. :SR TC CS

REFERENCES :

1) J.F. RELYEA ET.AL
PNL-SA-6957 P.125

2) J.F. RELYEA ET.AL
PNL-SA-7352-VOL2P259

3) A.N. MUCCIARDI ET.AL
PNL-SA-7352-VOL2P333

4) L.L. AMES
PNL-2797

SORPTION RESULTS

FOR MATERIAL NUMBER--- 45

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS	3			5.8E+2(17)	
	12			3.9E+3(109)	
	32			8.4E+3(79)	
SR	3			1.3E+1(45)	
	10			1.5E+1(24)	
	30			2.6E+1(11)	
TC	3			-1.1E+0(139)	
	13			1.7E+0(139)	
	32			7.9E+1(3.5)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 46
NAME : WESTERLY GRANITE 190
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)		MINERAL COMPOSITION(%)
SIO2	69.5	
AL2O3	16.7	
TIO2	.37	
FE2O3	2	
FEO	.3	
MNO	.04	
MGO	1.12	
CAO	2.25	
NA2O	3.3	
K2O	4.5	
P2O5	.08	
CO2	0	
H2O	0	
TOTAL	99.96	

ROCK PROPERTIES

CEC (MEQ/100 G) @ PH 3.6

SURFACE AREA (M2/G) 6

TRACE ELEMENTS (PPM)

AQUEOUS PHASE

	START	END
PH		9.4
EH		364
NA	690	
HCO3	1830	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :CRUSHED -150 MESH

RATIO :0.5 G/15 ML

TEMP. :RT

ATM. :AIR

SEP'N. :CENTRIF.,7000 RPM,20 MIN.

ANAL. :L

COMB. :SR TC CS

REFERENCES :

1) J.F. RELYEA ET.AL
PNL-SA-6957 P.125

2) J.F. RELYEA ET.AL
PNL-SA-7352-VOL2P259

3) A.N. MUCCIARDI ET.AL
PNL-SA-7352-VOL2P333

4) L.L. AMES
PNL-2797

SORPTION RESULTS

FOR MATERIAL NUMBER--- 46

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS	3			6.5E+1(22)	
	10			1.5E+2(11)	
	30			3.9E+1(8.7)	
SR	3			1.9E+1(47)	
	10			3.8E+1(15)	
	30			3.3E+1(6.2)	
TC	3			-2.0E+0(218)	
	10			2.1E+0(198)	
	30			2.7E+1(5.0)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 47
NAME : WESTERLY GRANITE 20A
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-20+50 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :SR TC CS
REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 47

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CS 137	8			2.1E+2(41)	
SR 85	8			6.5E+0(30)	
TC 95M	8			-9.1E-1(9.1)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 48
NAME : WESTERLY GRANITE 208
ORIGIN : NEW ENGLAND

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

ROCK PROPERTIES

AQUEOUS PHASE

TRACE ELEMENTS (PPM)	START	END
PH	7.8	
NA	6.7	
K	1.5	
CA	8.3	
MG	2.5	
SIO2	26.2	
HCO3	47.7	
CL	2.1	
SO4	2.7	

EXPERIMENTAL DETAILS

METHOD :BATCH(2W,BC)
STATE :-20+50 MESH
RATIO :1 G/15 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :FILTER 0.1 UM NUCLEOPORE
ANAL. :L
COMB. :NONE

REFERENCES : 1) S.C. MACLEAN ET.AL
UCID - 17928

SORPTION RESULTS

FOR MATERIAL NUMBER--- 48

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
PU 237	7			5.2E+2(16)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 49
NAME : GRANITE (FRESHLY FRACTURED) 30A
ORIGIN : GOETHEBORG, SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

ROCK PROPERTIES

AQUEOUS PHASE

TRACE ELEMENTS (PPM)	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :COUPONS - 27 CM-2 GSA

RATIO :

TEMP. :25 C

ATM. :AIR

SEP'N. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) B. ALLARD ET.AL
CHALMERS INST. TECH.
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 49

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KAS	KAD
AM 241	.5			2.0E+1(--)	
	1			2.0E+1(--)	
	1				1.1E+2(--)
CS 134	.5			7.9E-1(--)	
	1			6.3E-1(--)	
	1				3.2E+0(--)
SR 89	.5			1.0E-1(--)	
	1			2.5E-1(--)	
	1				5.0E+1(--)

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 50
NAME : GRANITE (AUSTRIAN) 22A
ORIGIN : GEBHARTS, WALDVIERTEL, LOWER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)

STATE :CRUSHED 144-324 CM-2

RATIO :10 G/100 ML

TEMP. :RT

ATM. :AIR

SEPIN. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 50

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			2.2E+2(--)	
	11.8			8.7E+2(--)	
	12.9			3.5E+3(--)	
CS 137	.17			1.1E+1(--)	
	2.3			2.1E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
SR 85	.17			2.0E+0(--)	
	2.3			2.9E+0(--)	
	6.3			3.1E+0(--)	
	14.2			4.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 51
NAME : GRANITE (AUSTRIAN) 228
ORIGIN : HERRSCHENBERG,WALDVIERTEL,LOWER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)

STATE :CRUSHED 144 - 324 CM-2

RATIO :10 G/100 ML

TEMP. :RT

ATM. :AIR

SEP'N. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP,BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 51

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			3.4E+2(--)	
	11.6			5.5E+2(--)	
	12.9			6.6E+2(--)	
CS 137	.17			1.4E+1(--)	
	2.3			4.0E+1(--)	
	6.3			9.0E+1(--)	
	14.2			9.0E+1(--)	
SR 85	.17			2.5E+0(--)	
	2.3			2.4E+0(--)	
	6.3			3.2E+0(--)	
	14.2			4.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 52
NAME : GRANITE (AUSTRIAN) 22C
ORIGIN : NEUHAUS LOWER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)

STATE :CRUSHED 144 - 324 CM-2

RATIO :10 G/100 ML

TEMP. :RT

ATM. :AIR

SEP'N. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP,BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 52

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			6.7E+2(--)	
	11.3			2.0E+3(--)	
	12.9			2.0E+3(--)	
CS 137	.17			0.0E+0(--)	
	2.3			5.0E+1(--)	
	6.3			>5.4E+2(--)	
	14.2			>5.0E+2(--)	
SR 85	.17			2.5E+0(--)	
	2.3			2.3E+0(--)	
	6.3			4.3E+0(--)	
	14.2			5.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 53
NAME : GRANITE (AUSTRIAN) 220
ORIGIN : NEUSTADEL PLATTE LOWER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)

STATE :CRUSHED 144 - 324 CM-2

RATIO :10 G/100 ML

TEMP. :RT

ATM. :AIR

SEP'N. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 53

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			9.0E+2(--)	
	11.8			1.6E+3(--)	
	12.9			2.2E+3(--)	
CS 137	.17			1.0E+1(--)	
	2.3			1.5E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
SR 85	.17			3.1E+0(--)	
	2.3			2.8E+0(--)	
	6.3			3.2E+0(--)	
	14.2			4.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 54
NAME : GRANITE (AUSTRIAN) 23A
ORIGIN : GLOXWALD UPPER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)
STATE :CRUSHED 144 - 324 CM-2
RATIO :10 G/100 ML
TEMP. :RT
ATM. :AIR
SEP'N. :NONE
ANAL. :L
COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 54

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			2.3E+2(--)	
	11.8			4.4E+2(--)	
	12.9			5.9E+2(--)	
CS 137	.17			1.2E+1(--)	
	2.3			8.0E+1(--)	
	6.3			3.5E+2(--)	
	14.2			3.2E+2(--)	
SR 85	.17			2.8E+0(--)	
	2.3			9.0E-1(--)	
	6.3			1.3E+0(--)	
	14.2			3.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 55
NAME : GRANITE (AUSTRIAN) 238
ORIGIN : GREIN, AUMUEHLE UPPER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)
STATE :CRUSHED 144 - 324 CM-2
RATIO :10 G/100 ML
TEMP. :RT
ATM. :AIR
SEP'N. :NONE
ANAL. :L
COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS AUSTR. UNIV. NUCLEAR WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 55

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			6.0E+2(--)	
	11.8			4.3E+2(--)	
	12.9			6.9E+2(--)	
CS 137	.17			2.8E+1(--)	
	2.3			1.3E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
SR 85	.17			2.2E+0(--)	
	2.3			2.0E+0(--)	
	6.3			2.9E+0(--)	
	14.2			4.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 56
NAME : GRANITE (AUSTRIAN) 23C
ORIGIN : GREIN, AUMUEHLE UPPER AUSTRIA

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)
STATE :CRUSHED 144 - 324 CM-2
RATIO :10 G/100 ML
TEMP. :RT
ATM. :AIR
SEP'N. :NONE
ANAL. :L
COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 56

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			9.9E+2(--)	
	11.8			2.1E+3(--)	
	12.9			>2.5E+3(--)	
CS 137	.17			1.5E+1(--)	
	2.3			>5.0E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
SR 85	.17			5.6E+0(--)	
	2.3			6.5E+0(--)	
	6.3			1.2E+1(--)	
	14.2			1.5E+1(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 57
NAME : GRANITE (AUSTRIAN) 230
ORIGIN : KASTERHOF, UPPER AUSTRIA-SURF. WEATHERED

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
PH	3.5	

EXPERIMENTAL DETAILS

METHOD :BATCH(BC)

STATE :CRUSHED 144 - 324 CM-2

RATIO :10 G/100 ML

TEMP. :RT

ATM. :AIR

SEP'N. :NONE

ANAL. :L

COMB. :NONE

REFERENCES : 1) M. TSCHURLOVITS
AUSTR. UNIV. NUCLEAR
WORKSHOP, BRUSSELS-79

SORPTION RESULTS

FOR MATERIAL NUMBER--- 57

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
CE 144	6.7			2.0E-1(--)	
	11.8			2.0E+1(--)	
	12.9			2.0E+1(--)	
CS 137	.17			9.0E+0(--)	
	2.3			4.0E+1(--)	
	6.3			1.9E+2(--)	
	14.2			1.4E+2(--)	
SR 85	.17			1.0E+0(--)	
	2.3			2.0E-1(--)	
	6.3			3.0E+1(--)	
	14.2			1.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 58
NAME : GRANITE 29A
ORIGIN : GOETHEBORG, SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

ROCK PROPERTIES

TRACE ELEMENTS (PPM)

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :CRUSHED, -140+230 MESH
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE

REFERENCES : 1) B. ALLARD ET.AL
CHALMERS INST. TECH.
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 58

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241				4.0E+3(--)	
CS 134				1.3E+2(--)	
SR 89				6.3E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 59
NAME : GRANITE 24A
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :CRUSHED
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B. ALLARD ET.AL
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 59

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.13			2.5E+3(--)	
	.25			1.0E+4(--)	
	7				
CS 134	.13			2.5E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
SR 89	.13			1.6E+0(--)	
	.25			2.5E+0(--)	
	7			2.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 6D
NAME : GRANITE 25A
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

ROCK PROPERTIES

AQUEOUS PHASE

TRACE ELEMENTS (PPM)	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :-140+230 MESH

RATIO :1 G/10 ML

TEMP. :25 C

ATM. :AIR

SEP'N. :CENTRIF.,4000 RPM,50 MIN.

