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# **A Compilation of Radionuclide Transfer Factors for the Plant, Meat, Milk, and Aquatic Food Pathways and the Suggested Default Values for the RESRAD Code**

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**ABSTRACT**

The ongoing development and revision of the RESRAD computer code at Argonne National Laboratory requires update of radionuclide transfer factors for the plant, meat, milk, and aquatic food pathways. Default values for these transfer factors used in published radiological assessment reports are compiled and compared with values used in RESRAD. The differences among the reported default values used in different radiological assessment codes and reports are also discussed. In data comparisons, values used in more recent reports are given more weight because more recent experimental work tends to be conducted under better-defined laboratory or field conditions. A new default value is suggested for RESRAD if one of the following conditions is met: (1) values used in recent reports are an order of magnitude higher or lower than the default value currently used in RESRAD, or (2) the same default value is used in several recent radiological assessment reports.

**1 INTRODUCTION**

The radionuclide transfer factors for the plant, meat, milk, and aquatic food pathways used in the current version of the RESRAD computer code (Gilbert et al. 1989) are derived primarily from a handbook compiled by Ng et al. (1968). These factors are being updated at Argonne National Laboratory as part of the ongoing RESRAD development and revision effort. In Section 2 of this report, values of transfer factors used in the literature are compiled and compared with default values used in the current version of RESRAD. In Section 3, on the basis of these comparisons, new default values are suggested for future application of RESRAD.

## 2 DATA COMPILATION AND COMPARISON

Data from several published radiological assessment reports, listed in Table 1, are used as the sources for the transfer factors compiled in this report. The vegetable/soil, beef/feed, milk/feed, and aquatic food bioaccumulation transfer factors are compiled and compared in the following subsections.

### 2.1 VEGETABLE/SOIL TRANSFER FACTORS FOR ROOT UPTAKE

Comparison of vegetable/soil transfer factors for root uptake used in RESRAD with those used in other published radiological assessment models can be difficult because the parameters are generally reported in one of two different formats. In RESRAD (Gilbert et al. 1989), the food transfer coefficient for plants is expressed as the ratio: pCi per gram plant (wet)/pCi per gram soil (dry). In other published radiological assessment reports, the plant/soil concentration ratios have been reported on the basis of either the fresh (wet) weight or the dry weight of the vegetation. Dry-to-wet weight conversion factors must be estimated to make comparison possible. An overall average value of 0.428 for this parameter has been estimated by Baes et al. (1984) by the following processes: (1) calculation of the dry-to-wet weight conversion factors for exposed produce, protected produce, and grains on the basis of relative importance of various nonleafy vegetables in the United States; and (2) calculation of the average dry-to-wet conversion factor by weighing these calculated values by the relative importance (based on production in kilograms) of each vegetable category in the United States. Baes et al. (1984) caution, however, that unnecessary uncertainty might be introduced into the estimated parameter, and thus the adoption of dry-weight concentration ratios is preferred so as to reduce additional imprecision in parameter estimates.

A similar recommendation has been made by the IAEA (1982). For vegetation consumed by animals, expressing the vegetation biomass on a dry-weight basis is preferred so as to reduce both the large variability associated with the moisture content of fresh vegetation and the difficulties in accurately determining the fresh weight. In addition, animal consumption rates are most frequently reported on a dry-weight basis. On the other hand, for vegetation consumed by humans, it is more convenient to refer to the harvest yield or standing crop biomass on a fresh-weight basis because human consumption is most frequently reported in fresh weight. To aid in converting between the two bases of measurement, representative dry-to-wet weight ratios for food crops and forage plants that have been presented by Baes et al. (1984) and NRC (1983) are summarized in Table 2.

The vegetable/soil transfer factor of a radionuclide varies in a complex manner with soil properties and the geochemical properties of the radionuclide in soil. After entering the transpiration stream, radionuclides may not be uniformly distributed within a plant, but instead tend to concentrate in certain organs (Grogan 1985). Many studies have shown that

**TABLE 1 Transfer Factors and References Cited in Each Radiological Assessment Report Used as a Source for Data Compilation**

Radiological Assessment Report	Transfer Factor	References
NCRP (1991)	Vegetable/soil, beef/feed, and milk/feed transfer factors Aquatic bioaccumulation factor	Baes et al. (1984); Frissel (1989); IAEA (1982); Ng et al. (1977, 1982a) Copeland et al. (1973); Hoffman and Baes (1979); IAEA (1982); Killough and McKay (1976); Newman (1985); Poston and Klopfer (1986); Thompson et al. (1972)
NRC (1977)	Vegetable/soil transfer factor Beef/feed transfer factor Milk/feed transfer factor	Ng et al. (1968) Booth et al. (1971); Garner (1972); Ng et al. (1968) Booth et al. (1971); Garner (1972); Ng et al. (1968)
NRC (1983)	Milk/feed transfer factor Beef/feed transfer factor Aquatic bioaccumulation factor	Ng et al. (1977) Ng et al. (1979a,b, 1982b) Davis and Foster (1958); Friend et al. (1965); Harvey (1964); IAEA (1975); NAS (1971); Vanderploeg (1975)
Ng et al. (1982a) (NUREG/CR-2975)	Vegetable/soil transfer factor	Baker et al. (1976); Fletcher and Dotson (1971); McDowell-Boyer and Baes (1980); Moore et al. (1979); NRPB/CEA (1979)
Baes et al. (1984) (ORNL-5786)	Vegetable/soil transfer factor Beef/feed transfer factor Milk/feed transfer factor	Ng et al. (1968); NRC (1977) Ng et al. (1968, 1979a,b) Ng et al. (1977, 1979b)
IAEA (1982)	Vegetable/soil transfer factor Beef/feed transfer factor Milk/feed transfer factor Aquatic bioaccumulation factor	McDowell-Boyer et al. (1979); Ng et al. (1982a) Little (1979); Ng et al. (1977, 1979a,b) McDowell-Boyer et al. (1979); Ng et al. (1977, 1979a,b) Hoffman and Baes (1979); IAEA (1978); Thompson et al. (1972); Vanderploeg et al. (1975)

**TABLE 1 (Cont.)**

Radiological Assessment Report	Transfer Factor	References
IAEA (1985)	Aquatic bioaccumulation factor	Coughtry et al (1983); Coughtry and Thorne (1983); Eisler (1981)
IAEA (1993)	Milk/feed transfer factor	Coughtry and Thorne (1983); Johnson et al. (1988); Morgan and Beetham (1990); Ng et al. (1977, 1982b); Van Bruwaene et al. (1982)
	Beef/feed transfer factor	Bishop et al. (1989); IAEA (1982); Johnson et al. (1988); Morgan and Beetham (1990); Ng et al. (1982b); Van Bruwaene et al. (1982)
	Aquatic bioaccumulation factor	Blaylock (1982); Copeland et al. (1973); IAEA (1982); Killough and McKay (1976); Newman (1985); Onishi et al. (1981); Poston and Klopfer (1986); Thompson et al. (1972); Vanderploeg et al. (1975)
Kennedy and Strenge (1992) (NUREG/CR-5512)	Vegetable/soil transfer factor Beef/feed transfer factor Milk/feed transfer factor	Baes et al. (1984); IUR (1989) Baes et al. (1984); Napier et al. (1988) Baes et al. (1984); Napier et al. (1988)



**TABLE 2 Dry-to-Wet Weight Conversion Factors for Food Crops and Forage Plants**

Crop	Baes et al. (1984)	NRC (1983)	Crop	Baes et al. (1984)	NRC (1983)
<b>Leafy Vegetables</b>			<b>Fruits (Cont.)</b>		
Asparagus	0.070	0.083	Raspberry	-	0.175
Cabbage	<sup>a</sup>	0.077	Cucumber	0.039	0.050
Cauliflower	-	0.083	Eggplant	0.073	0.077
Celery	-	0.063	Pepper	-	0.067
Lettuce	-	0.050	Pumpkin	-	0.084
Rhubarb	-	0.053	Squash	0.082	0.060
Spinach	-	0.083	Tomato	0.059	0.067
Broccoli	-	0.110	Grapefruit	0.112	0.116
Brussels sprout	-	0.147	Orange	0.128	0.141
Kale	-	0.125	Peach	0.131	0.109
Turnip green	-	0.100	Strawberry	0.101	0.101
			Cantaloupe	0.060	-
<b>Root Vegetables</b>			Watermelon	0.079	-
Potato	0.222	0.222	Lemon	0.107	-
Sweet potato	0.315	0.294			
Yam	-	0.263	<b>Grains</b>		
Beet	-	0.127	Barley	0.889	0.926
Carrot	0.118	0.118	Rice	-	0.877
Onion	0.125	0.116	Wheat	0.875	0.870
Radish	-	0.056	Corn	0.895	0.263
Turnip	-	0.085			
			<b>Forage</b>		
<b>Fruits</b>			Alfalfa	-	0.227
Apple	0.159	0.149	Clover	-	0.200
Apricot	-	0.147	Grass	-	0.182
Banana	-	0.244	Silage	-	0.238
Blackberry	-	0.156			
Blueberry	-	0.167	<b>Others</b>		
Cherry	0.170	0.196	Lima bean	-	0.322
Fig	-	0.227	Pea	0.257	0.169
Pear	0.173	0.167	Green bean	-	0.100
Pineapple	-	0.147	Chestnut	-	0.476
Plum	0.540	0.189	Peanut	0.920	0.943

<sup>a</sup> No conversion factor is given by the source.

the vegetable/soil transfer factor also varies with crop type and variety, stage of growth, and plant part, as well as with subsoil characteristics and agriculture practices (Baes et al. 1984; IAEA 1993; Ng et al. 1982a). Comprehensive data on transfer factors in different crops grown on various soils are available in the literature for relatively few radionuclides. Data for radionuclides for which little or no experimental information exists have been customarily estimated on the basis of the assumption that chemically similar elements act similarly in the soil-plant environment (Baes et al. 1984). Relationships between transfer factors for an element and those for other elements of the same or adjacent periods or groups were established and examined for possible trends. Such trends were extrapolated to the element in question.

In published radiological assessment models, default values for vegetable/soil transfer factors are reported as composite values from various food and feed crops or as separate values for forage vegetation and edible portions of various vegetables and produce. The current version of the RESRAD computer code uses composite values of vegetable/soil transfer factors. Differences among food crops (such as leafy vegetables, root vegetables, fruits, grain, and forage plants) and consumption groups (such as humans and animals) are not considered. To take any such differences into account, categorization of crop plants into different food classes is required. Four food classes (k=0, 1, 2, and 3) are used in this report to present data collected from different food crops. Food class descriptions and radiological assessment models used as the data source for vegetable/soil transfer factors are listed in Table 3.

Values of vegetable/soil transfer factors for root uptake compiled from published radiological assessment models are listed in Table 4 for the food classes defined in Table 3.

**TABLE 3 Descriptions of Food Classes for Human and Animal Food Consumption and Associated Data Sources**

Food Class	Class Description	Assessment Models Used as Data Sources
k=0	Composite	IAEA (1982); NCRP (1991); Ng et al. (1982a); NRC (1977)
k=1	Root vegetables, fruits, and grain for human consumption	Baes et al (1984); IAEA (1993); Kennedy and Strenge (1992); Napier et al. (1988); Ng et al. (1982a)
k=2	Leafy vegetables for human consumption	Baes et al. (1984); IAEA (1993); Kennedy and Strenge (1992); Napier et al. (1988); Ng et al. (1982a)
k=3	Forage plants for pasture vegetation and other animal feeds	IAEA (1982, 1993); NCRP (1991); Ng et al (1982a)

TABLE 4 Compilation of Vegetable/Soil Transfer Factors for Plant Foods

## Part I: Composite (k=0) and Root Vegetables, Fruits, and Grain (k=1)

Element	Composite, k=0 (pCi/kg wet weight per pCi/kg dry soil)					Root Vegetables, Fruits, and Grain, k=1 (pCi/kg dry weight per pCi/kg dry soil)				
	RESRAD	NCRP (1991)	NRC (1977)	Ng et al. (1982a)	IAEA (1982)	Napier et al. (1988)	Kennedy and Streng (1992)	Baas et al. (1984)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1998)
H	0	<sup>b</sup>	4.8	-	-	0.0	-	-	-	-
Be	$4.7 \times 10^{-4}$	0.004	-	-	-	$6.4 \times 10^{-3}$	$1.5 \times 10^{-3}$	-	-	-
C	5.5	-	5.5	-	-	0.0	$7.0 \times 10^{-1}$	-	-	-
N	7.5	7.5	-	-	-	7.5	$3.0 \times 10^{-1}$	-	-	-
F	$2.0 \times 10^{-2}$	0.02	-	-	-	$2.0 \times 10^{-2}$	$6.0 \times 10^{-3}$	-	-	-
Na	$5.0 \times 10^{-2}$	0.05	$5.2 \times 10^{-2}$	$5.0 \times 10^{-2} - 5.2 \times 10^{-2}$	$5 \times 10^{-2}$	$1.0 \times 10^{-2}$	$5.5 \times 10^{-2}$	$4.6 \times 10^{-2}$	-	-
P	$5.0 \times 10^{-1}$	1	1.1	$1.1 \times 10^0 - 5.0 \times 10^1$	1	4.0	3.5	-	-	-
Cl	5.0	20	-	-	-	$3.3 \times 10^{-1}$	$7.0 \times 10^{-1}$	-	-	-
Ar	0	0	-	-	-	0.0	-	-	-	-
K	$3.0 \times 10^{-1}$	0.3	-	-	-	3.3	$5.5 \times 10^{-1}$	-	-	-
Ca	$4.0 \times 10^{-2}$	0.5	-	-	-	2.0	$3.5 \times 10^{-1}$	-	-	-
Sc	$1.1 \times 10^{-3}$	0.002	-	-	-	$1.0 \times 10^{-2}$	$1.0 \times 10^{-3}$	-	-	-
Cr	$2.5 \times 10^{-4}$	0.01	$2.5 \times 10^{-4}$	$2.5 \times 10^{-4}$	$8 \times 10^{-4}$	$2.8 \times 10^{-2}$	$4.5 \times 10^{-3}$	$1.5 \times 10^{-2}$	-	-
Mn	$3.0 \times 10^{-2}$	0.3	$2.9 \times 10^{-2}$	$2.9 \times 10^{-2} - 3.0 \times 10^{-2}$	$5 \times 10^{-1}$	$5.3 \times 10^{-1}$	$1.6 \times 10^{-1}$	$2.1 \times 10^{-1}$	$3.0 \times 10^{-1}$	-
Fe	$4.0 \times 10^{-4}$	0.001	$6.6 \times 10^{-4}$	$1.5 \times 10^{-4} - 6.6 \times 10^{-4}$	$7 \times 10^{-4}$	$1.5 \times 10^{-2}$	$1.0 \times 10^{-3}$	$4.3 \times 10^{-3}$	-	-
Co	$9.4 \times 10^{-3}$	0.08	$9.4 \times 10^{-3}$	$1.0 \times 10^{-3} - 1.0 \times 10^{-2}$	$3 \times 10^{-2}$	$8.0 \times 10^{-3}$	$1.7 \times 10^{-2}$	$7.0 \times 10^{-3}$	$8.9 \times 10^{-2}$	$2.2 \times 10^{-2}$
Ni	$1.9 \times 10^{-2}$	0.05	$1.9 \times 10^{-2}$	$1.9 \times 10^{-2} - 1.9 \times 10^0$	$2 \times 10^{-2}$	$8.3 \times 10^{-2}$	$6.0 \times 10^{-2}$	$6.0 \times 10^{-2}$	$5.0 \times 10^{-2}$	$1.4 \times 10^{-1}$
Cu	$1.3 \times 10^{-1}$	0.005	$1.2 \times 10^{-1}$	$1.3 \times 10^{-1}$	-	$3.5 \times 10^{-2}$	$2.5 \times 10^{-1}$	$1.7 \times 10^{-1}$	-	-
Zn	$4.0 \times 10^{-1}$	0.4	$4.0 \times 10^{-1}$	$4.1 \times 10^{-1}$	$4 \times 10^{-1}$	2.0	$9.3 \times 10^{-1}$	$9.0 \times 10^{-1}$	$8.1 \times 10^{-1}$	-
As	$1.0 \times 10^{-2}$	0.08	-	-	-	$1.0 \times 10^{-2}$	$6.0 \times 10^{-3}$	-	-	-
Se	1.3	0.1	-	-	-	$3.5 \times 10^{-1}$	$2.5 \times 10^{-2}$	-	-	-
Br	$7.6 \times 10^{-1}$	0.4	-	-	-	$7.6 \times 10^{-1}$	1.5	-	-	-
Kr	0	0	-	-	-	0.0	-	-	-	-
Rb	$1.3 \times 10^{-1}$	0.2	$1.3 \times 10^{-1}$	$1.3 \times 10^{-1}$	-	$3.0 \times 10^{-1}$	$7.0 \times 10^{-2}$	-	-	-
Sr	$2.0 \times 10^{-1}$	0.3	$1.7 \times 10^{-2}$	$2.0 \times 10^{-2} - 1.0 \times 10^0$	$3 \times 10^{-1}$	1.4	$3.7 \times 10^{-1}$	$4.0 \times 10^{-1}$	$2.6 \times 10^{-1}$	-
Y	$2.5 \times 10^{-3}$	0.002	$2.6 \times 10^{-3}$	$2.5 \times 10^{-3} - 4.3 \times 10^{-3}$	$2 \times 10^{-3}$	$7.0 \times 10^{-3}$	$6.0 \times 10^{-3}$	-	-	-
Zr	$1.7 \times 10^{-4}$	0.001	$1.7 \times 10^{-4}$	$1.7 \times 10^{-4}$	$5 \times 10^{-3}$	$4.0 \times 10^{-2}$	$5.0 \times 10^{-4}$	$1.8 \times 10^{-3}$	-	-
Nb	$9.4 \times 10^{-3}$	0.01	$9.4 \times 10^{-3}$	$9.4 \times 10^{-3}$	$1 \times 10^{-2}$	$2.9 \times 10^{-2}$	$5.0 \times 10^{-3}$	-	-	-
Mo	$1.3 \times 10^{-1}$	0.1	$1.2 \times 10^{-1}$	$1.3 \times 10^{-1}$	-	$7.0 \times 10^{-1}$	$6.0 \times 10^{-2}$	-	-	-
Tc	$2.5 \times 10^{-1}$	5	$2.5 \times 10^{-1}$	$2.5 \times 10^{-1} - 5.0 \times 10^1$	5	$4.0 \times 10^{-1}$	1.1	-	5.8	-
Ru	$1.0 \times 10^{-2}$	0.03	$5.0 \times 10^{-2}$	$3.8 \times 10^{-3} - 6.0 \times 10^{-2}$	$8 \times 10^{-3}$	$2.0 \times 10^{-1}$	$1.5 \times 10^{-2}$	$9.4 \times 10^{-3}$	-	-
Rh	$1.3 \times 10^{-1}$	0.03	$1.3 \times 10^{-1}$	$1.3 \times 10^{-1}$	-	$3.5 \times 10^{-1}$	$4.0 \times 10^{-2}$	-	-	-
Pd	5.0	0.1	-	-	-	$3.2 \times 10^{-1}$	$4.0 \times 10^{-2}$	-	-	-
Ag	$1.5 \times 10^{-1}$	0.004	$1.5 \times 10^{-1}$	$1.5 \times 10^{-1}$	$2 \times 10^{-1}$	$4.2 \times 10^{-1}$	$3.4 \times 10^{-3}$	-	-	-
Cd	$3.0 \times 10^{-1}$	0.5	-	-	-	1.5	$1.5 \times 10^{-1}$	-	-	-
Sn	$2.5 \times 10^{-3}$	0.3	-	-	-	$7.0 \times 10^{-2}$	$6.0 \times 10^{-3}$	-	-	-

TABLE 4, Part I (Cont.)

