RISKIND Manual Errata

RISKIND — A Computer Program for Calculating Radiological Consequences and Health Risks from Transportation of Spent Nuclear Fuel, Y.C. Yuan, S.Y. Chen, B.M. Biwer, and D.J. LePoire, ANL/EAD-1, Argonne National Laboratory, Argonne, IL, Nov. 1995

pg. 30 In second line of definition for r^2 , should read $\sigma_x = \sigma_y \text{ (m}^2\text{)}$

pg. 38 $x_{y_{vir}}$ = distance from source location ... should read:

$x_{z_{vir}}$ = distance from source location ...

pg. 39 Equation 3.37 should read: $\sigma_{y_o} = (H_{cask} + L_{cask})^{1/2} / 4.3$

where H_{cask} is the height (diameter) of the cask (m) [2 * RSIZE]

pg. 41 Bottom of page. Definition for σ_{yb} and the following sentence should read:

σ_{yb} = buoyancy-induced horizontal dispersion (m).

This expression is combined with that for dispersion resulting from ambient turbulence, in the same manner described above for the vertical direction, to give the horizontal dispersion coefficient used in the RISKIND calculations for estimating air and ground concentrations:

pg. 44 Definition for $D(j)_{AirST}$ should read:

$D(j)_{AirST}$ = dose to receptor j from air submersion during plume passage (rem);

pg. 48 Equation 3.52 should read:

$$\bar{C}_g(i, x, y, T) = C_g(i, x, y) K \left[\frac{1 - \exp\{-[\lambda(i) + \lambda_g]T\}}{\lambda(i) + \lambda_g} \right]$$

where K is a conversion constant, $3.156 \times 10^7 \text{ s/yr}$

pg. 50 Equation 3.57 should read:

$$\bar{C}_r(i, x, y, T) = \begin{cases} FI C_g(i, x, y) K \left[\frac{1 - \exp\{-[\lambda(i) + \lambda_g + \lambda_r]T\}}{\lambda(i) + \lambda_g + \lambda_r} \right], & T \leq T_a \\ FI C_g(i, x, y) K \left[\frac{1 - \exp\{-[\lambda(i) + \lambda_g + \lambda_r]T_a\}}{\lambda(i) + \lambda_g + \lambda_r} \right] \\ + FE K (\bar{C}_g(i, x, y, T) - \bar{C}_g(i, x, y, T_a)), & T > T_a \end{cases}$$

where K is a conversion constant, $3.156 \times 10^7 \text{ s/yr}$

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- pg. 50 In equation 3.58, λ_{v_w} should be λ_{v_e} where
 λ_{v_e} = effective decay constant (1/d), $\lambda_{v_e} = \lambda_{v_w} + \lambda(i)/K$ and K is a conversion constant, 365.25 d/yr
- pg. 51 Equation 3.59 should read:

$$C_{v_e}(i, x, y, t) = \frac{C_g(i, x, y, t)B_v(i)}{\rho} + C_r(i, x, y, t)V_d(m)F_rE_{v_k} \left[\frac{1 - \exp(-\lambda_{v_e}t_{v_k})}{Y_{v_k}\lambda_{v_e}} \right]$$
- pg. 51 ρ is presented in equation 3.59, but not defined;
 ρ = effective surface soil density (kg/m²) [EFF_SURF_DEN]
- pg. 52 Equation 3.60 should read:

$$\bar{C}_{v_k}(i, x, y, T) = \frac{\bar{C}_a(i, x, y)V_d(m)F_rE_{v_k} \exp(-\lambda_{v_e}T_{v_k})}{Y_{v_k}} + \frac{\bar{C}_g(i, x, y, t)B_v(i)}{\rho} + \bar{C}_r(i, x, y, t)V_d(m)F_rE_{v_k}K \left[\frac{1 - \exp(-\lambda_{v_e}t_{v_k})}{Y_{v_k}\lambda_{v_e}} \right]$$
where K is a conversion constant, 86,400 s/d
- pg. 53 Table 3.6 is not complete. The table is reproduced at the end of the manual errata.
- pg. 64 Equation 3.84 should read:

$$C_i = C_{i-1} / \sqrt{10}$$
- pg. 78 "[$\lambda_b(i,1,3)$]" should be replaced by "[$T_b(i,1,3)$]" in the last sentence before Table 4.1.
- pg. 80 Table 4.2 continuation header should be the same as header on pg. 79.
j index in a(i,j,k) and T_b(i,j,k) listings is incorrect under Subcompartments 2 to 4.
- pg. 90 Reference for Slade (1968) is missing
D.H. Slade, ed., 1968, *Meteorology and Atomic Energy 1968*, TID-24190, prepared by the Air Resources Laboratories, Research Laboratories, Environmental Science Services Administration, U.S. Department of Commerce for the Division of Reactor Development and Technology, U.S. Atomic Energy Commission, July.