ANAL. :L

COMB. :NONE

REFERENCES : 1) B. ALLARD ET.AL
KBS; T.R. 55
2) B. ALLARD ET.AL
KBS, T.R. 98

SORPTION RESULTS

FOR MATERIAL NUMBER--- 60

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.4	1.0E-8		5.0E+3(--)	
	186	1.0E-8		1.6E+4(--)	
CE 144	.4	1.0E-8		6.3E+3(--)	
	.4	1.0E-5		5.0E+3(--)	
	186	1.0E-8		2.5E+4(--)	
	186	1.0E-5		2.0E+4(--)	
CS 134	.4	1.0E-8		6.3E+1(--)	
	.4	1.0E-5		2.0E+1(--)	
	186	1.0E-8		2.5E+2(--)	
	186	1.0E-5		4.0E+1(--)	
EU 152	.4	1.0E-8		1.0E+4(--)	
	.4	1.0E-5		1.3E+4(--)	
	186	1.0E-8		3.2E+4(--)	
	186	1.0E-5		1.0E+4(--)	
I 132	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
ND 147	.4	1.0E-8		2.0E+3(--)	
	.4	1.0E-5		1.6E+3(--)	
	186	1.0E-8		7.9E+3(--)	
	186	1.0E-5		5.0E+3(--)	
NP 237	.4	1.0E-8		2.5E+1(--)	
	186	1.0E-8		7.9E+1(--)	
PU 239	.4	1.0E-8		6.3E+1(--)	
	186	1.0E-8		3.2E+2(--)	
RA 226	.4	1.0E-8		1.0E+2(--)	
	186	1.0E-8		2.5E+2(--)	
SR 89	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		6.3E+0(--)	
	186	1.0E-8		1.0E+1(--)	
	186	1.0E-5		1.0E+1(--)	
TC 99M	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
TH 232	.4	1.0E-8		6.3E+2(--)	
	.4	1.0E-5		5.0E+2(--)	
	186	1.0E-8		1.0E+4(--)	
	186	1.0E-5		2.0E+3(--)	
U 233	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		4.0E+0(--)	
	186	1.0E-8		6.3E+0(--)	
	186	1.0E-5		5.0E+0(--)	
ZR 95	.4	1.0E-8		1.3E+3(--)	
	.4	1.0E-5		3.2E+3(--)	
	186	1.0E-8		1.0E+3(--)	
	186	1.0E-5		3.2E+3(--)	

9 2 1 2 6 2 0 3 2 3

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 51
NAME : GRANITE 258
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	12	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :CRUSHED, -140+230 MESH
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B. ALLARD ET.AL
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 61

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.13				
	.25			3.2E+3(--)	
	7			1.0E+4(--)	
CS 134	.13			3.2E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
SR 89	.13			2.5E+0(--)	
	.25			3.2E+0(--)	
	7			3.2E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 62
NAME : GRANITE 25C
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	12	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :-140+230 MESH
RATIO :1 G/10 ML
TEMP. :65 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES :

SORPTION RESULTS

FOR MATERIAL NUMBER--- 62

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.4	1.0E-8		6.3E+3(--)	
CE 144	.4	1.0E-8		5.0E+3(--)	
	.4	1.0E-5		1.0E+4(--)	
CS 134	.4	1.0E-8		4.0E+1(--)	
	.4	1.0E-5		7.9E+1(--)	
EU 152	.4	1.0E-8		2.5E+4(--)	
	.4	1.0E-5		2.5E+4(--)	
I 132	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
ND 147	.4	1.0E-8		2.0E+3(--)	
	.4	1.0E-5		1.0E+3(--)	
NP 237	.4	1.0E-8		4.0E+1(--)	
PU 239	.4	1.0E-8		1.0E+2(--)	
RA 226	.4	1.0E-8		7.9E+1(--)	
SR 89	.4	1.0E-8		1.0E+1(--)	
	.4	1.0E-5		1.0E+1(--)	
TC 99M	.4	1.0E-8		0.00	
TH 232	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		7.9E+2(--)	
U 233	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		4.0E+0(--)	
ZR 95	.4	1.0E-8		3.2E+3(--)	
	.4	1.0E-5		6.3E+3(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 63
NAME : GRANITE 250
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	42	
K	5	
CA	37.5	
MG	7.5	
HCO3	100	
CL	93	
SO4	7.5	
F	.8	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :-140+230 MESH
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES :

SORPTION RESULTS

FOR MATERIAL NUMBER--- 63

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.4	1.0E-8		1.3E+4(--)	
	186	1.0E-8		3.2E+4(--)	
CE 144	.4	1.0E-8		1.3E+4(--)	
	.4	1.0E-5		6.3E+3(--)	
	186	1.0E-8		2.5E+4(--)	
	186	1.0E-5		1.3E+4(--)	
CS 134	.4	1.0E-8		1.3E+2(--)	
	.4	1.0E-5		3.2E+1(--)	
	186	1.0E-8		3.2E+2(--)	
	186	1.0E-5		6.3E+1(--)	
EU 152	.4	1.0E-8		7.9E+3(--)	
	.4	1.0E-5		1.0E+4(--)	
	186	1.0E-8		1.6E+4(--)	
	186	1.0E-5		2.0E+4(--)	
I 132	.4	1.0E-8		7.9E-1(--)	
	.4	1.0E-5		6.3E-1(--)	
ND 147	.4	1.0E-8		4.0E+3(--)	
	.4	1.0E-5		3.2E+3(--)	
	186	1.0E-8		1.3E+4(--)	
	186	1.0E-5		2.0E+4(--)	
NP 237	.4	1.0E-8		4.0E+1(--)	
	186	1.0E-8		6.3E+1(--)	
PU 239	.4	1.0E-8		1.6E+2(--)	
	186	1.0E-8		3.2E+2(--)	
RA 226	.4	1.0E-8		1.0E+2(--)	
	186	1.0E-8		5.0E+2(--)	
SR 89	.4	1.0E-8		7.9E+0(--)	
	.4	1.0E-5		1.0E+1(--)	
	186	1.0E-8		1.6E+1(--)	
	186	1.0E-5		1.6E+1(--)	
TC 99M	.4	1.0E-8		5.0E-1(--)	
TH 232	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		1.3E+3(--)	
	186	1.0E-8		4.0E+3(--)	
	186	1.0E-5		5.0E+3(--)	
U 233	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		5.0E+0(--)	
	186	1.0E-8		6.3E+0(--)	
	186	1.0E-5		5.0E+0(--)	
ZR 95	.4	1.0E-8		1.3E+3(--)	
	.4	1.0E-5		2.0E+3(--)	
	186	1.0E-8		3.2E+3(--)	
	186	1.0E-5		2.5E+3(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 64
NAME : GRANITE 25E
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	42	
K	5	
CA	37.5	
MG	7.5	
HCO3	100	
CL	93	
SO4	7.5	
F	.8	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :-140+230 MESH
RATIO :1 G/10 ML
TEMP. :65 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES :

SORPTION RESULTS

FOR MATERIAL NUMBER--- 64

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.4	1.0E-8		1.3E+4(--)	
CE 144	.4	1.0E-8		2.0E+4(--)	
	.4	1.0E-5		7.9E+3(--)	
CS 134	.4	1.0E-8		6.3E+1(--)	
	.4	1.0E-5		3.2E+1(--)	
EU 152	.4	1.0E-8		2.0E+4(--)	
	.4	1.0E-5		1.6E+4(--)	
I 132	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
ND 147	.4	1.0E-8		4.0E+3(--)	
	.4	1.0E-5		7.9E+3(--)	
NP 237	.4	1.0E-8		5.0E+1(--)	
PU 239	.4	1.0E-8		1.0E+2(--)	
RA 226	.4	1.0E-8		1.0E+2(--)	
SR 89	.4	1.0E-8		1.0E+1(--)	
	.4	1.0E-5		1.0E+1(--)	
TC 99M	.4	1.0E-6		0.00	
TH 232	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		1.3E+3(--)	
U 233	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		5.0E+0(--)	
ZR 95	.4	1.0E-8		6.3E+3(--)	
	.4	1.0E-5		3.2E+3(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 65
NAME : GRANITE 26A
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :CRUSHED, -230+325 MESH
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B, ALLARD ET.AL
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 65

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.13				
	.25			3.2E+3(--)	
	7			1.3E+4(--)	
CS 134	.13			4.0E+2(--)	
	.25			4.0E+2(--)	
	7			7.9E+2(--)	
SR 89	.13			4.0E+0(--)	
	.25			5.0E+0(--)	
	7			5.0E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 64
NAME : GRANITE 27A
ORIGIN : SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)	TRACE ELEMENTS (PPM)
SIO2		
AL2O3		
TIO2		
FE2O3		
FEO		
MNO		
MGO		
CAO		
NA2O		
K2O		
P2O5		
CO2		
H2O		

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH
STATE :CRUSHED, -325 MESH
RATIO :1 G/10 ML
TEMP. :25 C
ATM. :AIR
SEP'N. :CENTRIF.,4000 RPM,50 MIN.
ANAL. :L
COMB. :NONE
REFERENCES : 1) B. ALLARD ET.AL
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 66

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.13				
	.25			4.0E+3(--)	
	7			1.6E+4(--)	
CS 134	.13			4.0E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
SR 89	.13			5.0E+0(--)	
	.25			6.3E+0(--)	
	7			6.3E+0(--)	

RADIONUCLIDE SORPTION PARAMETER DESCRIPTION

NOV 11, 1981

GEOLOGICAL MATERIAL

NUMBER : 67
NAME : GRANODIORITE 28A
ORIGIN : FINN LAKE, SWEDEN

CHEMICAL COMPOSITION(%)	MINERAL COMPOSITION(%)
SIO2	
AL2O3	
TIO2	
FE2O3	
FEO	
MNO	
MGO	
CAO	
NA2O	
K2O	
P2O5	
CO2	
H2O	

TRACE ELEMENTS (PPM)

ROCK PROPERTIES

AQUEOUS PHASE

	START	END
NA	288	
K	10	
CA	75	
MG	15	
HCO3	200	
CL	500	
SO4	15	
F	1.5	

EXPERIMENTAL DETAILS

METHOD :BATCH

STATE :CRUSHED, -140+230 MESH

RATIO :1 G/10 ML

TEMP. :25 C

ATM. :AIR

SEP'N. :CENTRIF.,4000 RPM,50 MIN.

