FASSET

Framework for Assessment of Environmental Impact

Deliverable 5: Appendix 1

Transfer Factor and Dose Conversion Coefficient Look-up Tables

Handbook for Assessment of the Exposure of Biota to Ionising Radiation from Radionuclides in the Environment

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A project within the EC 5th Framework Programme

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FASSET will bring to radiation protection a framework for the assessment of environmental impacts of ionising radiation. The framework will link together current knowledge about sources, exposure, dosimetry and environmental effects/consequences for reference organisms and ecosystems. Relevant components of the framework will be identified on an ecosystem basis through systematic consideration of the available data. The application of the framework in assessment situations will be described in an overall report from the project. The project started in November 2000 and is to end by October 2003.

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1 Transfer factor Look-up tables

1.1 Transfer Look-up tables for Forest ecosystems

Table 1.1.1 Transfer Factors for ^{137}**Cs** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots	1.2E-3	4.0E-2	Low	Cs-1
Understorey vegetation	2.0E-3	2.3E-1	High	Cs-2
Lichen and bryophytes	8.0E-2	2.0E-1	Low	Cs-3
Fungi	2.0E-3	1.9E+1	High	Cs-4
Herbivorous mammals	1.0E-3	1.0E+0	High	Cs-5
Roe deer	1.0E-3	3.5E-1	High	Cs-6
Moose	6.0E-3	8.9E-2	High	Cs-7
Reindeer	2.0E-2	1.0E+0	High	Cs-8
Carnivorous mammals	8.4E-2	2.0E+0	Low	Cs-9
Tree needles and leaves	1.0E-4	1.1E-1	High	Cs-10
Tree wood	2.0E-5	7.4E-3	High	Cs-11

Cs-1: Fesenko *et al*. (2001a)
Cs-2: IAEA (1994), Shcheglov *et al*. (2001), Fesenko *et al*. (2001b), ANPA (2000).
Cs-3: Shcheglov *et al*. (2001), Eckel *et al*. (1986).
Cs-4: IAEA (1994), Shcheglov *et al*. (2001), Fesenko *et al*. (2001b), ANPA (2000), Yoshida and Muramatsu (1994, 1998), Eckel *et al*. (1986). The majority of the observed values (> 90 %) fall within the interval from 5.0E-3 to 5.0E+0.
Cs-5: IAEA (1994), Avila (1998).
Cs-6: IAEA (1994), Avila (1998).
Cs-7: IAEA (1994), Avila (1998).
Cs-8: IAEA (1994), Avila (1998).
Cs-9: Calculated for a fox feeding on roe deer with kinetic-allometric model.
Cs-10: ANPA (2000), Fesenko *et al*. (2001a), Shcheglov *et al*. (2001).
Cs-11: ANPA (2000), Fesenko *et al*. (2001a), Shcheglov *et al*. (2001).

Table 1.1.2 Transfer Factors for **^{90}Sr** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots				Sr-1
Understorey vegetation	1.4E-5	5.5E-1	High	Sr-2
Lichen and bryophytes				Sr-3
Fungi	7.1E-5	1.4E-2	Low	Sr-4
Herbivorous mammals				Sr-5
Roe deer	7.4E-3	5.7E-1	Low	Sr-6
Moose	7.4E-3	5.2E-1	Low	Sr-7
Reindeer				Sr-8
Carnivorous mammals	1.4E-2	1.1E+0	Low	Sr-9
Tree needles and leaves	8.0E-5	6.8E-2	Medium	Sr-10
Tree wood	2.0E-5	1.2E-2	Medium	Sr-11

Sr-1:
Sr-2: Yoshida and Muramatsu (1998), IAEA (1994)
Sr-3:
Sr-4: Yoshida and Muramatsu (1998)
Sr-5:
Sr-6: Calculated with kinetic-allometric model
Sr-7: Calculated with kinetic-allometric model
Sr-8:
Sr-9: Calculated for a fox feeding on roe deer with kinetic-allometric model.
Sr-10: Shcheglov *et al*. (2001).
Sr-11: Shcheglov *et al*. (2001).

Table 1.1.3 Transfer Factors for ^{239}**Pu** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots	9.6E-5	6.7E-4	Medium	Pu-1
Understorey vegetation	4.0E-6	1.9E-5	Low	Pu-2
Lichen and bryophytes				Pu-3
Fungi				Pu-4
Herbivorous mammals				Pu-5
Roe deer	1.7E-8	3.0E-6	Low	Pu-6
Moose	9.1E-9	2.7E-6	Low	Pu-7
Reindeer				Pu-8
Carnivorous mammals	6.2E-10	1.1E-7	Low	Pu-9
Tree needles and leaves	8.8E-8	8.1E-7	Low	Pu-10
Tree wood	9.0E-8	8.1E-7	Low	Pu-11

Pu-1: Calculated with dynamic model described in Garten *et al*. (1978)
Pu-2: Calculated with dynamic model described in Garten *et al*. (1978)
Pu-3:
Pu-4:
Pu-5:
Pu-6: Calculated with kinetic-allometric model
Pu-7: Calculated with kinetic-allometric model
Pu-8:
Pu-9: Calculated for a Fox feeding on roe deer with kinetic-allometric model.
Pu-10: Calculated with dynamic model described in Garten *et al*. (1978)
Pu-11: Calculated with dynamic model described in Garten *et al*. (1978)

Table 1.1.4 Transfer Factors for ^{99}**Tc** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots	7.8E-1	3.3E+1	Medium	Tc-1
Understorey vegetation	5.0E-4	5.5E+1	Medium	Tc-2
Lichen and bryophytes				Tc-3
Fungi				Tc-4
Herbivorous mammals				Tc-5
Roe deer	1.3E-1	2.1E+0	Low	Tc-6
Moose	4.9E-1	7.5E+0	Low	Tc-7
Reindeer				Tc-8
Carnivorous mammals	3.7E-2	5.8E-1	Low	Tc-9
Tree needles and leaves	6.5E+0	2.9E2	Medium	Tc-10
Tree wood	6.5E+0	2.9E2	Medium	Tc-11

Tc-1: Calculated with dynamic model described in Garten (1987)
Tc-2: IAEA (1994).
Tc-3:
Tc-4:
Tc-5:
Tc-6: Calculated with kinetic-allometric model
Tc-7: Calculated with kinetic-allometric model
Tc-8:
Tc-9: Calculated for a fox feeding on roe deer with kinetic-allometric model.
Tc-10: Calculated with dynamic model described in Garten (1987)
Tc-11: Calculated with dynamic model described in Garten (1987)

Table 1.1.5 Transfer Factors for ^{36}**Cl** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots				Cl-1
Understorey vegetation	2.1E-2	1.2E+0	Medium	Cl-2
Lichen and bryophytes				Cl-3
Fungi				Cl-4
Herbivorous mammals				Cl-5
Roe deer	1.1E-2	2.6E-1	Low	Cl-6
Moose	8.3E-3	1.9E-1	Low	Cl-7
Reindeer				Cl-8
Carnivorous mammals	1.1E-2	2.7E-1	Low	Cl-9
Tree needles and leaves	5.7E-3	2.0E-1	Medium	Cl-10
Tree wood	5.7E-3	7.9E-2	Medium	Cl-11

Cl-1:
Cl-2: Sheppard et al. (1999)
Cl-3:
Cl-4:
Cl-5:
Cl-6: Calculated with kinetic-allometric model
Cl-7: Calculated with kinetic-allometric model
Cl-8:
Cl-9: Calculated for a fox feeding on roe deer with kinetic-allometric model.
Cl-10: Sheppard et al. (1999)
Cl-11: Sheppard et al. (1999)

Table 1.1.6 Transfer Factors for ^{59}**Ni** in forest ecosystems

Reference Organisms	Bq/kg per Bq/m^2		Confidence	Comments
	Min	Max		
Plant roots				Ni-1
Understorey vegetation	2.1E-5	3.7E-2	Medium	Ni-2
Lichen and bryophytes				Ni-3
Fungi	7.1E-4	1.2E-3	Low	Ni-4
Herbivorous mammals				Ni-5
Roe deer	1.3E-3	2.1E-2	Low	Ni-6
Moose	1.9E-3	1.9E-2	Low	Ni-7
Reindeer				Ni-8
Carnivorous mammals	8.7E-3	1.4E-1	Low	Ni-9
Tree needles and leaves	6.4E-4	1.6E-3	Low	Ni-10
Tree wood				Ni-11

Ni-1:
Ni-2: IAEA (1994), Denys *et al*. (2002). The so-called hyperaccumulators can show values that are 4 orders of magnitude higher.
Ni-3:
Ni-4: Yoshida and Muramatsu (1998)
Ni-5:
Ni-6: Calculated with kinetic-allometric model
Ni-7: Calculated with kinetic-allometric model
Ni-8:
Ni-9: Calculated for a fox feeding on roe deer with dynamic model.
Ni-10: Yoshida and Muramatsu (1998)
Ni-11:

1.2 Transfer Look-up tables for semi-natural pasture and heathland ecosystems

Details concerning the derivation of transfer coefficients for agricultural ecosystems have been provided in the main report (Section 4.1.3). Where look-up values have been derived from empirical data sets, the number of samples "n" used in this derivation is provided in a separate column.

Table 1.2.1 Transfer parameters describing the transfer of ^{3}**H** to reference organisms assuming a constant atmospheric concentration of ^{3}H. All values presented on a fresh weight reference organism basis.

Reference Organism	Bq/kg organism : Bq/m^3 air	Confidence	Comments
Soil Invertebrate (worm)	150	Medium	H-1
Lichen & bryophytes			H-2
Grasses	150	Medium	H-3
Shrub			H-4
Detritivores			H-5
Carnivorous mammals	150	Medium	H-6
Herbivorous mammals	150	Medium	H-7
Burrowing mammals			H-8
Bird egg	150	Medium	H-9

H-1: Specific activity model estimate
H-2:
H-3: Specific activity model estimate
H-4:
H-5:
H-6: Specific activity model estimate
H-7: Specific activity model estimate
H-8:
H-9: Specific activity model estimate

Table 1.2.2 Transfer parameters describing the transfer of **^{14}C** to reference organisms assuming a constant atmospheric concentration of ^{14}C. All values presented on a fresh weight reference organism basis.

Reference Organism	**Bq/kg organism : Bq/m^3 air**	**Confidence**	**Comments**
Soil Invertebrate (worm)	430	Low	C-1
Lichen & bryophytes			C-2
Grasses	890	Medium	C-3
Shrub			C-4
Detritivores			C-5
Carnivorous mammals	1340	Medium	C-6
Herbivorous mammals	1340	Medium	C-7
Burrowing mammals			C-8
Bird egg	890	Low	C-9

C-1: Specific activity model estimate
C-2:
C-3: Specific activity model estimate
C-4:
C-5:
C-6: Specific activity model estimate
C-7: Specific activity model estimate
C-8:
C-9: Specific activity model estimate

Table 1.2.3 Soil to reference organism concentration ratios for ^{36}**Cl**. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**Cl-1**
Lichen & bryophytes				**Cl-2**
Grasses				**Cl-3**
Grasses	**3.00E+01**	**1.9E+00**	**Low**	**Cl-4**
Shrub				**Cl-5**
Detritivores				**Cl-6**
Carnivorous mammals				**Cl-7**
Carnivorous mammals	**6.60E+00**	**4.3E-01**	**Low**	**Cl-8**
Herbivorous mammals				**Cl-9**
Herbivorous mammals	**6.30E+00**	**4.1E-01**	**Low**	**Cl-10**
Burrowing mammals				**Cl-11**
Bird egg				**Cl-12**

Cl-1:
Cl-2:
Cl-3:
Cl-4: FASTer best estimate prediction
Cl-5:
Cl-6:
Cl-7:
Cl-8: FASTer best estimate prediction
Cl-9:
Cl-10: FASTer best estimate prediction
Cl-11:
Cl-12:

Table 1.2.4 Soil to reference organism concentration ratios for ^{59}**Ni** and ^{63}**Ni** summarised from the available data. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1}: Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)	**7.17E-02**		**Low**	**Ni-1**	**32**
Lichen & bryophytes				**Ni-2**	
Grasses				**Ni-3**	
Grasses ^{59}Ni	**2.00E-01**	**3.1E-01**	**Low**	**Ni-4**	
Grasses ^{63}Ni	**2.00E-01**	**3.0E-01**		**Ni-4**	
Shrub				**Ni-5**	
Detritivores				**Ni-6**	
Carnivorous mammals				**Ni-7**	
Carnivorous mammals	**1.60E+00**	**2.4E+00**	**Low**	**Ni-8**	
Herbivorous mammals				**Ni-9**	
Herbivorous mammals	**2.30E-01**	**3.6E-01**	**Low**	**Ni-10**	
Burrowing mammals				**Ni-11**	
Bird egg				**Ni-12**	

Ni-1: Stable Ni data. Hendriks *et al.* (1995); Nelson *et al*. (1982); Pietz *et al*. (1984); Wei-chun (1982).
Ni-2:
Ni-3:
Ni-4: FASTer best estimate prediction
Ni-5:
Ni-6:
Ni-7:
Ni-8: FASTer best estimate prediction
Ni-9:
Ni-10: FASTer best estimate prediction
Ni-11:
Ni-12:

Table 1.2.5 Soil to reference organism concentration ratios for ^{90}**Sr** summarised from the available data; Best estimates as predicted by the FASTer model (shaded rows) at (i)equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)				**Sr-1**	
Lichen & bryophytes	**1.16E+01**		**Medium**	**Sr-2**	**356**
Grasses	**6.92E-01**		**Medium**	**Sr-3**	**327**
Grasses	**1.00E+00**	**3.5E-01**	**Low**	**Sr-4**	
Shrub	**1.08E+00**		**Low**	**Sr-5**	**78**
Detritivores				**Sr-6**	
Carnivorous mammals	**1.30E+00**		**Low**	**Sr-7**	**8**
Carnivorous mammals	**7.00E+00**	**2.5E+00**	**Low**	**Sr-8**	
Herbivorous mammals	**1.96E+00**		**Low**	**Sr-9**	**80**
Herbivorous mammals	**3.80E+00**	**1.3E+00**	**Low**	**Sr-10**	
Burrowing mammals				**Sr-11**	
Bird egg				**Sr-12**	

Sr-1:
Sr-2: Converted from Tag assuming a sampling depth of 10cm and soil bulk density of 1.4 g DM cm^{-3}. Miretsky *et al*. (1993); Regional Centre for Sanitary Inspection (RCSI; 1974-1998); Bakunov *et al*. (1998); Balanov (1999); Balanov (2000); Matishov *et al*. (1994).
Sr-3: Converted from Tag assuming a sampling depth of 10cm and soil bulk density of 1.4 g DM cm^{-3}. Balonov (1999); Balonov (2000); Miretsky *et al*. (1993); RCSI (1974-1998).
Sr-4: FASTer best estimate prediction
Sr-5: Balonov (1999); Balonov (2000); Miretsky *et al*. (1993); RCSI (1974-1998).
Sr-6:
Sr-7: Converted from Tag assuming a sampling depth of 10cm and soil bulk density of 1.4 g DM cm^{-3}. Gaschak *et al*. (2003).
Sr-8: FASTer best estimate prediction
Sr-9: Converted from Tag assuming a sampling depth of 10cm and soil bulk density of 1.4 g DM cm^{-3}. Does not include reindeer data. Bakunov *et al*. (1998); Balonov (1999); Balonov (2000); Lubashevsky *et al*. (1993); Miretsky *et al*. (1993); RCSI (1974-1998); Gaschak *et al*. (2003). If reindeer are included mean transfer is 5.18, n=445 (data from the same sources as without them)
Sr-10: FASTer best estimate prediction
Sr-11:
Sr-12:

Table 1.2.6 Soil to reference organism concentration ratios for **Nb**. Best estimates as predicted by the FASTer model (shaded rows) at (i)equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**Nb-1**
Lichen & bryophytes				**Nb-2**
Grasses				**Nb-3**
Grasses	**5.00E-03**	**1.9E-01**	**Low**	**Nb-4**
Shrub				**Nb-5**
Detritivores				**Nb-6**
Carnivorous mammals				**Nb-7**
Carnivorous mammals	**1.50E-07**	**5.7E-06**	**Low**	**Nb-8**
Herbivorous mammals				**Nb-9**
Herbivorous mammals	**2.60E-05**	**1.0E-03**	**Low**	**Nb-10**
Burrowing mammals				**Nb-11**
Bird egg				**Nb-12**

Nb-1:
Nb-2:
Nb-3:
Nb-4: FASTer best estimate prediction
Nb-5:
Nb-6:
Nb-7:
Nb-8: FASTer best estimate prediction
Nb-9:
Nb-10: FASTer best estimate prediction
Nb-11:
Nb-12:

Table 1.2.7 Soil to reference organism concentration ratios for ^{99}**Tc**. Best estimates as predicted by the FASTer model (shaded rows) at (i)equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**Tc-1**
Lichen & bryophytes				**Tc-2**
Grasses				**Tc-3**
Grasses	**8.00E+00**	**7.2E-01**	**Low**	**Tc-4**
Shrub				**Tc-5**
Detritivores				**Tc-6**
Carnivorous mammals				**Tc-7**
Carnivorous mammals	**1.00E-01**	**9.2E-03**	**Low**	**Tc-8**
Herbivorous mammals				**Tc-9**
Herbivorous mammals	**3.70E-01**	**3.3E-02**	**Low**	**Tc-10**
Burrowing mammals				**Tc-11**
Bird egg				**Tc-12**

Tc-1:
Tc-2:
Tc-3:
Tc-4: FASTer best estimate prediction
Tc-5:
Tc-6:
Tc-7:
Tc-8: FASTer best estimate prediction
Tc-9:
Tc-10: FASTer best estimate prediction
Tc-11:
Tc-12:

Table 1.2.8 Soil to reference organism concentration ratios for **^{103}Ru** and **^{106}Ru**. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^{2} y	Confidence	Comments
Soil Invertebrate (worm)				**Ru-1**
Lichen & bryophytes				**Ru-2**
Grasses				**Ru-3**
Grasses ^{103}Ru	**2.00E-02**	**2.0E-01**	**Low**	**Ru-4**
Grasses ^{106}Ru	**2.00E-02**	**2.6E-01**	**Low**	**Ru-4**
Shrub				**Ru-5**
Detritivores				**Ru-6**
Carnivorous mammals				**Ru-7**
Carnivorous mammals ^{103}Ru	**1.70E-03**	**1.7E-02**	**Low**	**Ru-8**
Carnivorous mammals ^{106}Ru	**1.20E-01**	**1.8E+00**	**Low**	**Ru-9**
Herbivorous mammals				**Ru-10**
Herbivorous mammals ^{103}Ru	**3.10E-03**	**3.0E-02**	**Low**	**Ru-11**
Herbivorous mammals ^{106}Ru	**2.30E-02**	**2.9E-01**	**Low**	**Ru-12**
Burrowing mammals				**Ru-13**
Bird egg				**Ru-14**

Ru-1:
Ru-2:
Ru-3:
Ru-4: FASTer best estimate prediction
Ru-5:
Ru-6:
Ru-7:
Ru-8: FASTer best estimate prediction
Ru-9: FASTer best estimate prediction
Ru-10:
Ru-11: FASTer best estimate prediction
Ru-12: FASTer best estimate prediction
Ru-13:
Ru-14:

Table 1.2.9 Soil to reference organism concentration ratios for ^{125}**I** and ^{131}**I**. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**I-1**
Lichen & bryophytes				**I-2**
Grasses				**I-3**
Grasses ^{129}I	**6.00E-01**	**3.8E-01**	**Low**	**I-4**
Grasses ^{131}I	**6.00E-01**	**9.5E-02**	**Low**	**I-4**
Shrub				**I-5**
Detritivores				**I-6**
Carnivorous mammals				**I-7**
Carnivorous mammals ^{129}I	**4.90E+00**	**3.1E+00**	**Low**	**I-8**
Carnivorous mammals ^{131}I	**4.10E-01**	**6.5E-02**	**Low**	**I-9**
Herbivorous mammals				**I-10**
Herbivorous mammals ^{129}I	**8.20E-01**	**5.2E-01**	**Low**	**I-11**
Herbivorous mammals ^{131}I	**2.50E-01**	**4.0E-02**	**Low**	**I-12**
Burrowing mammals				**I-13**
Bird egg				**I-14**

I-1:
I-2:
I-3:
I-4: FASTer best estimate prediction
I-5:
I-6:
I-7:
I-8: FASTer best estimate prediction
I-9: FASTer best estimate prediction
I-10:
I-11: FASTer best estimate prediction
I-12: FASTer best estimate prediction
I-13:
I-14:

Table 1.2.10 Soil to reference organism concentration ratios for ^{137}**Cs** summarised from the available data. . Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)	**5.66E-02**		**Low**	**Cs-1**	**12**
Lichen & bryophytes	**1.35E+01**		**Medium**	**Cs-2**	**388**
Grasses	**2.30E+00**		**Medium**	**Cs-3**	**542**
Grasses ^{135}Cs	**2.00E-01**	**3.1E-01**	**Low**	**Cs-4**	
Grasses ^{137}Cs	**2.00E-01**	**3.0E-01**	**Low**	**Cs-4**	
Shrub	**6.74E+00**		**Medium**	**Cs-5**	**637**
Detritivores	**8.49E-02**		**Low**	**Cs-6**	**6**
Carnivorous mammals	**4.96E+00**		**Low**	**Cs-7**	**12**
Carnivorous mammals	**1.30E+00**	**2.0E+00**	**Low**	**Cs-8**	
Herbivorous mammals	**1.84E+00**		**Medium**	**Cs-9**	**412**
Herbivorous mammals	**2.30E-01**		**Low**	**Cs-10**	
Herbivorous mammals ^{135}Cs	**2.30E-01**	**3.5E-01**	**Low**	**Cs-10**	
Herbivorous mammals ^{137}Cs	**2.30E-01**	**3.4E-01**	**Low**	**Cs-10**	
Burrowing mammals				**Cs-11**	
Bird egg	**6.40E-02**		**Low**	**Cs-12**	**-**

Cs-1: Copplestone *et al*. (1999); Janssen (1996a); Janssen (1996b)
Cs-2: Converted from Tag assuming a sampling depth of 10 cm and soil bulk density of 1.4 g DM cm^{-3}. Miretsky *et al*. (1993); Regional Centre for Sanitary Inspection (RCSI; 1974-1998); Bakunov *et al*. (1998); Balanov (1999); Balanov (2000); Matishov *et al*. (1994).
Cs-3: Converted from Tag assuming a sampling depth of 10 cm and soil bulk density of 1.4 g DM cm^{-3}. Howard *et al*. (2002); Albers *et al*. (2000); Anderson *et al*. (1992); Bunzl & Kracke (1984); Bunzl & Kracke (1986); Bunzl & Kracke (1989); Bunzl *et al*. (2000); Copplestone *et al*. (1999); Balanov (1999); Balanov (2000); Johanson (1994); Livens *et al*. (1991); Miretsky *et al*. (1993); Pálsson *et al*. (1994); Pietrzak-Flis *et al*. (1996); RCSI (1974-1998)
Cs-4: FASTer best estimate prediction
Cs-5: Balanov (1999, 2000); Miretsky *et al*. (1993); RCSI (1974-1998); Anderson *et al*. (1992); Howard *et al*. (2002); Bunzl & Kracke (1984); Bunzl & Kracke (1986); Johanson *et al*. (1994); Livens *et al*. (1991); Matishov *et al*. (1994); Pálsson *et al*. (1994)
Cs-6: Coppelstone *et al*. (1999); Toal *et al*. (2002a)
Cs-7: Converted from Tag assuming a sampling depth of 10 cm and soil bulk density of 1.4 g DM cm^{-3}. Gaschak *et al*. (2003);
Cs-8: FASTer best estimate prediction
Cs-9: Converted from Tag assuming a sampling depth of 10cm and soil bulk density of 1.4 g DM cm^{-3}. Does not include reindeer data. Balonov (1999); Balonov (2000); Miretsky *et al*. (1993); RCSI (1974-1998); Gaschak *et al*. (2003); Copplestone *et al*. (1999); Johanson & Bergstrom (1989); Johanson & Bergstrom (1994); Johanson *et al*. (1994); Nelin (1995); Rantavaara (1990); Rantavaara (pers. com.); Avila *et al*. (1999). If reindeer are included mean transfer is 12.6, n=1257 using the following extra sources of data: AMAP (1998); Bakunov *et al*. (1998).
Cs-10: FASTer best estimate prediction
Cs-11:

Cs-12: Estimated from comparison of transfer from soil - flesh of domestic hens and wild birds and transfer from diet to domestic hen eggs (IAEA 1994)

Table 1.2.11 Soil to reference organism concentration ratios for ^{210}**Po** summarised from the available data. All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil. Predictions from FASTer model are not available.

Reference Organism	Bq/kg organism : Bq/kg soil	Confidence	Comments	n
Soil Invertebrate (worm)			**Po-1**	
Lichen & bryophytes	**2.76E-01**	**Low**	**Po-2**	**5**
Grasses			**Po-3**	
Grasses			**Po-4**	
Shrub	**1.23E+00**	**Low**	**Po-5**	**4**
Detritivores			**Po-6**	
Carnivorous mammals	**1.68E+00**	**Low**	**Po-7**	**3**
Carnivorous mammals			**Po-8**	
Herbivorous mammals	**4.17E+00**	**Low**	**Po-9**	**42**
Herbivorous mammals			**Po-10**	
Burrowing mammals			**Po-11**	
Bird egg			**Po-12**	

Po-1:
Po-2: Regional Centre for Sanitary Inspection (RCSI; 1974-1998); Mahon & Mathews (1983)
Po-3:
Po-4:
Po-5: RCSI (1974-1998)
Po-6:
Po-7: Estimated from CR for soil : reindeer and transfer from reindeer to wolf muscle
Po-8:
Po-9:Reindeer data only. RCSI (1974-1998); Kauranen & Miettinen (1969); Troitskaya (1981)
Po-10:
Po-11:
Po-12:

Table 1.2.12 Soil to reference organism concentration ratios for ^{210}**Pb** summarised from the available data. All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil. Predictions from FASTer model are not available.

Reference Organism	Bq/kg organism : Bq/kg soil	Confidence	Comments	n
Soil Invertebrate (worm)	**1.29E-01**	**Low**	**Pb-1**	**89**
Lichen & bryophytes	**1.76E+01**	**Low**	**Pb-2**	**45**
Grasses			**Pb-3**	
Grasses			**Pb-4**	
Shrub	**1.74E+00**	**Low**	**Pb-5**	**28**
Detritivores			**Pb-6**	
Carnivorous mammals	**4.88E-01**	**Low**	**Pb-7**	**3**
Carnivorous mammals			**Pb-8**	
Herbivorous mammals	**4.11E+00**	**Low**	**Pb-9**	**53**
Herbivorous mammals			**Pb-10**	
Burrowing mammals	**7.56E-02**	**Low**	**Pb-11**	**17**
Bird egg			**Pb-12**	

Pb-1: Stable element data. Wei-Chun (1987); Diercxsens *et al*. (1985); Hendriks *et al*. (1995); Ireland (1979); Morgan & Morgan (1990); Morris & Morgan (1986); Nelson *et al*. (1982); Pietz *et al*. (1984); Spurgeon (1996); Wei-chun (1982)
Pb-2: Regional Centre for Sanitary Inspection (RCSI, 1974-1998); Balanov (1999); Balanov (2000); Holtzman (1966); Troitskaya (1981)
Pb-3:
Pb-4:
Pb-5: RCSI (1974-1998);. Bunzl & Kracke (1984)
Pb-6:
Pb-7: Estimated from CR for soil : reindeer and transfer from reindeer to wolf muscle
Pb-8:
Pb-9: Reindeer data only. Balonov (1999); Balonov (2000); Lubashevsky *et al.* (1993); RCSI (1974-1998); Kauranen & Miettinen (1969)
Pb10:
Pb-11: Stable element data. Wei-chun (1987); Read & Martin (1993)
Pb12:

Table 1.2.13 Soil to reference organism concentration ratios for ^{226}**Ra** summarised from the available data. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)	**8.14E-02**		**Low**	**Ra-1**	**4**
Lichen & bryophytes	**8.33E-01**		**Low**	**Ra-2**	**6**
Grasses				**Ra-3**	
Grasses	**8.00E-02**	**2.8E-01**	**Low**	**Ra-4**	
Shrub	**2.73E+00**		**Low**	**Ra-5**	**10**
Detritivores	**1.90E-01**		**Low**	**Ra-6**	**12**
Carnivorous mammals	**3.53E-02**		**Low**	**Ra-7**	**17**
Carnivorous mammals	**3.70E-01**	**1.3E+00**	**Low**	**Ra-8**	
Herbivorous mammals	**4.13E-02**		**Low**	**Ra-9**	**33**
Herbivorous mammals	**2.40E-01**	**8.5E-01**	**Low**	**Ra-10**	
Burrowing mammals	**6.01E-02**		**Low**	**Ra-11**	**34**
Bird egg				**Ra-12**	

Ra-1: Pokarzhevskii & Krivolutzkii (1997)
Ra-2: Verhovskaya (1972); Litver *et al*. (1976).
Ra-3:
Ra-4: FASTer best estimate prediction
Ra-5: Verhovskaya (1972)
Ra-6: Pokarzhevskii & Krivolutzkii (1997)
Ra-7: Pokarzhevskii & Krivolutzkii (1997) & Verhovskaya (1972)
Ra-8: FASTer best estimate prediction
Ra-9: Value quoted does not include reindeer. Pokarzhevskii & Krivolutzkii (1997); Verhovskaya (1972). If reindeer are included mean transfer is 4.77×10^{-2}, n=49 using the following extra sources of data: RCSI (1974-1998); Litver *et al*. (1976).
Ra-10: FASTer best estimate prediction
Ra-11: Pokarzhevskii & Krivolutzkii (1997); Verhovskaya (1972)
Ra-12:

Table 1.2.14 Soil to reference organism concentration ratios for ^{230}**Th** and ^{232}**Th** summarised from the available data. . Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)				**Th-1**	
Lichen & bryophytes	**2.67E-01**		**Low**	**Th-2**	**6**
Grasses				**Th-3**	
Grasses	**1.10E-02**	**2.7E-01**	**Low**	**Th-4**	
Shrub	**8.81E-02**		**Low**	**Th-5**	**10**
Detritivores				**Th-6**	
Carnivorous mammals	**5.52E-03**		**Low**	**Th-7**	**2**
Carnivorous mammals	**5.90E-07**	**1.4E-05**	**Low**	**Th-8**	
Herbivorous mammals	**7.74E-03**		**Low**	**Th-9**	**2**
Herbivorous mammals	**4.40E-05**	**1.1E-03**	**Low**	**Th-10**	
Burrowing mammals	**1.18E-02**		**Low**	**Th-11**	**4**
Bird egg				**Th-12**	

Th-1:
Th-2: Verhovskaya (1972); Litver *et al*. (1976).
Th-3:
Th-4: FASTer best estimate prediction
Th-5: Verhovskaya (1972)
Th-6:
Th-7: Verhovskaya (1972)
Th-8: FASTer best estimate prediction
Th-9: Verhovskaya (1972); Does not include reindeer data. If reindeer are included mean transfer is 6.39E-1, n=8 using the following extra sources of data: Litver *et al*. (1976).
Th-10: FASTer best estimate prediction
Th-11: Verhovskaya (1972)
Th-12:

Table 1.2.15 Soil to reference organism concentration ratios for **uranium** isotopes summarised from the available data. . Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)				**U-1**	
Lichen & bryophytes	**1.97E-01**		**Low**	**U-2**	**1**
Grasses				**U-3**	
Grasses	**2.30E-02**	**2.7E-01**	**Low**	**U-4**	
Shrub	**1.43E-01**		**Low**	**U-5**	**10**
Detritivores				**U-6**	
Carnivorous mammals	**7.09E-04**		**Low**	**U-7**	**1**
Carnivorous mammals	**6.60E-05**	**7.9E-04**	**Low**	**U-8**	
Herbivorous mammals	**1.80E-03**		**Low**	**U-9**	**3**
Herbivorous mammals	**5.50E-04**	**6.6E-03**	**Low**	**U-10**	
Burrowing mammals	**2.91E-03**		**Low**	**U-11**	**4**
Bird egg	**2.00E-03**		**Low**	**U-12**	**-**

U-1:
U-2: Verhovskaya (1972)
U-3:
U-4: FASTer best estimate prediction
U-5: Verhovskaya (1972)
U-6:
U-7: Verhovskaya (1972)
U-8: FASTer best estimate prediction
U-9: Verhovskaya (1972). Reindeer data only
U-10: FASTer best estimate prediction
U-11: Verhovskaya (1972)
U-12: Estimated from comparison of transfer from soil - flesh of domestic hens and wild birds and transfer from diet to domestic hen eggs (IAEA 1994)

Table 1.2.16 Soil to reference organism concentration ratios for ^{239,240}**Pu** isotopes summarised from the available data. . Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)				**Pu-1**	
Lichen & bryophytes				**Pu-2**	
Grasses				**Pu-3**	
Grasses	**4.00E-04**	**2.7E-01**	**Low**	**Pu-4**	
Shrub				**Pu-5**	
Detritivores	**2.16E-01**		**Low**	**Pu-6**	**4**
Carnivorous mammals				**Pu-7**	
Carnivorous mammals	**1.60E-07**	**1.1E-04**	**Low**	**Pu-8**	
Herbivorous mammals	**1.82E-03**		**Low**	**Pu-9**	**1**
Herbivorous mammals	**4.20E-06**	**2.9E-03**	**Low**	**Pu-10**	
Burrowing mammals				**Pu-11**	
Bird egg				**Pu-12**	

Pu-1:
Pu-2:
Pu-3:
Pu-4: FASTer best estimate prediction
Pu-5:
Pu-6: Copplestone *et al*. (1999)
Pu-7:
Pu-8: FASTer best estimate prediction
Pu-9: Converted from Tag assuming a sampling depth of 10 cm and soil bulk density of 1.4 g DM cm^{-3}. Copplestone *et al*. (1999).
Pu-10: FASTer best estimate prediction
Pu-11:
Pu-12:

Table 1.2.17 Soil to reference organism concentration ratios for ^{241}**Am** isotopes summarised from the available data. . Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activityconcentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments	n
Soil Invertebrate (worm)	**1.30E-01**		**Low**	**Am-1**	**2**
Lichen & bryophytes				**Am-2**	
Grasses				**Am-3**	
Grasses	**1.00E-03**	**2.7E-01**	**Low**	**Am-4**	
Shrub				**Am-5**	
Detritivores	**1.32E-01**		**Low**	**Am-6**	**4**
Carnivorous mammals				**Am-7**	
Carnivorous mammals	**4.00E-07**	**1.1E-04**	**Low**	**Am-8**	
Herbivorous mammals	**4.06E-03**		**Low**	**Am-9**	**1**
Herbivorous mammals	**1.10E-05**	**2.9E-03**	**Low**	**Am-10**	
Burrowing mammals				**Am-11**	
Bird egg				**Am-12**	

Am-1: Coppelstone *et al*. (1999)
Am-2:
Am-3:
Am-4: FASTer best estimate prediction
Am-5:
Am-6: Coppelstone *et al*. (1999)
Am-7:
Am-8: FASTer best estimate prediction
Am-9: Converted from Tag assuming a sampling depth of 10 cm and soil bulk density of 1.4 g DM cm^{-3}. Copplestone *et al*. (1999).
Am-10: FASTer best estimate prediction
Am-11:
Am-12:

Table 1.2.18 Soil to reference organism concentration ratios for ^{237}**Np**. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**Np-1**
Lichen & bryophytes				**Np-2**
Grasses				**Np-3**
Grasses	**7.00E-02**	**2.8E-01**	**Low**	**Np-4**
Shrub				**Np-5**
Detritivores				**Np-6**
Carnivorous mammals				**Np-7**
Carnivorous mammals	**9.30E-05**	**3.8E-04**	**Low**	**Np-8**
Herbivorous mammals				**Np-9**
Herbivorous mammals	**1.50E-03**	**6.0E-03**	**Low**	**Np-10**
Burrowing mammals				**Np-11**
Bird egg				**Np-12**

Np-1:
Np-2:
Np-3:
Np-4: FASTer best estimate prediction
Np-5:
Np-6:
Np-7:
Np-8: FASTer best estimate prediction
Np-9:
Np-10: FASTer best estimate prediction
Np-11:
Np-12:

Table 1.2.19 Soil to reference organism concentration ratios for ^{242}**Cm** and ^{244}**Cm**. Best estimates as predicted by the FASTer model (shaded rows) at (i) equilibrium (Bq kg^{-1} : Bq kg^{-1}) and (ii) predicted activity concentrations in selected reference organisms under conditions of constant chronic deposition are also presented; predictions for chronic deposition are made for year 50 after start of deposition and are normalised to the annual deposition rate (Bq kg^{-1} per Bq m^{-2} y^{-1}). All animal values presented on a fresh weight reference organism to dry weight soil basis. Plants are presented as dry weight reference organism to dry weight soil.

Reference Organism	Bq/kg organism : Bq/kg soil	Bq/kg^{-1} per Bq/m^2 y	Confidence	Comments
Soil Invertebrate (worm)				**Cm-1**
Lichen & bryophytes				**Cm-2**
Grasses				**Cm-3**
Grasses ^{242}Cm	**1.00E-03**	**2.5E-01**	**Low**	**Cm-4**
Grasses ^{244}Cm	**1.00E-03**	**2.7E-01**	**Low**	**Cm-4**
Shrub				**Cm-5**
Detritivores				**Cm-6**
Carnivorous mammals				**Cm-7**
Carnivorous mammals ^{242}Cm	**1.70E-08**	**4.4E-06**	**Low**	**Cm-8**
Carnivorous mammals ^{244}Cm	**1.40E-07**	**3.9E-05**	**Low**	**Cm-9**
Herbivorous mammals				**Cm-10**
Herbivorous mammals ^{242}Cm	**2.60E-06**	**6.6E-04**	**Low**	**Cm-11**
Herbivorous mammals ^{244}Cm	**6.40E-06**	**1.7E-03**	**Low**	**Cm-12**
Burrowing mammals				**Cm-13**
Bird egg				**Cm-14**

Cm-1:
Cm-2:
Cm-3:
Cm-4: FASTer best estimate prediction
Cm-5:
Cm-6:
Cm-7:
Cm-8: FASTer best estimate prediction
Cm-9: FASTer best estimate prediction
Cm-10:
Cm-11: FASTer best estimate prediction
Cm-12: FASTer best estimate prediction
Cm-13:
Cm-14:

1.3 Transfer Look-up tables for Agricultural ecosystems

Details concerning the derivation of transfer coefficients for agricultural ecosystems have been provided in the main report (Section 4.1.4). Soil concentrations are on a dry weight basis.

Table 1.3.1 ^{36}Cl – agricultural systems

Reference Organisms		**Bq/kg fresh per Bq/kg soil**	**Bq/kg per Bq/m^2 d**	**Confidence**	**Comments**
Soil associated plants	Roots	2,700E-01	7,612E+01	Medium	
Herbaceous layer	Leafy veget.	2,700E-01	7,589E+01	Medium	
	Fruit vegt.	2,700E-01	7,612E+01	Medium	
	Cereals	2,700E-01	7,617E+01	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	2,700E-01	7,617E+01	Medium	
Herbivorous mammals	Cow	3,672E-01	1,077E+02	Medium	
	Sheep	4,319E+00	1,160E+03	Medium	
	Pig				No CF

Table 1.3.2 ^{59}**Ni** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,385E-04	6,073E+00	Medium	
Herbaceous layer	Leafy veget.	5,385E-04	5,841E+00	Medium	
	Fruit vegt.	5,385E-04	6,073E+00	Medium	
	Cereals	5,385E-04	6,125E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	1,620E-02	1,019E+01	Low	
Herbivorous mammals	Cow	2,322E-02	3,676E+01	Medium	
	Sheep				No CF
	Pig				No CF

Table 1.3.3 ^{63}**Ni** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,192E-04	6,066E+00	Medium	
Herbaceous layer	Leafy veget.	5,192E-04	5,834E+00	Medium	
	Fruit vegt.	5,192E-04	6,066E+00	Medium	
	Cereals	5,192E-04	6,118E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	1,563E-02	1,004E+01	Low	
Herbivorous mammals	Cow	2,236E-02	3,648E+01	Medium	
	Sheep				No CF
	Pig				No CF

Table 1.3.4 ^{89}Sr – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	3,157E-04	4,710E+00	High	
Herbaceous layer	Leafy veget.	4,192E-04	4,651E+00	High	
	Fruit vegt.	4,192E-04	4,737E+00	High	
	Cereals	2,105E-04	4,696E+00	High	
Shrubs	Shrubs	1,052E-04	4,669E+00	High	
Trees	Fruit trees	1,795E-02	4,668E+00	High	
Herbivorous mammals	Cow	5,538E-04	2,392E+00	High	
	Sheep	2,491E-05	1,000E-01	High	
	Pig	1,365E-04	8,010E-01	High	

Table 1.3.5 ^{90}Sr – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,140E-02	8,889E+00	High	
Herbaceous layer	Leafy veget.	1,520E-02	9,646E+00	High	
	Fruit vegt.	1,520E-02	9,877E+00	High	
	Cereals	7,596E-03	7,952E+00	High	
Shrubs	Shrubs	3,796E-03	6,965E+00	High	
Trees	Fruit trees	3,796E-03	6,964E+00	High	
Herbivorous mammals	Cow	4,162E-02	1,693E+01	High	
	Sheep	9,115E-04	3,480E-01	High	
	Pig	1,165E-02	5,670E+00	High	

Table 1.3.6 ^{94}Nb – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	3,665E-07	4,206E+00	Medium	
Herbaceous layer	Leafy veget.	1,466E-06	4,151E+00	Medium	
	Fruit vegt.	3,665E-07	4,206E+00	Medium	
	Cereals	2,932E-06	4,214E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	3,665E-07	4,213E+00	Low	
Herbivorous mammals	Cow	5,350E-11	4,963E-05	Medium	
	Sheep				No CF
	Pig				No CF

Table 1.3.7 ^{99}Tc – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	2,700E-01	7,612E+00	Medium	
Herbaceous layer	Leafy veget.	2,700E-01	7,589E+00	Medium	
	Fruit vegt.	2,700E-01	7,612E+00	Medium	
	Cereals	2,700E-01	7,617E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	2,700E-01	7,617E+00	Medium	
Herbivorous mammals	Cow	5,073E-02	1,381E+01	Medium	
	Sheep	4,319E-01	1,160E+02	Medium	
	Pig	5,938E-01	1,618E+02	Medium	

Table 1.3.8 ^{106}Ru – agricultural systems

Reference Organism		**Bq/kg fresh per Bq/kg soil**	**Bq/kg per Bq/m^2 d**	**Confidence**	**Comments**
Soil associated plants	Roots	7,842E-05	5,737E+00	Medium	
Herbaceous layer	Leafy veget.	7,842E-05	5,535E+00	Medium	
	Fruit vegt.	7,842E-05	5,737E+00	Medium	
	Cereals	7,842E-05	5,780E+00	Medium	
Shrubs	Shrubs	7,842E-05	5,781E+00	Medium	
Trees	Fruit trees	7,842E-05	5,780E+00	Medium	
Herbivorous mammals	Cow	9,962E-04	2,638E+01	Medium	
	Sheep	2,505E-05	3,700E-01	Medium	
	Pig	2,186E-04	1,605E+01	Medium	

Table 1.3.9 ^{129}**I** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-03	7,337E+00	High	
Herbaceous layer	Leafy veget.	5,396E-03	7,105E+00	High	
	Fruit vegt.	5,396E-03	7,337E+00	High	
	Cereals	5,396E-03	7,388E+00	High	
Shrubs	Shrubs	5,396E-03	7,389E+00	High	
Trees	Fruit trees	5,396E-03	7,388E+00	High	
Herbivorous mammals	Cow	1,836E-02	3,549E+01	High	
	Sheep	4,319E-03	2,987E+00	High	
	Pig	1,977E-03	4,278E+00	High	

Table 1.3.10 ^{131}**I** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,574E-05	2,024E+00	High	
Herbaceous layer	Leafy veget.	1,574E-05	2,024E+00	High	
	Fruit vegt.	1,574E-05	2,024E+00	High	
	Cereals	1,574E-05	2,024E+00	High	
Shrubs	Shrubs	1,574E-05	2,025E+00	High	
Trees	Fruit trees	1,574E-05	2,024E+00	High	
Herbivorous mammals	Cow	4,331E-05	2,748E+00	High	
	Sheep	1,155E-05	7,310E-01	High	
	Pig	3,973E-06	2,520E-01	High	

Table 1.3.11 ^{134}**Cs** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,363E-04	5,861E+00	High	
Herbaceous layer	Leafy veget.	2,726E-04	5,679E+00	High	
	Fruit vegt.	2,726E-04	5,896E+00	High	
	Cereals	2,726E-04	5,943E+00	High	
Shrubs	Shrubs	2,726E-04	5,944E+00	High	
Trees	Fruit trees	2,726E-04	5,943E+00	High	
Herbivorous mammals	Cow	7,058E-03	3,018E+01	High	
	Sheep	5,446E-03	1,983E+01	High	
	Pig	1,069E-03	1,011E+01	High	