Element	Composite, k=0 (pCi/kg wet weight per pCi/kg dry soil)						Root Vegetables, Fruits, and Grain, k=1 (pCi/kg dry weight per pCi/kg dry soil)				
	RESRAD	NCRP (1991)	NRC (1977)	Ng et al. (1982a)	IAEA (1982)	Napier et al. (1988)	Kennedy and Streng (1992)	Baes et al. (1984)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1993)	
Sb	1.1 × 10 <sup>-2</sup>	0.01	-	-	1 × 10 <sup>-2</sup>	5.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	3.0 × 10 <sup>-2</sup>	-	-	
Te	1.3	0.1	1.3	1.3	6 × 10 <sup>-1</sup>	3.5	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
I	2.0 × 10 <sup>-2</sup>	0.02	2.0 × 10 <sup>-2</sup>	2.0 × 10 <sup>-2</sup> - 5.5 × 10 <sup>-2</sup>	2.0 × 10 <sup>-2</sup>	4.0 × 10 <sup>-1</sup>	5.0 × 10 <sup>-2</sup>	5.0 × 10 <sup>-2</sup>	3.8 × 10 <sup>-2</sup>	-	
Xe	0	0	-	-	-	0.0	-	-	-	-	
Cs	2.0 × 10 <sup>-3</sup>	0.04	1.0 × 10 <sup>-2</sup>	6.4 × 10 <sup>-4</sup> - 7.8 × 10 <sup>-2</sup>	3 × 10 <sup>-2</sup>	1.7 × 10 <sup>-2</sup>	9.8 × 10 <sup>-2</sup>	3.0 × 10 <sup>-2</sup>	1.9 × 10 <sup>-2</sup>	4.4 × 10 <sup>-2</sup>	
Ba	5.0 × 10 <sup>-3</sup>	0.01	5.0 × 10 <sup>-3</sup>	5.0 × 10 <sup>-3</sup>	5 × 10 <sup>-3</sup>	2.8 × 10 <sup>-2</sup>	1.5 × 10 <sup>-2</sup>	1.5 × 10 <sup>-2</sup>	-	-	
La	2.5 × 10 <sup>-3</sup>	0.002	2.5 × 10 <sup>-3</sup>	2.5 × 10 <sup>-3</sup>	2 × 10 <sup>-3</sup>	1.7 × 10 <sup>-2</sup>	6.4 × 10 <sup>-4</sup>	4.0 × 10 <sup>-3</sup>	-	6.6 × 10 <sup>-4</sup>	
Ce	5.0 × 10 <sup>-4</sup>	0.002	2.5 × 10 <sup>-3</sup>	5.0 × 10 <sup>-4</sup> - 7.0 × 10 <sup>-3</sup>	2 × 10 <sup>-3</sup>	2.8 × 10 <sup>-2</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.6 × 10 <sup>-3</sup>	-	
Pr	2.5 × 10 <sup>-3</sup>	0.002	2.5 × 10 <sup>-3</sup>	2.5 × 10 <sup>-3</sup>	-	7.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Nd	2.4 × 10 <sup>-3</sup>	0.002	2.4 × 10 <sup>-3</sup>	2.4 × 10 <sup>-3</sup>	-	7.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Pm	2.5 × 10 <sup>-3</sup>	0.002	-	-	2 × 10 <sup>-3</sup>	7.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Sm	2.5 × 10 <sup>-3</sup>	0.002	-	-	2 × 10 <sup>-3</sup>	7.3 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Eu	2.5 × 10 <sup>-3</sup>	0.002	-	-	2 × 10 <sup>-3</sup>	7.3 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Gd	2.5 × 10 <sup>-3</sup>	0.002	-	-	2 × 10 <sup>-3</sup>	7.3 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Tb	2.6 × 10 <sup>-3</sup>	0.002	-	-	-	3.5 × 10 <sup>-2</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Ho	2.6 × 10 <sup>-3</sup>	0.002	-	-	-	2.6 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
W	1.8 × 10 <sup>-2</sup>	0.8	1.8 × 10 <sup>-2</sup>	1.8 × 10 <sup>-2</sup>	-	1.1 × 10 <sup>-2</sup>	4.0 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	-	
Ir	9.9 × 10 <sup>-4</sup>	0.03	-	-	-	2.1	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	
Hg	3.8 × 10 <sup>-1</sup>	0.3	-	-	-	6.8 × 10 <sup>-2</sup>	1.5 × 10 <sup>-2</sup>	1.5 × 10 <sup>-2</sup>	-	-	
Pb	6.8 × 10 <sup>-2</sup>	0.004	-	-	-	7.0 × 10 <sup>-1</sup>	2.0 × 10 <sup>-1</sup>	2.0 × 10 <sup>-1</sup>	-	-	
Bi	1.5 × 10 <sup>-1</sup>	0.1	-	-	1 × 10 <sup>-2</sup>	7.0 × 10 <sup>-2</sup>	5.6 × 10 <sup>-3</sup>	9.0 × 10 <sup>-3</sup>	5.0 × 10 <sup>-3</sup>	5.0 × 10 <sup>-3</sup>	
Po	9.0 × 10 <sup>-3</sup>	0.001	-	-	1 × 10 <sup>-1</sup>	6.0 × 10 <sup>-1</sup>	5.0 × 10 <sup>-3</sup>	5.0 × 10 <sup>-3</sup>	-	-	
Rn	0	0	-	-	2 × 10 <sup>-4</sup>	7.0 × 10 <sup>-3</sup>	3.3 × 10 <sup>-4</sup>	4.0 × 10 <sup>-4</sup>	-	-	
Ra	1.4 × 10 <sup>-3</sup>	0.04	-	-	-	0.0	-	-	-	-	
Ac	2.5 × 10 <sup>-3</sup>	0.001	-	-	4 × 10 <sup>-2</sup>	7.0 × 10 <sup>-3</sup>	3.5 × 10 <sup>-3</sup>	1.5 × 10 <sup>-3</sup>	-	4.9 × 10 <sup>-3</sup>	
Th	4.2 × 10 <sup>-3</sup>	0.001	-	-	1 × 10 <sup>-3</sup>	4.4 × 10 <sup>-3</sup>	3.5 × 10 <sup>-4</sup>	3.5 × 10 <sup>-4</sup>	-	-	
Pa	2.5 × 10 <sup>-3</sup>	0.01	-	-	5 × 10 <sup>-4</sup>	2.8 × 10 <sup>-3</sup>	8.0 × 10 <sup>-5</sup>	8.5 × 10 <sup>-3</sup>	-	2.1 × 10 <sup>-4</sup>	
U	2.5 × 10 <sup>-3</sup>	0.002	-	-	4 × 10 <sup>-2</sup>	4.0 × 10 <sup>-2</sup>	2.5 × 10 <sup>-4</sup>	2.5 × 10 <sup>-4</sup>	-	-	
Np	2.5 × 10 <sup>-3</sup>	0.02	2.5 × 10 <sup>-3</sup>	1.0 × 10 <sup>-6</sup> - 2.5 × 10 <sup>-3</sup>	2 × 10 <sup>-3</sup>	2.7 × 10 <sup>-3</sup>	6.4 × 10 <sup>-3</sup>	4.0 × 10 <sup>-3</sup>	-	5.8 × 10 <sup>-3</sup>	
Pu	2.5 × 10 <sup>-4</sup>	0.001	-	-	4 × 10 <sup>-2</sup>	7.0 × 10 <sup>-1</sup>	7.4 × 10 <sup>-3</sup>	1.0 × 10 <sup>-2</sup>	1.4 × 10 <sup>-1</sup>	1.7 × 10 <sup>-2</sup>	
Am	2.5 × 10 <sup>-4</sup>	0.001	-	-	5 × 10 <sup>-4</sup>	2.8 × 10 <sup>-4</sup>	9.0 × 10 <sup>-4</sup>	4.5 × 10 <sup>-5</sup>	-	1.9 × 10 <sup>-4</sup>	
Cm	2.5 × 10 <sup>-3</sup>	0.001	-	-	1 × 10 <sup>-3</sup>	1.4 × 10 <sup>-3</sup>	2.4 × 10 <sup>-4</sup>	2.5 × 10 <sup>-4</sup>	-	4.1 × 10 <sup>-4</sup>	
Cf	2.5 × 10 <sup>-3</sup>	0.001	-	-	1 × 10 <sup>-3</sup>	1.4 × 10 <sup>-3</sup>	9.2 × 10 <sup>-4</sup>	1.5 × 10 <sup>-5</sup>	-	2.4 × 10 <sup>-4</sup>	
						2.5 × 10 <sup>-3</sup>	1.0 × 10 <sup>-2</sup>	-	-	-	

<sup>a</sup> Values are calculated as the geometric means of data presented in original document.

<sup>b</sup> Data not listed.

TABLE 4 (Cont.)

Part II: Leafy Vegetables (k=2) and Forage Plants (k=3)

Element	Leafy Vegetables, k=2 (pCi/kg dry weight per pCi/kg dry soil)				Forage Plants, k=3 (pCi/kg dry weight per pCi/kg dry soil)				
	Napier et al. (1988)	Kennedy and Streng (1992)	Baes et al. (1984)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1993)	NCRP (1991)	IAEA (1982)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1993)
H	0.0	<sup>b</sup>	-	-	-	-	-	-	-
Be	$8.0 \times 10^{-3}$	$1.0 \times 10^{-2}$	$1.0 \times 10^{-2}$	-	-	0.1	-	-	-
C	0.0	$7.0 \times 10^{-1}$	-	-	-	-	-	-	-
N	7.5	$3.0 \times 10$	$3.0 \times 10$	-	-	20	-	-	-
F	$2.0 \times 10^{-2}$	$6.0 \times 10^{-2}$	$6.0 \times 10^{-2}$	-	-	0.1	-	-	-
Na	$1.0 \times 10$	$7.5 \times 10^{-2}$	$7.5 \times 10^{-2}$	$3.5 \times 10^{-1}$	-	0.2	$2 \times 10^{-1}$	-	-
P	4.0	3.5	3.5	-	-	3	3	-	-
Cl	$5.0 \times 10$	$7.0 \times 10$	$7.0 \times 10$	-	-	100	-	-	-
Ar	0.0	-	-	-	-	0	-	-	-
K	3.0	1.0	1.0	-	-	3	-	-	-
Ca	2.0	3.5	3.5	-	-	5	-	-	-
Sc	$1.0 \times 10^{-2}$	$6.0 \times 10^{-3}$	$6.0 \times 10^{-3}$	-	-	0.1	-	-	-
Cr	$4.0 \times 10^{-2}$	$7.5 \times 10^{-3}$	$7.5 \times 10^{-3}$	-	-	0.1	$3 \times 10^{-3}$	$2.0 \times 10^{-2}$	-
Mn	$7.0 \times 10^{-1}$	$5.6 \times 10^{-1}$	$2.5 \times 10^{-1}$	2.1	$4.9 \times 10^{-1}$	10	$3 \times 10^{-1}$	$6.7 \times 10^{-1}$	$9.2 \times 10^{-1}$
Fe	$2.0 \times 10^{-2}$	$4.0 \times 10^{-3}$	$4.0 \times 10^{-3}$	-	-	0.1	$3 \times 10^{-3}$	$3.0 \times 10^{-3}$	-
Co	$1.0 \times 10^{-1}$	$8.1 \times 10^{-2}$	$2.0 \times 10^{-2}$	-	$1.6 \times 10^{-1}$	2	$4 \times 10^{-1}$	$1.1 \times 10^{-1}$	$8.8 \times 10^{-2}$
Ni	$1.0 \times 10^{-1}$	$2.8 \times 10^{-1}$	$6.0 \times 10^{-2}$	-	-	1	$4 \times 10^{-2}$	$1.1 \times 10^{-1}$	-
Cu	$5.0 \times 10^{-1}$	$4.0 \times 10^{-1}$	$4.0 \times 10^{-1}$	-	-	0.8	$5 \times 10^{-1}$	$5.3 \times 10^{-1}$	-
Zn	2.0	1.4	1.5	$6.4 \times 10^{-2}$	1.6	1	$5 \times 10^{-1}$	$6.4 \times 10^{-1}$	$5.6 \times 10^{-1}$
As	$1.0 \times 10^{-2}$	$4.0 \times 10^{-2}$	$4.0 \times 10^{-2}$	-	-	0.2	-	-	-
Se	$5.0 \times 10^{-1}$	$2.5 \times 10^{-2}$	$2.5 \times 10^{-2}$	-	-	0.5	-	-	-
Br	$7.6 \times 10^{-1}$	1.5	1.5	-	-	2	-	-	-
Kr	0.0	-	-	-	-	0	-	-	-
Rb	$3.0 \times 10^{-1}$	$1.5 \times 10^{-1}$	$1.5 \times 10^{-1}$	-	-	2	-	$8.1 \times 10^{-1}$	-
Sr	2.0	1.6	2.5	1.8	1.3	4	2	1.9	0.86
Y	$1.0 \times 10^{-2}$	$1.5 \times 10^{-2}$	$1.5 \times 10^{-2}$	-	-	0.1	$1 \times 10^{-2}$	-	-
Zr	$4.0 \times 10^{-2}$	$2.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$1.4 \times 10^{-2}$	-	0.1	$2 \times 10^{-2}$	$7.2 \times 10^{-2}$	-
Nb	$4.0 \times 10^{-2}$	$2.0 \times 10^{-2}$	$2.0 \times 10^{-2}$	-	-	0.1	$4 \times 10^{-2}$	-	-
Mo	1.0	$2.5 \times 10^{-1}$	$2.5 \times 10^{-1}$	-	-	0.4	-	-	-
Tc	$4.0 \times 10$	$4.4 \times 10^{-1}$	9.5	-	$1.8 \times 10^2$	40	20	-	-
Ru	$2.0 \times 10^{-1}$	$5.2 \times 10^{-1}$	$7.5 \times 10^{-2}$	$4.7 \times 10^{-2}$	-	0.2	$9 \times 10^{-2}$	$1.1 \times 10^{-1}$	-
Rh	$5.0 \times 10$	$1.5 \times 10^{-1}$	$1.5 \times 10^{-1}$	-	-	0.2	-	-	-
Pd	$3.0 \times 10^{-1}$	$1.5 \times 10^{-1}$	$1.5 \times 10^{-1}$	-	-	0.5	-	-	-
Ag	$6.0 \times 10^{-1}$	$2.7 \times 10^{-4}$	$4.0 \times 10^{-1}$	-	-	0.1	1	-	-
Cd	2.0	$5.5 \times 10^{-1}$	$5.5 \times 10^{-1}$	-	-	1	-	-	-
Sn	$1.0 \times 10^{-1}$	$3.0 \times 10^{-2}$	$3.0 \times 10^{-2}$	-	-	1	-	-	-

TABLE 4, Part II (Cont.)