ANAL. :L

COMB. :NONE

REFERENCES : 1) B. ALLARD ET.AL
CHALMERS INST. TECH.
KBS, T.R. 55

SORPTION RESULTS

FOR MATERIAL NUMBER--- 67

RADIONUCLIDE	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
AM 241	.25			1.0E+3(--)	
	7			3.2E+3(--)	
CS 134	.25			1.6E+2(--)	
	7			2.5E+2(--)	
SR 89	.25			2.0E+0(--)	
	7			3.2E+0(--)	

9 2 1 2 5 6 2 0 3 3 8

APPENDIX B

SORPTION DATA LISTED BY RADIONUCLIDE ALPHABETICALLY

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SORPTION RESULTS

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KAS	KAD
1	.5			7.9E+0(--)	
	1			5.0E+0(--)	
	1				1.1E+2(--)
49	.5			2.0E+1(--)	
	1			2.0E+1(--)	
	1				1.1E+2(--)

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [PN] (M/L)	FINAL [PN] (M/L)	KDS	KDD
9	7.7	1.0E-6		1.2E+3(--)	
	14.7	1.0E-6		3.0E+3(7.0)	
	28.7	1.0E-6		5.3E+3(--)	
	56.7	1.0E-6		7.8E+3(17)	
	15.7				2.9E+3(--)
	16.8				7.7E+2(3.7)
	19.7				4.7E+2(--)
10	7.7	1.0E-6		7.6E+2(--)	
	14.7	1.0E-6		1.3E+3(--)	
	28.7	1.0E-6		1.7E+3(--)	
	56.7	1.0E-6		3.0E+3(--)	
	16.8				4.4E+2(--)
	19.7				3.2E+2(--)
	29.7				3.3E+2(--)
11	7.7	1.0E-6		3.6E+2(--)	
	14.7	1.0E-6		4.8E+2(--)	
	28.7	1.0E-6		1.6E+3(83)	
	56.7	1.0E-6		4.1E+3(--)	
	15.7				3.0E+3(--)
	16.8				
	19.7				4.0E+2(7.1)

SORPTION RESULTS

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
12	7.7	1.0E-6		6.2E+3(--)	
	14.7	1.2E-6		4.5E+3(--)	
	18.7	1.0E-6		1.7E+4(--)	
	56.7	1.2E-6		1.8E+4(--)	
	16.8	1.2E-6			4.6E+2(--)
	19.7	1.0E-6			3.8E+2(--)
13	7.7	1.2E-6		1.0E+3(--)	
	14.7	1.0E-6		1.8E+3(--)	
	28.7	1.0E-6		2.4E+3(--)	
	56.7	1.0E-6		2.0E+3(--)	
	15.7	1.0E-6			1.9E+3(--)
16	7.7	1.2E-6		2.2E+3(--)	
	14.7	1.0E-6		2.3E+3(--)	
	28.7	1.2E-6		8.5E+3(--)	
	56.7	1.2E-6		3.9E+3(22)	
	15.7				1.8E+4(--)
	16.8				5.4E+2(--)

SORPTION RESULTS

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
19	7.7	1.0E-6		7.8E+2(--)	
	14.7	1.0E-6		1.1E+3(--)	
	28.7	1.0E-6		1.7E+3(--)	
	56.7	1.0E-6		2.4E+3(--)	
	15.7				2.4E+3(81)
	16.8				2.2E+2(--)
	19.7				6.2E+2(--)
22	7.7	1.0E-6		5.4E+2(1.3)	
	14.7	1.0E-6		1.0E+3(23)	
	28.7	1.0E-6		1.7E+3(18)	
	56.7	1.0E-6		3.7E+3(49)	
	16.8				5.0E+2(--)
	19.7				1.5E+2(--)
	29.7				3.4E+2(42)
25	7.7	1.0E-6		2.3E+3(--)	
	14.7	1.0E-6		4.4E+3(--)	
	28.7	1.0E-6		1.1E+4(--)	
	56.7	1.0E-6		6.3E+4(--)	
	16.8	1.0E-6			4.0E+2(--)

SORPTION RESULTS

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
30		1.5E-10		6.1E+3(--)	
		1.6E-9		1.8E+4(--)	
		1.1E-8		2.7E+4(--)	
		1.5E-7		5.9E+4(--)	
31	14			2.7E+4(44)	
32	8	7.9E-6		6.0E+4(48)	
33	14			2.1E+4(24)	
58				4.0E+3(--)	
59	.13				
	.25			2.5E+3(--)	
	7			1.0E+4(--)	
60	.4	1.0E-8		5.0E+3(--)	
	186	1.0E-8		1.6E+4(--)	

9 2 SORPTION RESULTS 2 0 3 4 4

FOR-- AM

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
61	.13				
	.25			3.2E+3(--)	
	9			1.0E+4(--)	
62	.4	1.0E-8		6.3E+3(--)	
63	.4	1.0E-8		1.3E+4(--)	
	186	1.0E-8		3.2E+4(--)	
64	.4	1.0E-8		1.3E+4(--)	
65	.13				
	.25			3.2E+3(--)	
	9			1.3E+4(--)	
66	.13				
	.25			4.0E+3(--)	
	7			1.6E+4(--)	
67	.25			1.0E+3(--)	
	7			3.2E+3(--)	

FOR-- BA

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	9.92	2.4E-8		2.6E+2(4)	
	16.98	2.4E-8		2.0E+2(4)	
	27.91	2.4E-8		2.7E+2(4)	
	62.04	2.4E-8		4.2E+2(4)	
	13.67				2.6E+2(6)
	27.66				2.5E+2(6)
	55.72				3.9E+2(9)
7	9.91	2.4E-8		7.5E+1(4.1)	
	16.98	2.4E-8		9.6E+1(4.0)	
	27.91	2.4E-8		8.0E+1(4.3)	
	62.03	2.4E-8		1.5E+2(3.3)	
	13.67				8.4E+1(6.7)
	27.66				7.9E+1(5.2)
	55.72				8.1E+1(5.5)
8	9.91	2.4E-8		7.3E+1(4.0)	
	16.97	2.4E-8		7.8E+1(4.0)	
	29.97	2.4E-8		7.7E+1(3.9)	
	62.03	2.4E-8		7.8E+1(3.4)	
	13.67				7.7E+1(6.4)
	27.66				9.1E+1(6.3)
	55.72				7.9E+1(5.9)

FOR-- BA

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	9,9	2.4E-8		2,3E+2(4,2)	
	16,99	2.4E-8		2,9E+2(4,3)	
	27,96	2.4E-8		3,8E+2(4,3)	
	62,02	2.4E-8		4,7E+2(3,8)	
	13,67				3,6E+2(6,4)
	27,66				3,6E+2(5,9)
	55,72				3,2E+2(5,5)
17	9,9	2.4E-8		6,8E+1(4,0)	
	16,98	2.4E-8		8,4E+1(4,0)	
	27,96	2.4E-8		1,0E+2(4,0)	
	62,02	2.4E-8		9,7E+1(3,6)	
	13,67				8,3E+1(6,0)
	27,66				1,1E+2(6,1)
	55,72				7,5E+1(5,5)
20	9,89	2.4E-8		9,1E+1(4,3)	
	16,98	2.4E-8		9,5E+1(4,5)	
	27,96	2.4E-8		9,3E+1(4,2)	
	62,02	2.4E-8		9,6E+1(3,7)	
	13,67				9,6E+1(6,0)
	27,66				9,9E+1(5,7)
	55,72				9,7E+1(5,9)

SORPTION RESULTS

FOR-- BA

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
23	7.08	2.4E-8		7.2E+2(4.4)	
	17.05	2.4E-8		1.3E+3(4.6)	
	27.93	2.4E-8		1.3E+3(4.8)	
	66.12	2.4E-8		2.9E+3(15)	
	13.69				1.2E+3(6.2)
	27.72				1.8E+3(6.2)
	55.75				1.8E+3(5.7)
26	7.07	2.4E-8		1.7E+2(3.7)	
	17.04	2.4E-8		3.2E+2(3.9)	
	27.93	2.4E-8		4.7E+2(4.3)	
	66.11	2.4E-8		5.7E+2(11)	
	13.69				4.7E+2(5.6)
	27.72				3.8E+2(6.3)
	55.75				3.8E+2(5.6)
28	9.08	2.4E-8		1.3E+2(3.9)	
	17.04	2.4E-8		1.8E+2(3.9)	
	27.92	2.4E-8		1.9E+2(4.1)	
	66.11	2.4E-8		3.7E+2(5.9)	
	13.69				1.6E+2(5.6)
	27.72				2.3E+2(5.9)
	55.75				3.1E+2(6.1)

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FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	9,92	1.3E-6		1,3E+2(5)	
	16,98	1.3E-6		9,8E+1(4)	
	27,91	1.3E-6		1,4E+2(5)	
	62,04	1.3E-6		1,3E+3(4)	
	13,67				7.5E+2(6)
	27,06				1.6E+3(8)
	55,72				5.2E+3(13)
7	9,91	1.3E-6		1,0E+2(4,3)	
	16,98	1.3E-6		9,0E+1(4,3)	
	27,91	1.3E-6		8,6E+1(4,6)	
	62,03	1.3E-6		3,7E+2(3,6)	
	13,67				6.6E+2(7,1)
	27,66				6.1E+2(5,8)
	55,72				1.0E+3(7,7)
8	9,91	1.3E-6		1,8E+2(4,2)	
	16,97	1.3E-6		1,2E+2(4,4)	
	29,97	1.3E-6		1,2E+2(4,0)	
	62,03	1.3E-6		1,9E+2(3,6)	
	13,67				9.4E+2(6,8)
	27,66				9.1E+2(7,0)
	55,72				1.1E+3(8,4)

FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	9.9	1.3E-6		7.7E+1(4.3)	
	16.99	1.3E-6		1.8E+2(4.5)	
	27.96	1.3E-6		3.5E+2(4.6)	
	62.02	1.3E-6		6.8E+2(7.8)	
	13.67				1.4E+3(6.9)
	27.66				2.2E+3(6.9)
	55.72				3.2E+3(8.4)
17	9.9	1.3E-6		5.7E+1(4.3)	
	16.98	1.3E-6		8.6E+1(4.3)	
	27.96	1.3E-6		1.1E+2(4.3)	
	62.02	1.3E-6		2.5E+2(3.8)	
	13.67				5.5E+2(6.4)
	27.66				6.0E+2(7.3)
	55.72				1.1E+3(8.6)
20	9.89	1.3E-6		1.7E+2(4.5)	
	16.98	1.3E-6		2.7E+2(4.7)	
	27.96	1.3E-6		1.3E+2(4.5)	
	62.02	1.3E-6		4.2E+2(4.0)	
	13.67				1.0E+3(6.5)
	27.66				1.1E+3(7.2)
	55.72				1.4E+3(7.7)