TABLE 3.6 Transfer Coefficients Applicable to Food Chain Pathways for Various Radionuclides

Index (i)	Element	Transfer Coefficients		
		Soil-to-Plant $B_v(i)$ (dimensionless)	Grass-to-Meat $F_b(i)$ (d/kg)	Grass-to-Milk $F_m(i)$ (d/L)
1	Hydrogen	4.8	1.2×10^{-2}	1.0×10^{-2}
2	Helium	0.0	0.0	0.0
3	Lithium	8.3×10^{-4}	1.0×10^{-2}	5.0×10^{-2}
4	Beryllium	4.2×10^{-4}	1.0×10^{-3}	1.0×10^{-4}
5	Boron	1.2×10^{-1}	8.0×10^{-4}	2.7×10^{-3}
6	Carbon	5.5	3.1×10^{-2}	1.2×10^{-2}
7	Nitrogen	7.5	7.7×10^{-2}	2.2×10^{-2}
8	Oxygen	1.6	1.6×10^{-2}	2.0×10^{-2}
9	Fluorine	6.5×10^{-4}	1.5×10^{-1}	1.4×10^{-2}
10	Neon	1.4×10^{-1}	2.0×10^{-2}	2.0×10^{-2}
11	Sodium	5.2×10^{-2}	3.0×10^{-2}	4.0×10^{-2}
12	Magnesium	1.3×10^{-1}	5.0×10^{-3}	1.0×10^{-2}
13	Aluminum	1.8×10^{-4}	1.5×10^{-3}	5.0×10^{-4}
14	Silicon	1.5×10^{-4}	4.0×10^{-5}	1.0×10^{-4}
15	Phosphorous	1.1	4.6×10^{-2}	2.5×10^{-2}
16	Sulfur	5.9×10^{-1}	1.0×10^{-1}	1.8×10^{-2}
17	Chlorine	5.0	8.0×10^{-2}	5.0×10^{-2}
18	Argon	0.0	0.0	0.0
19	Potassium	3.7×10^{-1}	1.2×10^{-2}	1.0×10^{-2}
20	Calcium	3.6×10^{-2}	4.0×10^{-3}	8.0×10^{-3}
21	Scandium	1.1×10^{-3}	1.6×10^{-2}	5.0×10^{-6}
22	Titanium	5.4×10^{-5}	3.1×10^{-2}	5.0×10^{-6}
23	Vanadium	1.3×10^{-3}	2.3×10^{-3}	1.0×10^{-3}
24	Chromium	2.5×10^{-4}	2.4×10^{-3}	2.2×10^{-3}
25	Manganese	2.9×10^{-2}	8.0×10^{-4}	2.5×10^{-4}
26	Iron	6.6×10^{-4}	4.0×10^{-2}	1.2×10^{-3}
27	Cobalt	9.4×10^{-3}	1.3×10^{-2}	1.0×10^{-3}
28	Nickel	1.9×10^{-2}	5.3×10^{-3}	6.7×10^{-3}
29	Copper	1.2×10^{-1}	8.0×10^{-3}	1.4×10^{-2}
30	Zinc	4.0×10^{-1}	3.0×10^{-2}	3.9×10^{-2}
31	Gallium	2.5×10^{-4}	1.3	5.0×10^{-5}
32	Germanium	1.0×10^{-1}	2.0×10^1	5.0×10^{-4}
33	Arsenic	1.0×10^{-2}	2.0×10^{-3}	6.0×10^{-3}
34	Selenium	1.3	1.5×10^{-2}	4.5×10^{-3}
35	Bromine	7.6×10^{-1}	2.6×10^{-2}	5.0×10^{-2}
36	Krypton	0.0	0.0	0.0

TABLE 3.6 (Cont.)