Table 1.3.12 ^{135}**Cs** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	4,192E-04	6,043E+00	High	
Herbaceous layer	Leafy veget.	8,423E-04	5,921E+00	High	
	Fruit vegt.	8,423E-04	6,153E+00	High	
	Cereals	8,423E-04	6,204E+00	High	
Shrubs	Shrubs	8,423E-04	6,205E+00	High	
Trees	Fruit trees	8,423E-04	6,204E+00	High	
Herbivorous mammals	Cow	2,325E-02	3,677E+01	High	
	Sheep	1,691E-02	2,304E+01	High	
	Pig	3,558E-03	1,174E+01	High	

Table 1.3.13 ^{137}**Cs** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	3,812E-04	6,024E+03	High	
Herbaceous layer	Leafy veget.	7,615E-04	5,893E+00	High	
	Fruit vegt.	7,615E-04	6,124E+00	High	
	Cereals	7,615E-04	6,175E+00	High	
Shrubs	Shrubs	7,615E-04	6,175E+00	High	
Trees	Fruit trees	7,615E-04	6,175E+00	High	
Herbivorous mammals	Cow	2,087E-02	3,598E+01	High	
	Sheep	1,524E-02	2,259E+01	High	
	Pig	3,192E-03	1,158E+01	High	

Table 1.3.14 ^{210}**Po** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,858E-06	5,388E+00	Medium	
Herbaceous layer	Leafy veget.	5,858E-06	5,226E+00	Medium	
	Fruit vegt.	5,858E-06	5,388E+00	Medium	
	Cereals	5,858E-06	5,419E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	5,858E-06	5,419E+00	Medium	
Herbivorous mammals	Cow	5,523E-06	4,380E-01	Medium	
	Sheep	4,662E-06	3,910E-01	Medium	
	Pig				No CF

Table 1.3.15 ^{210}Pb – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	4,615E-04	6,043E+00	Medium	
Herbaceous layer	Leafy veget.	4,615E-04	5,813E+00	Medium	
	Fruit vegt.	4,615E-04	6,043E+00	Medium	
	Cereals	4,615E-04	6,095E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	9,269E-04	6,215E+00	Medium	
Herbivorous mammals	Cow	4,527E-05	4,380E-01	Medium	
	Sheep	7,423E-05	3,910E-01	Medium	
	Pig				No CF

Table 1.3.16 ^{226}**Ra** – agricultural systems

Reference Organism		**Bq/kg fresh per Bq/kg soil**	**Bq/kg per Bq/m^2 d**	**Confidence**	**Comments**
Soil associated plants	Roots	5,385E-06	5,947E+00	Medium	
Herbaceous layer	Leafy veget.	5,385E-04	5,841E+00	Medium	
	Fruit vegt.	5,385E-04	6,073E+00	Medium	
	Cereals	5,385E-06	5,998E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	2,154E-03	6,545E+00	Medium	
Herbivorous mammals	Cow	1,023E-03	3,338E+00	Medium	
	Sheep	4,308E-05	1,970E-01	Medium	
	Pig				No CF

Table 1.3.17 ^{227}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,923E-07	3,319E+00	Medium	
Herbaceous layer	Leafy veget.	1,923E-07	3,302E+00	Medium	
	Fruit vegt.	1,923E-07	3,319E+00	Medium	
	Cereals	1,923E-07	3,320E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	3,846E-07	3,320E+00	Medium	
Herbivorous mammals	Cow	2,206E-09	9,839E-02	Medium	
	Sheep	2,965E-09	2,371E-02	Medium	
	Pig				No CF

Table 1.3.18 ^{228}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	7,554E-06	5,824E+00	Medium	
Herbaceous layer	Leafy veget.	7,554E-06	5,608E+00	Medium	
	Fruit vegt.	7,554E-06	5,824E+00	Medium	
	Cereals	7,554E-06	5,889E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	1,511E-05	5,873E+00	Medium	
Herbivorous mammals	Cow	1,155E-06	5,688E-02	Medium	
	Sheep	1,208E-07	3,685E-02	Medium	
	Pig				No CF

Table 1.3.19 ^{230}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	2,699E-05	5,940E+00	Medium	
Herbaceous layer	Leafy veget.	2,699E-05	5,708E+00	Medium	
	Fruit vegt.	2,699E-05	5,940E+00	Medium	
	Cereals	2,699E-05	5,992E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	5,396E-05	5,999E+00	Medium	
Herbivorous mammals	Cow	4,481E-06	6,261E-02	Medium	
	Sheep	4,319E-07	3,740E-02	Medium	
	Pig				No CF

Table 1.3.20 ^{231}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,892E-09	2,220E-01	Medium	
Herbaceous layer	Leafy veget.	5,892E-09	2,220E-01	Medium	
	Fruit vegt.	5,892E-09	2,220E-01	Medium	
	Cereals	5,892E-09	2,220E-01	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	1,178E-08	2,220E-01	Medium	
Herbivorous mammals	Cow	1,840E-11	3,466E-04	Medium	
	Sheep	4,904E-11	9,242E-04	Medium	
	Pig				No CF

Table 1.3.21 ^{232}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	2,700E-05	5,940E+00	Medium	
Herbaceous layer	Leafy veget.	2,700E-05	5,708E+00	Medium	
	Fruit vegt.	2,700E-05	5,940E+00	Medium	
	Cereals	2,700E-05	5,992E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	5,396E-05	5,999E+00	Medium	
Herbivorous mammals	Cow	4,481E-06	6,261E-02	Medium	
	Sheep	4,319E-07	3,740E-02	Medium	
	Pig				No CF

Table 1.3.22 ^{234}Th – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	2,505E-07	3,701E+00	Medium	
Herbaceous layer	Leafy veget.	2,505E-07	3,671E+00	Medium	
	Fruit vegt.	2,505E-07	3,701E+00	Medium	
	Cereals	2,505E-07	3,704E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	5,008E-07	3,704E+00	Medium	
Herbivorous mammals	Cow	1,476E-09	1,202E-02	Medium	
	Sheep	3,892E-09	2,608E-02	Medium	
	Pig				No CF

Table 1.3.23 ^{234}**U** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-05	5,947E+00	Medium	
Herbaceous layer	Leafy veget.	5,396E-05	5,715E+00	Medium	
	Fruit vegt.	5,396E-05	5,947E+00	Medium	
	Cereals	5,396E-05	5,999E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	4,385E-03	6,125E+00	Medium	
Herbivorous mammals	Cow	2,689E-04	1,913E+00	Medium	
	Sheep	1,728E-06	7,502E-02	Medium	
	Pig	8,346E-05	2,310E+00	Medium	

Table 1.3.24 ^{235}**U** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-05	5,947E+00	Medium	
Herbaceous layer	Leafy veget.	5,396E-05	5,715E+00	Medium	
	Fruit vegt.	5,396E-05	5,947E+00	Medium	
	Cereals	5,396E-05	5,999E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	4,385E-03	6,125E+00	Medium	
Herbivorous mammals	Cow	2,689E-04	1,913E+00	Medium	
	Sheep	1,728E-06	7,502E-02	Medium	
	Pig	8,346E-05	2,310E+00	Medium	

Table 1.3.25 ^{238}**U** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-05	5,947E+00	Medium	
Herbaceous layer	Leafy veget.	5,396E-05	5,715E+00	Medium	
	Fruit vegt.	5,396E-05	5,947E+00	Medium	
	Cereals	5,396E-05	5,999E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	4,385E-03	6,125E+00	Medium	
Herbivorous mammals	Cow	2,689E-04	1,913E+00	Medium	
	Sheep	1,728E-06	7,502E-02	Medium	
	Pig	8,346E-05	2,310E+00	Medium	

Table 1.3.26 ^{238}**Pu** – agricultural systems

Reference Organism		Bq/kg fresh perBq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,188E-06	5,932E+00	Medium	
Herbaceous layer	Leafy veget.	5,188E-06	5,700E+00	Medium	
	Fruit vegt.	5,188E-06	5,932E+00	Medium	
	Cereals	5,188E-06	5,983E+00	Medium	
Shrubs	Shrubs	5,188E-06	5,983E+00	Medium	No soil-plant Tf
Trees	Fruit trees	5,188E-06	5,983E+00	Medium	
Herbivorous mammals	Cow	2,499E-05	1,290E-01	Medium	
	Sheep	6,642E-08	1,492E-02	Medium	
	Pig	1,581E-07	3,152E-03	Medium	

Table 1.3.27 ^{239}**Pu** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-06	5,934E+00	Medium	
Herbaceous layer	Leafy veget.	5,396E-06	5,702E+00	Medium	
	Fruit vegt.	5,396E-06	5,934E+00	Medium	
	Cereals	5,396E-06	5,986E+00	Medium	
Shrubs	Shrubs	5,396E-06	5,986E+00		No soil-plant Tf
Trees	Fruit trees	5,396E-06	5,986E+00	Medium	
Herbivorous mammals	Cow	2,604E-05	1,290E-01	Medium	
	Sheep	6,908E-08	1,493E-02	Medium	
	Pig	1,647E-07	3,161E-03	Medium	

Table 1.3.28 ^{240}**Pu** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-06	5,934E+00	Medium	
Herbaceous layer	Leafy veget.	5,396E-06	5,702E+00	Medium	
	Fruit vegt.	5,396E-06	5,934E+00	Medium	
	Cereals	5,396E-06	5,986E+00	Medium	
Shrubs	Shrubs	5,396E-06	5,986E+00		No soil-plant Tf
Trees	Fruit trees	5,396E-06	5,986E+00	Medium	
Herbivorous mammals	Cow	2,603E-05	1,290E-01	Medium	
	Sheep	6,904E-08	1,493E-02	Medium	
	Pig	1,725E-07	3,163E-03	Medium	

Table 1.3.29 ^{241}**Pu** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	4,692E-06	5,925E+00	Medium	
Herbaceous layer	Leafy veget.	4,692E-06	5,694E+00	Medium	
	Fruit vegt.	4,692E-06	5,925E+00	Medium	
	Cereals	4,692E-06	5,976E+00	Medium	
Shrubs	Shrubs	4,692E-06	5,976E+00	Medium	No soil-plant Tf
Trees	Fruit trees	4,692E-06	5,976E+00	Medium	
Herbivorous mammals	Cow	2,249E-05	1,270E-01	Medium	
	Sheep	6,008E-08	1,491E-02	Medium	
	Pig	1,423E-07	3,130E-03	Medium	

Table 1.3.30 ^{241}Am – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	4,285E-06	5,933E+00	Medium	
Herbaceous layer	Leafy veget.	2,678E-06	5,701E+00	Medium	
	Fruit vegt.	2,678E-06	5,933E+00	Medium	
	Cereals	2,678E-06	5,985E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	1,071E-04	6,012E+00	Medium	
Herbivorous mammals	Cow	4,604E-06	6,262E-02	Medium	
	Sheep	3,428E-07	1,500E-02	Medium	
	Pig	5,954E-08	5,815E+00	Medium	

Table 1.3.31 ^{237}**Np** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	5,396E-05	5,947E+00	Medium	
Herbaceous layer	Leafy veget.	1,080E-04	5,729E+00	Medium	
	Fruit vegt.	1,080E-04	5,961E+00	Medium	
	Cereals	1,080E-04	6,013E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	2,158E-03	6,546E+00	Medium	
Herbivorous mammals	Cow	2,481E-03	6,790E+00	Medium	
	Sheep	3,455E-06	1,581E-02	Medium	
	Pig				No CF

Table 1.3.32 ^{242}**Cm** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,039E-07	5,464E+00	Medium	
Herbaceous layer	Leafy veget.	1,732E-07	5,293E+00	Medium	
	Fruit vegt.	1,732E-07	5,464E+00	Medium	
	Cereals	6,927E-08	5,498E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	3,464E-06	5,498E+00	Medium	
Herbivorous mammals	Cow	4,192E-08	8,617E-03	Medium	
	Sheep	2,207E-08	1,410E-02	Medium	
	Pig				No CF

Table 1.3.33 ^{243}**Cm** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,438E-06	5,925E+00	Medium	
Herbaceous layer	Leafy veget.	2,396E-06	5,695E+00	Medium	
	Fruit vegt.	2,396E-06	5,926E+00	Medium	
	Cereals	9,585E-07	5,977E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	4,792E-05	5,989E+00	Medium	
Herbivorous mammals	Cow	8,196E-07	1,243E-02	Medium	
	Sheep	3,067E-07	1,498E-02	Medium	
	Pig				No CF

Table 1.3.34 ^{244}**Cm** – agricultural systems

Reference Organism		Bq/kg fresh per Bq/kg soil	Bq/kg per Bq/m^2 d	Confidence	Comments
Soil associated plants	Roots	1,345E-06	5,921E+00	Medium	
Herbaceous layer	Leafy veget.	2,242E-06	5,691E+00	Medium	
	Fruit vegt.	2,242E-06	5,921E+00	Medium	
	Cereals	8,969E-07	5,972E+00	Medium	
Shrubs	Shrubs				No soil-plant Tf
Trees	Fruit trees	4,485E-05	5,983E+00	Medium	
Herbivorous mammals	Cow	7,646E-07	1,237E-02	Medium	
	Sheep	2,870E-07	1,496E-02	Medium	
	Pig				No CF

1.4 Transfer Look-up tables for freshwater ecosystems

Details concerning the derivation of concentration factors for freshwater ecosystems have been provided in the main report (Section 4.1.6).

The confidence of the concentration factors was estimated as defined in the main report; Section 4.1. It should be noted that for freshwaters, a confidence level of *Low*, was also attributed to look-up table values derived from non-European waters in some cases.

In the ‘comments’ column there is an additional explanation given, for instance, if the value is presented as dry weight basis, different from the default which is fresh weight basis. If the concentration factor is given for a special tissue or organ of an organism and not for the whole organism, which is the default, this is also mentioned in the ‘comments’ column of the look-up tables. (Tables 1.4.1–1.4.9). The references from which CF data were derived are provided under Section 3.3.

Table 1.4.1 Freshwater concentration factors of ^{36}**Cl** for two organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Crustacean	50	Medium	Cl-1
Macrophytes	400 (500)	Medium	Cl-2

Cl-1**:** From Coughtrey *et al.* (1983)
Cl-2: From Chapman *et al*. (1968).

Table 1.4.2. Freshwater concentration factors of **^{90}Sr** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Fish, pelagic	25	Medium	Sr-1
Macrophytes	150 (130)	Medium	Sr-2
Mollusc	300	Medium	Sr-3
Phytoplankton	40	Medium	Sr-4
Zooplankton	60	Medium	Sr-4

Sr-1: The value pertains to pike muscle. From Saxén *et al*. (1996).
Sr-2: The value is for whole plant. From Vanderploeg *et al*., (1975).
Sr-3 The value is for soft tissues. From Vanderploeg *et al*., (1975).
Sr-4: From Chester & Garten (1982).