9 SORPTION RESULTS 2 0 3 5 0

FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
23	9,08	1.3E-6		5,5E+1(4,3)	
	17,05	1.3E-6		5,0E+1(4,3)	
	27,93	1.3E-6		5,5E+1(4,7)	
	66,12	1.3E-6		7,7E+1(15)	
	33,69				6.6E+2(6,9)
	27,72				1.4E+3(7,9)
	95,75				1.3E+3(8,3)
26	7,07	1.3E-6		3,5E+1(4,1)	
	17,04	1.3E-6		2,5E+1(4,2)	
	27,93	1.3E-6		2,3E+1(4,5)	
	66,11	1.3E-6		3,4E+1(11)	
	33,69				9.5E+2(6,9)
	27,72				9.2E+2(8,8)
	95,75				7.7E+2(10)
28	9,08	1.3E-6		2,3E+1(4,3)	
	17,04	1.3E-6		2,2E+1(4,3)	
	27,92	1.3E-6		2,8E+1(4,4)	
	66,11	1.3E-6		6,5E+1(6,1)	
	33,69				4.6E+2(6,6)
	27,72				6.6E+2(8,0)
	95,75				2.3E+3(19)

SORPTION RESULTS

FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
50	6.7			2.2E+2(--)	
	11.8			8.7E+2(--)	
	12.9			3.5E+3(--)	
51	6.7			3.4E+2(--)	
	11.8			5.5E+2(--)	
	12.9			6.6E+2(--)	
52	6.7			6.7E+2(--)	
	11.8			2.0E+3(--)	
	12.9			2.0E+3(--)	
53	6.7			9.0E+2(--)	
	11.8			1.6E+3(--)	
	12.9			2.2E+3(--)	
54	6.7			2.3E+2(--)	
	11.8			4.4E+2(--)	
	12.9			5.9E+2(--)	

SORPTION RESULTS

FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
55	6.7			6.0E+2(--)	
	11.8			4.3E+2(--)	
	12.9			6.9E+2(--)	
56	6.7			9.9E+2(--)	
	11.8			2.1E+3(--)	
	12.9			>2.5E+3(--)	
57	6.7			2.0E-1(--)	
	11.8			2.0E+1(--)	
	12.9			2.0E+1(--)	
60	.4	1.0E-8		6.3E+3(--)	
	.4	1.0E-5		5.0E+3(--)	
	186	1.0E-8		2.5E+4(--)	
	186	1.0E-5		2.0E+4(--)	
62	.4	1.0E-8		5.0E+3(--)	
	.4	1.0E-5		1.0E+4(--)	

SORPTION RESULTS

FOR-- CE

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
63	.4	1.0E-8		1.3E+4(--)	
	.4	1.0E-5		6.3E+3(--)	
	186	1.0E-8		2.5E+4(--)	
	186	1.0E-5		1.3E+4(--)	
64	.4	1.0E-8		2.0E+4(--)	
	.4	1.0E-5		7.9E+3(--)	

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KAS	KAD
1	.5			6.3E+0(--)	
	1			5.0E+0(--)	
	1				2.0E+1(--)
49	.5			7.9E-1(--)	
	1			6.3E-1(--)	
	1				3.2E+0(--)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
2	14			6.6E+2(1.4)	
	28			5.8E+2(2.2)	
	14				1.6E+2(6.1)
	28				1.4E+2(21)
3	14			5.0E+2(20)	
	14			4.8E+2(17)	
	28				1.3E+2(25)
	28				1.2E+2(14)
4	14	7.4E-6		3.9E-1(18)	
	28	7.4E-6		1.2E-1(130)	
	14	7.4E-6			0.0E+0(0)
	28	7.4E-6			0.0E+0(0)
5	14	7.4E-6		6.3E-1(7.2)	
	28	7.4E-6		3.3E-1(64)	
	14	7.4E-6			0.0E+0(0)
	28	7.4E-6			0.0E+0(0)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	9.92	1.4E-9		4.6E+2(3)	
	16.98	1.4E-9		4.2E+2(3)	
	27.91	1.4E-9		4.5E+2(3)	
	62.04	1.4E-9		5.2E+2(2)	
	13.67				5.8E+2(7)
	27.66				6.2E+2(7)
	55.72				7.6E+2(7)
7	9.91	1.4E-9		2.2E+2(2.6)	
	16.98	1.4E-9		2.5E+2(2.6)	
	87.91	1.4E-9		2.8E+2(2.9)	
	62.03	1.4E-9		2.8E+2(2.3)	
	13.67				4.0E+2(7.3)
	27.66				3.8E+2(7.4)
	55.72				4.1E+2(7.3)
8	9.91	1.4E-9		2.7E+2(2.6)	
	16.97	1.4E-9		3.1E+2(2.6)	
	29.97	1.4E-9		3.0E+2(2.6)	
	62.03	1.4E-9		4.1E+2(2.4)	
	13.67				5.2E+2(7.3)
	27.66				4.7E+2(7.3)
	55.72				6.6E+2(7.3)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	9.9	1.4E-9		3.5E+2(2.6)	
	16.99	1.4E-9		4.0E+2(2.7)	
	27.96	1.4E-9		5.5E+2(2.8)	
	62.02	1.4E-9		7.2E+2(2.5)	
	13.67				6.3E+2(7.3)
	27.66				6.4E+2(7.3)
	55.72				6.8E+2(7.2)
15	6.49	1.44E-9		1.4E+2(1.2)	
	13.53	1.44E-9		1.6E+2(1.2)	
	27.6	1.44E-9		1.7E+2(1.7)	
	55.58	1.44E-9		1.9E+2(1.6)	
	14.01				3.9E+2(11)
	27.7				4.5E+2(11)
	56.78				5.8E+2(11)
17	9.9	1.4E-9		2.5E+2(2.6)	
	16.98	1.4E-9		3.4E+2(2.6)	
	27.96	1.4E-9		3.4E+2(2.6)	
	62.02	1.4E-9		5.3E+2(2.4)	
	13.67				4.5E+2(7.3)
	27.66				7.3E+2(7.3)
	55.72				6.1E+2(7.3)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
18	6,58	1.44E-9		8,3E+1(1,1)	
	13,52	1,44E-9		1,0E+2(0,8)	
	27,59	1,44E-9		1,1E+2(1,8)	
	55,58	1.44E-9		1,3E+2(1,7)	
	14,01				2,9E+2(11)
	27,7				3.4E+2(10)
	56,78				3.4E+2(10)
20	0,89	1,4E-9		4,6E+2(2,7)	
	16,98	1,4E-9		6,1E+2(2,9)	
	27,96	1.4E-9		4,8E+2(2,7)	
	62,02	1,4E-9		7,8E+2(2,5)	
	13,67				8.2E+2(7.2)
	27,66				1,0E+3(7,3)
	55,72				1,0E+3(7,2)
21	6,58	1.44E-9		7,7E+1(1,1)	
	13,52	1,44E-9		1,0E+2(1,1)	
	27,59	1.44E-9		1,2E+2(1,8)	
	55,57	1,44E-9		1,2E+2(1,6)	
	14,01				3,2E+2(10)
	27,7				3,7E+2(11)
	56,77				3,4E+2(10)

SORPTION RESULTS

9 2 1 2 5 2 0 3 5 9

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
23	9.08	1.4E-9		3.2E+2(2.6)	
	17.05	1.4E-9		4.4E+2(2.6)	
	27.93	1.4E-9		6.7E+2(2.8)	
	66.12	1.4E-9		2.8E+4(11)	
	13.69				1.1E+3(7.2)
	27.72				8.0E+2(7.3)
	95.75				9.9E+2(7.2)
24	6.83	1.44E-9		2.2E+2(1.3)	
	13.84	1.44E-9		5.0E+2(1.7)	
	27.84	1.44E-9		1.6E+3(2.2)	
	95.83	1.44E-9		3.6E+3(2.0)	
	14.04				2.0E+3(14)
	27.71				8.6E+2(11)
	96.76				8.6E+2(11)
26	7.07	1.4E-9		1.8E+2(2.4)	
	17.04	1.4E-9		2.3E+2(2.5)	
	27.93	1.4E-9		4.5E+2(2.7)	
	66.11	1.4E-9		1.4E+4(7.4)	
	13.69				7.8E+2(7.2)
	27.72				5.7E+2(7.3)
	95.75				1.4E+3(7.2)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
27	6.83	1.44E-9		1.4E+2(1.7)	
	33.83	1.44E-9		3.3E+2(1.4)	
	27.84	1.44E-9		1.4E+3(2.4)	
	55.82	1.44E-9		2.5E+3(1.9)	
	14.04				2.7E+3(15)
	27.7				1.3E+3(13)
	56.76				1.6E+3(13)
28	7.08	1.4E-9		1.4E+2(2.5)	
	17.04	1.4E-9		1.9E+2(2.5)	
	27.92	1.4E-9		2.1E+2(2.6)	
	66.11	1.4E-9		4.3E+3(4.1)	
	13.69				4.9E+2(7.3)
	27.72				4.5E+2(7.4)
	55.75				4.8E+3(7.4)
29	6.82	1.44E-9		1.0E+2(1.1)	
	33.83	1.44E-9		3.0E+2(1.4)	
	27.84	1.44E-9		4.8E+2(1.9)	
	55.81	1.44E-9		2.8E+3(1.9)	
	14.04				1.6E+3(13)
	27.7				1.3E+3(13)
	56.76				1.1E+3(7.2)

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
30		1.1E-8		1.4E+3(--)	
		1.1E-7		9.1E+2(--)	
		1.1E-6		2.3E+2(--)	
		1.1E-5		1.1E+2(--)	
31	14			1.1E+3(18)	
32	2	4.4E-9		6.5E+2(7.1)	
33	14			1.1E+3(27)	
34	7			4.6E+2(4.6)	
35	9			1.0E+3(0.5)	
36	7			1.0E+3(1.5)	
37	7			1.5E+3(47)	
38	7			1.4E+3(1.2)	

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
39	9			9.4E+2(2.8)	
40	7			1.1E+3(5.7)	
41	8			3.8E+2(35)	
43	3			8.0E+0(61)	
	10			5.5E-1(999)	
	30			1.2E+1(45)	
44	3			7.9E+2(8.7)	
	10			2.7E+3(12)	
	30			5.9E+3(27)	
45	3			5.8E+2(17)	
	10			3.9E+3(109)	
	30			8.4E+3(79)	
46	3			6.5E+1(22)	
	10			1.5E+2(11)	
	30			3.9E+1(8.7)	