Element	Leafy Vegetables, k=2 (pCi/kg dry weight per pCi/kg dry soil)				Forage Plants, k=3 (pCi/kg dry weight per pCi/kg dry soil)				
	Napier et al. (1988)	Kennedy and Strenge (1992)	Baes et al. (1984)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1993)	NCRP (1991)	IAEA (1982)	Ng et al. <sup>a</sup> (1982a)	IAEA <sup>a</sup> (1993)
Sb	5.0 × 10 <sup>-2</sup>	1.3 × 10 <sup>-1</sup>	2.0 × 10 <sup>-1</sup>	-	-	0.1	4 × 10 <sup>-2</sup>	-	-
Te	5.0	2.5 × 10 <sup>-2</sup>	2.5 × 10 <sup>-2</sup>	-	-	40	2	-	-
I	4.0 × 10 <sup>-1</sup>	3.4 × 10 <sup>-3</sup>	1.5 × 10 <sup>-1</sup>	1.6 × 10 <sup>-1</sup>	-	0.1	9 × 10 <sup>-1</sup>	1.7 × 10 <sup>-1</sup>	-
Xe	0.0	-	-	-	-	0	-	-	-
Cs	2.0 × 10 <sup>-2</sup>	1.3 × 10 <sup>-1</sup>	8.0 × 10 <sup>-2</sup>	1.1 × 10 <sup>-1</sup>	2.8 × 10 <sup>-1</sup>	0.2	1 × 10 <sup>-1</sup>	1.4 × 10 <sup>-1</sup>	1.7 × 10 <sup>-1</sup>
Ba	4.0 × 10 <sup>-2</sup>	1.5 × 10 <sup>-1</sup>	1.5 × 10 <sup>-1</sup>	-	-	0.1	2 × 10 <sup>-2</sup>	3.9 × 10 <sup>-2</sup>	-
La	1.0 × 10 <sup>-2</sup>	5.7 × 10 <sup>-4</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	4 × 10 <sup>-2</sup>	-	-
Ce	4.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	3.0 × 10 <sup>-2</sup>	-	0.1	4 × 10 <sup>-2</sup>	5.8 × 10 <sup>-2</sup>	-
Pr	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	-	-	-
Nd	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	-	-	-
Pm	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	4 × 10 <sup>-2</sup>	-	-
Sm	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	4 × 10 <sup>-2</sup>	-	-
Eu	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	4 × 10 <sup>-2</sup>	-	-
Gd	5.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	-	-	-
Tb	2.6 × 10 <sup>-3</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	-	-	-
Ho	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	1.0 × 10 <sup>-2</sup>	-	-	0.1	-	-	-
W	3.0	4.5 × 10 <sup>-2</sup>	4.5 × 10 <sup>-2</sup>	-	-	3	-	-	-
Ir	1.0 × 10 <sup>-1</sup>	5.5 × 10 <sup>-2</sup>	5.5 × 10 <sup>-2</sup>	-	-	0.2	-	-	-
Hg	1.0	9.0 × 10 <sup>-1</sup>	9.0 × 10 <sup>-1</sup>	-	-	1	-	-	-
Pb	1.0 × 10 <sup>-1</sup>	5.8 × 10 <sup>-3</sup>	4.5 × 10 <sup>-2</sup>	-	-	0.1	9 × 10 <sup>-2</sup>	-	-
Bi	6.0 × 10 <sup>-1</sup>	3.5 × 10 <sup>-2</sup>	3.5 × 10 <sup>-2</sup>	-	-	0.5	5 × 10 <sup>-1</sup>	-	-
Po	1.0 × 10 <sup>-2</sup>	2.5 × 10 <sup>-3</sup>	2.5 × 10 <sup>-3</sup>	-	-	0.1	4 × 10 <sup>-3</sup>	-	-
Rn	0.0	-	-	-	-	0	-	-	-
Ra	1.0 × 10 <sup>-1</sup>	7.5 × 10 <sup>-2</sup>	1.5 × 10 <sup>-2</sup>	-	-	0.2	2 × 10 <sup>-1</sup>	-	-
Ac	1.0 × 10 <sup>-2</sup>	3.5 × 10 <sup>-3</sup>	3.5 × 10 <sup>-3</sup>	-	-	0.1	4 × 10 <sup>-3</sup>	-	-
Th	4.0 × 10 <sup>-3</sup>	6.6 × 10 <sup>-3</sup>	8.5 × 10 <sup>-4</sup>	-	-	0.1	1 × 10 <sup>-3</sup>	9.0 × 10 <sup>-3</sup>	-
Pa	5.0 × 10 <sup>-2</sup>	2.5 × 10 <sup>-3</sup>	2.5 × 10 <sup>-3</sup>	-	-	0.1	1 × 10 <sup>-1</sup>	-	-
U	4.0 × 10 <sup>-3</sup>	1.7 × 10 <sup>-2</sup>	8.5 × 10 <sup>-3</sup>	-	-	0.1	1 × 10 <sup>-2</sup>	-	-
Np	1.0	1.3 × 10 <sup>-2</sup>	1.0 × 10 <sup>-1</sup>	-	5.1 × 10 <sup>-2</sup>	0.1	1 × 10 <sup>-1</sup>	1.1	2.3 × 10 <sup>-2</sup>
Pu	4.0 × 10 <sup>-4</sup>	3.9 × 10 <sup>-4</sup>	4.5 × 10 <sup>-4</sup>	-	1.2 × 10 <sup>-4</sup>	0.1	1 × 10 <sup>-3</sup>	-	2.7 × 10 <sup>-4</sup>
Am	2.0 × 10 <sup>-3</sup>	5.8 × 10 <sup>-4</sup>	5.5 × 10 <sup>-3</sup>	-	2.0 × 10 <sup>-4</sup>	0.1	4 × 10 <sup>-3</sup>	-	1.0 × 10 <sup>-3</sup>
Cm	2.0 × 10 <sup>-3</sup>	3.0 × 10 <sup>-4</sup>	8.5 × 10 <sup>-4</sup>	-	-	0.1	4 × 10 <sup>-3</sup>	-	4.8 × 10 <sup>-4</sup>
Cf	2.5 × 10 <sup>-3</sup>	1.0 × 10 <sup>-2</sup>	-	-	-	0.1	-	-	-

<sup>a</sup> Values are calculated as the geometric means of data presented in original document.

<sup>b</sup> Data not listed.

The data are intended to reflect only uptake of radionuclides from plant roots and to exclude the effects of deposition of radionuclides on plant surfaces following resuspension from soil. Comparison of these data is subjective, depending on the number of references available for an element. When many references are available for an element, data comparison can be conducted with reasonable confidence to suggest an appropriate value for future use.

In comparing data, we do not consider a twofold or threefold difference between default values in published reports and those used in RESRAD to be significant. When the difference is greater than an order of magnitude, the values from more recent reports are recommended for use in RESRAD (Section 3). This procedure is based on the assumption that the more recent experimental work has been conducted under better-defined laboratory or field conditions. In addition, a new default value is suggested for RESRAD when the new value, regardless of the magnitude of the difference, is used in several other reports that are based on independent work.

## 2.2 BEEF/FEED TRANSFER FACTORS

A beef/feed transfer factor represents the fraction of the daily intake of a radionuclide by beef cattle that is transferred to and remains in 1 kg of meat at equilibrium or at the time of slaughter. It is reported that this transfer factor is perhaps the least well documented in the literature because of the obvious practical difficulty — the need to sacrifice the meat-producing animals to collect the required experimental data (IAEA 1982).

For many elements and/or radionuclides, the beef/feed transfer factor is derived from other sources, such as stable element concentrations in feed and animal tissues, extrapolations from single-dose tracer experiments, and comparison of elemental concentrations in associated or unassociated meat, or milk, and feed (Ng et al. 1982b). Some of the difficulties in deriving the beef/feed transfer factor include the following:

- *The need for equilibrium* — With a few exceptions, the time required for a radionuclide to reach equilibrium in many animal products (e.g., beef) is so long that few experiments can be conducted sufficiently long to approach equilibrium conditions (IAEA 1993). Hence, a transfer factor derived from comparatively short experiments will underestimate the equilibrium transfer factor.
- *Effect of chemical and physical forms of diet and composition* — The availability of a radionuclide for gut uptake differs markedly, depending on the chemical and physical forms of the radionuclide and on the constituents of the diet (Beresford et al. 1989; Howard et al. 1989; Johnson et al. 1968). Higher radionuclide concentrations are often found in tissues other than muscle, particularly liver (e.g., for Pu, Am, Co, Ag, Ru) and bone (e.g., Pu, Am) (IAEA 1993). Radionuclide transfer models often underestimate soil adhesion on vegetation ingested by animals. The extent of soil ingestion will be influenced by the species of animal,

season, soil type, stocking rates, and pasture management. Consequently, values for soil ingestion will be highly site specific.

- *Influence of age* — The intake of radionuclides by an animal is dependent on the animal's species, mass, age, and growth rate, as well as on the digestibility of the feed. Young animals often have enhanced gut uptake and, hence, higher transfer coefficients than adults. Few available transfer coefficient data take these factors into account.

Published radiological assessments used for comparison of beef/feed transfer factors are Baes et al. (1984), IAEA (1982, 1993), Kennedy and Strenge (1992), Napier et al. (1988), NCRP (1991), Ng et al. (1982b), and NRC (1977, 1983). Table 5 lists default values of beef/feed transfer factors compiled from these sources. The same criteria used to compare plant uptake transfer factors were applied.

### **2.3 MILK/FEED TRANSFER FACTORS**

A milk/feed transfer factor for milk cows is expressed as the fraction of the daily elemental intake in feed that is transferred to a kilogram of milk. Ng et al. (1977) report that radionuclide concentrations in animal food products depend on the relationship between intake, turnover in animal tissue, and excretion. The biological availability of a radionuclide in feed for uptake by dairy cattle depends on the physical and chemical forms of that radionuclide. In addition, the secretion of isotopes in milk is influenced by many factors besides physical and chemical states. For example, breed of dairy cow, age, nutritional status, stage of lactation, and feed and management practices are some of the important parameters that must be considered.

Reports reviewed for compilation and comparison of milk/feed transfer factors are Baes et al. (1984), IAEA (1982, 1993), Kennedy and Strenge (1992), Napier et al. (1988), NCRP (1991), and NRC (1977, 1983). The milk/feed transfer factors from these sources are compiled in Table 6. The criteria used for comparing the plant uptake transfer factors were applied.

### **2.4 AQUATIC BIOACCUMULATION FACTORS**

A bioaccumulation factor is used to calculate the transfer of a radionuclide from contaminated water through various trophic levels of aquatic foodstuffs consumed by humans. The factor is normally expressed as the ratio of radioactivity in animal tissue to that in water at equilibrium conditions (Bq/kg wet or dry weight organism per Bq/kg or L water).

The physicochemical form of the radionuclide is generally more important in aquatic ecosystems than in terrestrial ecosystems. In terrestrial ecosystems, most of the food products are produced in situations where most of the factors can be controlled. In aquatic



TABLE 5 Compilation of Beef/Feed Transfer Factors (pCi/kg beef per pCi/daily intake)

Element	RESRAD	NCRP (1991)	Baes et al. (1984)	Napier et al. (1988)	IAEA (1993)	IAEA (1982)	Kennedy & Strenge (1992)	Ng et al. (1982b)	NRC (1977)	NRC (1983)
H	0	<sup>a</sup>	-	0.0	-	-	-	-	0.012	-
Be	$8.0 \times 10^{-4}$	0.005	$1.0 \times 10^{-3}$	$8.0 \times 10^{-4}$	-	-	$1.0 \times 10^{-3}$	-	-	-
C	0	-	-	0.0	-	-	-	-	0.031	-
N	$9.9 \times 10^{-4}$	0.01	0.075	$9.9 \times 10^{-4}$	-	-	0.075	-	-	-
F	$2.0 \times 10^{-2}$	0.02	0.15	$2.0 \times 10^{-2}$	-	-	0.15	-	-	-
Na	$5.0 \times 10^{-2}$	0.08	0.055	-	$8 \times 10^{-2}$	$2 \times 10^{-1}$	0.055	$8.3 \times 10^{-2}$	0.03	$8.3 \times 10^{-3}$
P	$5.0 \times 10^{-2}$	0.05	0.055	-	$5 \times 10^{-2}$	$8 \times 10^{-2}$	0.055	$4.9 \times 10^{-2}$	0.046	$4.9 \times 10^{-2}$
Cl	$6.0 \times 10^{-2}$	0.04	0.080	$3.0 \times 10^{-2}$	$1.7 \times 10^{-2}$	-	0.080	-	-	-
Ar	0	0	-	0.0	-	-	-	-	-	-
K	$2.0 \times 10^{-2}$	0.02	$2.0 \times 10^{-2}$	$1.8 \times 10^{-2}$	$1.8 \times 10^{-2}$	-	$2.0 \times 10^{-2}$	$1.8 \times 10^{-2}$	-	$1.8 \times 10^{-2}$
Ca	$3.3 \times 10^{-3}$	0.002	$7.0 \times 10^{-4}$	$1.6 \times 10^{-3}$	$2 \times 10^{-3}$	-	$7.0 \times 10^{-4}$	$1.6 \times 10^{-3}$	-	$1.6 \times 10^{-3}$
Sc	$6.0 \times 10^{-3}$	0.002	0.015	$6.0 \times 10^{-3}$	-	-	0.015	-	-	-
Cr	$9.9 \times 10^{-4}$	0.03	$5.5 \times 10^{-3}$	$9.0 \times 10^{-3}$	$9 \times 10^{-3}$	$3 \times 10^{-2}$	$5.5 \times 10^{-3}$	$9.2 \times 10^{-3}$	$2.4 \times 10^{-3}$	$9.2 \times 10^{-3}$
Mn	$5.0 \times 10^{-3}$	0.001	$4.0 \times 10^{-4}$	$5.0 \times 10^{-4}$	$5 \times 10^{-4}$	$1 \times 10^{-3}$	$4.0 \times 10^{-4}$	$5.0 \times 10^{-4}$	$8.0 \times 10^{-4}$	$5.0 \times 10^{-4}$
Fe	$2.0 \times 10^{-2}$	0.03	0.020	$2.0 \times 10^{-2}$	$2 \times 10^{-2}$	$3 \times 10^{-2}$	0.020	$2.1 \times 10^{-2}$	0.04	$2.1 \times 10^{-2}$
Co	$1.0 \times 10^{-3}$	0.03	0.020	$2.0 \times 10^{-2}$	$1 \times 10^{-2}$	$3 \times 10^{-2}$	0.020	$2.0 \times 10^{-3}$	0.013	$1.2 \times 10^{-2}$
Ni	$1.0 \times 10^{-3}$	0.005	$6.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$5.2 \times 10^{-3}$	$5 \times 10^{-3}$	$6.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.053	$2.0 \times 10^{-3}$
Cu	$1.0 \times 10^{-2}$	0.01	0.010	$9.0 \times 10^{-3}$	$9 \times 10^{-3}$	-	0.010	$9.0 \times 10^{-3}$	$8.0 \times 10^{-3}$	$1.3 \times 10^{-2}$
Zn	$5.0 \times 10^{-2}$	0.1	0.10	$1.0 \times 10^{-1}$	$1 \times 10^{-1}$	-	0.10	$9.8 \times 10^{-2}$	0.03	-
As	$1.5 \times 10^{-3}$	0.02	$2.0 \times 10^{-3}$	$1.5 \times 10^{-3}$	-	-	$2.0 \times 10^{-3}$	-	-	-
Se	1.0	0.1	0.015	1.0	-	-	0.015	-	-	-
Br	$2.0 \times 10^{-2}$	0.05	0.025	$2.0 \times 10^{-2}$	-	-	0.025	-	-	-
Kr	0	0	-	0.0	-	-	-	-	-	-
Rb	$1.5 \times 10^{-1}$	0.03	0.015	$1.0 \times 10^{-2}$	$1 \times 10^{-2}$	-	0.015	$1.1 \times 10^{-2}$	0.031	$1.1 \times 10^{-2}$
Sr	$3.0 \times 10^{-4}$	0.01	$3.0 \times 10^{-4}$	$8.0 \times 10^{-4}$	$8 \times 10^{-3}$	$6 \times 10^{-4}$	$3.0 \times 10^{-4}$	$8.1 \times 10^{-4}$	$6.0 \times 10^{-4}$	$8.1 \times 10^{-4}$
Y	$5.0 \times 10^{-3}$	0.002	$3.0 \times 10^{-4}$	$1.0 \times 10^{-3}$	$1 \times 10^{-3}$	$2 \times 10^{-3}$	$3.0 \times 10^{-4}$	$1.0 \times 10^{-3}$	$4.6 \times 10^{-3}$	$1.0 \times 10^{-3}$
Zr	$5.0 \times 10^{-4}$	$1 \times 10^{-6}$	$5.5 \times 10^{-3}$	$1.2 \times 10^{-6}$	$1 \times 10^{-6}$	$2 \times 10^{-2}$	$5.5 \times 10^{-3}$	$2.0 \times 10^{-2}$	0.034	$2.1 \times 10^{-2}$
Nb	$5.0 \times 10^{-4}$	$3 \times 10^{-7}$	0.25	$2.6 \times 10^{-7}$	$3 \times 10^{-7}$	$3 \times 10^{-1}$	0.25	$2.5 \times 10^{-1}$	0.28	$2.0 \times 10^{-3}$
Mo	$1.0 \times 10^{-2}$	0.001	$6.0 \times 10^{-3}$	$1.2 \times 10^{-3}$	$1 \times 10^{-3}$	-	$6.0 \times 10^{-3}$	$6.8 \times 10^{-3}$	$8.0 \times 10^{-3}$	$6.8 \times 10^{-3}$
Tc	$9.9 \times 10^{-4}$	$1 \times 10^{-4}$	$8.5 \times 10^{-3}$	$9.9 \times 10^{-4}$	$1 \times 10^{-4}$	$1 \times 10^{-2}$	$8.5 \times 10^{-3}$	-	0.4	$8.7 \times 10^{-3}$
Ru	$1.0 \times 10^{-3}$	0.002	$2.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$5.1 \times 10^{-2}$	$2 \times 10^{-3}$	$2.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.4	$2.0 \times 10^{-3}$
Rh	$1.0 \times 10^{-3}$	0.002	$2.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-	-	$2.0 \times 10^{-3}$	-	$1.5 \times 10^{-3}$	-
Pd	$1.0 \times 10^{-3}$	0.0002	$4.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-	-	$4.0 \times 10^{-3}$	-	-	-
Ag	$9.9 \times 10^{-4}$	0.003	$3.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$3 \times 10^{-3}$	$5 \times 10^{-3}$	$3.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.017	-
Cd	$1.6 \times 10^{-2}$	0.001	$5.5 \times 10^{-4}$	$4.0 \times 10^{-4}$	$4 \times 10^{-4}$	-	$5.5 \times 10^{-4}$	$3.5 \times 10^{-4}$	-	-

TABLE 5 (Cont.)