Table 1.4.3 Freshwater concentration factors of **iodine** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Amphibian	130	Medium	I-1
Bivalve mollusc	12 (16)	Medium	I-2
Bivalve mollusc	17 (23)	Medium	I-3
Crustacean	2.4 (2.9)	Medium	I-4
Crustacean	200 (270)	Medium	I-5
Fish	40	Medium	I-6
Insect larvae	400	Medium	I-7
Insect	400 (300)	Medium	I-8
Macrophytes	200 (160)	Medium	I-9
Mollusc	50	Medium	I-10
Mollusc	400	Medium	I-11
Phytoplankton	700 (600)	Medium	I-12
Zooplankton	3000 (4000)	Medium	I-13

I-1: Mean value of 17 aquatic species, including tadpoles. From Vanderploeg *et al*. (1975)
I-2: Estimated from water only---(dry), muscle. From Coughtrey *et al.* (1983).
I-3: Estimated from water only---(dry), shell. From Coughtrey *et al.* (1983).
I-4: Estimated from water only---(dry), muscle. From Coughtrey *et al.* (1983).
I-5: Estimated from water only---(dry), carapace. From Vanderploeg *et al*. (1975); Coughtrey *et al.* (1983).
I-6: From IAEA (2001).
I-7: Whole larvae. From From Vanderploeg *et al*. (1975)
I-8: From Vanderploeg *et al*. (1975)
I-9: I-125, I-129, I-131 studies, mean of several species (dry). From Chester & Garten (1982); Vanderploeg *et al*. (1975); Chapman *et al*. (1968); Miller (1984); Thompson *et al*. (1968); Coughtrey *et al.* (1983); Jørgensen *et al*. (1991).
I-10: Soft tissues. From Vanderploeg *et al*. (1975)
I-11: Shell. From Vanderploeg *et al*. (1975)
I-12 Stable Iodine and I-129, dry. From Vanderploeg *et al*. (1975); Coughtrey *et al.* (1983).
I-13: Dry. From Coughtrey *et al.* (1983).

Table 1.4.4 Freshwater concentration factors of **^{137}Cs** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Birds	3000	Medium	Cs-1
Fish, pelagic	10200 (10300)	Medium	Cs-2
Fish, pelagic	4900 (5200)	Medium	Cs-3
Fish, benthic	12200 (7200)	Medium	Cs-4
Insect	330 (240)	Medium	Cs-5
Macrophytes	1000 (700)	Medium	Cs-6
Mollusc	100	Medium	Cs-7
Mollusc	1000	Medium	Cs-8
Plankton	3400 (1800)	Medium	Cs-9

Cs-1: From Vanderploeg *et al*. (1975).
Cs-2: Perch, muscle. From IAEA (2000); Saxén & Koskelainen (2001); Saxén & Koskelainen (1992); Smith *et al*. (2000).
Cs-3: Perch, bones. From IAEA (2000);
Cs-4: Burbot, muscle. From Saxén & Koskelainen (1992);
Cs-5: Dry weight, stonefly. From IAEA (2000)
Cs-6: From Chester & Garten (1982); Vanderploeg *et al*. (1975).
Cs-7: Shell. From Vanderploeg *et al*. (1975).
Cs-8: Soft tissues. From Vanderploeg *et al*. (1975).
Cs-9: Dry weight. From IAEA (2000).

Table 1.4.5 Freshwater Concentration factors of ^{210}**Po** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
	Mean (SD)		
Bivalve mollusc	3100 (3200)	Low	Po-1
Bivalve mollusc	73200 (24100)	Low	Po-2
Crustacean	8900 (4500)	Medium	Po-3
Crustacean	10900 (4500)	Medium	Po-4
Gastropod mollusc	2600 (3500)	Low	Po-5
Gastropod mollusc	40500 (20500)	Low	Po-6
Macrophytes	1400 (900)	Medium	Po-7
Macrophytes	14600 (10400)	Low	Po-8
Macrophytes	3600 (1400)	Low	Po-9
Plankton	27300 (6600)	Low	Po-10

Po-1: Shell. From Hameed *et al*. (1997a).
Po-2: Soft tissues. From Hameed *et al*. (1997a).
Po-3: Exoskeleton. From Hameed *et al*. (1997a).
Po-4: Muscle. From Hameed *et al*. (1997a).
Po-5: Shell. From Hameed *et al*. (1997a).
Po-6: Soft tissues. From Hameed *et al*. (1997a).
Po-7: Generic. From Chapman *et al*. (1968).
Po-8: Rot. From Hameed *et al*. (1997a).
Po-9: Soot. From Hameed *et al*. (1997a).
Po-10: Mixed. From Shaheed *et al*., (1997a); Shaheed *et al*., (1997b).

Table 1.4.6 Freshwater Concentration factors of ^{226}**Ra** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	Bq/kg fresh per Bq/l Mean (SD)	Confidence	Comments
Birds	0.08 (0.06)	Medium	Ra-1
Bivalve mollusc	2700	Low	Ra-2
Bivalve mollusc	330	Low	Ra-3
Crustacean	750	Medium	Ra-4
Crustacean	2400	Low	Ra-5
Crustacean	150	Low	Ra-6
Fish, pelagic	10	Low	Ra-7
Gastropod	1600	Low	Ra-8
Gastropod	280	Low	Ra-9
Macrophytes	2000 (2600)	Medium	Ra-10
Macrophytes	890 (900)	Low	Ra-11
Macrophytes	100	Low	Ra-12
Macrophytes	70 (80)	Low	Ra-13
Mammals	0.02 (0.03)	Low	Ra-14
Phytoplankton	1100 (920)	Low	Ra-15

Ra-1: From Montalbano *et al.* (1983).
Ra-2: Shell. From Hameed *et al*. (1997b).
Ra-3: Soft tissues. From Hameed *et al*. (1997b).
Ra-4: From Hesslein & Slavicek (1984).
Ra-5: Exoskeleton. From Hameed *et al*. (1997b).
Ra-6: Muscle. From Hameed *et al*. (1997b).
Ra-7: Roach. From Rissanen (1982).
Ra-8: Shell. From Hameed *et al*. (1997b).
Ra-9: Soft tissues. From Hameed *et al*. (1997b); Chester & Garen (1982); Hesslein & Slavicek (1984); Petterson *et al*. (1993); Waite *et al.* (1988).
Ra-10: From Chapman et al. (1968); Miller (1984); Thompson et al. (1968); Poston & Klopfer (1986);
Ra-11: Roots. From Hameed *et al*. (1997b); Waite et al. (1988); Kalin & Sharma (1982);
Ra-12: Shoot. From Hameed *et al*. (1997b).
Ra-13: Stem. From Hameed *et al*. (1997b).
Ra-14: Vole. From Cloutier *et al*. (1985).
Ra-15: From Chester & Garen (1982); Hameed *et al*. (1997b).

Table 1.4.7 Freshwater Concentration factors of ^{230}**Th** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Fish, pelagic	50 (40)	Medium	Th-1
Macrophytes	1200 (2000)	Medium	Th-2
Macrophytes	670	Medium	Th-3

Th-1: Muscle or edible parts. From IAEA (1994); Waite *et al*. (1988); Thompson *et al.* (1968); Poston (1982); IAEA (2001);
Th-2: Various species. From Petterson *et al.* (1993); Waite *et al.* (1988); Chapman *et al*. (1968); Miller (1984); Thompson *et al*. (1968).
Th-3: Stem or root. From Waite *et al.* (1988);

Table 1.4.8 Freshwater Concentration factors of **U** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Fish, pelagic	200 (750)	Medium	U-1
Macrophytes	2800 (6800)	Medium	U-2
Macrophytes	3500 (12000)	Medium	U-3
Macrophytes	2500 (3500)	Medium	U-4
Phytoplankton	120 (50)	Medium	U-5
Zooplankton	50 (30)	Medium	U-5

U-1: Muscle or edible parts. From IAEA (1994); Chester & Garten (1982); Waite *et al*. (1988).
U-2: Various species. From Chester & Garten (1982); Petterson *et al*. (1993); Waite *et al*. (1988); Thompson *et al.* (1968); Miller (1984); Chapman *et al.* (1968).
U-3: Root. From Waite *et al*. (1988);
U-4: Stem. From Waite *et al*. (1988);
U-5: From Chester & Garten (1982);

Table 1.4.9 Freshwater Concentration factors of ^{239,240}**Pu** for various organism groups. Mean values, standard deviations (SD) and confidence levels have been estimated as described in the text.

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
	Mean (SD)		
Fish, pelagic	17 (7)	Medium	Pu-1
Macrophytes	2900 (3500)	Medium	Pu-2
Phytoplankton	8000 (10400)	Medium	Pu-2
Zooplankton	390 (380)	Medium	Pu-2

Pu-1: From Chester & Garten (1982).
Pu-2: From Poston & Klopfer (1986).

Additional notes :

The recommended CF values are based on the references listed at the end of Appendix 1, Section 3.3.

1.5 Transfer Look-up tables for marine ecosystems

In the process of constructing look-up tables, presenting transfer and uptake data for marine reference organisms, it was deemed appropriate to present data on equilibrium concentration factors. Although the application of such quotients may have a number of limitations as discussed in the main report (Section 3.2.3), the scope, detail and robustness of information required to parameterise, for example, fully dynamic-biokinetic models was not sufficient to allow any alternative approach to be taken at the present time (however desirable).

The recommended data have been derived specifically for European marine environments (see Appendix 2, Section 7), whenever possible, although in many cases the values for temperate world-ocean have been employed for lack of regional data. The latter information is extracted from IAEA (in press), in recognition that many of those conducting an assessment may choose to refer to an internationally-sanctioned data-base. Where differences between the data collated in the review conducted within FASSET and the IAEA recommended values were not great, the IAEA values were normally used. Supplementary data are also provided for body-parts/organs within organisms, where sufficient information was available. In a number of instances, empirical data pertaining to whole body CFs were not available. In such cases, a combination of empirical concentration factors and biokinetic models were used as described in Appendix 2, Section 8. The data included in the subsequent look-up tables, therefore, are intended to provide a substantial supplement to the more generic values provided in IAEA (IAEA, in press). **Values presented in italicized, bold text are those given in the updated IAEA Techdoc 247 (IAEA, in press). Grey boxes are intended for reference only.**

In the process of deriving CF values, field and laboratory data have often been combined although the application of data derived under experimentally controlled conditions to "impact assessment" field conditions may be an issue for contention. It is recognized that laboratory data may provide a true indication of CF if the experiment is performed within a closed system and carried through to equilibrium whereas field derived CFs may often reflect a "snap-shot" where abiotic (water) and biological compartments have not equilibrated.

Unless otherwise stated the values provided in the tables relate to the whole body CF for the organism. The IAEA note (IAEA, in press) that where reliable information exists for element/organism combinations, in almost every case, the maximum and minimum values observed in the population fall within one order of magnitude of the recommended values. The Agency therefore advises that, except where noted, it can be assumed that CFs vary by one order of magnitude around the recommended value. In view of the compatibility of the FASSET marine transfer tables with the IAEA values, a similar approach is approved here.

Table 1.5.1 H - Concentration factors for marine systems

There is evidence that the steady-state concentration of tritium in biological tissues approaches, but does not exceed the concentrations in ambient water (Whicker & Schultz, 1982). For this reason the default CF for tritium is normally taken as unity for all marine biota types. This is indeed the approach adopted by the IAEA (IAEA, in press)

However, there is also some evidence that organically-bound tritium may account for cases in which the Tritium/Hydrogen ratio in biota slightly exceeds the ratio in ambient water (Whicker & Schultz,1982). The fact that higher than expected activity concentrations in marine biota have been observed in environments in which a significant proportion of environmental tritium is present in an organically-bound form, e.g. Cardiff Bay area in the UK, exemplifies the limitations in applying a default unit CF.

For lack of more detailed information on the biological uptake of OBT in marine organisms, a default concentration factor of 1 is taken for H in all cases. These concentration factors may be suitably applicable where ^{3}H is present as tritiated water or water-exchangeable ^{3}H.

Table 1.5.2 **C** Concentration factors* (l/kg) for marine systems

Reference organism	**Bq/kg fresh per Bq/l**	**Confidence**	**Comments**
Bacteria	n/a	n/a	C-1
Phytoplankton	***9 000***	***Medium***	***C-2***
Macroalgae	***10 000***	***Medium***	***C-3***
Vascular plant	10 000	Low	C-4
Zooplankton	***20 000***	***Medium***	***C-5***
(Bivalve) mollusc	***20 000***	***Medium***	***C-6***
Polychaete worm	20 000	Low	C-7
Crustacean	***20 000***	***Medium***	***C-8***
Fish	***20 000***	***Medium***	***C-9***
Benthic fish	***20 000***	***Medium***	***C-10***
Pelagic fish	***20 000***	***Medium***	***C-11***
Wading bird	50 000	Low	C-12
Mammal	50 000	Low	C-13

n/a = Not applicable.

*The IAEA (IAEA, in press) provide specific comments in relation to the derivation of carbon CFs in the accompanying notes to their tabulated recommended values. It is noted that for most elements, CFs are derived by dividing the body concentration of the element (or radioisotope) by the total concentration of the element (or radioisotope) in filtered sweater. If this was carried out for C, the denominator would include dissolved, CO_2, $(CO_3)^{2-}$ HCO_3^- disssolved organic carbon etc. For the purpose of consistency, all values relate to the organic carbon content of seawater.

C-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented by the activity concentration in the surrounding medium.
C-2: Value from IAEA (in press).
C-3: Value from IAEA (in press).
C-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
C-5: Value from IAEA (in press).
C-6 : Value from IAEA (in press).
C-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
C-8: Value from IAEA (in press).
C-9: Value from IAEA (in press).
C-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
C-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
C-12: This is a rough estimate based on the derivation of information from humans. The carbon content of the body of man is 16 kg (ICRP, 1975). Dividing by the mass of reference man (70 kg), this yields a C concentration of 228.5 g/kg. This value is 2.39 x the C concentration used for fish. Multiplying this value by the CF reported for fish in IAEA (in press) yields a CF of 5×10^4. The application of human data to seabirds is open to question.
C-13: This is a rough estimate based on the derivation of information from humans (see C-12). In view of physiological similarities between mammals the derived CF value might be more appropriately applied to seals than to seabirds.

Table 1.5.3 **Cl** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Cl-1
Phytoplankton	***1***	***Medium***	***Cl-2***
Macroalgae	***0.05***	***Medium***	***Cl-3***
Vascular plant	0.05	Low	Cl-4
Zooplankton	***1***	***Medium***	***Cl-5***
Bivalve mollusc	***0.05***	***Medium***	***Cl-6***
Polychaete worm	0.05	Low	Cl-7
Crustacean	***0.06***	***Medium***	***Cl-8***
Fish	***0.06***	***Medium***	***Cl-9***
Benthic fish	0.06	Medium	Cl-10
Pelagic fish	0.06	Medium	Cl-11
Wading bird	0.06	Low	Cl-12
Mammal	0.01	Low	Cl-13

Cl-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Cl-2: Value from IAEA (in press).
Cl-3: Value from IAEA (in press). The IAEA notes that this was based on a very limited stable element dataset for brown algae.
Cl-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Cl-5: Value from IAEA (in press).
Cl-6: Value from IAEA (in press).
Cl-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Cl-8: Value from IAEA (in press).
Cl-9: Value from IAEA (in press).
Cl-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Cl-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Cl-12: Based on the output from a biokinetic model (Appendix 2, Section 8). An allometric relationship was used to derive the elimination rate parameter within the model.
Cl-13: Based on the output from a biokinetic model (Appendix 2, Section 8). An allometric relationship was used to derive the elimination rate parameter within the model.