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
47	8			2.1E+2(41)	
50	.17			1.1E+1(--)	
	2.3			2.1E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
51	.17			1.4E+1(--)	
	2.3			4.0E+1(--)	
	6.3			9.0E+1(--)	
	14.2			9.0E+1(--)	
52	.17			8.0E+0(--)	
	2.3			5.0E+1(--)	
	6.3			>5.4E+2(--)	
	14.2			>5.0E+2(--)	
53	.17			1.0E+1(--)	
	2.3			1.5E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
54	.17			1.2E+1(--)	
	2.3			8.0E+1(--)	
	6.3			3.5E+2(--)	
	14.2			3.2E+2(--)	
55	.17			2.8E+1(--)	
	2.3			1.3E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
56	.17			1.5E+1(--)	
	2.3			>5.0E+2(--)	
	6.3			>5.0E+2(--)	
	14.2			>5.0E+2(--)	
57	.17			9.0E+0(--)	
	2.3			4.0E+1(--)	
	6.3			1.9E+2(--)	
	14.2			1.4E+2(--)	

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
58				1.3E+2(--)	
59	.13			2.5E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
60	.4	1.0E-8		6.3E+1(--)	
	.4	1.0E-5		2.0E+1(--)	
	186	1.0E-8		2.5E+2(--)	
	186	1.0E-5		4.0E+1(--)	
61	.13			3.2E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
62	.4	1.0E-8		4.0E+1(--)	
	.4	1.0E-5		7.9E+1(--)	
63	.4	1.0E-8		1.3E+2(--)	
	.4	1.0E-5		3.2E+1(--)	
	186	1.0E-8		3.2E+2(--)	
	186	1.0E-5		6.3E+1(--)	

SORPTION RESULTS

FOR-- CS

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
64	.4	1.0E-8		6.3E+1(--)	
	.4	1.0E-5		3.2E+1(--)	
65	.13			4.0E+2(--)	
	.25			4.0E+2(--)	
	7			7.9E+2(--)	
66	.13			4.0E+2(--)	
	.25			4.0E+2(--)	
	7			6.3E+2(--)	
67	.25			1.6E+2(--)	
	7			2.5E+2(--)	

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9 SORPTION RESULTS 2 0 3 6 7

FOR-- EU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	9,92	8.0E-8		3,5E+2(4)	
	16,98	8.0E-8		2,7E+2(4)	
	27,91	8.0E-8		3,5E+2(4)	
	62,04	8.0E-8		3,6E+3(4)	
	13,67				1.1E+3(6)
	27,66				1.9E+3(6)
	55,72				4.6E+3(8)
7	9,91	8.0E-8		1,9E+2(4,0)	
	16,98	8.0E-8		2,0E+2(4.0)	
	27,91	8.0E-8		1,8E+2(4,3)	
	62,03	8.0E-8		1,0E+3(3.4)	
	13,67				8.1E+2(6.7)
	27,66				7.2E+2(5,2)
	55,72				1.1E+3(5,6)
8	9,91	8.0E-8		2,5E+2(3,9)	
	16,97	8.0E-8		2,2E+2(4,0)	
	29,97	8.0E-8		2,1E+2(3,9)	
	62,03	8.0E-8		3,7E+2(3,4)	
	13,67				9,0E+2(5,9)
	27,66				8.8E+2(6,3)
	55,72				9.4E+2(6,3)

FOR-- EU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	9,9	8,0E-8		2,1E+2(4,1)	
	16,99	8,0E-8		4,6E+2(4,3)	
	27,96	8,0E-8		7,8E+2(4,4)	
	62,02	8,0E-8		2,0E+3(8,1)	
	13,67				2,0E+3(6,4)
	27,66				2.7E+3(6,0)
	55,72				3.4E+3(5,6)
17	9,9	8,0E-8		1,2E+2(4,0)	
	16,98	8,0E-8		1,7E+2(4,0)	
	27,96	8,0E-8		2,4E+2(4,0)	
	62,02	8,0E-8		6,0E+2(3,6)	
	13,67				7,0E+2(6,0)
	27,66				9.5E+2(6,1)
	55,72				1,0E+3(5,6)
20	9,89	8,0E-8		2,8E+2(4,3)	
	16,98	8,0E-8		4,4E+2(4,4)	
	27,96	8,0E-8		2,6E+2(4,2)	
	62,02	8,0E-8		8,4E+2(3,8)	
	13,67				1,1E+3(6,0)
	27,66				1,2E+3(5,7)
	55,72				1,2E+3(5,9)

SORPTION RESULTS

FOR-- EU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
23	7.08	8.0E-8		1.0E+2(4.1)	
	17.05	8.0E-8		8.8E+1(3.8)	
	27.93	8.0E-8		1.0E+2(4.3)	
	66.12	8.0E-8		1.6E+2(15)	
	13.69				8.1E+2(6.2)
	27.72				1.6E+3(6.3)
	55.75				1.4E+3(5.7)
26	7.07	8.0E-8		4.9E+1(3.8)	
	17.04	8.0E-8		3.9E+1(3.9)	
	27.93	8.0E-8		3.9E+1(4.1)	
	66.11	8.0E-8		5.4E+1(11)	
	13.69				1.2E+3(5.9)
	27.72				1.2E+3(6.6)
	55.75				9.7E+2(5.7)
28	7.28	8.0E-8		3.2E+1(4.0)	
	17.04	8.0E-8		3.2E+1(3.9)	
	27.92	8.0E-8		4.5E+1(4.0)	
	66.11	8.0E-8		1.1E+2(5.9)	
	13.69				5.9E+2(5.8)
	27.72				7.5E+2(6.1)
	55.75				1.9E+3(6.4)

SORPTION RESULTS

FOR-- EU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		1.0E+4(--)	
	.4	1.0E-5		1.3E+4(--)	
	186	1.0E-8		3.2E+4(--)	
	186	1.0E-5		1.0E+4(--)	
62	.4	1.0E-8		2.5E+4(--)	
	.4	1.0E-5		2.5E+4(--)	
63	.4	1.0E-8		7.9E+3(--)	
	.4	1.0E-5		1.0E+4(--)	
	186	1.0E-8		1.6E+4(--)	
	186	1.0E-5		2.0E+4(--)	
64	.4	1.0E-8		2.0E+4(--)	
	.4	1.0E-5		1.6E+4(--)	

SORPTION RESULTS

FOR-- I

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
62	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	
63	.4	1.0E-8		7.9E-1(--)	
	.4	1.0E-5		6.3E-1(--)	
64	.4	1.0E-8		0.00	
	.4	1.0E-5		0.00	

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SORPTION RESULTS

FOR-- ND

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		2.0E+3(--)	
	.4	1.0E-5		1.6E+3(--)	
	186	1.0E-8		7.9E+3(--)	
	186	1.0E-5		5.0E+3(--)	
62	.4	1.0E-8		2.0E+3(--)	
	.4	1.0E-5		1.0E+3(--)	
63	.4	1.0E-8		4.0E+3(--)	
	.4	1.0E-5		3.2E+3(--)	
	186	1.0E-8		1.3E+4(--)	
	186	1.0E-5		2.0E+4(--)	
64	.4	1.0E-8		4.0E+3(--)	
	.4	1.0E-5		7.9E+3(--)	

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SORPTION RESULTS

FOR-- NP

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
30		9.2E-7		2.6E+2(--)	
		7.8E-6		3.2E+1(--)	
		9.0E-5		1.5E+2(--)	
		7.0E-4		1.5E+2(--)	
31	14			4.5E+1(4.4)	
33	14			3.9E+1(7.7)	
60	.4	1.0E-8		2.5E+1(--)	
	186	1.0E-8		7.9E+1(--)	
62	.4	1.0E-8		4.0E+1(--)	
63	.4	1.0E-8		4.0E+1(--)	
	186	1.0E-8		6.3E+1(--)	
64	.4	1.0E-8		5.0E+1(--)	

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SORPTION RESULTS

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
2	14			1.9E+2(28)	
	28			3.6E+2(26)	
	14				9.4E+2(1.4)
	28				5.3E+2(22)
3	14			2.4E+2(45)	
	14			3.3E+2(16)	
	28				7.2E+2(8.6)
	28				5.6E+2(7.5)
4	14			3.0E+0(30)	
	28			2.1E+0(83)	
	14				4.0E+1(15)
	28				2.9E+1(44)
5	14			4.1E+0(22)	
	28			4.3E+0(26)	
	14				4.0E+1(37)
	28				3.7E+1(28)

SORPTION RESULTS

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
9	9.7	1.0E-12			
	14.7	1.0E-12		1.4E+3(--)	
	28.7	1.0E-12		1.2E+3(--)	
	56.7	1.0E-12		2.3E+3(--)	
	15.7				
	16.8				
	19.7				
10	9.7	1.0E-12			
	14.7	1.0E-12		9.8E+2(--)	
	28.7	1.0E-12		7.1E+2(--)	
	56.7	1.0E-12		2.5E+3(--)	
	16.8				
	19.7				
	29.7				
11	9.7	1.0E-12			
	14.7	1.0E-12		4.0E+2(--)	
	28.7	1.0E-12		5.2E+2(--)	
	56.7	1.0E-12		8.4E+2(--)	
	15.7				
	16.8				
	19.7				

SORPTION RESULTS

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
12	7.7	1.0E-12			
	14.7	1.0E-12		3.5E+2(--)	
	18.7	1.0E-12		4.3E+2(--)	
	56.7	1.0E-12		9.4E+2(--)	
	16.8	1.0E-12			
	19.7	1.0E-12			
13	7.7	1.0E-12			
	14.7	1.0E-12		2.8E+2(--)	
	28.7	1.0E-12		5.0E+2(--)	
	56.7	1.0E-12		7.0E+2(--)	
	15.7	1.0E-12			
16	7.7	1.0E-12			
	14.7	1.0E-12		1.1E+3(--)	
	28.7	1.0E-12		1.5E+3(--)	
	56.7	1.0E-12		2.9E+3(--)	
	15.7				
	16.8				

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
19	7.7	1.0E-12			
	14.7	1.0E-12		5.1E+2(--)	
	28.7	1.0E-12		6.0E+2(--)	
	56.7	1.0E-12		9.7E+2(--)	
	15.7				
	16.8				
	19.7				
22	7.7	1.0E-12			
	14.7	1.0E-12		6.9E+2(--)	
	28.7	1.0E-12		1.2E+3(--)	
	56.7	1.0E-12		2.5E+3(--)	
	16.8				
	19.7				
	29.7				
25	7.7	1.0E-12			
	14.7	1.0E-12		3.6E+3(--)	
	28.7	1.0E-12		4.4E+3(--)	
	56.7	1.0E-12		2.5E+4(--)	
	16.8	1.0E-12			