Element	RESRAD	NCRP (1991)	Baes et al. (1984)	Napier et al. (1988)	IAEA (1993)	IAEA (1982)	Kennedy & Streng (1992)	Ng et al. (1982b)	NRC (1977)	NRC (1983)
Sn	$9.9 \times 10^{-4}$	0.01	0.080	$1.0 \times 10^{-2}$	-	-	0.080	-	-	-
Sb	$3.0 \times 10^{-3}$	0.001	$1.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	$1 \times 10^{-3}$	-	$1.0 \times 10^{-3}$	$9.2 \times 10^{-4}$	-	$1.2 \times 10^{-3}$
Te	$5.0 \times 10^{-2}$	0.007	0.015	$7.0 \times 10^{-3}$	$2 \times 10^{-2}$	-	0.015	-	0.077	$1.5 \times 10^{-2}$
I	$2.0 \times 10^{-2}$	0.004	$7.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$3.8 \times 10^{-2}$	-	$7.0 \times 10^{-3}$	$3.6 \times 10^{-3}$	$2.9 \times 10^{-3}$	$7.2 \times 10^{-3}$
Xe	0	0	-	0.0	-	-	-	-	-	-
Cs	$3.0 \times 10^{-2}$	0.05	0.020	$3.0 \times 10^{-2}$	$5.1 \times 10^{-2}$	$2 \times 10^{-2}$	0.020	$2.6 \times 10^{-2}$	$4.0 \times 10^{-3}$	$2.0 \times 10^{-3}$
Ba	$5.0 \times 10^{-4}$	0.0002	$1.5 \times 10^{-4}$	$5.0 \times 10^{-4}$	$2.3 \times 10^{-4}$	$2 \times 10^{-4}$	$1.5 \times 10^{-4}$	$9.7 \times 10^{-5}$	$3.2 \times 10^{-3}$	-
La	$5.0 \times 10^{-3}$	0.002	$3.0 \times 10^{-4}$	$5.0 \times 10^{-3}$	-	$2 \times 10^{-3}$	$3.0 \times 10^{-4}$	-	$2.0 \times 10^{-4}$	-
Ce	$1.0 \times 10^{-3}$	$2 \times 10^{-5}$	$7.5 \times 10^{-4}$	$2.0 \times 10^{-3}$	$2 \times 10^{-5}$	$2 \times 10^{-3}$	$7.5 \times 10^{-4}$	$2.0 \times 10^{-3}$	$1.2 \times 10^{-3}$	-
Pr	$5.0 \times 10^{-3}$	0.002	$3.0 \times 10^{-4}$	$5.0 \times 10^{-3}$	-	-	$3.0 \times 10^{-4}$	-	$4.7 \times 10^{-3}$	-
Nd	$5.0 \times 10^{-3}$	0.002	$3.0 \times 10^{-4}$	$5.0 \times 10^{-3}$	-	-	$3.0 \times 10^{-4}$	-	$3.3 \times 10^{-3}$	-
Pm	$5.0 \times 10^{-3}$	0.002	$5.0 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	$2 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	-	-
Sm	$5.0 \times 10^{-3}$	0.002	$5.0 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	$2 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	-	-
Eu	$5.0 \times 10^{-3}$	0.002	$5.0 \times 10^{-3}$	$6.0 \times 10^{-3}$	-	$2 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	-	-
Gd	$5.0 \times 10^{-3}$	0.002	$3.5 \times 10^{-3}$	$2.0 \times 10^{-3}$	-	-	$3.5 \times 10^{-3}$	-	-	-
Tb	$5.0 \times 10^{-3}$	0.002	$4.5 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	-	$4.5 \times 10^{-3}$	-	-	-
Ho	$5.0 \times 10^{-3}$	0.002	$4.5 \times 10^{-3}$	$5.0 \times 10^{-3}$	-	-	$4.5 \times 10^{-3}$	-	-	-
W	$9.9 \times 10^{-4}$	0.04	0.045	$3.7 \times 10^{-2}$	$4 \times 10^{-2}$	-	0.045	$3.7 \times 10^{-2}$	$1.3 \times 10^{-3}$	$3.7 \times 10^{-2}$
Ir	$9.9 \times 10^{-4}$	0.002	$1.5 \times 10^{-3}$	$2.0 \times 10^{-3}$	-	-	$1.5 \times 10^{-3}$	-	-	-
Hg	$1.0 \times 10^{-1}$	0.01	0.25	$1.0 \times 10^{-1}$	-	-	0.25	-	-	-
Pb	$9.9 \times 10^{-4}$	0.0008	$3.0 \times 10^{-4}$	$4.0 \times 10^{-4}$	$4 \times 10^{-4}$	$8 \times 10^{-4}$	$3.0 \times 10^{-4}$	$4.0 \times 10^{-4}$	-	$4.0 \times 10^{-4}$
Bi	$9.9 \times 10^{-4}$	0.002	$4.0 \times 10^{-4}$	$1.7 \times 10^{-2}$	-	$2 \times 10^{-2}$	$4.0 \times 10^{-4}$	-	-	-
Po	$9.9 \times 10^{-4}$	0.005	$9.5 \times 10^{-5}$	$4.5 \times 10^{-3}$	$5 \times 10^{-3}$	$3 \times 10^{-3}$	$3.0 \times 10^{-4}$	$4.5 \times 10^{-3}$	-	$4.5 \times 10^{-3}$
Rn	0	0	-	0.0	-	-	-	-	-	-
Ra	$9.9 \times 10^{-4}$	0.001	$2.5 \times 10^{-4}$	$9.0 \times 10^{-4}$	$9 \times 10^{-4}$	$5 \times 10^{-4}$	$2.5 \times 10^{-4}$	$9.0 \times 10^{-4}$	-	$5.1 \times 10^{-4}$
Ac	$5.0 \times 10^{-3}$	$2 \times 10^{-5}$	$2.5 \times 10^{-5}$	$4.0 \times 10^{-4}$	-	$2 \times 10^{-5}$	$2.5 \times 10^{-5}$	-	-	-
Th	$5.0 \times 10^{-3}$	0.0001	$6.0 \times 10^{-6}$	$5.0 \times 10^{-3}$	-	$1 \times 10^{-4}$	$6.0 \times 10^{-6}$	-	-	$2.0 \times 10^{-4}$
Pa	$5.0 \times 10^{-3}$	$5 \times 10^{-6}$	$1.0 \times 10^{-5}$	$5.0 \times 10^{-3}$	-	$1 \times 10^{-3}$	$1.0 \times 10^{-5}$	-	-	-
U	$5.0 \times 10^{-3}$	0.0008	$2.0 \times 10^{-4}$	$2.0 \times 10^{-4}$	$3.4 \times 10^{-4}$	$3 \times 10^{-2}$	$2.0 \times 10^{-4}$	-	-	$3.4 \times 10^{-4}$
Np	$5.0 \times 10^{-3}$	0.001	$5.5 \times 10^{-5}$	$1.0 \times 10^{-3}$	$1 \times 10^{-3}$	$1 \times 10^{-3}$	$5.5 \times 10^{-5}$	-	$2.0 \times 10^{-4}$	-
Pu	$5.0 \times 10^{-3}$	0.0001	$5.0 \times 10^{-7}$	$2.0 \times 10^{-6}$	$1.8 \times 10^{-5}$	$1 \times 10^{-5}$	$5.0 \times 10^{-7}$	$2.0 \times 10^{-6}$	-	$1.0 \times 10^{-6}$
Am	$5.0 \times 10^{-3}$	$5 \times 10^{-5}$	$3.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	$4 \times 10^{-5}$	$2 \times 10^{-5}$	$3.5 \times 10^{-6}$	-	-	-
Cm	$5.0 \times 10^{-3}$	$2 \times 10^{-5}$	$3.5 \times 10^{-6}$	$5.0 \times 10^{-3}$	-	$2 \times 10^{-5}$	$3.5 \times 10^{-6}$	-	-	-
Cf	$5.0 \times 10^{-3}$	$6 \times 10^{-5}$	-	$5.0 \times 10^{-3}$	-	-	$5.0 \times 10^{-3}$	-	-	-

a Data not listed.

TABLE 6 Compilation of Milk/Feed Transfer Factors (pCi/L milk per pCi/daily intake)

Element	RESRAD	NCRP (1991)	Baes et al. (1984)	Napier et al. (1988)	IAEA (1993)	IAEA (1982)	Kennedy & Strenge (1992)	NRC (1983)	NRC (1977)
H	0	<sup>a</sup>	-	0.0	-	-	-	$1.4 \times 10^{-2}$	0.01
Be	$2.0 \times 10^{-6}$	$2 \times 10^{-6}$	$9.0 \times 10^{-7}$	$2.0 \times 10^{-6}$	-	-	$9.0 \times 10^{-7}$	-	-
C	0	-	-	0.0	-	-	-	$1.5 \times 10^{-2}$	0.012
N	$1.0 \times 10^{-2}$	0.01	0.025	$1.1 \times 10^{-2}$	-	-	0.025	-	-
F	$7.0 \times 10^{-3}$	0.007	$1.0 \times 10^{-3}$	$7.0 \times 10^{-3}$	-	-	$1.0 \times 10^{-3}$	-	-
Na	$4.0 \times 10^{-2}$	0.04	0.035	$2.0 \times 10^{-2}$	$1.6 \times 10^{-2}$	$4 \times 10^{-2}$	0.035	$3.5 \times 10^{-2}$	0.04
P	$1.2 \times 10^{-2}$	0.02	0.015	$1.5 \times 10^{-2}$	$1.6 \times 10^{-2}$	$2 \times 10^{-2}$	0.015	$1.6 \times 10^{-2}$	0.025
Cl	$8.0 \times 10^{-2}$	0.02	0.015	$2.0 \times 10^{-2}$	$1.7 \times 10^{-2}$	-	0.015	-	-
Ar	0	0	-	0.0	-	-	-	-	-
K	$7.0 \times 10^{-3}$	0.007	$7.0 \times 10^{-3}$	$7.0 \times 10^{-3}$	$7.2 \times 10^{-3}$	-	$7.0 \times 10^{-3}$	$7.2 \times 10^{-3}$	-
Ca	$8.0 \times 10^{-3}$	0.003	0.010	$8.0 \times 10^{-3}$	$3 \times 10^{-3}$	-	0.010	$1.1 \times 10^{-2}$	-
Sc	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$5.0 \times 10^{-6}$	$2.5 \times 10^{-6}$	-	-	$5.0 \times 10^{-6}$	-	-
Cr	$1.1 \times 10^{-3}$	0.002	$1.5 \times 10^{-3}$	$1.0 \times 10^{-5}$	$1 \times 10^{-5}$	$2 \times 10^{-3}$	$1.5 \times 10^{-3}$	$2.0 \times 10^{-3}$	$2.5 \times 10^{-3}$
Mn	$1.0 \times 10^{-4}$	0.0003	$3.5 \times 10^{-4}$	$3.0 \times 10^{-4}$	$3 \times 10^{-5}$	$3 \times 10^{-4}$	$3.5 \times 10^{-4}$	$8.4 \times 10^{-5}$	$2.5 \times 10^{-4}$
Fe	$6.0 \times 10^{-4}$	0.0003	$2.5 \times 10^{-4}$	$5.0 \times 10^{-5}$	$3 \times 10^{-5}$	$3 \times 10^{-4}$	$2.5 \times 10^{-4}$	$5.9 \times 10^{-5}$	$1.2 \times 10^{-3}$
Co	$5.0 \times 10^{-4}$	0.002	$2.0 \times 10^{-3}$	$1.0 \times 10^{-4}$	<sup>b</sup>	$2 \times 10^{-3}$	$2.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	$1.0 \times 10^{-3}$
Ni	$3.4 \times 10^{-3}$	0.02	$1.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	$1.6 \times 10^{-2}$	$1 \times 10^{-2}$	$1.0 \times 10^{-3}$	$1.0 \times 10^{-2}$	$6.7 \times 10^{-3}$
Cu	$7.0 \times 10^{-3}$	0.002	$1.5 \times 10^{-3}$	$2.0 \times 10^{-3}$	-	-	$1.5 \times 10^{-3}$	$1.7 \times 10^{-3}$	0.014
Zn	$6.0 \times 10^{-3}$	0.01	0.010	$1.0 \times 10^{-2}$	-	$1 \times 10^{-2}$	0.010	$1.0 \times 10^{-2}$	0.039
As	$3.0 \times 10^{-3}$	$1 \times 10^{-4}$	$6.0 \times 10^{-3}$	$8.0 \times 10^{-5}$	-	-	$6.0 \times 10^{-5}$	-	-
Se	$2.3 \times 10^{-2}$	0.01	$4.0 \times 10^{-3}$	$2.3 \times 10^{-2}$	-	-	$4.0 \times 10^{-3}$	-	-
Br	$2.5 \times 10^{-2}$	0.02	0.020	$2.0 \times 10^{-2}$	-	-	0.020	$2.0 \times 10^{-2}$	-
Kr	0	0	-	0.0	-	-	-	$2.0 \times 10^{-2}$	-
Rb	$1.0 \times 10^{-2}$	0.01	0.010	$1.0 \times 10^{-2}$	$1.2 \times 10^{-2}$	-	0.010	$1.2 \times 10^{-2}$	0.03
Sr	$1.5 \times 10^{-3}$	0.002	$1.5 \times 10^{-3}$	$1.3 \times 10^{-3}$	$2.8 \times 10^{-3}$	$1 \times 10^{-3}$	$1.5 \times 10^{-3}$	$1.4 \times 10^{-3}$	$8.0 \times 10^{-4}$
Y	$5.0 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$5.0 \times 10^{-6}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	$1.0 \times 10^{-5}$
Zr	$2.5 \times 10^{-6}$	$6 \times 10^{-7}$	$3.0 \times 10^{-5}$	$5.5 \times 10^{-7}$	$5.5 \times 10^{-7}$	$3 \times 10^{-5}$	$3.0 \times 10^{-5}$	$8.0 \times 10^{-2}$	$5.0 \times 10^{-6}$
Nb	$1.2 \times 10^{-3}$	$2 \times 10^{-6}$	0.020	$4.1 \times 10^{-7}$	$4.1 \times 10^{-7}$	$2 \times 10^{-2}$	0.020	$2.0 \times 10^{-2}$	$2.5 \times 10^{-3}$
Mo	$4.0 \times 10^{-3}$	0.002	$1.5 \times 10^{-3}$	$1.7 \times 10^{-3}$	$1.7 \times 10^{-3}$	-	$1.5 \times 10^{-3}$	$1.4 \times 10^{-3}$	$7.5 \times 10^{-3}$
Tc	$1.2 \times 10^{-2}$	0.001	0.010	$3.0 \times 10^{-4}$	$1.1 \times 10^{-3}$	$1 \times 10^{-2}$	0.010	$9.9 \times 10^{-3}$	0.025
Ru	$5.0 \times 10^{-7}$	$2 \times 10^{-5}$	$6.0 \times 10^{-7}$	$6.0 \times 10^{-7}$	$3.3 \times 10^{-6}$	$5 \times 10^{-7}$	$6.0 \times 10^{-7}$	$6.1 \times 10^{-7}$	$1.0 \times 10^{-6}$
Rh	$5.0 \times 10^{-3}$	0.0005	0.010	$5.0 \times 10^{-3}$	-	-	0.010	-	0.01
Pd	$5.0 \times 10^{-3}$	0.0001	0.010	$5.0 \times 10^{-3}$	-	-	0.010	-	-
Ag	$2.5 \times 10^{-2}$	0.006	0.020	$2.5 \times 10^{-2}$	$5 \times 10^{-5}$	$3 \times 10^{-2}$	0.020	-	0.05
Cd	$6.2 \times 10^{-5}$	0.002	$1.0 \times 10^{-3}$	$1.2 \times 10^{-4}$	-	-	$1.0 \times 10^{-3}$	-	-
Sn	$1.3 \times 10^{-3}$	0.001	$1.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-	-	$1.0 \times 10^{-3}$	-	-

TABLE 6 (Cont.)

