101
~~108.~~2/JAC/DJB/82/09/02/0

- 1 - SEP 07 1982

Distribution
WMHT r/f
NMSS r/f
WM r/f
CF
JBMartin
REBrowning
MJBell
PAltomare
HJMiller
PJustus
JCorrado & r/f
DBrooks & r/f

WMHT: 101 ~~3108.2~~

MEMORANDUM FOR: M. J. Wise
M. R. Knapp
High-Level Waste Licensing
Management Branch
Division of Waste Management

FROM: David J. Brooks
Julia A. Corrado
High-Level Waste Technical
Development Branch
Division of Waste Management

SUBJECT: K_D VALUES FOR BWIP SENSITIVITY ANALYSES

Attached are draft tables of K_d values* and solubility data* for various isotopes. Ranges of K_d values are stated for both oxidizing and reducing conditions. Solubilities are only for reducing conditions.

In order to achieve conservative results, we recommended that for this exercise the lowest K_d value for the elements appearing in both tables be used. If no K_d is available in our list use zero. In the case of solubility, use the highest value available. However, keep in mind that these values (at best) apply only to the conditions under which they were measured and may have no meaning if applied to the whole Hanford site.

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* The attached tables are data acquired at the geochemistry workshop at BWIP and should not be used for more than preliminary, in house, evaluations.

OFC						
NAME						20065
DATE	82/09/02					

(F)(H)
8610029

SEP 07 1982

In addition to the above work, we would like an analysis based on conservative solubility limits, available "EPA" radionuclide release limits, and range of K_d values (i.e. 0, 1, 10, 100 and 1000) for each radionuclide. Such an exercise would help us focus on sorption information needs and the adequacy of the available sorption data. Finally, we are still in the process of reviewing both sets of data and we will keep you informed of our progress. Please see either Dave or Julia regarding decision points in geochemistry in the modeling effort.

ORIGINAL SIGNED BY

David J. Brooks
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Enclosure:
As stated

cc: P.S. Justus
R.J. Wright

PRE-DECISIONAL IN NATURE

OFC	WMHT	WMHT	WMHT	WMHT			
NAME	JCorrado:ls	DBrooks	PJustus	HJMiller			
DATE	82/09/02	8/ 7 /82	8/03/82	8/ /82			

Comparison of Table 7.1 and BWIP Values
for Solubilities and Distribution Coefficients

Element	Solubility (moles/liter)		Kn (ml/gm)	
	Table 7.1	BWIP†	Table 7.1	BWIP
Sr	high, 10^{-4}	10^{-6}	20	170*
Cs	high	10^{-5}	100	500*
Tc	10^{-8}, 10^{-15}	10^{-13}	0.4	29*
I	high	10^{-5}	0	0*
U	10^{-8}	10^{-9}		40*
Np	10^{-8}	10^{-15}		200*
Pu	10^{-8}, 10^{-10}	10^{-12}	50	42*
Am	10^{-9}, 10^{-13}	10^{-12}	50	340*
Cm	10^{-8}	10^{-9}	50	100
Ra	10^{-7}	10^{-7}	50	200*
Pb	10^{-6}	10^{-12}	5	50
Th	10^{-8}	10^{-10}	500	100
Zr	10^{-9}	10^{-6}	500	10
Sn	10^{-8}	10^{-12}	100	100
Se	10^{-8}	10^{-12}	5	8*
Sb	10^{-8}	10^{-5}	10	10

DRAFT

*Experimentally determined, Salter and Others, 1981, RHO-BWI-LD-48

†Calculated for Eh ~ -0.35 to -0.50 volts, pH ~8-10.

* 300° C crushed basalt

- not yet entered

Screening experiments

gj

MENT TIMES = 100 1000
(YRS)

based on Thermal [illegible]