SORPTION RESULTS

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
30		1.0E-8		6.4E+2(--)	
		1.0E-7		8.3E+3(--)	
		1.0E-6		7.7E+2(--)	
		1.0E-5		1.7E+5(--)	
31	14			1.2E+4(83)	
32	2			5.4E+3(21)	
33	14			1.2E+4(58)	
42	7			5.6E+2(27)	
48	7			5.2E+2(16)	
60	.4	1.0E-8		6.3E+1(--)	
	186	1.0E-8		3.2E+2(--)	
62	.4	1.0E-8		1.0E+2(--)	

SORPTION RESULTS

FOR-- PU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
63	.4	1.0E-8		1.6E+2(--)	
	186	1.0E-8		3.2E+2(--)	
64	.4	1.0E-8		1.0E+2(--)	

SORPTION RESULTS

FOR-- RA

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		1.0E+2(--)	
	186	1.0E-8		2.5E+2(--)	
62	.4	1.0E-8		7.9E+1(--)	
63	.4	1.0E-8		1.0E+2(--)	
	186	1.0E-8		5.0E+2(--)	
64	.4	1.0E-8		1.0E+2(--)	

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SORPTION RESULTS

FOR-- RU

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
32	8	2.0E-10		2.1E+2(8.2)	

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SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KAS	KAD
1	.5			3.2E-1(--)	
	1			2.0E-1(--)	
	1				2.0E-1(--)
49	.5			1.0E-1(--)	
	1			2.5E-1(--)	
	1				5.0E+1(--)

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
2	14			1.1E+1(27)	
	28			1.1E+1(28)	
	14				2.1E+1(24)
	28				2.0E+1(19)
3	14			7.7E+0(13)	
	14			8.0E+0(15)	
	28				1.4E+1(10)
	28				1.4E+1(23)
4	14	1.4E-5		1.8E-1(110)	
	28	1.4E-5		2.8E-1(122)	
	14	1.4E-5			2.4E+0(143)
	28	1.4E-5			2.9E+0(124)
5	14	1.4E-5		9.0E-2(150)	
	28	1.4E-5		3.8E-1(120)	
	14	1.4E-5			3.1E+0(110)
	28	1.4E-5			4.4E+0(100)

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	9.92	1.2E-6		2.2E+1(4)	
	16.98	1.2E-6		1.6E+1(4)	
	27.91	1.2E-6		1.7E+1(5)	
	62.04	1.2E-6		1.9E+1(9)	
	13.67				2.3E+1(7)
	27.66				2.2E+1(8)
	55.72				2.8E+1(10)
7	9.91	1.2E-6		1.3E+1(5.2)	
	16.98	1.2E-6		1.2E+1(5.8)	
	27.91	1.2E-6		1.1E+1(6.0)	
	62.03	1.2E-6		1.3E+1(3.1)	
	13.67				1.7E+1(9.5)
	27.66				1.3E+1(7.7)
	55.72				1.3E+1(8.5)
8	9.91	1.2E-6		1.3E+1(5.4)	
	16.97	1.2E-6		1.2E+1(5.7)	
	29.97	1.2E-6		1.2E+1(5.8)	
	62.03	1.2E-6		1.1E+1(5.8)	
	13.67				1.8E+1(8.4)
	27.66				1.6E+1(9.2)
	55.72				1.7E+1(8.8)

9 2 1 2 5 6 2 0 3 3 4

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	9.9	1.2E-6		2.3E+1(4.1)	
	16.99	1.2E-6		2.3E+1(4.2)	
	27.96	1.2E-6		2.4E+1(4.0)	
	62.02	1.2E-6		2.6E+1(3.6)	
	13.67				5.0E+1(7.8)
	27.66				2.7E+1(7.5)
	55.72				2.7E+1(7.2)
17	9.9	1.2E-6		1.4E+1(5.2)	
	16.98	1.2E-6		1.6E+1(5.0)	
	27.96	1.2E-6		1.4E+1(5.3)	
	62.02	1.2E-6		1.4E+1(5.0)	
	13.67				1.6E+1(8.1)
	27.66				2.3E+1(8.4)
	55.72				1.4E+1(8.6)
20	9.89	1.2E-6		1.7E+1(4.7)	
	16.98	1.2E-6		1.7E+1(4.7)	
	27.96	1.2E-6		1.6E+1(5.0)	
	62.02	1.2E-6		1.5E+1(4.7)	
	13.67				2.0E+1(7.6)
	27.66				2.2E+1(7.2)
	55.72				2.0E+1(8.3)

9 2 1 2 5 6 2 0 3 3 5

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
23	9,08	1.2E-6		4,7E+1(3,0)	
	17,05	1.2E-6		6,2E+1(2,9)	
	27,93	1.2E-6		5,7E+1(2,9)	
	66,12	1.2E-6		1,5E+2(15)	
	13,69				5,4E+1(6,7)
	27,72				6,2E+1(6,9)
	55,75				5,9E+1(6,3)
26	9,07	1.2E-6		2,2E+2(4,0)	
	17,04	1.2E-6		2,9E+1(3,6)	
	27,93	1.2E-6		3,4E+1(3,3)	
	66,11	1.2E-6		8,7E+1(11)	
	13,69				3,3E+1(6,3)
	27,72				3,4E+1(7,7)
	55,75				3,2E+1(7,1)
28	9,08	1.2E-6		2,1E+1(4,0)	
	17,04	1.2E-6		2,5E+1(3,8)	
	27,92	1.2E-6		2,5E+1(3,9)	
	66,11	1.2E-6		8,6E+1(6,2)	
	13,69				2,1E+1(6,6)
	27,72				3,1E+1(7,5)
	55,75				3,0E+1(7,1)

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
30		1.1E-7		6.1E+2(--)	
		1.1E-6		7.0E+0(--)	
		1.1E-5		6.3E+0(--)	
		1.1E-4		7.9E+0(--)	
31	14			6.2E+0(8.1)	
32	2	6.0E-8		5.5E+0(10)	
33	14			6.4E+0(13)	
34	7			1.8E+2(2.0)	
35	7			6.0E+2(1.2)	
36	9			6.1E+2(1.6)	
37	9			6.0E+2(3.8)	
38	7			4.4E+2(2.7)	

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
39	9			3.1E+2(2.9)	
40	9			3.2E+2(2.2)	
41	8			1.7E+1(7.3)	
43	3			6.9E+0(70)	
	10			-3.2E+0(239)	
	30			1.6E+0(57)	
44	3			4.4E+0(31)	
	10			5.4E+0(73)	
	30			4.1E+0(13)	
45	3			1.3E+1(45)	
	10			1.5E+1(24)	
	30			2.6E+1(11)	
46	3			1.9E+1(47)	
	10			3.8E+1(15)	
	30			3.3E+1(6.2)	

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
47	8			6,5E+0(30)	
50	.17			2,0E+0(--)	
	2,3			2,9E+0(--)	
	6,3			3,1E+0(--)	
	14,2			4,0E+0(--)	
51	.17			2,5E+0(--)	
	2,3			2,4E+0(--)	
	6,3			3,2E+0(--)	
	14,2			4,0E+0(--)	
52	.17			2,5E+0(--)	
	2,3			2,3E+0(--)	
	6,3			4,3E+0(--)	
	14,2			5,0E+0(--)	
53	.17			3,1E+0(--)	
	2,3			2,8E+0(--)	
	6,3			3,2E+0(--)	
	14,2			4,0E+0(--)	

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
54	.17			2.8E+0(--)	
	2.3			9.0E-1(--)	
	6.3			1.3E+0(--)	
	14.2			3.0E+0(--)	
55	.17			2.2E+0(--)	
	2.3			2.0E+0(--)	
	6.3			2.9E+0(--)	
	14.2			4.0E+0(--)	
56	.17			5.6E+0(--)	
	2.3			6.5E+0(--)	
	6.3			1.2E+1(--)	
	14.2			1.5E+1(--)	
57	.17			1.0E+0(--)	
	2.3			2.0E-1(--)	
	6.3			3.0E-1(--)	
	14.2			1.0E+0(--)	

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
58				6.3E+0(--)	
59	.13			1.6E+0(--)	
	.25			2.5E+0(--)	
	7			2.0E+0(--)	
60	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		6.3E+0(--)	
	186	1.0E-8		1.0E+1(--)	
	186	1.0E-5		1.0E+1(--)	
61	.13			2.5E+0(--)	
	.25			3.2E+0(--)	
	7			3.2E+0(--)	
62	.4	1.0E-8		1.0E+1(--)	
	.4	1.0E-5		1.0E+1(--)	
63	.4	1.0E-8		7.9E+0(--)	
	.4	1.0E-5		1.0E+1(--)	
	186	1.0E-8		1.6E+1(--)	
	186	1.0E-5		1.6E+1(--)	

SORPTION RESULTS

FOR-- SR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
64	.4	1.0E-8		1.0E+1(--)	
	.4	1.0E-5		1.0E+1(--)	
65	.13			4.0E+0(--)	
	.25			5.0E+0(--)	
	9			5.0E+0(--)	
66	.13			5.0E+0(--)	
	.25			6.3E+0(--)	
	7			6.3E+0(--)	
67	.25			2.0E+0(--)	
	7			3.2E+0(--)	

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9 SORPTION RESULTS 2 0 3 9 3

FOR-- TC

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
15	6.49	1.92E-12		3.2E+1(3.4)	
	13.53	1.92E-12		4.4E+1(3.3)	
	27.6	1.92E-12		1.6E+2(2.9)	
	55.58	1.92E-12		8.0E+1(2.5)	
	14.01				6.0E+2(30)
	27.7				2.1E+2(20)
	56.78				2.0E+2(21)
18	6.58	1.92E-12		-7.0E-1(51)	
	13.52	1.92E-12		-3.0E-1(114)	
	27.59	1.92E-12		-9.0E-1(38)	
	55.58	1.92E-12		-9.0E-1(36)	
	14.01				-2.3E+1(9.1)
	27.7				-4.2E+1(16)
	56.78				-3.0E+1(12)
21	6.58	1.92E-12		-8.0E-1(42)	
	13.52	1.92E-12		-9.0E-1(38)	
	27.59	1.92E-12		-7.0E-1(49)	
	55.57	1.92E-12		-1.1E+0(29)	
	14.01				-3.3E+1(14)
	27.7				-3.4E+1(13)
	56.77				-3.7E+1(15)