Element	RESRAD	NCRP (1991)	Baes et al. (1984)	Napier et al. (1988)	IAEA (1993)	IAEA (1982)	Kennedy & Strenge (1992)	NRC (1983)	NRC (1977)
Sb	$7.5 \times 10^{-4}$	0.0001	$1.0 \times 10^{-4}$	$7.5 \times 10^{-4}$	$2.5 \times 10^{-5}$	$2 \times 10^{-5}$	$1.0 \times 10^{-4}$	$2.0 \times 10^{-5}$	-
Te	$5.0 \times 10^{-4}$	0.0005	$2.0 \times 10^{-4}$	$4.5 \times 10^{-4}$	$4.5 \times 10^{-4}$	$2 \times 10^{-4}$	$2.0 \times 10^{-4}$	$2.0 \times 10^{-4}$	1.3
I	$1.0 \times 10^{-2}$	0.01	0.010	$1.2 \times 10^{-2}$	$1 \times 10^{-2}$	$1 \times 10^{-2}$	0.010	$9.9 \times 10^{-3}$	$2.0 \times 10^{-2}$
Xe	0	0	-	0.0	-	-	-	-	-
Cs	$5.0 \times 10^{-3}$	0.01	$7.0 \times 10^{-3}$	$7.0 \times 10^{-3}$	$7.9 \times 10^{-3}$	$8 \times 10^{-3}$	$7.0 \times 10^{-3}$	$7.1 \times 10^{-3}$	$1.0 \times 10^{-2}$
Ba	$4.0 \times 10^{-4}$	0.0005	$3.5 \times 10^{-4}$	$4.8 \times 10^{-4}$	$4.8 \times 10^{-4}$	$4 \times 10^{-4}$	$3.5 \times 10^{-4}$	-	$5.0 \times 10^{-3}$
La	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-6}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	$2.5 \times 10^{-3}$
Ce	$1.0 \times 10^{-5}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$4.0 \times 10^{-5}$	$3 \times 10^{-5}$	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-3}$
Pr	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-6}$	-	-	$2.0 \times 10^{-5}$	-	$2.5 \times 10^{-3}$
Nd	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	-	$2.0 \times 10^{-5}$	-	$2.4 \times 10^{-3}$
Pm	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-6}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	-
Sm	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	-
Eu	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	-
Gd	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$6.0 \times 10^{-5}$	-	-	$2.0 \times 10^{-5}$	-	-
Tb	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-6}$	-	-	$2.0 \times 10^{-5}$	-	-
Hf	$2.5 \times 10^{-6}$	$6 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.5 \times 10^{-6}$	-	-	$2.0 \times 10^{-5}$	-	-
W	$2.5 \times 10^{-4}$	0.0003	$3.0 \times 10^{-4}$	$3.0 \times 10^{-4}$	-	-	$3.0 \times 10^{-4}$	$2.9 \times 10^{-4}$	$1.8 \times 10^{-2}$
Ir	$9.9 \times 10^{-4}$	$2 \times 10^{-6}$	$2.0 \times 10^{-6}$	$2.0 \times 10^{-6}$	-	-	$2.0 \times 10^{-6}$	$5.0 \times 10^{-6}$	-
Hg	$1.9 \times 10^{-2}$	0.0005	$4.5 \times 10^{-4}$	$4.0 \times 10^{-4}$	$4.7 \times 10^{-4}$	-	$4.5 \times 10^{-4}$	$9.7 \times 10^{-6}$	-
Pb	$1.0 \times 10^{-5}$	0.0003	$2.5 \times 10^{-4}$	$3.0 \times 10^{-5}$	-	$3 \times 10^{-4}$	$2.5 \times 10^{-4}$	$2.6 \times 10^{-4}$	-
Bi	$2.5 \times 10^{-4}$	0.001	$5.0 \times 10^{-4}$	$5.0 \times 10^{-4}$	-	$5 \times 10^{-4}$	$5.0 \times 10^{-4}$	$5.0 \times 10^{-4}$	-
Po	$1.2 \times 10^{-4}$	0.0004	$3.5 \times 10^{-4}$	$1.2 \times 10^{-4}$	$3.4 \times 10^{-4}$	$1 \times 10^{-4}$	$3.5 \times 10^{-4}$	$1.4 \times 10^{-2}$	-
Rn	0	0	-	0.0	-	-	-	$3.0 \times 10^{-2}$	-
Ra	$2.0 \times 10^{-4}$	0.001	$4.5 \times 10^{-4}$	$2.0 \times 10^{-4}$	$1.3 \times 10^{-3}$	$6 \times 10^{-4}$	$4.5 \times 10^{-4}$	$4.5 \times 10^{-4}$	-
Ac	$2.5 \times 10^{-6}$	$2 \times 10^{-6}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	$2.0 \times 10^{-5}$	-
Th	$2.5 \times 10^{-6}$	$5 \times 10^{-6}$	$5.0 \times 10^{-6}$	$2.5 \times 10^{-6}$	-	$5 \times 10^{-6}$	$5.0 \times 10^{-6}$	$5.0 \times 10^{-6}$	-
Pa	$2.5 \times 10^{-6}$	$5 \times 10^{-6}$	$5.0 \times 10^{-6}$	$2.5 \times 10^{-6}$	-	$5 \times 10^{-6}$	$5.0 \times 10^{-6}$	$5.0 \times 10^{-6}$	-
U	$6.0 \times 10^{-4}$	0.0004	$6.0 \times 10^{-4}$	$6.0 \times 10^{-4}$	$4 \times 10^{-4}$	$6 \times 10^{-4}$	$6.0 \times 10^{-4}$	$6.1 \times 10^{-4}$	-
Np	$2.5 \times 10^{-6}$	$1 \times 10^{-5}$	$5.0 \times 10^{-6}$	$1.0 \times 10^{-5}$	$5 \times 10^{-6}$	$5 \times 10^{-6}$	$5.0 \times 10^{-6}$	$5.0 \times 10^{-6}$	$2.5 \times 10^{-3}$
Pu	$2.5 \times 10^{-8}$	$1 \times 10^{-6}$	$1.0 \times 10^{-7}$	$1.0 \times 10^{-7}$	$1.1 \times 10^{-6}$	$1 \times 10^{-7}$	$1.0 \times 10^{-7}$	$2.7 \times 10^{-9}$	-
Am	$2.5 \times 10^{-6}$	$2 \times 10^{-6}$	$4.0 \times 10^{-7}$	$3.0 \times 10^{-7}$	$1.5 \times 10^{-6}$	$4 \times 10^{-7}$	$4.0 \times 10^{-7}$	-	-
Cm	$2.5 \times 10^{-6}$	$2 \times 10^{-6}$	$2.0 \times 10^{-5}$	$3.0 \times 10^{-7}$	-	$2 \times 10^{-5}$	$2.0 \times 10^{-5}$	-	-
Cf	$7.5 \times 10^{-7}$	$2 \times 10^{-6}$	-	$7.5 \times 10^{-7}$	-	-	$7.5 \times 10^{-7}$	-	-

<sup>a</sup> Data not listed.

<sup>b</sup> Cobalt transfer differs according to its chemical form. For organically bound cobalt, a higher value of  $3 \times 10^{-4}$  is expected; for inorganic forms, a lower value of  $7 \times 10^{-5}$  is appropriate.

and marine environments, numerous species in the food chain are mobile and can move over considerable distances. Therefore, the concentration of a radionuclide can change much faster with time in aquatic ecosystems than in terrestrial systems, and an equilibrium condition is less likely to be achieved in the former. A radionuclide may exist in water in a truly dissolved state or in an undissolved state as a colloid or sorbed to particulate matter. Reactions between radionuclide and chemical species present in the water determine the biological availability of a radionuclide for uptake in aquatic environments. A dissolved radionuclide might precipitate out of solution and become less available for uptake if the concentrations of ligands in the water system are sufficiently high that the corresponding solubility product is exceeded. A radionuclide that is adsorbed to particulate matter might dissolve and become available for uptake if the concentrations of ligands and stable isotopes of the radionuclide are such that the solubility product is not exceeded.

The physiological status of fish also plays an important role in their uptake of radionuclides. Young, rapidly growing fish may accumulate higher levels of biologically active radionuclides than fish in a stationary growth period. The osmoregulatory problem faced by freshwater fish and marine fish also determines the difference in the route of radionuclide uptake (Poston and Klopfer 1986). In seawater, the salt concentration is high, and marine fish drink large amounts of water and expend considerable energy to excrete salt against a concentration gradient. In freshwater, fish retain salt and excrete a large amount of water. Therefore, radionuclides found in the water column, either as dissolved species or sorbed to particulate matter, are more prone to gastrointestinal (GI) absorption in marine species than in freshwater species (Poston and Klopfer 1986).

In the literature, bioaccumulation factors are derived by a number of methods, and the reported values vary widely. Historically, radioactivity in animal tissue is estimated on the basis of ash weight, dry weight, wet weight, whole body burdens, and/or muscle tissue. Radioactivity in water is estimated on the basis of filtered or unfiltered water. Wet weight to dry weight and dry weight to ash weight ratios can vary as a function of the age, size, and species of fish. To make comparisons possible, Poston and Klopfer (1986) listed the values summarized by Vinogradov (1953) for conversion as follows: ash weights ranged from 0.11 to 6.82%, with most in the range of 1-2%; water content ranged from 52.78 to 89.94%; and dry weights ranged from 20 to 40%. For radionuclides that partition into soluble and particulate phases, the degree of partitioning must be considered. A high transfer factor will be obtained if the radioactivity of the soluble (filtrate) fraction is measured. For instance, if 1% of a radionuclide is present as a soluble species, and the rest is in the solid phase, the transfer factor for a filtered water sample would be estimated to be 100 times greater than the factor for an unfiltered water sample (Poston and Klopfer 1986).

Published radiological assessments used for comparison of bioaccumulation transfer through the freshwater pathway are IAEA (1982, 1993), Kennedy and Strenge (1992), NCRP (1991), NRC (1977, 1983), and Thompson et al. (1972). Values for freshwater fish compiled from these reports are listed in Table 7. Aquatic bioaccumulation factors for crustacea and mollusks in freshwater, presented in NRC (1983), are listed in Table 8. The criteria used for comparing plant uptake transfer factors were applied.

TABLE 7 Compilation of Aquatic Bioaccumulation Factors for Freshwater Fish (Bq/kg freshwater fish per Bq/L water)

Element	RESRAD	Thompson et al. (1972)	NCRP (1991)	IAEA (1993)	IAEA (1982)	Kennedy & Streng (1992)	NRC (1983)	NRC (1977)
H	$9.0 \times 10^{-1}$	<sup>a</sup>	1	1	-	1	-	0.9
Be	2.0	-	$1.0 \times 10^2$	100	-	2	-	-
C	$4.6 \times 10^3$	-	$5.0 \times 10^4$	$5.0 \times 10^4$	-	$4.6 \times 10^3$	-	$4.6 \times 10^3$
N	0	-	$1.5 \times 10^5$	$2.0 \times 10^5$	-	$1.5 \times 10^5$	-	-
F	$1.0 \times 10^1$	-	10	-	-	10	-	-
Na	$1.0 \times 10^2$	20	20	20	20	$1.0 \times 10^2$	$1.3 \times 10^2$	$1 \times 10^2$
P	$1.0 \times 10^5$	$1.0 \times 10^5$	$5.0 \times 10^4$	$5.0 \times 10^4$	$1 \times 10^5$	$7.0 \times 10^4$	$3.8 \times 10^5$	$1 \times 10^5$
Cl	$1.3 \times 10^2$	-	$1.0 \times 10^3$	-	-	50	-	-
Ar	1.0	-	0	-	-	-	-	-
K	$1.0 \times 10^3$	-	$1.0 \times 10^4$	-	-	$1.0 \times 10^3$	-	-
Ca	$4.0 \times 10^1$	-	$1.0 \times 10^3$	-	-	40	-	-
Sc	2.0	100	$1.0 \times 10^2$	$1.0 \times 10^2$	-	$1.0 \times 10^2$	-	-
Cr	$2.0 \times 10^1$	-	$2.0 \times 10^2$	$2.0 \times 10^2$	$2 \times 10^2$	$2.0 \times 10^2$	$1.2 \times 10^2$	$2.0 \times 10^2$
Mn	$4.0 \times 10^2$	100	$5.0 \times 10^2$	$4.0 \times 10^2$	$4 \times 10^2$	$4.0 \times 10^2$	$1.6 \times 10^2$	$4.0 \times 10^2$
Fe	$1.0 \times 10^2$	100	$2.0 \times 10^2$	$2.0 \times 10^2$	$1 \times 10^2$	$2.0 \times 10^3$	$2.0 \times 10^3$	$1.0 \times 10^2$
Co	$5.0 \times 10^1$	20	$3.0 \times 10^2$	$3.0 \times 10^2$	$3 \times 10^2$	$3.3 \times 10^2$	$1.3 \times 10^2$	50
Ni	$1.0 \times 10^2$	100	$1.0 \times 10^2$	$1.0 \times 10^2$	$1 \times 10^2$	$1.0 \times 10^2$	-	$1.0 \times 10^2$
Cu	$5.0 \times 10^1$	-	$2.0 \times 10^2$	$2.0 \times 10^2$	-	50	9.2	50
Zn	$2.0 \times 10^3$	1000	$1.0 \times 10^3$	$1.0 \times 10^3$	$1 \times 10^3$	$2.5 \times 10^3$	$8.3 \times 10^2$	$2.0 \times 10^3$
As	$3.0 \times 10^2$	-	$4.0 \times 10^2$	-	-	$1.0 \times 10^2$	-	-
Se	$1.7 \times 10^2$	-	$2.0 \times 10^2$	-	-	$1.7 \times 10^2$	-	-
Br	$4.2 \times 10^2$	-	$4.0 \times 10^2$	$4.0 \times 10^2$	-	$4.2 \times 10^2$	-	$4.2 \times 10^2$
Kr	1.0	-	0	-	-	-	-	-
Rb	$2.0 \times 10^3$	-	$2.0 \times 10^3$	$2 \times 10^3$	-	$2.0 \times 10^3$	-	$2.0 \times 10^3$
Sr	$3.0 \times 10^1$	5	60	60	60	50	$2.8 \times 10^1$	30
Y	$2.5 \times 10^1$	-	30	30	30	25	-	25
Zr	3.3	3.33	$3.0 \times 10^2$	$3.0 \times 10^2$	$3 \times 10^2$	$2.0 \times 10^2$	2.6	3.3
Nb	$3.0 \times 10^4$	30,000	$3.0 \times 10^2$	$3.0 \times 10^2$	$3 \times 10^2$	$2.0 \times 10^2$	-	$3 \times 10^4$
Mo	$1.0 \times 10^1$	10	10	10	-	10	10	10
Tc	$1.5 \times 10^1$	15	20	20	20	15	$7.8 \times 10^1$	15
Ru	$1.0 \times 10^1$	10	10	10	10	$1.0 \times 10^2$	$1.9 \times 10^1$	10
Rh	$1.0 \times 10^1$	-	$3.0 \times 10^2$	10	-	10	-	10
Pd	$1.0 \times 10^1$	-	10	-	-	10	-	-
Ag	2.3	-	10	5	2	2.3	-	-
Cd	$2.0 \times 10^2$	-	$2.0 \times 10^2$	-	-	$2.0 \times 10^2$	-	-

TABLE 7 (Cont.)

Element	RESRAD	Thompson et al. (1972)	NCRP (1991)	IAEA (1993)	IAEA (1982)	Kennedy & Streng (1992)	NRC (1983)	NRC (1977)
Sn	$3.0 \times 10^3$	-	$3.0 \times 10^3$	$3 \times 10^3$	-	$3.0 \times 10^3$	$1.0 \times 10^2$	-
Sb	1.0	1	$1.0 \times 10^2$	$1 \times 10^2$	1	$2.0 \times 10^2$	-	-
Te	$4.0 \times 10^2$	-	$4.0 \times 10^2$	$4 \times 10^2$	$4 \times 10^2$	$4.0 \times 10^2$	40	$4.0 \times 10^2$
I	$1.5 \times 10^1$	15	40	40	40	$5.0 \times 10^2$	40	15
Xe	1.0	-	0	-	-	-	-	-
Cs	$2.0 \times 10^3$	400	$2.0 \times 10^3$	$2 \times 10^3$	$2 \times 10^3$	$2.0 \times 10^3$	$5.6 \times 10^3$	$2.0 \times 10^3$
Ba	4.0	25	4	4	4	$2.0 \times 10^2$	-	4
La	$2.5 \times 10^1$	-	30	30	30	25	-	25
Ce	1.0	-	30	30	30	$5.0 \times 10^2$	$1.6 \times 10^2$	1
Pr	$2.5 \times 10^1$	-	$1.0 \times 10^2$	$1 \times 10^2$	-	25	-	25
Nd	$2.5 \times 10^1$	-	$1.0 \times 10^2$	$1 \times 10^2$	-	25	-	25
Pm	$2.5 \times 10^1$	-	30	30	30	25	-	-
Sm	$2.5 \times 10^1$	-	25	-	-	25	-	-
Eu	$2.5 \times 10^1$	-	50	50	-	25	-	-
Gd	$2.5 \times 10^1$	-	30	-	-	25	-	-
Tb	$2.5 \times 10^1$	-	25	-	-	25	-	-
Ho	$2.5 \times 10^1$	-	$1.2 \times 10^4$	-	-	25	-	-
W	$1.2 \times 10^3$	-	$1.2 \times 10^4$	10	-	$1.2 \times 10^3$	-	$1.2 \times 10^3$
Ir	$5.0 \times 10^1$	-	10	-	-	10	-	-
Hg	$2.0 \times 10^4$	-	$1.0 \times 10^3$	$1 \times 10^3$	-	$1.0 \times 10^3$	-	-
Pb	$1.0 \times 10^2$	-	$3.0 \times 10^2$	$3 \times 10^2$	$3 \times 10^2$	$1.0 \times 10^2$	-	-
Bi	$1.5 \times 10^1$	-	15	10	20	15	-	-
Po	$5.0 \times 10^2$	-	$1.0 \times 10^2$	50	50	$5.0 \times 10^2$	-	-
Rn	$5.7 \times 10^1$	-	0	-	-	-	-	-
Ra	$5.0 \times 10^1$	50	50	50	50	70	$5.2 \times 10^2$	-
Ac	$2.5 \times 10^1$	-	15	-	-	25	-	-
Th	$3.0 \times 10^1$	30	$1.0 \times 10^2$	$1 \times 10^2$	30	$1.0 \times 10^2$	$8.0 \times 10^1$	-
Pa	$1.1 \times 10^1$	-	10	10	10	11	-	-
U	2.0	10	10	10	10	50	7.5	-
Np	$1.0 \times 10^1$	10	30	30	10	$2.5 \times 10^2$	-	10
Pu	3.5	3.5	30	30	4	$2.5 \times 10^2$	8.0	-
Am	$2.5 \times 10^1$	25	30	30	30	$2.5 \times 10^2$	-	-
Cm	$2.5 \times 10^1$	25	30	30	30	$2.5 \times 10^2$	-	-
Cf	$2.5 \times 10^1$	-	25	-	-	25	-	-

a

Data not listed.