NUCLIDE DATA

LABEL	HALF-LIFE (YRS)	SOLUBILITY (MOLES/LITER)	KD (CC/GM)	EPA RELEASE RATE (CURIES/1000MTHM/YR)
C14	0.5730E+04	0.9000E-03	0.0000E+00	0.2000E-01
SE79	0.6500E+05	0.1000E-11	0.0000E+00	0.5000E-01
RB87	0.4800E+11	0.1000E-03	0.5000E+02	0.5000E-01
SR90	0.2800E+02	0.1000E-05	0.7500E+02	0.8000E-02
ZR93	0.1500E+07	0.1000E-03	0.1000E+02	0.2500E-01
TC99	0.2100E+06	0.1000E-11	0.0000E+00	0.2000E+00
PD107	0.7000E+07	0.1000E-09	0.1000E+02	0.5000E-01
CD113	0.1360E+02	0.1000E-09	0.7500E+02	0.5000E-01
SN121	0.7600E+02	0.1000E-09	0.1000E+02	0.5000E-01
SN126	0.1000E+06	0.1000E-09	0.1000E+02	0.8000E-02
I129	0.1700E+08	0.1000E+02	0.0000E+00	0.5000E-01
CS135	0.3000E+07	0.1000E+02	0.1000E+03	0.2000E+00
CS137	0.3000E+02	0.1000E+02	0.1000E+03	0.5000E-01
SM151	0.9000E+02	0.1000E-06	0.1000E+03	0.5000E-01
EU152	0.1270E+02	0.1000E-06	0.1000E+02	0.5000E-01
EU154	0.1600E+02	0.1000E-06	0.1000E+02	0.5000E-01
[illegible]	0.1200E+04	0.1000E-06	0.1000E+02	0.5000E-01
PB210	0.2230E+02	0.1000E-0[illegible]	0.1000E+02	0.9840E-03
RA226	0.1600E+04	0.1000E-0[illegible]	0.5000E+02	0.1250E-03
RA228	0.6700E+01	0.1000E-06	0.5000E+02	0.5000E-01
AC227	0.2160E+02	0.1000E-06	0.5000E+02	0.1410E-03
TH228	0.1900E+01	0.1000E-08	0.5000E+02	0.1000E-02
TH229	0.7340E+04	0.1000E-08	0.5000E+02	0.1970E-03
TH230	0.8000E+05	0.1000E-08	0.5000E+02	0.1000E-02
TH232	0.1400E+11	0.1000E-08	0.5000E+02	0.1640E-03
PA231	0.3250E+05	0.1000E-06	0.5000E+02	0.1000E-02
U232	0.7200E+02	0.1000E-08	0.3000E+02	0.1000E-02
U233	0.1620E+06	0.1000E-08	0.3000E+02	0.1000E-02
U234	0.2470E+06	0.1000E-08	0.3000E+02	0.1000E-02
U235	0.7100E+09	0.1000E-08	0.3000E+02	0.9800E-03
U236	0.2390E+08	0.1000E-08	0.3000E+02	0.1000E-02
U238	0.4510E+10	0.1000E-08	0.3000E+02	0.9620E-03
NP237	0.2140E+07	0.1000E-17	0.3000E+01	0.1920E-02
PU238	0.8600E+02	0.1000E-11	0.2000E+02	0.4000E-01
PU239	0.2430E+05	0.1000E-11	0.2000E+02	0.1000E-01
PU240	0.6580E+04	0.1000E-11	0.2000E+02	0.1000E-01
PU241	0.1320E+02	0.1000E-11	0.2000E+02	0.5000E-01
PU242	0.3790E+06	0.1000E-11	0.2000E+02	0.1000E-01
AM241	0.4580E+03	0.1000E-14	0.5000E+02	0.1000E-02
AM242	0.1520E+03	0.1000E-14	0.5000E+02	0.9800E-03
AM243	0.7950E+04	0.1000E-14	0.5000E+02	0.3970E-03
CM243	0.3200E+02	0.1000E-08	0.5000E+02	0.1000E-02
CM244	0.1760E+02	0.1000E-08	0.5000E+02	0.1000E-02
CM245	0.9300E+04	0.1000E-08	0.5000E+02	0.9800E-03
CM246	0.5500E+04	0.1000E-08	0.5000E+02	0.1000E-02

INVENTORY DATA
(CURIES/1000MTHM)

CONTAINMENT TIMES

CO_3 / 04 / 50= / Cl- / F- /

...e. Current Conservative Best Estimates for Radionuclide-Distribution-Coefficient Values for the Columbia River Basalt Geohydrologic System.

	Distribution coefficient (mL/g)					
	(A) Basalt		(B) Secondary minerals		(C) Interbed materials	
	O[a]	R[a]	O[a]	R[a]	O[a]	R[a]
^{125}I	0 (0-7)	--	0	--	0	--
^{99}Tc	0 (0-1)	29	0	50	0 (0-4)	70 (40-110)
^{237}Np	10 (7-42)	200 (150-2,000)	50	200	20	50 (30-100)
^{79}Se	4 (2-9)	8 (3-18)	5 (0-14)	8	0 (0-4)	2
^{233}U	6 (1-15)	40 (17-650)	70	NA[b]	NA[b]	NA[b]
^{226}Ra	200 (50-400)	--	100	--	4,000 (2,800-6,200)	--
^{237}Pu	22 (20-25)	42	2,000	4,000	300 (200-500)	470 (350-1,000)
^{241}Am	340 (230-600)	NA[b]	1,000	NA[b]	>10,000[c]	>10,000[c]
^{137}Cs	500 (200-900)	--	5,000	--	2,200	--
^{8}Sr	170	--	200	--	340	--
Surface area (m^2/g)	10-30		650		50-180	

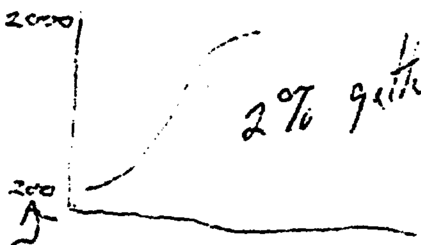
Values in parentheses are the range of distribution-coefficient values measured.

[a]O = Oxidizing conditions, R = Reducing conditions.

[b]NA = No data available.

[c]Greater than 98% removal.

are these ranges isotherms?



2% getting out

- this would be most concern?
- It would be interesting to know A+B+C

Copy

Gary Jacobs

TABLE 1. Reference K_d Values for Umtanum Basalt

	K_d					
	Umtanum Basalt ml/g		Secondary Minerals ml/g		Interbed Materials ml/g	
Radionuclide	(R)	(O)	(R)	(O)	(R)	(O)
I	--	0	--	0	--	0
Tc	29	0	50	0	70	0
Np	20	10	200	50	50	20
Se	8	4	8	5	2	0
U	40	6	NA[b]	70	NA[b]	NA[b]
Ra	--	200	--	100	--	4,000
Pu	42	22	4,000	2,000	470	300
Am	NA[b]	340	NA[b]	1,000	10,000[c]	10,000[c]
Cs	--	500	--	5,000	--	2,200
Si	--	170	--	200	--	340
Surface Area m^2/g	10-30		650		50-180	
Pd[a]	10		10		10	
Th[a]	100		100		100	
Pb[a]	50		50		50	
Zr[a]	10		10		10	
Cm[a]	100		100		100	
Sn[a]	10		10		10	

DRAFT

a. No data specific to basalt environment available; K_d values are a best estimate based on general geochemical behavior of these elements (Handbook of Geochemistry; Garrels & Christ)

b. No data available.

c. Greater than 98% removal from solution