FOR-- TC

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
24	6.83	1.92E-12		2.3E+1(4.0)	
	13.84	1.92E-12		6.1E+1(3.1)	
	27.84	1.92E-12		2.7E+1(3.5)	
	55.83	1.92E-12		1.3E+0(29)	
	14.04				4.2E+2(30)
	27.71				2.4E+2(21)
	56.76				1.0E+2(19)
27	6.83	1.92E-12		7.0E-1(60)	
	13.83	1.92E-12		4.0E-1(97)	
	27.84	1.92E-12		3.0E-1(108)	
	55.82	1.92E-12		-1.3E+0(24)	
	14.04				-8.9E+0(6.7)
	27.7				-8.0E+0(17)
	56.76				-8.0E-1(415)
29	6.82	1.92E-12		3.1E+0(15)	
	13.83	1.92E-12		-3.0E-1(107)	
	27.84	1.92E-12		-2.0E-1(190)	
	55.81	1.92E-12		2.5E+1(3.3)	
	14.04				-1.9E+1(6.7)
	27.7				-2.4E+1(9.9)
	56.76				1.0E+2(41)

SORPTION RESULTS

FOR-- TC

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
34	7			-5,0E-1(14)	
35	9			-6,0E-1(23)	
36	9			-7,0E-1(22)	
37	9			-5,0E-1(21)	
38	7			-2,0E-1(60)	
39	7			-2,0E-1(137)	
40	7			-4,0E-1(30)	
41	8			-8,0E-1(26)	
43	3			7,2E+0(60)	
	10			-4,3E+0(117)	
	30			9,4E+0(45)	

SORPTION RESULTS

FOR-- TC

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
44	5			3,7E+0(30)	
	30			6,3E+0(80)	
	30			7,4E+1(9,5)	
45	3			-1,1E+0(139)	
	10			1,7E+0(139)	
	50			7,9E+1(3,5)	
46	5			-2,0E+0(218)	
	10			2,1E+0(198)	
	50			2,7E+1(5,0)	
47	8			-9,1E-1(9,1)	
60	.4	1.0E-8		0,00	
	.4	1.0E-5		0,00	
62	.4	1.0E-8		0,00	
63	.4	1.0E-8		5,0E-1(--)	

SORPTION RESULTS

FOR-- TC

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
64	.4	1.0E-8		0.00	

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SORPTION RESULTS

FOR-- TH

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KOD
60	.4	1.0E-8		6.3E+2(--)	
	.4	1.0E-5		5.0E+2(--)	
	186	1.0E-8		1.0E+4(--)	
	186	1.0E-5		2.0E+3(--)	
62	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		7.9E+2(--)	
63	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		1.3E+3(--)	
	186	1.0E-8		4.0E+3(--)	
	186	1.0E-5		5.0E+3(--)	
64	.4	1.0E-8		7.9E+2(--)	
	.4	1.0E-5		1.3E+3(--)	

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SORPTION RESULTS

FOR-- U

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
6	6.95	5.4E-8		9.9E+0(22)	
	13.95	5.4E-8		1.0E+1(22)	
	20.95	5.4E-8		1.0E+1(21)	
	9.89				2.9E+1(31)
	13.64				2.7E+1(33)
	19.76				2.0E+1(40)
7	6.95	5.4E-8		2.2E+0(72)	
	13.95	5.4E-8		2.0E+0(80)	
	20.95	5.4E-8		3.1E+0(52)	
	9.89				2.0E+1(87)
	13.64				1.5E+1(149)
	9.89				1.1E+1(169)
8	6.95	5.4E-8		3.3E+0(50)	
	13.95	5.4E-8		4.0E-1(360)	
	20.95	5.4E-8		1.3E+0(117)	
	9.89				1.3E+1(218)
	13.64				-3.6E+0(731)
	19.76				3.9E+1(65)

SORPTION RESULTS

FOR-- U

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
14	6,95	5.4E-8		1,1E+1(21)	
	13,95	5.4E-8		8,2E+0(24)	
	20,95	5.4E-8		8,8E+0(23)	
	7,89				2,4E+1(37)
	13,64				2,2E+1(39)
	19,76				1,7E+1(39)
17	6,95	5.4E-8		2,3E+0(70)	
	13,95	5.4E-8		2,8E+0(55)	
	20,95	5.4E-8		1,9E+0(80)	
	7,89				1,2E+1(163)
	13,64				2,3E+1(85)
	19,76				1,2E+1(158)
20	6,95	5.4E-8		6,0E-1(260)	
	13,95	5.4E-8		1,0E+0(147)	
	20,95	5.4E-8		1,1E+0(143)	
	7,89				7,4E+0(367)
	13,64				1,2E+1(280)
	19,76				1,7E+0(600)

SORPTION RESULTS

FOR-- U

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		4.0E+0(--)	
	186	1.0E-8		6.3E+0(--)	
	186	1.0E-5		5.0E+0(--)	
62	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		4.0E+0(--)	
63	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		5.0E+0(--)	
	186	1.0E-8		6.3E+0(--)	
	186	1.0E-5		5.0E+0(--)	
64	.4	1.0E-8		6.3E+0(--)	
	.4	1.0E-5		5.0E+0(--)	

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SORPTION RESULTS

FOR-- ZR

RECORD NUMBER	TIME (D)	INITIAL [RN] (M/L)	FINAL [RN] (M/L)	KDS	KDD
60	.4	1.0E-8		1.3E+3(--)	
	.4	1.0E-5		3.2E+3(--)	
	186	1.0E-8		1.0E+3(--)	
	186	1.0E-5		3.2E+3(--)	
62	.4	1.0E-8		3.2E+3(--)	
	.4	1.0E-5		6.3E+3(--)	
63	.4	1.0E-8		1.3E+3(--)	
	.4	1.0E-5		2.0E+3(--)	
	186	1.0E-8		3.2E+3(--)	
	186	1.0E-5		2.5E+3(--)	
64	.4	1.0E-8		6.3E+3(--)	
	.4	1.0E-5		3.2E+3(--)	

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9 2 1 2 3 5 2 0 4 0 3

APPENDIX C

RECOMMENDED SORPTION COEFFICIENTS AND RANGES OF COEFFICIENTS

1. TRITIUM (T)

Although there is a possibility that tritiated hydroxyl anions may exchange with hydroxyl ions in clays and hydrated minerals present in old fractures in rock, it should be assumed that tritium sorption is negligible.

In our studies we have not observed any difference in transfer time between ^{14}C labelled sucrose - a non-polar compound - and $^{3}T_2O$ through columns of crushed and wet-sieved granitic rock.

9 2 1 2 5 2 0 4 0 4

Recommended Range

k_a : -

k_d : -

Recommended Value

k_a = 0 cm

k_d = 0 mL/g

Dated

1980 June 1.

2. STRONTIUM (Sr)

k_d values for Sr range from 0.6 to 600 mL/g. Allard and co-workers'[C.1] results on an unknown crushed granite ranged from 6 to 16 mL/g with little effect noted due to increasing the Sr concentration from 10^{-8} mol/L to 10^{-5} mol/L. There is some correlation of k_d with particle size, as would be expected.

Erdal et al.[C.2] report k_d values of 14 to 18 mL/ at 20°C, 38 mL/g at 70°C. Desorption values (k_d based on a desorption of the nuclide from the rock surface) are about the same, indicating reversible sorption.

MacLean et al.[C.3] report values ranging from 6 to 600 mL/g on a number of granites from the Climax Stock mine. Barney and Grutzeck[C.4] report Sr k_d values of 6 to 8 mL/g, while Relyea at PNL obtained a range of 1.6 to 39 mL/g on the same material with various aqueous solutions. Our values for Sr on Climax Stock granite were 8 to 11 mL/g in the sorption step, 14 to 21 mL/g on desorption.

There is some information on k_a values. Allard et al. obtained sorption values of 0.2 and 0.25 and desorption values of 0.5 and 0.2 on fresh and weathered granite fractions. Our results range from 0.3 cm on Lac du Bonnet granite to 0.5 to 0.7 cm on White Lake gneiss for the sorption stage and 0.8 to 1.5 cm (LdB) and 1.6 to 2.2 cm (WL) during desorption.

9 2 1 2 5 6 2 0 4 0 5

Recommended Range

k_a : 0.2 - 2.2 cm

k_d : 0.6 - 600 mL/g

Recommended Value

k_a = 0.7 cm

k_d = 10 mL/g

Dated

1980 June 1.

9 2 1 2 3 6 2 0 4 0 6

3. ZIRCONIUM (Zr)

Allard and coworkers'[C.1] values of 1000 to 6000 mL/g on -140+230 mesh materials are the only ones available for zirconium. There is some evidence of precipitation of zirconium from the solution which would give too high a sorption coefficient.

In the light of our results for ^{95}Nb (quo vide) which behaves chemically very similarly to zirconium, I would recommend a k_d value of 1000 mL/g, and a k_a value of 10 cm.

Recommended Range

k_a : -

k_d : 1000-6000 mL/g

Recommended Value

k_a = 10 cm

k_d = 1000 mL/g

Dated

1980 June 1.

9 2 1 2 3 6 2 0 4 0 7

4. NIOBIUM (Nb)

Our results[C.5] are the only ones available for granitics and granitic rocks.

These results should be used for the time being.

Recommended Range

k_a : 5 - 12 cm

k_d : only one value available (210 mL/g)

Recommended Value

k_a = 5 cm

k_d = 210 mL/g

Dated

1980 June 1.

9 2 1 2 5 2 0 4 0 9

5. TECHNETIUM (Tc)

With few exceptions Tc does not sorb under oxic conditions. In dynamic studies, we have not observed any difference between the elution patterns of ^{3}T and ^{99}Tc from columns of crushed White Lake gneiss or Lac du Bonnet granite.

Erdal et al.[C.6] have observed a positive k_d value for Tc on "opaque" (magnetite and illite) rich fractions of crushed Climax granite, and Bondietti and Francis[C.7] have observed almost complete sorption of ^{99}Tc under anoxic conditions on Westerly granite.

My earlier recommendation[C.5] of a k_d of 26 mL/g stands, providing anoxic conditions will exist in the repository.

9 2 1 2 3 6 2 0 4 0 9

Recommended Range

k_a : -

k_d : 0 - 80 mL/g

Recommended Value

k_a = 0 cm

k_d = 26 mL/g

Dated

1980 June 1.

6. RUTHENIUM (Ru)

The only available data for Ru are a k_d of 200 mL/g obtained by Barney and Grutzeck[C.4] on Climax Stock granite and our k_a of 0.66 cm, obtained on White Lake gneiss.