TABLE 8 (Cont.)

Element	RESRAD		NRC (1983)		Element	RESRAD		NRC (1983)	
	Crustacea and Mollusks		Crustaceans	Mollusks		Crustacea and Mollusks		Crustaceans	Mollusks
Rh	$3.0 \times 10^2$		-	-	Pu	$1.0 \times 10^2$		$1.0 \times 10^3$	-
Pd	$3.0 \times 10^2$		-	-	Am	$1.0 \times 10^3$		-	-
Ag	$7.7 \times 10^2$		-	-	Cm	$1.0 \times 10^3$		-	-
					Cf	$1.0 \times 10^3$		-	-

<sup>a</sup> Data not listed.

### **3 SUGGESTED VALUES FOR RESRAD REVISION**

Summary tables of current and suggested elemental transfer factors for vegetable/soil, beef/feed, milk/feed, and aquatic food bioaccumulation pathways are presented in this section. For future application of RESRAD, suggested default values of vegetable/soil transfer factors for root uptake are presented in Tables 9 and 10. Suggested default values of beef/feed and milk/feed transfer factors are presented in Tables 11 and 12, respectively. Suggested default values of aquatic bioaccumulation factors for freshwater fish are presented in Table 13. Each table lists the current value, the suggested value, the change ( $[\text{suggested value} - \text{default value}]/[\text{default value}]$ ), and the assessment models on which the suggested changes are based.

### **4 SUGGESTIONS FOR FUTURE WORK**

The aquatic bioaccumulation factors used in RESRAD for pathways involving crustacea and mollusks in freshwater are listed in Table D.5 of Gilbert et al. (1989) and are compiled with data reported from NRC (1983) in Table 8. As indicated by the IAEA (1982, 1993), freshwater mollusks and crustacea are minor components of the human food chain. Default values for bioaccumulation factors for freshwater mollusks and crustacea are lacking in most radiological reports reviewed. To provide an overview of possible values of transfer factors for these species, bioaccumulation factors for mollusks and crustacea in marine are listed in Table 14 for future use. Appropriate bioaccumulation factors for freshwater mollusks and crustacea are not suggested in this report because the NRC (1983) report is the only source for data comparison. Update of RESRAD bioaccumulation factors for mollusks and crustacea is recommended for future work.

**TABLE 9 Current RESRAD Default Values and Suggested Values for Vegetable/Soil Transfer Factors for Composite Plant Foods (k=0) (pCi/kg wet weight per pCi/kg dry soil)**

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
H	0	4.8	_b	NRC (1977)
Be	$4.7 \times 10^{-4}$	$4.0 \times 10^{-3}$	7.5	NCRP (1991)
C	5.5	NC	NC <sup>c</sup>	NRC (1977)
N	7.5	NC	NC	NCRP (1991)
F	$2.0 \times 10^{-2}$	NC	NC	NCRP (1991)
Na	$5.0 \times 10^{-2}$	NC	NC	IAEA (1982); NCRP (1991)
P	$5.0 \times 10^{-1}$	1	1.0	IAEA (1982); NCRP (1991)
Cl	5.0	20	3.0	NCRP (1991)
Ar	0	NC	NC	NCRP (1991)
K	$3.0 \times 10^{-1}$	NC	NC	NCRP (1991)
Ca	$4.0 \times 10^{-2}$	$5.0 \times 10^{-1}$	11.5	NCRP (1991)
Sc	$1.1 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.82	NCRP (1991)
Cr	$2.5 \times 10^{-4}$	NC	NC	Ng et al. (1982a); NRC (1977)
Mn	$3.0 \times 10^{-2}$	$3.0 \times 10^{-1}$	9.0	NCRP (1991)
Fe	$4.0 \times 10^{-4}$	$1.0 \times 10^{-3}$	1.5	NCRP (1991)
Co	$9.4 \times 10^{-3}$	$8.0 \times 10^{-2}$	7.5	NCRP (1991)
Ni	$1.9 \times 10^{-2}$	$5.0 \times 10^{-2}$	1.6	NCRP (1991)
Cu	$1.3 \times 10^{-1}$	NC	NC	Ng et al. (1982a)
Zn	$4.0 \times 10^{-1}$	NC	NC	IAEA (1982); NCRP (1991); Ng et al. (1982a); NRC (1977)
As	$1.0 \times 10^{-2}$	$8.0 \times 10^{-2}$	7.0	NCRP (1991)
Se	1.3	$1.0 \times 10^{-1}$	-0.92	NCRP (1991)
Br	$7.6 \times 10^{-1}$	NC	NC	
Kr	0	NC	NC	NCRP (1991)
Rb	$1.3 \times 10^{-1}$	NC	NC	Ng et al. (1982a); NRC (1977)
Sr	$2.0 \times 10^{-1}$	$3.0 \times 10^{-1}$	0.50	IAEA (1982); NCRP (1991)
Y	$2.5 \times 10^{-3}$	NC	NC	
Zr	$1.7 \times 10^{-4}$	$1.0 \times 10^{-3}$	4.9	NCRP (1991)
Nb	$9.4 \times 10^{-3}$	$1.0 \times 10^{-2}$	0.06	IAEA (1982); NCRP (1991)
Mo	$1.3 \times 10^{-1}$	NC	NC	Ng et al. (1982a); NRC (1977)
Tc	$2.5 \times 10^{-1}$	5	19	IAEA (1982); NCRP (1991)
Ru	$1.0 \times 10^{-2}$	$3.0 \times 10^{-2}$	2.0	NCRP (1991)
Rh	$1.3 \times 10^{-1}$	NC	NC	Ng et al. (1982a); NRC (1977)
Pd	5.0	$1.0 \times 10^{-1}$	-0.98	NCRP (1991)
Ag	$1.5 \times 10^{-1}$	NC	NC	Ng et al. (1982a); NRC (1977)
Cd	$3.0 \times 10^{-1}$	NC	NC	
Sn	$2.5 \times 10^{-3}$	NC	NC	
Sb	$1.1 \times 10^{-2}$	$1.0 \times 10^{-2}$	-0.09	IAEA (1982); NCRP (1991)
Te	1.3	$6.0 \times 10^{-1}$	-0.54	IAEA (1982)
I	$2.0 \times 10^{-2}$	NC	NC	IAEA (1982); NCRP (1991); Ng et al. (1982a), NRC (1977)
Xe	0	NC	NC	NCRP (1991)
Cs	$2.0 \times 10^{-3}$	$4.0 \times 10^{-2}$	19	NCRP (1991)
Ba	$5.0 \times 10^{-3}$	NC	NC	IAEA (1982); Ng et al. (1982a); NRC (1977)

TABLE 9 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
La	$2.5 \times 10^{-3}$	NC	NC	Ng et al. (1982a); NRC (1977)
Ce	$5.0 \times 10^{-4}$	$2.0 \times 10^{-3}$	3.0	IAEA (1982); NCRP (1991)
Pr	$2.5 \times 10^{-3}$	NC	NC	Ng et al. (1982a); NRC (1977)
Nd	$2.4 \times 10^{-3}$	NC	NC	Ng et al. (1982a); NRC (1977)
Pm	$2.5 \times 10^{-3}$	NC	NC	
Sm	$2.5 \times 10^{-3}$	NC	NC	
Eu	$2.5 \times 10^{-3}$	NC	NC	
Gd	$2.5 \times 10^{-3}$	NC	NC	
Tb	$2.6 \times 10^{-3}$	NC	NC	
Ho	$2.6 \times 10^{-3}$	NC	NC	
W	$1.8 \times 10^{-2}$	NC	NC	
Ir	$9.9 \times 10^{-4}$	$3.0 \times 10^{-2}$	29	NCRP (1991)
Hg	$3.8 \times 10^{-1}$	NC	NC	
Pb	$6.8 \times 10^{-2}$	$1.0 \times 10^{-2}$	-0.85	IAEA (1982)
Bi	$1.5 \times 10^{-1}$	$1.0 \times 10^{-1}$	-0.33	IAEA (1982); NCRP (1991)
Po	$9.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.89	NCRP (1991)
Rn	0	NC	NC	NCRP (1991)
Ra	$1.4 \times 10^{-3}$	$4.0 \times 10^{-2}$	28	IAEA (1982); NCRP (1991)
Ac	$2.5 \times 10^{-3}$	NC	NC	
Th	$4.2 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.76	NCRP (1991)
Pa	$2.5 \times 10^{-3}$	$1.0 \times 10^{-2}$	3.0	NCRP (1991)
U	$2.5 \times 10^{-3}$	NC	NC	
Np	$2.5 \times 10^{-3}$	$2.0 \times 10^{-2}$	7	NCRP (1991)
Pu	$2.5 \times 10^{-4}$	$1.0 \times 10^{-3}$	3	NCRP (1991)
Am	$2.5 \times 10^{-4}$	$1.0 \times 10^{-3}$	3	NCRP (1991)
Cm	$2.5 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.60	NCRP (1991)
Cf	$2.5 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.60	NCRP (1991)

<sup>a</sup> Change = (suggested value - default value)/(default value).

<sup>b</sup> Not calculated.

<sup>c</sup> No change.

**TABLE 10 Suggested RESRAD Default Values for Specific Plant Foods (k=1, 2, and 3; for root vegetables, fruit, and grain; leafy vegetables; and forage plants, respectively) (pCi/kg dry weight per pCi/kg dry soil)<sup>a</sup>**

Element	k=1	Radiological Assessment Model Source	k=2	Radiological Assessment Model Source	k=3	Radiological Assessment Model Source
H	0.0	b	0.0	b	<sup>i</sup>	NA <sup>j</sup>
Be	$1.5 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
C	$7.0 \times 10^{-1}$	c	$7.0 \times 10^{-1}$	c	-	NA
N	7.5	b	$3.0 \times 10$	c; d	$2.0 \times 10$	g
F	$6.0 \times 10^{-3}$	c; d	$6.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Na	$5.5 \times 10^{-2}$	c; d	$7.5 \times 10^{-2}$	c; d	$2.0 \times 10^{-1}$	g; h
P	3.5	c; d	3.5	c; d	3	g; h
Cl	$7.0 \times 10$	c; d	$7.0 \times 10$	c; d	$1.0 \times 10^2$	g
Ar	0.0	b	0.0	b	0	g
K	$5.5 \times 10^{-1}$	c; d	1.0	c; d	3	g
Ca	$3.5 \times 10^{-1}$	c; d	3.5	c; d	5	g
Sc	$1.0 \times 10^{-3}$	c; d	$6.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g
Cr	$1.5 \times 10^{-2}$	e	$7.5 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g
Mn	$1.6 \times 10^{-1}$	c	$5.6 \times 10^{-1}$	c	$9.2 \times 10^{-1}$	f
Fe	$1.0 \times 10^{-3}$	c; d	$4.0 \times 10^{-3}$	c; d	$3.0 \times 10^{-3}$	e; h
Co	$1.7 \times 10^{-2}$	c	$8.1 \times 10^{-2}$	c	$4.0 \times 10^{-1}$	h
Ni	$6.0 \times 10^{-2}$	c; d	$2.8 \times 10^{-1}$	c	$1.1 \times 10^{-1}$	e
Cu	$2.5 \times 10^{-1}$	c; d	$4.0 \times 10^{-1}$	c; d	$8.0 \times 10^{-1}$	g
Zn	$9.3 \times 10^{-1}$	c; d	1.5	d	$5.0 \times 10^{-1}$	h
As	$6.0 \times 10^{-3}$	c; d	$4.0 \times 10^{-2}$	c; d	$2.0 \times 10^{-1}$	g
Se	$2.5 \times 10^{-2}$	c	$2.5 \times 10^{-2}$	c; d	$5.0 \times 10^{-1}$	g
Br	1.5	c; d	1.5	c; d	2	g
Kr	0.0	b	0.0	b	0	g
Rb	$7.0 \times 10^{-2}$	c; d	$1.5 \times 10^{-1}$	c; d	2	g
Sr	$3.7 \times 10^{-1}$	c	1.6	c	2	h
Y	$6.0 \times 10^{-3}$	c; d	$1.5 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Zr	$1.8 \times 10^{-3}$	e	$2.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g
Nb	$5.0 \times 10^{-3}$	c; d	$2.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Mo	$6.0 \times 10^{-2}$	c; d	$2.5 \times 10^{-1}$	c; d	$4.0 \times 10^{-1}$	g
Tc	1.5	d	$4.0 \times 10$	b	$4.0 \times 10$	g
Ru	$1.5 \times 10^{-2}$	c	$2.0 \times 10^{-1}$	b	$2.0 \times 10^{-1}$	g
Rh	$4.0 \times 10^{-2}$	c; d	$1.5 \times 10^{-1}$	c; d	$2.0 \times 10^{-1}$	g
Pd	$4.0 \times 10^{-2}$	c; d	$1.5 \times 10^{-1}$	c; d	$5.0 \times 10^{-1}$	g
Ag	$1.0 \times 10^{-1}$	d	$4.0 \times 10^{-1}$	d	$1.0 \times 10^{-1}$	g
Cd	$1.5 \times 10^{-1}$	c; d	$5.5 \times 10^{-1}$	c; d	1	g
Sn	$6.0 \times 10^{-3}$	c; d	$3.0 \times 10^{-2}$	c; d	1	g
Sb	$3.0 \times 10^{-2}$	d	$5.0 \times 10^{-2}$	b	$1.0 \times 10^{-1}$	g
Te	$4.0 \times 10^{-3}$	c; d	$2.5 \times 10^{-2}$	c; d	$4.0 \times 10$	g
I	$5.0 \times 10^{-2}$	c; d	$1.5 \times 10^{-1}$	d	$1.7 \times 10^{-1}$	e
Xe	0.0	b	0.0	b	0	g
Cs	$9.8 \times 10^{-2}$	c	$1.3 \times 10^{-1}$	c	$2.0 \times 10^{-1}$	g
Ba	$1.5 \times 10^{-2}$	c; d	$1.5 \times 10^{-1}$	c; d	$1.0 \times 10^{-1}$	g
La	$6.4 \times 10^{-4}$	c	$1.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Ce	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g

TABLE 10 (Cont.)

Element	k=1	Radiological Assessment Model Source	k=2	Radiological Assessment Model Source	k=3	Radiological Assessment Model Source
Pr	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
Nd	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
Pm	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
Sm	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
Eu	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
Gd	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Tb	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	c; d	$1.0 \times 10^{-1}$	g
Ho	$4.0 \times 10^{-3}$	c; d	$1.0 \times 10^{-2}$	b; c; d	$1.0 \times 10^{-1}$	g
W	$1.0 \times 10^{-2}$	c; d	$4.5 \times 10^{-2}$	c; d	3	g
Ir	$1.5 \times 10^{-2}$	c; d	$5.5 \times 10^{-2}$	c; d	$2.0 \times 10^{-1}$	g
Hg	$2.0 \times 10^{-1}$	c; d	$9.0 \times 10^{-1}$	c; d	1	g
Pb	$5.6 \times 10^{-3}$	c	$4.5 \times 10^{-2}$	d	$1.0 \times 10^{-1}$	g
Bi	$5.0 \times 10^{-3}$	c; d	$3.5 \times 10^{-2}$	c; d	$5.0 \times 10^{-1}$	g; h
Po	$3.3 \times 10^{-4}$	c	$2.5 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g
Rn	0.0	b	0.0	b	0	g
Ra	$3.5 \times 10^{-3}$	c	$7.5 \times 10^{-2}$	c	$2.0 \times 10^{-1}$	g; h
Ac	$3.5 \times 10^{-4}$	c; d	$3.5 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g
Th	$2.1 \times 10^{-4}$	f	$4.0 \times 10^{-3}$	b	$9.0 \times 10^{-3}$	f
Pa	$2.5 \times 10^{-4}$	c; d	$2.5 \times 10^{-3}$	c; d	$1.0 \times 10^{-1}$	g; h
U	$6.4 \times 10^{-3}$	c	$8.5 \times 10^{-3}$	d	$1.0 \times 10^{-1}$	g
Np	$1.7 \times 10^{-2}$	f	$1.3 \times 10^{-2}$	c	$1.0 \times 10^{-1}$	g; h
Pu	$1.9 \times 10^{-4}$	f	$3.9 \times 10^{-4}$	c	$2.7 \times 10^{-4}$	f
Am	$4.1 \times 10^{-4}$	f	$2.0 \times 10^{-3}$	b	$4.0 \times 10^{-3}$	h
Cm	$9.2 \times 10^{-4}$	c	$8.5 \times 10^{-4}$	d	$4.0 \times 10^{-3}$	h
Cf	$1.0 \times 10^{-2}$	c	$1.0 \times 10^{-2}$	c	$1.0 \times 10^{-1}$	g

<sup>a</sup> Use dry-to-wet weight conversion factors listed in Table 2 to apply these suggested values for RESRAD input.

<sup>b</sup> Napier et al. (1988).

<sup>c</sup> Kennedy and Strenge (1992).

<sup>d</sup> Baes et al. (1984).

<sup>e</sup> Ng et al. (1982a).

<sup>f</sup> IAEA (1993).

<sup>g</sup> NCRP (1991).

<sup>h</sup> IAEA (1982).

<sup>i</sup> Data not listed.

<sup>j</sup> Not applicable.