Table 1.5.4 **Ni** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Ni-1
Phytoplankton	***3000***	***Medium***	***Ni-2***
Macroalgae	***2000***	***High***	***Ni-3***
Vascular plant	2 000	Low	Ni-4
Zooplankton	***1000***	***Medium***	***Ni-5***
(Bivalve) mollusc	***2000***	***Medium***	***Ni-6***
Polychaete worm	2000	Low	Ni-7
Crustacean	***1000***	***Medium***	***Ni-8***
Fish	***1000***	***Medium***	***Ni-9***
Benthic fish	***1000***	***Medium***	***Ni-10***
Pelagic fish	***1000***	***Medium***	***Ni-11***
Wading bird	17 500	Low	Ni-12
Mammal	400*	Low	Ni-13

n/a = Not applicable.
* Concentration ratio.

Ni-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Ni-2: Value from IAEA (in press). This value was derived from stable element data.
Ni-3: Value from IAEA (in press). This value was derived from stable element data for red, green and brown algae and was compatible with other cited data on radionuclide CFs from European marine environments.
Ni-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Ni-5: Value from IAEA (in press).
Ni-6: Value from IAEA (in press). This value was derived from stable element data.
Ni-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Ni-8: Value from IAEA (in press). The IAEA notes that concentrations of Ni in crustaceans vary considerably. A stable element concentration was used in the calculations.
Ni-9: Value from IAEA (in press). The IAEA notes that the range of data was considerable. It was also noted that although flesh concentrations were likely to be lower than the values used to calculate CF, allowance was made for whole fish consumption. In other words the reported CF pertains to fish whole body.
Ni-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Ni-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Ni-12: This is a concentration ratio based on the output from a biokinetic model (Appendix2, Section 8). This value was derived for a simulation period of 10 years when the system was still not under equilibrium. A period of > 25 years is required for the system to truly equilibrate.The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Ni-13: This is a concentration ratio based on the output from a biokinetic model (Appendix2, Section 8). This value was derived for a simulation period of 10 years when the system was still not under equilibrium. A period of > 25 years is required for the system to truly equilibrate.

Table 1.5.5 **Sr** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Sr-1
Phytoplankton	***1***	***Medium***	***Sr-2***
Macroalgae	***10***	***Medium***	***Sr-3***
Macroalgae	180	Medium	Sr-4
Vascular plant	180	Low	Sr-5
Zooplankton	***2***	***Medium***	***Sr-6***
(Bivalve) mollusc	***10***	***Medium***	***Sr-7***
Polychaete worm	10	Low	Sr-8
Crustacean	***5***	***Medium***	***Sr-9***
Crustacean	25	Medium	Sr-10
Fish	***3***	***Medium***	***Sr-11***
Benthic fish	17	Medium	Sr-12
Pelagic fish	17	Medium	Sr-13
Wading bird	940	Low	Sr-14
Mammal	1	Medium	Sr-15
Mammal	320	Low	Sr-16

n/a = Not applicable

Sr-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al.*, 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Sr-2: Value from IAEA (in press).
Sr-3: Value from IAEA (in press).
Sr-4: This value corresponds to ^{90}Sr brown macroalgae sampled from the Kara and Barents Sea areas (Fisher *et al.*, 1999).
Sr-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Sr-6: Value from IAEA (in press). This value in turn was derived from stable Sr concentrations in planktonic crustaceans.
Sr-7: Value from IAEA (in press).
Sr-8: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Sr-9: Value from IAEA (in press). The IAEA qualify this value by stating that few data are available on Sr concentrations for the edible parts of crustacean and therefore a typical body concentration has been assumed.
Sr-10: This value pertains to shrimp sampled in the Barents Sea in 1999 (Brown & Iosjpe, 2001).
Sr-11: Value from IAEA (in press). This is a whole body Sr content
Sr-12: This is a mean value derived from 3 published values for fish whole bodies: CF = 3 from (in press), 4 from (Fisher *et al*., 1999) and 43 from Franic & Lokobauer (1993).
Sr-13: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species although variations for different species in the same environment probably occur.
Sr-14: Based on the output of a biokinetic model (Appendix 2, Section 8)
Sr-15: A CF range of 0.4 to 1.2 for seal muscle by reported in Fisher *et al.* (1999) based on 2 samples. This provides a mean of 0.8. In environmental impact assessments, the whole body concentration of the radionuclide is of overriding concern, therefore a higher CF, accounting for the influence of the relatively higher activity concentrations of ^{90}Sr associated with bone, may be more appropriate.
Sr-16: Based on the output of a biokinetic model (Appendix 2, Section 8)

Table 1.5.6 **Nb** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Nb-1
Phytoplankton	***1000***	***Medium***	***Nb-2***
Macroalgae	***3000***	***Low***	***Nb-3***
Vascular plant	3 000	Medium	Nb-4
Zooplankton	***20 000***	***Low***	***Nb-5***
(Bivalve) mollusc	***1000***	***Medium***	***Nb-6***
Polychaete worm	1000	Low	Nb-7
Crustacean	***200***	***Medium***	***Nb-8***
Fish	***30***	***Low***	***Nb-9***
Benthic fish	***30***	***Low***	***Nb-10***
Pelagic fish	***30***	***Low***	***Nb-11***
Wading bird	100	Low	Nb-12
Mammal	0.1	Low	Nb-13

n/a = Not applicable.

Nb-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Nb-2: Value from IAEA (in press).
Nb-3: Value from IAEA (in press). The IAEA notes that there were insufficient data to distinguish between the accumulation of ^{95}Zr and ^{95}Nb. A suggestion was therefore made to use Zr data.
Nb-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Nb-5: Value from IAEA (in press). The CF value has been assumed to be the same as that for Zr.
Nb-6: Value from IAEA (in press). Stable element data for blue mussels, *Mytilus edulis* suggest a CF value of no greater than 40. However, experimental studies cited by the IAEA suggest much higher CFs hence the recommended value.
Nb-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Nb-8: Value from IAEA (in press). The IAEA note that no new data were available and that in situ ^{95}Nb and ^{95}Zr CF values were typically in the order of 100.
Nb-9: Value from IAEA (in press). The IAEA notes that Stable element data were not used because they were not compatible with observed radioactivity data. Instead, a Zr CF was multiplied by 1.5 in order to account for the fact that some enhancement of ^{95}Nb over ^{95}Zr has been observed in biological materials.
Nb-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Nb-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Nb-12: Based on the output from a biokinetic model (Appendix 2, Section 8). The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Nb-13: Based on the output from a biokinetic model (Appendix 2, Section 8). In view of the fact that the CF for fish, the value for which has been used in the parametrisation of the model, is defined as a “rough estimate”, the CF value for sea mammal is also considered to be a rough estimate.

Table 1.5.7 **Tc** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Tc-1
Phytoplankton	***4***	***Medium***	***Tc-2***
Macroalgae	***30 000***	***High***	***Tc-3***
Macrolalgae	26 000	High	Tc-4
Vascular plant	26 000	Low	Tc-5
Zooplankton	***100***	***Medium***	***Tc-6***
Zooplankton	400	Medium	Tc-7
(Bivalve) mollusc	***500***	***Medium***	***Tc-8***
Polychaete worm	500	Low	Tc-9
Crustacean	***1000***	***Medium***	***Tc-10***
Crustacean • Muscle • Hepatopancreas • Green gland • Gills	 2500 5000 65000 1400	 Medium Medium Medium Medium	 Tc-11 Tc-12 Tc-12 Tc-12
Fish	***80***	***Medium***	***Tc-13***
Benthic fish	45	Medium	Tc-14
Pelagic fish	45	Medium	Tc-15
Wading bird	870	Low	Tc-16
Mammal	20	Low	Tc-17

n/a = Not applicable

Tc-1: No CF data for bacteria have been derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Tc-2: Based on IAEA (in press)
Tc-3: Based on IAEA (in press)
Tc-4: Based on a mean value for brown seaweeds for 4 European marine areas (Hurtgen *et al*., 1988; Masson *et al*., 1995; Brown *et al*., 1999).
Tc-5: This is an estimate. No data have been collated and thus the value for macroalgae has been selected.
Tc-6: Based on IAEA (in press). In the notes on this IAEA inform us that this is based on the experimental data of Fowler *et al*. (1981). The reported CF value if 1 x 10^1 has been increased by a factor of 10 for reasons unspecified.
Tc-7: An average CF value has been derived from the data of Brown *et al*. (1999) for shrimp, *Pandalus borealis*.
Tc -8: Based on IAEA (in press). The recommended value was derived using data in Brown *et al*. (1999) and IPSN (1999).
Tc-9: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Tc-10: Based on IAEA (in press). The IAEA inform that these data are based on the field observations of Brown *et al*. (1999) and Swift and Kershaw (1999).
Tc-11: CF data for lobster muscle from 2 European sea areas (Norwegian coastal and Irish Sea). The value is based on a mean of data reported in Busby *et al*. (1997), Brown *et al.* (1999) and Smith *et al.* (2001).
Tc-12: CF data for organs within lobster based on the data reported in Busby *et al*. (1997) for the Irish Sea.
Tc-13: Based on IAEA (in press) derived from data from the English Channel (IPSN, 1999).
Tc-14: Based on data from 2 European marine areas (English Channel and Irish Sea-Irish coastal) i.e. mean of 2 averages from data reported by IPSN, 1999 and Smith *et al.* (2001).
Tc-15: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species although variations for different species in the same environment probably occur.
Tc-16: Based on the output of a biokinetic model (Appendix 2, Section 8)

Tc-17: Based on the average of 2 biokinetic model outputs (See Appendix 2, Section 8).

Table 1.5.8 **Ru** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Ru-1
Phytoplankton	***20 000***	***Medium***	***Ru-2***
Macroalgae	***2000***	***Medium***	***Ru-3***
Macroalgae	400	Medium	Ru-4
Vascular plant	400	Low	Ru-5
Zooplankton	***30 000***	***Medium***	***Ru-6***
(Bivalve) mollusc	***500***	***Medium***	***Ru-7***
Polychaete worm	500	Low	Ru-8
Crustacean	***100***	***Medium***	***Ru-9***
Fish	***2***	***Medium***	***Ru-10***
Benthic fish	***2***	***Medium***	***Ru-11***
Pelagic fish	***2***	***Medium***	***Ru-12***
Wading bird	920	Low	Ru-13
Mammal	0.2	Low	Ru-14

n/a = Not applicable.

Ru-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Ru-2: Value from IAEA (in press).
Ru-3: Value from IAEA (in press). These values pertain to red and green algae that are known to accumulate greater concentrations of Ru than brown algae.
Ru-4: This value has been derived for brown seaweeds from Holm *et al*. (1994) for the Mediterranean Sea and uptake at 11^0C from experimental studies performed by Boisson *et al*. (1997).
Ru-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Ru-6: Value from IAEA (in press).
Ru-7: Value from IAEA (in press).
Ru-8: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Ru-9: Value from IAEA (in press).
Ru-10: Value from IAEA (in press). The IAEA notes that the CF values for ^{106}Ru to fish muscle express a range of 0.1-1. The recommended value relates to whole body.
Ru-11: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Ru-12: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Ru-13: Based on the output from a biokinetic model (Appendix 2, Section 8). The value was derived for Ru-106 allowing for physical decay. The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Ru-14: Based on the output from a biokinetic model (Appendix 2, Section 8). The value was derived for Ru-106 allowing for physical decay.

Table 1.5.9 I Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	I-1
Phytoplankton	***800***	***Medium***	***I-2***
Macroalgae	***10 000***	***Medium***	***I-3***
Macroalgae	400	Medium	I-4
Vascular plant	400	Low	I-5
Zooplankton	***3000***	***Medium***	***I-6***
(Bivalve) mollusc	***10***	***Medium***	***I-7***
Bivalve mollusc	100	Medium	I-8
Polychaete worm	100	Low	I-9
Crustacean	***3***	***Medium***	***I-10***
Fish	***9***	***Medium***	***I-11***
Benthic fish	9	Medium	I-12
Pelagic fish	9	Medium	I-13
Wading bird	880	Low	I-14
Mammal	8	Low	I-15

I-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
I-2: Value from IAEA (in press). The recommended value was derived using stable element data.
I-3: Value from IAEA (in press).
I-4: Data for brown seaweed reported in Holm *et al.* (1994). It should be noted that Holm *et al*. (1994) reported large variations in ^{131}I concentrations between red (mean = 48 800), green (CF = 921) and brown seaweed (CF = 418). This may account for the discrepancy observed with the IAEA recommended value which presumably pertains to all 3 seaweed groups.
I-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
I-6: Value from IAEA (in press).
I-7: Value from IAEA (in press) derived using stable element data.
I-8: This value pertains to a CF for *Mytilus edulis* from the Mediterranean as reported by Whitehead *et al.* (1998). Experimental studies (Shunhua *et al*., 1997) have shown that the internal heterogeneity in I-131 activity concentrations can be high for molluscs.
I-9: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (ingestion of benthic particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
I-10: Value from IAEA (in press). The IAEA notes that there are few recent I CF data for crustaceans and little to support or refute the concentration of 1 mg/kg (d.w.) used in the derivation of the recommended value.
I-11: Value from IAEA (in press).
I-12: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
I-13: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
I-14: Based on the output from a biokinetic model (Appendix 2, Section 8). An allometric relationship was used to derive the elimination rate parameter within the model.
I-15: Based on the output from a biokinetic model (Appendix 2, Section 8). An allometric relationship was used to derive the elimination rate parameter within the model.

Table 1.5.10 Cs Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Cs-1
Phytoplankton	***20***	***Medium***	***Cs-2***
Macroalgae	***50***	***Medium***	***Cs-3***
Macroalgae	75	Medium	Cs-4
Vascular plant	75	Low	Cs-5
Zooplankton	***40***	***Medium***	***Cs-6***
(Bivalve) Mollusc	***60***	***Medium***	***Cs-7***
Polychaete worm	40	Low	Cs-8
Crustacean	***50***	***Medium***	***Cs-9***
Fish	***100***	***Medium***	***Cs- 10***
Benthic fish	90	Medium	Cs-11
Pelagic fish	90	Medium	Cs-12
Wading bird	400	Medium	Cs-13
Wading bird	540	Low	Cs-14
Mammal - pinnipeds	***400***	***Medium***	***Cs-15***
Mammal	40	Medium	Cs-16
Mammal	190	Low	Cs-17

n/a = Not applicable

Cs-1: No CF data for bacteria have been derived. It has been argued, and demonstrably shown (Pröhl *et al.*, 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Cs-2: Based on IAEA (1985) and IAEA (in press). These values in turn are based on 2 references Styron *et al*. (1976) and Heldal *et al*. (2001).
Cs-3: IAEA (1985). This value was derived from Irish Sea monitoring data. CF values were observed to vary considerably from species to species – the value reflect CFs for green (mean CF =60), red (mean CF = 26) and brown seaweeds (mean CF = 34).
Cs-4: This value is based on mean of values cited in 2 publications (Holm *et al*, 1994) and Fisher *et al.* (1999) for brown macroalgae. Brown macroalgae has been selected as the reference type in this case owing to the fact that it exhibits the highest uptake. Brown seaweeds are more common in northern marine environments and are often sampled in monitoring work although they are normally not consumed by humans.
Cs-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Cs-6: Based on IAEA (in press) where a value has been derived based on several publications including data for microzooplankton and euphausiids.
Cs-7: Based on IAEA (in press) where a value has been derived from data from Arctic waters (Fisher *et al*., 1999) and data from the English Channel.
Cs-8: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Cs-9: Based on IAEA (in press) where data have been extracted from Fisher *et al*. (1999).
Cs-10: Based on IAEA (in press).
Cs-11: Based on the mean ^{137}Cs concentrations in fish (flesh and whole body) from 5 European marine areas (Steele, 1990; Sazykina, 1998; Fisher *et al*., 1999; Berrow *et al*., 1998; Franic & Lokobauer, 1993; Osvath *et al*., 1990).
Cs-12: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species although variations for different species in the same environment are known to occur (see IAEA, in press)
Cs-13: Based on the value of 414 ± 352 for seabird muscle given in Fisher *et al*. (1999) for northern sea areas. The equilibrium CF for a wading bird might be quite different to this value which also included many open ocean seabirds (e.g *Larus spp*.).