Index (i)	Element	Transfer Coefficients		
		Soil-to-Plant $B_v(i)$ (dimensionless)	Grass-to-Meat $F_b(i)$ (d/kg)	Grass-to-Milk $F_m(i)$ (d/L)
37	Rubidium	1.3×10^{-1}	3.1×10^{-2}	3.0×10^{-2}
38	Strontium	1.7×10^{-2}	6.0×10^{-4}	8.0×10^{-4}
39	Yttrium	2.6×10^{-3}	4.6×10^{-3}	1.0×10^{-5}
40	Zirconium	1.7×10^{-4}	3.4×10^{-2}	5.0×10^{-6}
41	Niobium	9.4×10^{-3}	2.8×10^{-1}	2.5×10^{-3}
42	Molybdenum	1.2×10^{-1}	8.0×10^{-3}	7.5×10^{-3}
43	Technetium	2.5×10^{-1}	4.0×10^{-1}	2.5×10^{-2}
44	Ruthenium	5.0×10^{-2}	4.0×10^{-1}	1.0×10^{-6}
45	Rhodium	1.3×10^1	1.5×10^{-3}	1.0×10^{-2}
46	Palladium	5.0	4.0×10^{-3}	1.0×10^{-2}
47	Silver	1.5×10^{-1}	1.7×10^{-2}	5.0×10^{-2}
48	Cadmium	3.0×10^{-1}	5.3×10^{-4}	1.2×10^{-4}
49	Indium	2.5×10^{-1}	8.0×10^{-3}	1.0×10^{-4}
50	Tin	2.5×10^{-3}	8.0×10^{-2}	2.5×10^{-3}
51	Antimony	1.1×10^{-2}	4.0×10^{-3}	1.5×10^{-3}
52	Tellurium	1.3	7.7×10^{-2}	1.0×10^{-3}
53	Iodine	2.0×10^{-2}	2.9×10^{-3}	6.0×10^{-3}
54	Xenon	0.0	0.0	0.0
55	Cesium	1.0×10^{-2}	4.0×10^{-3}	1.2×10^{-2}
56	Barium	5.0×10^{-3}	3.2×10^{-3}	4.0×10^{-4}
57	Lanthanum	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
58	Cerium	2.5×10^{-3}	1.2×10^{-3}	6.0×10^{-4}
59	Praseodymium	2.5×10^{-3}	4.7×10^{-3}	5.0×10^{-6}
60	Neodymium	2.4×10^{-3}	3.3×10^{-3}	5.0×10^{-6}
61	Promethium	2.5×10^{-3}	4.8×10^{-3}	5.0×10^{-6}
62	Samarium	2.5×10^{-3}	5.0×10^{-3}	5.0×10^{-6}
63	Europium	2.5×10^{-3}	4.8×10^{-3}	5.0×10^{-6}
64	Gadolinium	2.6×10^{-3}	3.6×10^{-3}	5.0×10^{-6}
65	Terbium	2.6×10^{-3}	4.4×10^{-3}	5.0×10^{-6}
66	Dysprosium	2.5×10^{-3}	5.3×10^{-3}	5.0×10^{-6}
67	Holmium	2.6×10^{-3}	4.4×10^{-3}	5.0×10^{-6}
68	Erbium	2.5×10^{-3}	4.0×10^{-3}	5.0×10^{-6}
69	Thulium	2.6×10^{-3}	4.4×10^{-3}	5.0×10^{-6}
70	Ytterbium	2.5×10^{-3}	4.0×10^{-3}	5.0×10^{-6}
71	Lutetium	2.6×10^{-3}	4.4×10^{-3}	5.0×10^{-6}
72	Hafnium	1.7×10^{-4}	4.0×10^{-1}	5.0×10^{-6}
73	Tantalum	6.3×10^{-3}	1.6	2.5×10^{-2}

TABLE 3.6 (Cont.)

Index (i)	Element	Transfer Coefficients		
		Soil-to-Plant $B_v(i)$ (dimensionless)	Grass-to-Meat $F_b(i)$ (d/kg)	Grass-to-Milk $F_m(i)$ (d/L)
74	Tungsten	1.8×10^{-2}	1.3×10^{-3}	5.0×10^{-4}
75	Rhenium	2.5×10^{-1}	8.0×10^{-3}	2.5×10^{-2}
76	Osmium	5.0×10^{-2}	4.0×10^{-1}	5.0×10^{-3}
77	Iridium	1.3×10^1	1.5×10^{-3}	5.0×10^{-3}
78	Platinum	5.0×10^{-1}	4.0×10^{-3}	5.0×10^{-3}
79	Gold	2.5×10^{-3}	8.0×10^{-3}	5.0×10^{-3}
80	Mercury	3.8×10^{-1}	2.6×10^{-1}	3.8×10^{-2}
81	Thallium	2.5×10^{-1}	4.0×10^{-2}	2.2×10^{-2}
82	Lead	6.8×10^{-2}	2.9×10^{-4}	6.2×10^{-4}
83	Bismuth	1.5×10^{-1}	1.3×10^{-2}	5.0×10^{-4}
84	Polonium	1.5×10^{-1}	1.2×10^{-2}	3.0×10^{-4}
85	Astatine	2.5×10^{-1}	8.0	5.0×10^{-2}
86	Radon	0.0	0.0	0.0
87	Francium	1.0×10^{-2}	2.0×10^{-2}	5.0×10^{-2}
88	Radium	3.1×10^{-4}	3.4×10^{-2}	8.0×10^{-3}
89	Actinium	2.5×10^{-3}	6.0×10^{-2}	5.0×10^{-6}
90	Thorium	4.2×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
91	Protactinium	2.5×10^{-3}	8.0×10^2	5.0×10^{-6}
92	Uranium	2.5×10^{-3}	3.4×10^{-4}	5.0×10^{-4}
93	Neptunium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
94	Plutonium	2.5×10^{-4}	1.4×10^{-5}	2.0×10^{-6}
95	Americium	2.5×10^{-4}	2.0×10^{-4}	5.0×10^{-6}
96	Curium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
97	Berkelium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
98	Californium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
99	Einsteinium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}
100	Fermium	2.5×10^{-3}	2.0×10^{-4}	5.0×10^{-6}

Source: NRC (1977a).