TABLE 11 Current RESRAD Default Values and Suggested Values for Beef/Feed Transfer Factors (pCi/kg beef per pCi/daily intake)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
H	0	$1.2 \times 10^{-2}$	<sup>b</sup>	NRC (1977)
Be	$8.0 \times 10^{-4}$	$1.0 \times 10^{-3}$	0.25	Baes et al. (1984); Kennedy and Strenge (1992)
C	0	$3.1 \times 10^{-2}$	-	NRC (1977)
N	$9.9 \times 10^{-4}$	$1.0 \times 10^{-2}$	9.10	NCRP (1991)
F	$2.0 \times 10^{-2}$	NC <sup>c</sup>	NC	Napier et al. (1988); NCRP (1991)
Na	$5.0 \times 10^{-2}$	$8.0 \times 10^{-2}$	0.60	IAEA (1993); NCRP (1991)
P	$5.0 \times 10^{-2}$	NC	NC	IAEA (1993); NCRP (1991)
Cl	$6.0 \times 10^{-2}$	NC	NC	
Ar	0	NC	NC	Napier et al. (1988); NCRP (1991)
K	$2.0 \times 10^{-2}$	NC	-	Baes et al. (1984); Kennedy and Strenge (1992); NCRP (1991)
Ca	$3.3 \times 10^{-3}$	$1.6 \times 10^{-3}$	-0.52	Napier et al. (1988); Ng (1982b); NRC (1983)
Sc	$6.0 \times 10^{-3}$	$1.5 \times 10^{-2}$	1.5	Baes et al. (1984); Kennedy and Strenge (1992)
Cr	$9.9 \times 10^{-4}$	$9.0 \times 10^{-3}$	8.1	IAEA (1993); Napier et al. (1988)
Mn	$5.0 \times 10^{-3}$	$5.0 \times 10^{-4}$	-0.90	IAEA (1993); Napier et al. (1988); Ng (1982b); NRC (1983)
Fe	$2.0 \times 10^{-2}$	NC	NC	Baes et al. (1984); IAEA (1993); Kennedy and Strenge (1992); Napier et al. (1988)
Co	$1.0 \times 10^{-3}$	$2.0 \times 10^{-2}$	19	Baes et al. (1984); Kennedy and Strenge (1992); Napier et al. (1984)
Ni	$1.0 \times 10^{-3}$	$5.0 \times 10^{-3}$	4	IAEA (1982); NCRP (1991)
Cu	$1.0 \times 10^{-2}$	NC	NC	Baes et al. (1984); Kennedy and Strenge (1992); NCRP (1991)
Zn	$5.0 \times 10^{-2}$	$1.0 \times 10^{-1}$	1	Baes et al. (1984); IAEA (1993); Kennedy and Strenge (1992); Napier et al. (1988); NCRP (1991)
As	$1.5 \times 10^{-3}$	NC	NC	Napier et al. (1988)
Se	1.0	$1.0 \times 10^{-1}$	-0.90	NCRP (1991)
Br	$2.0 \times 10^{-2}$	NC	NC	Napier et al. (1988)
Kr	0	NC	NC	Napier et al. (1988); NCRP (1991)
Rb	$1.5 \times 10^{-1}$	$1.5 \times 10^{-2}$	-0.9	Baes et al. (1984); Kennedy and Strenge (1992)
Sr	$3.0 \times 10^{-4}$	$8.0 \times 10^{-3}$	26	IAEA (1993)
Y	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.6	IAEA (1982); NCRP (1991)
Zr	$5.0 \times 10^{-4}$	$1.0 \times 10^{-6}$	-1.0	IAEA (1993); NCRP (1991)
Nb	$5.0 \times 10^{-4}$	$3.0 \times 10^{-7}$	-1.0	IAEA (1993); NCRP (1991)
Mo	$1.0 \times 10^{-2}$	$1.0 \times 10^{-3}$	-0.90	IAEA (1993); NCRP (1991)

TABLE 11 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Tc	$9.9 \times 10^{-4}$	$1.0 \times 10^{-4}$	-0.90	IAEA (1993); NCRP (1991)
Ru	$1.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	1.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991); Ng (1982b); NRC (1983)
Rh	$1.0 \times 10^{-3}$	NC	NC	Napier et al. (1988)
Pd	$1.0 \times 10^{-3}$	NC	NC	Napier et al. (1988)
Ag	$9.9 \times 10^{-4}$	$3.0 \times 10^{-3}$	2.0	Baes et al. (1984); IAEA (1993); Kennedy and Streng (1992); NCRP (1991)
Cd	$1.6 \times 10^{-2}$	$4.0 \times 10^{-4}$	-1.0	IAEA (1993); Napier et al. (1988)
Sn	$9.9 \times 10^{-4}$	$1.0 \times 10^{-2}$	9.1	Napier et al. (1988); NCRP (1991)
Sb	$3.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.67	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991)
Te	$5.0 \times 10^{-2}$	$7.0 \times 10^{-3}$	-0.86	IAEA (1993); Napier et al. (1988); NCRP (1991)
I	$2.0 \times 10^{-2}$	$7.0 \times 10^{-3}$	-0.65	Baes et al. (1984); Kennedy and Streng (1992)
Xe	0	NC	NC	Napier et al. (1988); NCRP (1991);
Cs	$3.0 \times 10^{-2}$	NC	NC	Napier et al. (1988)
Ba	$5.0 \times 10^{-4}$	$2.0 \times 10^{-4}$	-0.60	IAEA (1982); NCRP (1991)
La	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	IAEA (1982); NCRP (1991)
Ce	$1.0 \times 10^{-3}$	$2.0 \times 10^{-5}$	-0.98	IAEA (1993); NCRP (1991)
Pr	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	NCRP (1991)
Nd	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	NCRP (1991)
Pm	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	IAEA (1982); NCRP (1991)
Sm	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	IAEA (1982); NCRP (1991)
Eu	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	IAEA (1982); NCRP (1991)
Gd	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	Napier et al. (1988); NCRP (1991)
Tb	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	NCRP (1991)
Ho	$5.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.60	NCRP (1991)
W	$9.9 \times 10^{-4}$	$4.0 \times 10^{-2}$	39	IAEA (1993); NCRP (1991)
Ir	$9.9 \times 10^{-4}$	$2.0 \times 10^{-3}$	1.0	Napier et al. (1988); NCRP (1991)
Hg	$1.0 \times 10^{-1}$	NC	NC	Napier et al. (1988)
Pb	$9.9 \times 10^{-4}$	$8.0 \times 10^{-4}$	-0.19	IAEA (1982); NCRP (1991)
Bi	$9.9 \times 10^{-4}$	$2.0 \times 10^{-3}$	1.0	NCRP (1991)
Po	$9.9 \times 10^{-4}$	$5.0 \times 10^{-3}$	4.1	IAEA (1993); NCRP (1991)
Rn	0	NC	NC	Napier et al. (1988); NCRP (1991)



TABLE 11 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Ra	$9.9 \times 10^{-4}$	$1.0 \times 10^{-3}$	0.01	NCRP (1991)
Ac	$5.0 \times 10^{-3}$	$2.0 \times 10^{-5}$	-1.0	IAEA (1982); NCRP (1991)
Th	$5.0 \times 10^{-3}$	$1.0 \times 10^{-4}$	-1.0	IAEA (1982); NCRP (1991)
Pa	$5.0 \times 10^{-3}$	NC	NC	Napier et al. (1988)
U	$5.0 \times 10^{-3}$	$3.4 \times 10^{-4}$	-0.93	IAEA (1993); NRC (1983)
Np	$5.0 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.80	IAEA (1982, 1993); Napier et al. (1988); NCRP (1991)
Pu	$5.0 \times 10^{-3}$	$1.0 \times 10^{-4}$	-1.0	NCRP (1991)
Am	$5.0 \times 10^{-3}$	$5.0 \times 10^{-5}$	-1.0	NCRP (1991)
Cm	$5.0 \times 10^{-3}$	$2.0 \times 10^{-5}$	-1.0	IAEA (1982); NCRP (1991)
Cf	$5.0 \times 10^{-3}$	$6.0 \times 10^{-5}$	-1.0	NCRP (1991)

<sup>a</sup> Change = (suggested value - default)/(default value).

<sup>b</sup> Not calculated.

<sup>c</sup> No change.

TABLE 12 Current RESRAD Default Values and Suggested Values for Milk/Feed Transfer Factors (pCi/L milk per pCi/daily intake)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
H	0	$1.0 \times 10^{-2}$	<sup>b</sup>	NRC (1977)
Be	$2.0 \times 10^{-6}$	NC <sup>c</sup>	NC	Napier et al. (1988); NCRP (1991)
C	0	$1.2 \times 10^{-2}$	-	NRC (1977)
N	$1.0 \times 10^{-2}$	NC	NC	NCRP (1991)
F	$7.0 \times 10^{-3}$	NC	NC	Napier et al. (1988); NCRP (1991)
Na	$4.0 \times 10^{-2}$	NC	NC	IAEA (1982); NCRP (1991); NRC (1977)
P	$1.2 \times 10^{-2}$	$1.6 \times 10^{-2}$	0.33	IAEA (1993); NRC (1983)
Cl	$8.0 \times 10^{-2}$	$2.0 \times 10^{-2}$	-0.75	Napier et al. (1988); NCRP (1991)
Ar	0	NC	NC	Napier et al. (1988); NCRP (1991)
K	$7.0 \times 10^{-3}$	NC	NC	Baes et al. (1984); Kennedy and Strenge (1992); Napier et al. (1988); NCRP (1991)
Ca	$8.0 \times 10^{-3}$	$3.0 \times 10^{-3}$	-0.63	IAEA (1993); NCRP (1991)
Sc	$2.5 \times 10^{-6}$	$5.0 \times 10^{-6}$	1.0	Baes et al. (1984); Kennedy and Strenge (1992)
Cr	$1.1 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.82	IAEA (1982); NCRP (1991); NRC (1983)
Mn	$1.0 \times 10^{-4}$	$3.0 \times 10^{-4}$	2.0	IAEA (1982); Napier et al. (1988); NCRP (1991)
Fe	$6.0 \times 10^{-4}$	$3.0 \times 10^{-4}$	-0.5	IAEA (1982); NCRP (1991)
Co	$5.0 \times 10^{-4}$	$2.0 \times 10^{-3}$	3	Baes et al. (1984); IAEA (1982); Kennedy and Strenge (1992); NCRP (1991); NRC (1983)
Ni	$3.4 \times 10^{-3}$	$2.0 \times 10^{-2}$	4.89	NCRP (1991)
Cu	$7.0 \times 10^{-3}$	$2.0 \times 10^{-3}$	-0.71	Napier et al. (1988); NCRP (1991)
Zn	$6.0 \times 10^{-3}$	$1.0 \times 10^{-2}$	0.67	Baes et al. (1984); IAEA (1982); Kennedy and Strenge (1992); Napier et al. (1988); NCRP (1991); NRC (1983)
As	$3.0 \times 10^{-3}$	$1.0 \times 10^{-4}$	-1.0	NCRP (1991)
Se	$2.3 \times 10^{-2}$	$1.0 \times 10^{-2}$	-0.57	NCRP (1991)
Br	$2.5 \times 10^{-2}$	$2.0 \times 10^{-2}$	-0.20	Baes et al. (1984); Kennedy and Strenge (1992); Napier et al. (1988); NCRP (1991); NRC (1983)
Kr	0	NC	NC	Napier et al. (1988); NCRP (1991)
Rb	$1.0 \times 10^{-2}$	NC	NC	Baes et al. (1984); Kennedy and Strenge (1992); Napier et al. (1988); NCRP (1991)
Sr	$1.5 \times 10^{-3}$	$2.0 \times 10^{-3}$	0.33	NCRP (1991)

TABLE 12 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Y	$5.0 \times 10^{-6}$	$2.0 \times 10^{-5}$	3.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); NRC (1983)
Zr	$2.5 \times 10^{-6}$	$6.0 \times 10^{-7}$	-0.76	NCRP (1991)
Nb	$1.2 \times 10^{-3}$	$2.0 \times 10^{-6}$	-1.0	NCRP (1991)
Mo	$4.0 \times 10^{-3}$	$1.7 \times 10^{-3}$	-0.58	IAEA (1993); Napier et al. (1988)
Tc	$1.2 \times 10^{-2}$	$1.0 \times 10^{-3}$	-0.92	IAEA (1993); NCRP (1991)
Ru	$5.0 \times 10^{-7}$	$3.3 \times 10^{-6}$	5.6	IAEA (1993)
Rh	$5.0 \times 10^{-3}$	NC	NC	Napier et al. (1988)
Pd	$5.0 \times 10^{-3}$	NC	NC	Napier et al. (1988)
Ag	$2.5 \times 10^{-2}$	NC	NC	Napier et al. (1988)
Cd	$6.2 \times 10^{-5}$	$1.0 \times 10^{-3}$	15	Baes et al. (1984); Kennedy and Streng (1992)
Sn	$1.3 \times 10^{-3}$	$1.0 \times 10^{-3}$	-0.23	Baes et al. (1984); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991)
Sb	$7.5 \times 10^{-4}$	$1.0 \times 10^{-4}$	-0.87	Baes et al. (1984); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991)
Te	$5.0 \times 10^{-4}$	NC	NC	NCRP (1991)
I	$1.0 \times 10^{-2}$	NC	NC	Baes et al. (1984); IAEA (1982, 1993); Kennedy and Streng (1992); NCRP (1991)
Xe	0	NC	NC	Napier et al. (1988); NCRP (1991)
Cs	$5.0 \times 10^{-3}$	$8.0 \times 10^{-3}$	0.60	IAEA (1982, 1993)
Ba	$4.0 \times 10^{-4}$	$5.0 \times 10^{-4}$	0.25	NCRP (1991)
La	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992)
Ce	$1.0 \times 10^{-5}$	$3.0 \times 10^{-5}$	2.0	IAEA (1993)
Pr	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); Kennedy and Streng (1992)
Nd	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); Kennedy and Streng (1992); Napier et al. (1988)
Pm	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992)
Sm	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988);
Eu	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988);
Gd	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); Kennedy and Streng (1992)
Tb	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); Kennedy and Streng (1992)

TABLE 12 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Ho	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7.0	Baes et al. (1984); Kennedy and Streng (1992)
W	$2.5 \times 10^{-4}$	$3.0 \times 10^{-4}$	0.20	Baes et al. (1984); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991)
Ir	$9.9 \times 10^{-4}$	$2.0 \times 10^{-6}$	-1.0	Baes et al. (1984); Kennedy and Streng (1992); Napier et al. (1988); NCRP (1991)
Hg	$1.9 \times 10^{-2}$	$5.0 \times 10^{-4}$	-1.0	NCRP (1991)
Pb	$1.0 \times 10^{-5}$	$3.0 \times 10^{-4}$	29	IAEA (1982); NCRP (1991)
Bi	$2.5 \times 10^{-4}$	$5.0 \times 10^{-4}$	1.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988); NRC (1983)
Po	$1.2 \times 10^{-4}$	$3.4 \times 10^{-4}$	1.8	Baes et al. (1984); IAEA (1993); Kennedy and Streng (1992)
Rn	0	NC	NC	Napier et al. (1988); NCRP (1991)
Ra	$2.0 \times 10^{-4}$	$1.0 \times 10^{-3}$	4.0	NCRP (1991)
Ac	$2.5 \times 10^{-6}$	$2.0 \times 10^{-5}$	7	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988); NRC (1983)
Th	$2.5 \times 10^{-6}$	$5.0 \times 10^{-6}$	1.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); NCRP (1991); NRC (1983)
Pa	$2.5 \times 10^{-6}$	$5.0 \times 10^{-6}$	1.0	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); NCRP (1991); NRC (1983)
U	$6.0 \times 10^{-4}$	NC	NC	Baes et al. (1984); IAEA (1982); Kennedy and Streng (1992); Napier et al. (1988); NRC (1983)
Np	$2.5 \times 10^{-6}$	$5.0 \times 10^{-6}$	1.0	Baes et al. (1984); IAEA (1982, 1993); Kennedy and Streng (1992); NRC (1983)
Pu	$2.5 \times 10^{-8}$	$1.0 \times 10^{-6}$	39	IAEA (1993); NCRP (1991)
Am	$2.5 \times 10^{-6}$	$2.0 \times 10^{-6}$	-0.20	NCRP (1991)
Cm	$2.5 \times 10^{-6}$	$2.0 \times 10^{-6}$	-0.20	NCRP (1991)
Cf	$7.5 \times 10^{-7}$	NC	NC	Kennedy and Streng (1992); Napier et al. (1988)

<sup>a</sup> Change = (suggested value - default)/(default value).

<sup>b</sup> Not calculated.

<sup>c</sup> No change.