Cs-14: Based on the output of a biokinetic model (Appendix 2, Section 8)
Cs-15: Based on IAEA (in press) for pinnipeds
Cs-16: Based on the data given in Fisher *et al.* (1999) where a range of 13-70 was given for seal muscle from northern sea areas.
Cs-17: Based on the average of 2 biokinetic model outputs (See Appendix 2, Section 8).

Table 1.5.11 **Po** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Po-1
Phytoplankton	***70 000***	***Medium***	***Po-2***
Phytoplankton	4 900	Medium	Po-3
Macroalgae	***1000***	***Medium***	***Po-4***
Vascular plant	1000	Low	Po-5
Zooplankton	***30 000***	***Medium***	***Po-6***
Zooplankton	36 500	Medium	Po-7
(Bivalve) mollusc	***20 000***	***Medium***	***Po-8***
Mollusc (whole) • Digestive glands • Pallial complex • Muscle	14 000 29 000 9 700 1 700	Medium	Po-9 Po-10 Po-10 Po-10
Polychaete worm	16 000	Medium	Po-11
Crustacean	***20 000***	***Medium***	***Po-12***
Crustacean • Hepatopancreas • Gill • Muscle	30 000 377 000 19 000 8 000	Medium	Po-13 Po-13 Po-13 Po-13
Fish	***2 000***	***Medium***	***Po-14***
Benthic fish	6 000	Medium	Po-15
Pelagic fish • Liver • Gonad • Bone • Muscle	 300 000 60 000 30 000 6 000	 Medium Medium Medium Medium	 Po-16 Po-16 Po-16 Po-16
Wading bird	39 000	Low	Po-17
Mammal	760	Low	Po-18

n/a = Not applicable.

Po-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al.*, 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Po-2: Value from IAEA (in press).
Po-3: The reported value is derived from the work of Skwarzec & Bojanowski (1988). The value has not been adopted as a recommended value because the study pertained to the Baltic Sea. It is uncertain whether values for this brackish environment are representative of true marine environments.
Po-4: Value from IAEA (in press). No new information has been collated on the uptake of Po by macroalgae following IAEA-TECDOC-211 (IAEA, 1978). However, it should be noted that information for European marine environments has been published by McDonald *et al*. (1992) and that the mean value derived from this study coincide exactly with the figure recommended by the IAEA.
Po-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Po-6: Value from IAEA (in press).
Po-7: This is a mean value derived from natural compositions of zooplankton in 2 European marine environments (Skwarzec & Bojanowski, 1988; Carvalho, 1988). The fact that (i) the value does not differ dramatically from the IAEA recommended value and (ii) some data pertain to the brackish Baltic Sea has resulted in the adoption of the IAEA value.
Po-8: Value from IAEA (in press).
Po-9: These data have been derived for whole gastropod molluscs for UK coastal environments (McDonald *et al*., 1992). A mean value of 13723 can be derived from this study.

Po-10: Based on data from McDonald *et al.* (1993) for the Irish Sea
Po-11: These data are for whole annelids sampled in the Baltic Sea (Skwarzec & Falkowski, 1988).
Po-12: Value from IAEA (in press).
Po-13: These data are for isopods sampled from the Baltic Sea (Skwarzec & Falkowski, 1988). The applicability of brackish water data to marine environments may be questionable and therefore these data have not been selected in place of the IAEA recommended value.
Po-14: Value from IAEA (in press).
Po-15: Derived from the data of Carvalho (1988) pertaining to epipelagic fish muscle from the North-east Atlantic. It is assumed that benthic and pelagic fish exhibit similar CF values.
Po-16: Data from Carvalho (1988) for epipelagic fish from the North-east Atlantic.
Po-17: Based on the output from a biokinetic model (Appendix 2, Section 8). A single compartmental model for retention of Po in man has been used.
Po-18: Based on the output from a biokinetic model (Appendix 2, Section 8). A single compartmental model for retention of Po in man has been used. The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.

Table 1.5.12 **Pb** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Pb-1
Phytoplankton	***10 000***	***Medium***	***Pb-2***
Macroalgae	***1000***	***Low***	***Pb-3***
Macroalgae	180	Medium	Pb-4
Vascular plant	180	Low	Pb-5
Zooplankton	***1000***	***Medium***	***Pb-6***
(Bivalve) mollusc	***50 000***	***Medium***	***Pb-7***
Bivalve mollusc	1500	Medium	Pb-8
Polychaete worm	1500	Low	Pb-9
Crustacean	***90 000***	***Medium***	***Pb-10***
Crustacean	680	Medium	Pb-11
Fish	***200***	***Medium***	***Pb-12***
Benthic fish	***200***	***Medium***	***Pb-13***
Pelagic fish	***200***	***Medium***	***Pb-14***
Wading bird	3900	Low	Pb-15
Mammal	3000	Medium	Pb-16
Mammal	25	Low	Pb-17

n/a = Not applicable.

Pb-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Pb-2: Value from IAEA (in press).
Pb-3: The IAEA report (in press) that no new information has been collated on the uptake of Pb by macroalgae following IAEA-TECDOC-211 (IAEA, 1978).
Pb-4: Based on the data of McDonald *et al*. (1992). Data pertain to ^{210}Pb in macrolagae collected in UK coastal waters. A range of 10-440 was reported for these samples. A mean of 183 can be derived from this study.
Pb-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Pb-6 : Value from IAEA (in press).
Pb-7: Value from IAEA (in press). The value is derived from stable Pb determinations.
Pb-8: Based on data from McDonald *et al*. (1992). Reported (field) ^{210}Pb CF values for UK coastal waters ranged from 30-7360 with a mean of 1508 for bivalve mollusc.
Pb-9: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Pb-10: Value from IAEA (in press).
Pb-11: This value is based on laboratory-based experimental data for ^{210}Pb in shrimp reported by Fernando & Fowler (1993). The value has not been adopted for use owing to uncertainty over its application to field conditions.
Pb-12: Value from IAEA (in press).
Pb-13: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Pb-14: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Pb-15: Based on the output from a biokinetic model (Appendix 2, Section 8). The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Pb-16: Value from IAEA (in press) for pinniped muscle.
Pb-17: Based on the output from a biokinetic model (Appendix 2, Section 8). It should be noted that the derived CF was found to be crucially dependent on the selected food source. If crustaceans, as oppose to fish, were selected as the sole dietary intake, a CF of 10 000 was derived.

Table 1.5.13 **Ra** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Ra-1
Phytoplankton	***2000***	***Medium***	***Ra-2***
Macroalgae	***100***	***Low***	***Ra-3***
Vascular plant	100	Low	Ra-4
Zooplankton	***100***	***Medium***	***Ra-5***
(Bivalve) mollusc	***100***	***Low***	***Ra-6***
Polychaete worm	100	Low	Ra-7
Crustacean	***100***	***Low***	***Ra-8***
Fish	***100***	***Medium***	***Ra-9***
Benthic fish	***100***	***Medium***	***Ra-10***
Pelagic fish	***100***	***Medium***	***Ra-11***
Wading bird	520	Low	Ra-12
Mammal	25	Low	Ra-13

n/a = Not applicable.

Ra-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Ra-2: Value from IAEA (in press).
Ra-3: The IAEA report (in press) that no new information has been collated on the uptake of Ra to macroalgae following IAEA-TECDOC-211 (IAEA, 1978).
Ra-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Ra-5: Value from IAEA (in press).
Ra-6: The IAEA state (in press) that this value was derived from information which did not include CFs for lamellibranch or gastropod molluscs. The application of this CF value to bivalve molluscs must therefore be viewed with caution.
Ra-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Ra-8: The IAEA report (in press) that no new information has been collated on the uptake of Ra to crustaceans following IAEA-TECDOC-211 (IAEA, 1978).
Ra-9: Value from IAEA (in press).
Ra-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Ra-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Ra-12: Based on the output of a biokinetic model (Appendix 2, Section 8). The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Ra-13: Based on the output of a biokinetic model (Appendix 2, Section 8).

Table 1.5.14 **Th** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Th-1
Phytoplankton	***40 000***	***Medium***	***Th-2***
Macroalgae	***200***	***Medium***	***Th-3***
Vascular plant	200	Low	Th-4
Zooplankton	***10 000***	***Medium***	***Th-5***
(Bivalve) Mollusc	***1000***	***Medium***	***Th-6***
Polychaete worm	1000	Low	Th-7
Crustacean	***1000***	***Medium***	***Th-8***
Fish	***600***	***Medium***	***Th-9***
Benthic fish	***600***	***Medium***	***Th-10***
Pelagic fish	***600***	***Medium***	***Th-11***
Wading bird	65	Low	Th-12
Mammal	6*	Low	Th-13

n/a = Not applicable
* Concentration ratio.

Th-1. No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Th-2: Value from IAEA (in press)
Th-3: Value from IAEA (in press)
Th-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Th-5: Value from IAEA (in press)
Th-6: Value from IAEA (in press). The derivation of this value is somewhat unclear as the technical report provides only the information that "no CF data for lamellibranch or gastropods molluscs were located".
Th-7: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Th-8: Value from IAEA (in press). It should be noted that additional data pertaining to Th CFs for crustaceans were not found to supplement a value first derived in the 1970s (IAEA, 1978).
Th-9: Value from IAEA (in press).
Th-10: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Th-11: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Th-12: Based on the output of a biokinetic model (Appendix 2, Section 8)
Th-13: Based on the average of 2 biokinetic model outputs (See Appendix 2, Section 8). In the case of both models (model using allometrically derived excretion rate and multi-compartmental excretion model), the concentration ratio at 10 y, as oppose to the (equilibrium) CF, was used in the derivation of this value.

Table 1.5.15 U Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	U-1
Phytoplankton	***20***	***Medium***	***U-2***
Macroalgae	***100***	***Medium***	***U-3***
Macroalgae	50	Medium	U-4
Vascular plant	50	Low	U-5
Zooplankton	***30***	***Medium***	***U-6***
Mollusc	***30***	***Medium***	***U-7***
Bivalve mollusc	20	Medium	U-8
Polychaete worm	20	Low	U-9
Crustacean	10	Medium	U-10
Fish	***1***	***Medium***	***U-11***
(Benthic) fish	***1***	***Medium***	***U-12***
(Pelagic) fish	***1***	***Medium***	***U-13***
Wading bird	3	Low	U-14
Mammal	0.05*	Low	U-15

n/a = Not applicable
* Concentration ratio.

U-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
U-2: Value from IAEA (in press).
U-3: Value from IAEA (in press). IAEA have considered a number of references in the derivation of this value. Nonetheless, it is stipulated that this value may well be too high.
U-4: This is a mean value derived for 3 European marine areas taken from McDonald *et al.* (1992).
U-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
U-6: Value from IAEA (in press).
U-7: Value from IAEA (in press). Value is for Lamellibranch or bivalve molluscs
U-8: Data from McDonald *et al*. (1992) for coastal regions of the UK.
U-9: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
U-10 Value from IAEA (in press). It should be noted that additional data pertaining to U CFs for crustaceans were not found to supplement a value first derived in the 1970s (IAEA, 1978).
U-11: Value from IAEA (in press). This value in turn is based on values cited in Pentreath (1977) where a CF of 0.1 was derived – the value was increased to 1 to allow for the ingestion, by humans, of some bone.
U-12: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
U-13: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species although variations for different species in the same environment probably occur.
U-14: Based on the output of a biokinetic model (Appendix 2, Section 8).
U-15: Based on the average of 2 biokinetic model outputs (See Appendix 2, Section 8). In the case of the multi-compartmental excretion model, the concentration ratio at 10 y, as oppose to the (equilibrium) CF, was used in the derivation of this value.

Table 1.5.16 **Pu** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	*n/a*	*n/a*	*Pu-1*
Phytoplankton	***20 000***	***Medium***	***Pu-2***
Macroalgae	***4 000***	***Medium***	***Pu-3***
Macroalgae	4 650	High	Pu-4
Vascular plant	4 650	Low	Pu-5
Zooplankton	***4 000***	***Medium***	***Pu-6***
Mollusc	***3000***	***Medium***	***Pu-7***
Bivalve mollusc (whole) • Byssal threads • Viscera • Soft tissue	1 230 29500 4 800 1 400	Medium Medium Medium Medium	Pu-8 Pu-9 Pu-10 Pu-11
Polychaete worm	1 230	Low	Pu-12
Crustacean	***200***	***Medium***	***Pu-13***
Fish	***100***	***Medium***	***Pu-14***
Benthic fish	***100***	***Medium***	***Pu-15***
Pelagic fish	***100***	***Medium***	***Pu-16***
Wading bird	540	Low	Pu-17
Mammal	5*	Low	Pu-18
Mammal	***8***	***Medium***	***Pu-19***

n/a = Not applicable
* Concentration ratio.

Pu-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Pu-2: Value from IAEA (in press).
Pu-3: Value from IAEA (in press).
Pu-4: Value pertains to brown macroalgae and is based on 4 references (Fisher et al., 1999; Germain *et al*., 2000; Holm *et al*., 1991 and Holm *et al.* 1994) covering 3 European marine waters.
Pu-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Pu-6: Value from IAEA (in press).
Pu-7: Value from IAEA (in press).
Pu-8: Based on a mean value derived from values in McDonald *et al.* (1992) and McDonald *et al.* (1993).
Pu-9: Data from McDonald *et al.* (1993).
Pu-10: Data from McDonald *et al.* (1993).
Pu-11: Data from McDonald *et al.* (1993).
Pu-12: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Pu-13: Value from IAEA (in press).
Pu-14: Value from IAEA (in press).
Pu-15: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Pu-16: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Pu-17: Based on the output of a biokinetic model (Appendix 2, Section 8). It should be noted that this value is only obtained after an equilibration period of approximately 10 years. Shorter contaminant contact times will lead to concomitantly lower concentration ratios.
Pu-18: This is a Concentration ratio based on the output of 2 biokinetic models (Appendix 2, Section 8). This value was derived for a simulation period of 10 years at which time the system had not reached equilibrium. A period of several hundred years is required for the system to truly equilibrate.
Pu-19: Value from IAEA (in press) for the liver of pinnipeds.