Recommended Range

k_a : only one value available (0.66 cm)

k_d : only one value available (200 mL/g)

Recommended Value

k_a = 0.66 cm

k_d = 200 mL/g

Dated

1980 June 1.

9 2 1 2 5 2 0 4 1 0

7. PALLADIUM (Pd)

Our results for ^{103}Pd, determined on Lac du Bonnet granite, are the only ones available[C.5]. For crushed and sieved granite with a particle size of 106 to 180 μm at pH 7, k_d ranged from 10 to 12 mL/g. For machined coupons, k_a values were 0.4 and 1.0 cm at pH 7.4.

Recommended Range

k_a : 0.4 - 1.1 cm

k_d : 0 - 28 mL/g

Recommended Value

k_a = 0.7 cm

k_d = 11 mL/g

Dated

1980 June 1.

9 2 1 2 3 6 2 0 4 1 1

8. CADMIUM (Cd)

Our k_a of 1.1 cm for Cd is the only one available. It was measured on White Lake gneiss machined coupons.

9 2 1 2 5 6 2 0 4 1 2

Recommended Range

k_a : only one value available (1.1 cm)

Recommended Value

k_a = 1.1 cm

Dated

1980 June 1.

9. ANTIMONY (Sb)

We have obtained a value of 11 cm for Sb on White Lake gneiss. It is the only available result on granitic material.

9 2 1 2 3 6 2 0 4 1 3

Recommended Range

k_a : only one value available (11 cm)

Recommended Value

k_a = 11 cm

Dated

1980 June 1.

10. TELLURIUM (Te)

Our k_a value of 1.8 cm, obtained on White Lake gneiss, is the only one available. This number was obtained under oxic conditions, and it is possible that a higher value can be obtained under anoxic conditions, if $TeO_4^{=}$ can be reduced to a cationic species.

9 2 1 2 3 5 2 0 4 1 4

Recommended Range

k_a : only one value available (1.8 cm)

Recommended Value

k_a = 1.8 cm

Dated

1980 June 1.

11. IODINE (I)

Iodine forms no known cationic species and, until information to the contrary becomes available, a k_a and k_d of zero must be assumed.

9 2 1 2 5 6 2 0 4 1 5

Recommended Range

k_a : -

k_d : -

Recommended Value

k_a = 0 cm

k_d = 0 mL/g

Dated

1980 June 1.

12. CESIUM (Cs)

In general, U.S. results[C.2-C.4] are in the range 100 to 1000 mL/g, with a few very high values, up to 3×10^4 mL/g. Allard and coworkers' values run between 20 and 120 mL/g after sorption for 0.5 day, but increased to 100 to 800 mL/g after 7 days[C.1]. Austrian results[C.8] range from 60 to over 2500 mL/g on uncharacterized granites from upper and lower Austria.

k_a values range from 0.6 cm on Lac du Bonnet granite and 0.6 cm on WNRE fresh fractured Swedish granite to 3.7 to 5 cm on White Lake gneiss and on old fractures in Swedish granite. Clearly, the rock type has an effect on k_a and I would use our Lac du Bonnet k_a of 0.6 cm. Our own results in the WISAP* round robin on Climax Stock granite were 48 to 60 mL/g (sorption) and 120 to 160 mL/g (desorption) but, using crushed Lac du Bonnet granite and a different radionuclide/rock weight ratio, a k_d of 1.2×10^3 mL/g was obtained. We have already shown that k_d may be very sensitive to changes in the above ratio, and this may well be the reason for much of the spread in k_d values. For the time being I suggest that a k_d of 100 mL/g be used in cesium migration calculations.

9 2 1 2 5 5 2 0 4 1 6

Recommended Range

k_a : 0.6 - 5 cm

k_d : 40 - 1000 mL/g

Recommended Value

k_a = 0.6 cm

k_d = 100 mL/g

Dated

1980 June 1.

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* WISAP - Waste Isolation Safety Assessment Program.

13. CERIUM (Ce)

A large variation in results exists for cerium. Allard and coworkers' results[C.1] on Swedish granite ranged from 5000 to 20 000 mL/g. Erdal and coworkers'[C.2] k_d values on Climax Stock granite are in the range 250 to 350 mL/g. We have found that, on crushed material, k_d for ^{144}Ce is about an order of magnitude higher than for ^{137}Cs, and a value of 1000 should be used.

On coupons, machined from WNRE drill core material, k_a for ^{144}Ce ranged from 2.2 to 7.9 cm. It ranged from 5.4 to 16 cm on CRNL drill core material. A k_a for 8 cm should be used.

9 2 1 2 5 6 2 0 4 1 7

Recommended Range

k_a : 2.2 - 16 cm

k_d : 250 - 5000 mL/g

Recommended Value

k_a = 8 cm

k_d = 1000 mL/g

Dated

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14. NEODYMIUM (Nd)

Allard and coworkers[C.1] have reported the only result on granitic rocks (3000 mL/g). Based on the similarities in chemical behaviour of the rare earths, the recommended values for cerium should be applied to neodymium as well.

9 2 1 2 3 5 2 0 4 1 8

Recommended Range

k_a : 2.2 - 16 cm

k_d : 250 - 5000 mL/g

Recommended Value

k_a = 8 cm

k_d = 1000 mL/g

Dated

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15. EUROPIUM (Eu)

Erdal and coworkers'[C.2] values are much lower than Allard and coworkers' (110 and 490 vs. 1.0×10^4 mL/g). There is no chemical reason why Eu should behave differently from Nd or Ce, and the recommendations for cerium should apply for europium.

9 2 1 2 5 2 0 4 1 9

Recommended Range

k_a : 2.2 - 16 cm

k_d : 250 - 5000 mL/g

Recommended Value

k_a = 8 cm

k_d = 1000 mL/g

Dated

1980 June 1.

16. RADIUM (Ra)

Allard and coworkers[C.1] have reported the only sorption coefficients for granitic rocks. Their value of 80 mL/g should be used. Because of the similarity in chemical behaviour between strontium and radium, a "pro-rated" k_a value of 6 cm may be used tentatively.

9 2 1 2 3 5 2 0 4 2 0

Recommended Range

k_a : 1 - 18 cm

k_d : 5 - 5000 mL/g

Recommended Value

k_a = 6 cm

k_d = 80 mL/g

Dated

1980 June 1.

17. THORIUM (Th)

Allard and coworkers[C.1] accepted value for thorium of 850 mL/g is the only one available.

9 2 1 2 3 5 2 0 4 2 1

Recommended Range

k_d : only one value available (850 mL/g)

Recommended Value

k_d = 850 mL/g

Dated

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18. URANIUM (U)

No efforts have been made to obtain anoxic conditions to measure U sorption, and it must thus be assumed that U(VI) sorption has been measured. Agreement between Allard and coworkers (6 mL/g)[C.1] and the LASL results (4.4 mL/g)[C.2] is excellent and a k_d of 5 mL/g should be used. In addition, we have obtained a k_a of 0.3 cm for U on White Lake gneiss.

Under anoxic conditions, U(IV) should be the preferred oxidation state and it should have a higher sorption coefficient. The recommended values should thus be considered as a lower limit.

9 2 1 2 5 6 2 0 4 2 2

Recommended Range

k_a : only one value available (0.3 cm)

k_d : 0.4 – 10 mL/g

Recommended Value

k_a = 0.3 cm

k_d = 5 mL/g

Dated

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19. NEPTUNIUM (Np)

Allard and coworkers[C.1] have reported a value of 40 mL/g. Barney and Grutzeck[C.4] obtained a k_d of 100 ± 90 mL/g. Bondietti and Francis[C.7] have shown that under anoxic conditions essentially all Np is removed by Westerly Granite.

Allard and coworkers' value should then be taken as a lower limit.

9 2 1 2 3 5 2 0 4 2 3

Recommended Range

k_a : 40 - 100 mL/g

Recommended Value

k_d = 80 mL/g

Dated

1980 June 1.

20. PLUTONIUM (Pu)

There is a large discrepancy in k_d values for plutonium. Allard and coworkers[C.1] obtained a value for k_d of 100 mL/g. MacLean and coworkers' results are much higher, $\sim 2 \times 10^4$ mL/g[C.2]. Our results are more in line with those obtained by Allard and coworkers, 280 mL/g. The possibilities of high values due to precipitation of plutonium compounds should not be overlooked and our k_d value should be used.

Our k_a results also show great fluctuations, again ranging from 4 to 1000 cm obtained at different times. The high value may include precipitation of an insoluble Pu compound. The low values were obtained on prefiltered tagged solutions and most likely do not include a precipitation contribution. I recommend a value of 4 cm for Pu.

9 2 1 2 3 5 2 0 4 2 4

Recommended Range

k_a : 4 - 500 cm

k_d : 280 - 2000 mL/g

Recommended Value

k_a = 4 cm

k_d = 280 mL/g

Dated

1980 June 1.

21. AMERICIUM (Am)

k_d values for Am are generally in the 1000 to 2 x 10^4 mL/g range. Barney and Grutzeck[C.4] report very high (6 x 10^4 mL/g) values for 10^{-7} mol/L Am. This may be due to precipitation of an insoluble Am compound rather than to sorption, as his k_d increases with Am concentration. We have obtained a value of 1 x 10^4 mL/g on crushed Lac du Bonnet granite but I am not convinced that precipitation did not take place, and a (perhaps conservative) k_d of 1000 mL/g should be used.

We have obtained a k_a value of 30 cm on White Lake pieces and rather low k_a results, ranging from 3.4 to 8 cm on granite, supplied by the Geological Survey of Canada. A k_a of 8 cm should be used.

9 2 1 2 3 6 2 0 4 2 5

Recommended Range

k_a : 3.4 - 30 cm

k_d : 1000 - 2 x 10^4 mL/g

Recommended Value

k_a = 8 cm

k_d = 1000 mL/g

Dated

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22. CURIUM (Cm)

No k_d values for curium have been reported on granitic rocks.

We have obtained k_a in the range of 5 to 24 cm on White Lake gneiss.

Since the chemistry of curium is very similar to that of americium, the recommended values for americium should be used.

9 2 1 2 3 6 2 0 4 2 6

Recommended Range

k_a : 5 - 24 cm

Recommended Value

k_a = 8 cm

k_d = 1000 mL/g

Dated

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SUMMARY

RECOMMENDED k_d AND k_a VALUES

Element	k_d (mL/g)	k_a (cm)
T	0	0
Sr	10	0.7
Zr	1000	10
Nb	210	5
Tc	26	-
Ru	200	0.66
Pd	11	0.7
Cd	-	1.1
Sb	-	11
Te	-	1.8
I	0	0
Cs	100	0.6
Ce	1000	8
Nd	1000	8
Eu	1000	8
Ra	80	6
Th	850	-
U	5	0.3
Np	80	-
Pu	280	4
Am	1000	8
Cm	1000	8

Dated

1980 June 1

9 2 1 2 5 6 2 0 4 2 7

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