TABLE 13 Current RESRAD Default Values and Suggested Values for Aquatic Bioaccumulation Factors for Freshwater Fish (Bq/kg freshwater fish per Bq/L water)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
H	$9.0 \times 10^{-1}$	1	0.11	IAEA (1993); Kennedy and Streng (1992); NCRP (1991)
Be	2.0	$1.0 \times 10^2$	49	IAEA (1993); NCRP (1991)
C	$4.6 \times 10^3$	$5.0 \times 10^4$	9.9	IAEA (1993); NCRP (1991)
N	0	$1.5 \times 10^5$	<sup>b</sup>	Kennedy and Streng (1992); NCRP (1991)
F	$1.0 \times 10^1$	NC <sup>c</sup>	NC	Kennedy and Streng (1992); NCRP (1991)
Na	$1.0 \times 10^2$	$2.0 \times 10^1$	-0.80	IAEA (1982, 1993); NCRP (1991); Thompson et al. (1972)
P	$1.0 \times 10^5$	$5.0 \times 10^4$	-0.50	IAEA (1993); NCRP (1991)
Cl	$1.3 \times 10^2$	$1.0 \times 10^3$	6.7	NCRP (1991)
Ar	1.0	0	-1.0	NCRP (1991)
K	$1.0 \times 10^3$	NC	NC	Kennedy and Streng (1992)
Ca	$4.0 \times 10^1$	$1.0 \times 10^3$	24	NCRP (1991)
Sc	2.0	$1.0 \times 10^2$	49	IAEA (1993); Kennedy and Streng (1992); NCRP (1991); Thompson et al. (1972)
Cr	$2.0 \times 10^1$	$2.0 \times 10^2$	9.0	IAEA (1982, 1993); Kennedy and Streng (1992); NCRP (1991); NRC (1977)
Mn	$4.0 \times 10^2$	NC	NC	IAEA (1982, 1993); Kennedy and Streng (1992); NRC (1977)
Fe	$1.0 \times 10^2$	$2.0 \times 10^2$	1.0	IAEA (1993); NCRP (1991)
Co	$5.0 \times 10^1$	$3.0 \times 10^2$	5.0	IAEA (1982, 1993); NCRP (1991)
Ni	$1.0 \times 10^2$	NC	NC	IAEA (1982, 1993); Kennedy and Streng (1992); NCRP (1991); NRC (1977); Thompson et al. (1972)
Cu	$5.0 \times 10^1$	$2.0 \times 10^2$	3.0	IAEA (1993); NCRP (1991)
Zn	$2.0 \times 10^3$	$1.0 \times 10^3$	-0.50	IAEA (1982, 1993); NCRP (1991); Thompson et al. (1972)
As	$3.0 \times 10^2$	NC	NC	
Se	$1.7 \times 10^2$	$2.0 \times 10^2$	0.2	NCRP (1991)
Br	$4.2 \times 10^2$	NC	NC	Kennedy and Streng (1992); NRC (1977)
Kr	1.0	0	-1.0	NCRP (1991)
Rb	$2.0 \times 10^3$	NC	NC	IAEA (1993); Kennedy and Streng (1992); NCRP (1991); NRC (1977)
Sr	$3.0 \times 10^1$	$6.0 \times 10^1$	1.0	IAEA (1982, 1993); NCRP (1991)
Y	$2.5 \times 10^1$	$3.0 \times 10^1$	0.20	IAEA (1982, 1993); NCRP (1991)
Zr	3.3	$3.0 \times 10^2$	90	IAEA (1982, 1993); NCRP (1991)
Nb	$3.0 \times 10^4$	$3.0 \times 10^2$	-0.99	IAEA (1982, 1993); NCRP (1991)

TABLE 13 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Mo	$1.0 \times 10^1$	NC	NC	IAEA (1993); Kennedy and Strenge (1992); NCRP (1991); NRC (1977, 1983); Thompson et al. (1972)
Tc	$1.5 \times 10^1$	$2.0 \times 10^1$	0.33	IAEA (1982, 1993); NCRP (1991)
Ru	$1.0 \times 10^1$	NC	NC	IAEA (1982, 1993); NCRP (1991); NRC (1977); Thompson et al. (1972)
Rh	$1.0 \times 10^1$	NC	NC	IAEA (1993); Kennedy and Strenge (1992); NRC (1977)
Pd	$1.0 \times 10^1$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)
Ag	2.3	5	1.20	IAEA (1993)
Cd	$2.0 \times 10^2$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)
Sn	$3.0 \times 10^3$	NC	NC	IAEA (1993); Kennedy and Strenge (1992); NCRP (1991)
Sb	1.0	$1.0 \times 10^2$	99	IAEA (1993); NCRP (1991)
Te	$4.0 \times 10^2$	NC	NC	IAEA (1982, 1993); Kennedy and Strenge (1992); NCRP (1991); NRC (1977)
I	$1.5 \times 10^1$	$4.0 \times 10^1$	1.7	IAEA (1982, 1993); NCRP (1991); NRC (1983)
Xe	1.0	0	-1.0	NCRP (1991)
Cs	$2.0 \times 10^3$	NC	NC	IAEA (1982, 1993); Kennedy and Strenge (1992); NCRP (1991); NRC (1977)
Ba	4.0	NC	NC	IAEA (1982, 1993); NCRP (1991); NRC (1977)
La	$2.5 \times 10^1$	$3.0 \times 10^1$	0.20	IAEA (1982, 1993); NCRP (1991)
Ce	1.0	$3.0 \times 10^1$	29	IAEA (1982, 1993); NCRP (1991)
Pr	$2.5 \times 10^1$	$1.0 \times 10^2$	3.0	IAEA (1993); NCRP (1991)
Nd	$2.5 \times 10^1$	$1.0 \times 10^2$	3.0	IAEA (1993); NCRP (1991)
Pm	$2.5 \times 10^1$	$3.0 \times 10^1$	0.20	IAEA (1982, 1993); NCRP (1991)
Sm	$2.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)
Eu	$2.5 \times 10^1$	$5.0 \times 10^1$	1.0	IAEA (1993); NCRP (1991)
Gd	$2.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992)
Tb	$2.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)
Ho	$2.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992)
W	$1.2 \times 10^3$	NC	NC	Kennedy and Strenge (1992); NRC (1977)
Ir	$5.0 \times 10^1$	$1.0 \times 10^1$	-0.80	Kennedy and Strenge (1992); NCRP (1991)
Hg	$2.0 \times 10^4$	$1.0 \times 10^3$	-0.95	IAEA (1993); Kennedy and Strenge (1992); NCRP (1991)
Pb	$1.0 \times 10^2$	$3.0 \times 10^2$	2.0	IAEA (1982, 1993); NCRP (1991)
Bi	$1.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)
Po	$5.0 \times 10^2$	$1.0 \times 10^2$	-0.80	NCRP (1991)
Rn	$5.7 \times 10^1$	0	-1.0	NCRP (1991)

TABLE 13 (Cont.)

Element	Current Default Value	Suggested Value	Change <sup>a</sup>	Radiological Assessment Model Source
Ra	$5.0 \times 10^1$	NC	NC	IAEA (1982, 1993); NCRP (1991); Thompson et al. (1972)
Ac	$2.5 \times 10^1$	$1.5 \times 10^1$	-0.40	NCRP (1991)
Th	$3.0 \times 10^1$	$1.0 \times 10^2$	2.3	IAEA (1993); Kennedy and Strenge (1992); NCRP (1991)
Pa	$1.1 \times 10^1$	$1.0 \times 10^1$	-0.09	IAEA (1982, 1993); NCRP (1991)
U	2.0	$1.0 \times 10^1$	4.0	IAEA (1982, 1993); NCRP (1991); Thompson et al. (1972)
Np	$1.0 \times 10^1$	$3.0 \times 10^1$	2.0	IAEA (1993); NCRP (1991)
Pu	3.5	$3.0 \times 10^1$	7.6	IAEA (1993); NCRP (1991)
Am	$2.5 \times 10^1$	$3.0 \times 10^1$	0.20	IAEA (1982, 1993); NCRP (1991)
Cm	$2.5 \times 10^1$	$3.0 \times 10^1$	0.20	IAEA (1982, 1993); NCRP (1991)
Cf	$2.5 \times 10^1$	NC	NC	Kennedy and Strenge (1992); NCRP (1991)

<sup>a</sup> Change = (suggested value - default value)/(default value).

<sup>b</sup> Not calculated.

<sup>c</sup> No change.

TABLE 14 Compilation of Aquatic Bioaccumulation Factors for Crustacea and Mollusks in Marine Environments (Bq/kg organism per Bq/L water)

Element	Crustacea			Mollusks			Shellfish
	IAEA (1982)	IAEA (1985)	NRC (1983)	IAEA (1982)	IAEA (1985)	NRC (1983)	
H	<sup>a</sup>	1	-	-	1	-	1
Be	-	-	-	-	-	-	2.0 × 10 <sup>2</sup>
C	-	2.0 × 10 <sup>4</sup>	-	-	2.0 × 10 <sup>4</sup>	-	2.0 × 10 <sup>3</sup>
N	-	-	-	-	-	-	6.0 × 10 <sup>4</sup>
F	-	-	-	-	-	-	4
Na	1	1.0 × 10 <sup>-1</sup>	3.0 × 10 <sup>-1</sup>	1	3.0 × 10 <sup>-1</sup>	2.0 × 10 <sup>-1</sup>	1.0 × 10 <sup>1</sup>
P	1 × 10 <sup>4</sup>	-	2.4 × 10 <sup>4</sup>	1 × 10 <sup>4</sup>	-	6.0 × 10 <sup>3</sup>	2.0 × 10 <sup>4</sup>
Cl	-	5.0 × 10 <sup>-2</sup>	-	-	5.0 × 10 <sup>-2</sup>	-	1
Ar	-	0	-	-	0	-	0
Ca	-	5.0	-	-	1.0 × 10 <sup>0</sup>	-	1
Sc	-	3.0 × 10 <sup>2</sup>	-	-	1.0 × 10 <sup>5</sup>	-	1.0 × 10 <sup>4</sup>
Cr	5 × 10 <sup>2</sup>	5.0 × 10 <sup>2</sup>	1.9 × 10 <sup>3</sup>	5 × 10 <sup>2</sup>	8.0 × 10 <sup>2</sup>	6.4 × 10 <sup>3</sup>	5.0 × 10 <sup>2</sup>
Mn	1 × 10 <sup>4</sup>	5.0 × 10 <sup>2</sup>	9.4 × 10 <sup>2</sup>	1 × 10 <sup>4</sup>	5.0 × 10 <sup>3</sup>	2.3 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>
Fe	1 × 10 <sup>3</sup>	5.0 × 10 <sup>3</sup>	1.8 × 10 <sup>3</sup>	1 × 10 <sup>3</sup>	3.0 × 10 <sup>4</sup>	2.1 × 10 <sup>4</sup>	1.0 × 10 <sup>4</sup>
Co	1 × 10 <sup>3</sup>	5.0 × 10 <sup>3</sup>	2.2 × 10 <sup>2</sup>	1 × 10 <sup>3</sup>	5.0 × 10 <sup>3</sup>	2.4 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>
Ni	1 × 10 <sup>2</sup>	1.0 × 10 <sup>3</sup>	-	1 × 10 <sup>2</sup>	2.0 × 10 <sup>3</sup>	-	1.0 × 10 <sup>2</sup>
Cu	-	-	-	-	-	-	1.7 × 10 <sup>3</sup>
Zn	4 × 10 <sup>3</sup>	5.0 × 10 <sup>4</sup>	1.3 × 10 <sup>4</sup>	1 × 10 <sup>5</sup>	3.0 × 10 <sup>4</sup>	1.5 × 10 <sup>4</sup>	2.0 × 10 <sup>4</sup>
As	-	-	-	-	-	-	1.0 × 10 <sup>3</sup>
Se	-	5.0 × 10 <sup>3</sup>	-	-	6.0 × 10 <sup>3</sup>	-	1.0 × 10 <sup>3</sup>
Br	-	-	-	-	-	-	1.0 × 10 <sup>1</sup>
Kr	-	1	-	-	1	-	0
Rb	-	-	-	-	-	-	2.0 × 10 <sup>1</sup>
Sr	1 × 10 <sup>1</sup>	2	1.5	1 × 10 <sup>1</sup>	1	9.6	1.0 × 10 <sup>1</sup>
Y	1 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>	-	1 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>	-	1.0 × 10 <sup>3</sup>
Zr	1 × 10 <sup>2</sup>	2.0 × 10 <sup>2</sup>	-	1 × 10 <sup>3</sup>	5.0 × 10 <sup>3</sup>	-	-
Nb	1 × 10 <sup>2</sup>	2.0 × 10 <sup>2</sup>	-	1 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>	-	-
Mo	-	-	-	-	-	-	-
Tc	1 × 10 <sup>3</sup>	1.0 × 10 <sup>3</sup>	-	1 × 10 <sup>2</sup>	1.0 × 10 <sup>3</sup>	-	-
Ru	6 × 10 <sup>2</sup>	1.0 × 10 <sup>2</sup>	4.0 × 10 <sup>2</sup>	2 × 10 <sup>3</sup>	2.0 × 10 <sup>3</sup>	3.8 × 10 <sup>2</sup>	3.8 × 10 <sup>2</sup>
Rh	-	-	-	-	-	-	-



TABLE 14 (Cont.)

Element	Crustacea			Mollusks			Shellfish
	IAEA (1982)	IAEA (1985)	NRC (1983)	IAEA (1982)	IAEA (1985)	NRC (1983)	
Pd	-	$3.0 \times 10^2$	-	-	$3.0 \times 10^2$	-	$2.0 \times 10^3$
Ag	$5 \times 10^3$	$5.0 \times 10^3$	$9.5 \times 10^2$	$1 \times 10^5$	$1.0 \times 10^4$	$5.9 \times 10^3$	$5.0 \times 10^3$
Cd	-	$1.0 \times 10^4$	-	-	$2.0 \times 10^4$	-	$2.5 \times 10^5$
Sn	-	$5.0 \times 10^4$	$1.7 \times 10^2$	-	$5.0 \times 10^2$	$4.4 \times 10^2$	$3.0 \times 10^2$
Sb	$3 \times 10^2$	$4.0 \times 10^2$	-	$1 \times 10^2$	$2.0 \times 10^2$	-	$3.0 \times 10^2$
Te	$1 \times 10^3$	$1.0 \times 10^3$	-	$1 \times 10^4$	$1.0 \times 10^3$	-	$1.0 \times 10^4$
I	$1 \times 10^2$	$1.0 \times 10^1$	$5.0 \times 10$	$1 \times 10^2$	$1.0 \times 10^1$	$3.0 \times 10$	$1.0 \times 10^2$
Xe	-	1	-	-	1	-	0
Cs	$3 \times 10^1$	$3.0 \times 10^1$	$5.7 \times 10$	$1 \times 10^1$	$3.0 \times 10^1$	$3.5 \times 10$	$3.0 \times 10^1$
Ba	$1 \times 10^2$	1	-	$1 \times 10^2$	$2.0 \times 10^1$	-	$1.0 \times 10^2$
La	$1 \times 10^3$	-	-	$1 \times 10^3$	-	-	$1.0 \times 10^3$
Ce	$1 \times 10^1$	$1.0 \times 10^3$	$1.4 \times 10^3$	$1 \times 10^1$	$5.0 \times 10^3$	$8.6 \times 10^2$	$1.0 \times 10^1$
Pr	-	-	-	-	-	-	$1.0 \times 10^1$
Nd	-	-	-	-	-	-	$1.0 \times 10^3$
Pm	$1 \times 10^3$	$1.0 \times 10^3$	-	$1 \times 10^3$	$5.0 \times 10^3$	-	$1.0 \times 10^3$
Sm	-	$1.0 \times 10^3$	-	-	$5.0 \times 10^3$	-	$1.0 \times 10^3$
Eu	-	$1.0 \times 10^3$	-	-	$7.0 \times 10^3$	-	$1.0 \times 10^3$
Gd	-	$2.0 \times 10^3$	-	-	$5.0 \times 10^3$	-	$1.0 \times 10^3$
Tb	-	$1.0 \times 10^3$	-	-	$3.0 \times 10^3$	-	$1.0 \times 10^3$
Ho	-	-	-	-	-	-	$3.0 \times 10^1$
W	-	$1.0 \times 10^1$	-	-	$1.0 \times 10^2$	-	$3.0 \times 10^1$
Ir	-	$1.0 \times 10^2$	-	-	$1.0 \times 10^2$	-	$2.0 \times 10^3$
Hg	-	$2.0 \times 10^4$	-	-	$1.0 \times 10^4$	-	$1.0 \times 10^3$
Pb	$1 \times 10^2$	$1.0 \times 10^3$	-	$1 \times 10^2$	$1.0 \times 10^3$	$4.0 \times 10$	$1.0 \times 10^2$
Bi	$1 \times 10^3$	-	-	$1 \times 10^3$	-	-	$1.0 \times 10^3$
Po	$2 \times 10^4$	$5.0 \times 10^4$	-	$2 \times 10^4$	$1.0 \times 10^4$	-	$2.0 \times 10^4$
Rn	-	-	-	-	-	-	0
Ra	$1 \times 10^2$	$1.0 \times 10^2$	$1.4 \times 10^2$	$1 \times 10^2$	$1.0 \times 10^3$	$1.3 \times 10^3$	$1.0 \times 10^2$
Ac	-	$1.0 \times 10^3$	-	-	$1.0 \times 10^3$	-	$5.0 \times 10^1$
Th	$1 \times 10^3$	$1.0 \times 10^3$	-	$1 \times 10^3$	$1.0 \times 10^3$	-	$1.0 \times 10^3$
Pa	$1 \times 10^1$	$1.0 \times 10^1$	-	$1 \times 10^1$	$5.0 \times 10^2$	-	$1.0 \times 10^1$
U	$1 \times 10^1$	$1.0 \times 10^1$	-	$1 \times 10^1$	$3.0 \times 10^1$	-	$1.0 \times 10^1$
Np	$1 \times 10^2$	$1.0 \times 10^2$	-	$1 \times 10^3$	$4.0 \times 10^2$	-	$1.0 \times 10^3$

TABLE 14 (Cont.)

Element	Crustacea			Mollusks			Shellfish NCRP (1991)
	IAEA (1982)	IAEA (1985)	NRC (1983)	IAEA (1982)	IAEA (1985)	NRC (1983)	
Pu	$1 \times 10^2$	$3.0 \times 10^2$	$1.9 \times 10^2$	$1 \times 10^3$	$3.0 \times 10^3$	$2.6 \times 10^2$	$1.0 \times 10^2$
Am	$2 \times 10^2$	$5.0 \times 10^2$	$2.0 \times 10^2$	$2 \times 10^3$	$2.0 \times 10^4$	-	$2.0 \times 10^3$
Cm	$2 \times 10^2$	$5.0 \times 10^2$	-	$2 \times 10^3$	$3.0 \times 10^4$	-	$2.0 \times 10^2$
Cf	-	$5.0 \times 10^2$	-	-	$2.0 \times 10^4$	-	$1.0 \times 10^3$

<sup>a</sup> Data not listed.

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