Table 1.5.17 **Am** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Am-1
Phytoplankton	***20 000***	***Medium***	***Am-2***
Macroalgae	***8 000***	***High***	***Am-3***
Vascular plant	8 000	Low	Am-4
Zooplankton	***4 000***	***Medium***	***Am-5***
Mollusc	***1000***	***Medium***	***Am-6***
Bivalve mollusc	700	Medium	Am-7
Polychaete worm	700	Low	Am-8
Crustacean	***400***	***Low***	***Am-9***
Crustacean	145	Low	Am-10
Fish	***100***	***Medium***	***Am-11***
Benthic fish	***100***	***Medium***	***Am-12***
Pelagic fish	***100***	***Medium***	***Am-13***
Wading bird	310	Low	Am-14
Mammal	5*	Low	Am-15

n/a = Not applicable
* Concentration ratio.

Am-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Am-2: Value from IAEA (in press).
Am-3: Value from IAEA (in press). IAEA have derived a value for brown seaweed based on 4 references mainly dealing with European coastal environments.
Am-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Am-5: Value from IAEA (in press).
Am-6: Value from IAEA (in press).
Am-7: Based on a median value derived from 3 publications: Mitchell *et al*. (1991); Mitchell *et al*. (1992) and Vives I Batlle (1993).
Am-8: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Am-9: Value from IAEA (in press). The CF value for Am was assumed to be the same as for Cf – a radionuclide for which experimental data were available.
Am-10: This value is derived from the experimental studies of Guary & Fowler (1990) and pertains to crab
Am-11: Value from IAEA (in press).
Am-12: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Am-13: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Am-14: Based on the output of a biokinetic model (Appendix 2, Section 8). It should be noted that this value is only obtained after an equilibration period of approximately 10 years. Shorter contaminant contact times will lead to concomitantly lower concentration ratios.
Am-15: This is a Concentration ratio based on the output of 2 biokinetic models (Appendix 2, Section 8). This value was derived for a simulation period of 10 years at which time the system had not reached equilibrium. A period of several hundred years is required for the system to truly equilibrate.

Table 1.5.18 **Np** Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Np-1
Phytoplankton	***100***	***Medium***	***Np-2***
Macroalgae	***50***	***Medium***	***Np-3***
Vascular plant	50	Low	Np-4
Zooplankton	***400***	***Low***	***Np-5***
Bivalve mollusc	***400***	***Medium***	***Np-6***
Bivalve mollusc	200	Medium	Np-7
Polychaete worm	2	Medium	Np-8
Crustacean	***100***	***Low***	***Np-9***
Fish	***1***	***Low***	***Np-10***
Benthic fish	***1***	***Low***	***Np-11***
Pelagic fish	***1***	***Low***	***Np-12***
Wading bird	230*	Low	Np-13
Mammal	0.05*	Low	Np-14

n/a = Not applicable.
* Concentration ratio.

Np-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al.*, 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Np-2: Value from IAEA (in press).
Np-3: Value from IAEA (in press).
Np-4: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Np-5: Value from IAEA (in press). The IAEA noted that Environmental CF data for Np were scarce. The fact that laboratory data suggested that Np CF values were approximately an order of magnitude less than those observed for Pu, led to the tabulated recommendation.
Np-6: Value from IAEA (in press). This value is based on one report published in the early 1980s.
Np-7: Experimental studies concerning the uptake of neptunium by benthic organisms conducted by Germain *et al*. (1987) provide a concentration ratio value of 14 for the soft tissues of bivalve molluscs. This value has been used in conjunction with the IAEA recommended value to derive a mean value ((400 + 14)/2) of approximately 200.
Np-8: This value is also derived from experimental studies concerning the uptake of neptunium by benthic organisms conducted by Germain *et al*. (1987). The reported value was 1.5 and was considered to represent equilibrium within the system.
Np-9: The IAEA report (in press) indicate that no new information has been collated on the uptake of Np to crustaceans following IAEA-TECDOC-211 (IAEA, 1978).
Np-10: The IAEA cite the work of Pentreath & Harvey (1981) for which a CF for fish flesh is < 0.01. However, the uncertainty surrounding this number coupled to a requirement to account for whole fish consumption leads to the recommendation of the CF value tabulated.
Np-11: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Np-12: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Np-13: This is a Concentration ratio based on the output of a biokinetic models (Appendix 2, Section 8). This value was derived for a simulation period of 10 years when the system was still not under equilibrium. A period of several hundred years is required for the system to truly equilibrate. The appropriateness of using elimination rates derived from retention factors for man (ICRP-30, parts 1-4) is of some concern.
Np-14: This is a Concentration ratio based on the output of a biokinetic model (Appendix 2, Section 8). This value was derived for a simulation period of 10 years at which time the system had not reached equilibrium. A period of several hundred years is required for the system to truly equilibrate.

Table 1.5.19 Cm Concentration factors (l/kg) for marine systems

Reference organism	Bq/kg fresh per Bq/l	Confidence	Comments
Bacteria	n/a	n/a	Cm-1
Phytoplankton	***20 000***	***Medium***	***Cm-2***
Macroalgae	***5000***	***Medium***	***Cm-3***
Macroalgae	3160	Medium	Cm-4
Vascular plant	3160	Low	Cm-5
Zooplankton	***4000***	***Low***	***Cm-6***
Bivalve mollusc	***1000***	***Medium***	***Cm-7***
Polychaete worm	1000	Low	Cm-8
Crustacean	***400***	***Low***	***Cm-9***
Fish	***100***	***Medium***	***Cm-10***
Benthic fish	***100***	***Medium***	***Cm-11***
Pelagic fish	***100***	***Medium***	***Cm-12***
Wading bird	75	Low	Cm-13
Mammal	0.4	Low	Cm-14

n/a = Not applicable

Cm-1: No data for bacteria derived. It has been argued, and demonstrably shown (Pröhl *et al*., 2003) that absorbed doses for bacteria will be essentially determined by the external source represented.
Cm-2: Value from IAEA (in press).
Cm-3: Value from IAEA (in press). This value was derived from data from the English Channel.
Cm-4: Holm *et al*. (1991) derived a value of 1320 for brown macroalgae samples taken from the Mediterranean Sea. This value has been combined with the IAEA datat to produce a mean of 3160.
Cm-5: This is a rough estimate. No data have been collated and therefore the value for macroalgae has been selected as a suitable proxy.
Cm-6: Value from IAEA (in press). Environmental data pertaining to Cm CF values are scarse in the open literature. For this reason the IAEA have opted to use a value similar to that of Am.
Cm-7: Value from IAEA (in press).
Cm-8: This is an estimate. In view of similarities with mollusc in terms of habitat and feeding habits (benthic organism ingesting suspended particulate matter), this organism may represent a suitable proxy for the derivation of CFs. Empirical data are required.
Cm-9: Value from IAEA (in press). No information specifically on Cm had been collated by the IAEA. In view of the similar behaviour of Cm to Am, the Am CF was adopted.
Cm-10: Value from IAEA (in press). Data from the English Channel.
Cm-11: The value for generic fish derived from IAEA (in press) has been taken to represent benthic fish.
Cm-12: As for benthic fish – no distinction is made between the uptake for pelagic and benthic species.
Cm-13: Based on the output of a biokinetic model (Appendix 2, Section 8). The value was derived for Cm-242 allowing for physical decay.
Cm-14: Based on the output of a biokinetic model (Appendix 2, Section 8). The value was derived for Cm-242 allowing for physical decay.

1.6 Transfer Look-up tables for brackish water ecosystems

CF data are mainly based on Finnish monitoring results from the time before the Chernobyl accident, from 1988-1989 and from the late 1990s, as well as on the open data of the HELCOM/MORS data base from the years 1988-1991. The data are mainly focused on ^{137}Cs and ^{134}Cs; only few data on ^{90}Sr or $^{239,240}Pu$ were available. The values provided in the tables relate to the whole body CF for the organism. Data for specific organs were given, where sufficient information was available. For the sake of comparison, the CF's for phytoplankton and zooplankton were calculated on fresh weight basis, although the fresh weight of a plankton sample is always more uncertain than that in dry weight. The values are arithmetic mean values of individual monitoring results. The confidence levels in the tables are as defined in the main report, Section 4.1.

Table 1.6.1 **Sr** Concentration factors (l/kg) for brackish water systems

Reference organism	**Bq/kg fresh per**	**Confidence**	**Comments**
	Bq/l water		
Sr-90			
Macroalgae (*Fucus vesiculosus*)	150	High	
Crusteceans (*Saduria entomon*)	280	High	
Pelagic fish (Baltic herring; edible parts)	4	High	
bones	30	Medium	

Table 1.6.2 **Cs** Concentration factors (l/kg) for brackish water systems

Cs-134

Reference organism	Bq/kg fresh per	Confidence	Comments
	Bq/l water		
Cs-134			
Macroalgae (*Fucus vesiculosus*)	240	Medium	
Bivalve molluscs (*Mytilus edulis*; whole)	45	Medium	
Crusteceans (*Saduria entomon*)	200	Medium	
Benthic fish (cod; fillets)	310	Medium	
Pelagic fish (Baltic herring; edible parts)	150	Medium	
Birds (Common Gull); muscle	260	Low	few results
liver	360	Low	few results
eggs	30	Low	few results

Cs-137

Reference organism	Bq/kg fresh per	Confidence	Comments
	Bq/l water		
Cs-137			
Phytoplankton	4.4	Medium	
Zooplankton	9.3	Medium	
Macroalgae (*Fucus vesiculosus*)	200	High	
Vascular plants	32	Medium	
Bivalve molluscs (*Mytilus edulis*; whole)	15	High	
Worms	110	Low	few results
Crustaceans (*Saduria entomon*)	140	Medium	
Insect larvae	140	High	
Benthic fish (cod; fillets)	340	Medium	
Pelagic fish (Baltic herring; edible parts)	160	High	
Birds (Common Gull); muscle	230	Medium	
liver	260	Medium	
eggs	50	Medium	
Mammals (seals); muscle	530	Medium	soon after Chernobyl
liver	240	Low	soon after Chernobyl
kidney	270	Low	soon after Chernobyl
train	20	Low	soon after Chernobyl

Table 1.6.3 **Pu** Concentration factors (l/kg) for brackish water systems

Reference organism	Bq/kg fresh per Bq/l water	Confidence	Comments
Pu-239,240			
Macroalgae (Fucus vesiculosus)	7000	Medium	
Crustaceans (Saduria entomon)	4900	Medium	
Pelagic fish (Baltic herring; edible parts)	60	Medium	

1.6.1 Brackish waters Concentration factors for C-14 for coastal areas of the Baltic Sea

Results obtained from the modelling simulations allowed the derivation C-14 concentration factors for functional groups (Table 1.6.4). Details concerning model simulations are provided in the main report (Section 4.1.8).

Table 1.6.4 Concentration factors ([Bq/kg w.w.]/[Bq/l]) for **C-14** for organisms in brackish water environments, derived for simulation A, B and C (described in Section 4.1.8.1 : Main report) from a C-14 flow model described in Kumblad *et al*., (in press).

Simulation / Functional group	A [Bq/kgww]/[Bq/l]	B [Bq/kgww]/[Bq/l]	C [Bq/kgww]/[Bq/l]
Phytoplankton	2.2×10^{3}	1.5×10^{2}	1.6×10^{4}
Zooplankton	8.8	6.2×10^{-1}	3.8×10^{2}
Benthic plants	2.4×10^{3}	4.1×10^{6}	2.4×10^{3}
Grazing macrofauna	1.7×10^{3}	3.0×10^{6}	1.7×10^{3}
Fish	4.9×10^{2}	8.3×10^{5}	9.8×10^{2}
Benthos	1.3×10^{2}	2.2×10^{5}	1.1×10^{3}
Seal	4.9×10^{2}	8.3×10^{5}	9.8×10^{2}
Eider duck	1.8×10^{2}	3.0×10^{5}	1.4×10^{3}
Eagle	4.9×10^{2}	8.3×10^{5}	9.8×10^{2}

2 Dose Conversion Coefficient Look-up tables

2.1 DCCs (unweighted) for terrestrial ecosystems

Table 2.1.1 *Unweighted* **DCCs** for *external exposure* for organisms that live *on soil* for *a planar source* with a surface roughness of 3 mm.

Radio-nuclide	Unweighted external dose conversion coefficients (µGy/h per Bq/m²)													
	wood-louse	earth-worm	mouse	mole	weasel	snake	rabbit	red fox	row deer	cattle	small egg	big egg	herbi-vorous bird	carni-vorous bird
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	4.8E-7	4.8E-7	4.8E-7	4.7E-7	4.7E-7	4.6E-7	4.3E-7	4.1E-7	3.2E-7	1.5E-7	4.8E-7	4.8E-7	4.2E-7	3.0E-7
Cl-36	5.3E-10	5.3E-10	5.2E-10	5.2E-10	5.2E-10	5.0E-10	4.6E-10	4.3E-10	3.3E-10	1.3E-10	5.3E-10	5.2E-10	4.5E-10	3.2E-10
Ni-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-89	2.8E-10	2.8E-10	2.8E-10	2.8E-10	2.8E-10	2.7E-10	2.5E-10	2.3E-10	1.8E-10	7.5E-11	2.8E-10	2.8E-10	2.4E-10	1.7E-10
Sr-90	1.8E-12	1.8E-12	1.8E-12	1.7E-12	1.7E-12	1.7E-12	1.6E-12	1.4E-12	8.8E-13	1.6E-13	1.8E-12	1.8E-12	1.2E-12	4.3E-13
Nb-94	5.3E-6	5.3E-6	5.3E-6	5.2E-6	5.2E-6	5.0E-6	4.7E-6	4.4E-6	3.4E-6	1.4E-6	5.3E-6	5.3E-6	4.5E-6	3.2E-6
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ru-106	7.0E-7	7.0E-7	6.9E-7	6.9E-7	6.9E-7	6.6E-7	6.1E-7	5.7E-7	4.5E-7	1.8E-7	7.0E-7	6.9E-7	6.0E-7	4.2E-7
I-129	9.4E-8	9.4E-8	9.4E-8	9.3E-8	9.3E-8	9.0E-8	8.4E-8	7.6E-8	5.0E-8	1.0E-8	9.4E-8	9.4E-8	8.2E-8	5.2E-8
I-131	1.3E-6	1.3E-6	1.3E-6	1.3E-6	1.3E-6	1.2E-6	1.2E-6	1.1E-6	8.3E-7	3.2E-7	1.3E-6	1.3E-6	1.1E-6	8.0E-7
Cs-134	5.3E-6	5.3E-6	5.2E-6	5.2E-6	5.2E-6	5.0E-6	4.6E-6	4.3E-6	3.4E-6	1.4E-6	5.3E-6	5.2E-6	4.5E-6	3.2E-6
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	1.9E-6	1.9E-6	1.9E-6	1.9E-6	1.9E-6	1.8E-6	1.7E-6	1.6E-6	1.2E-6	5.0E-7	1.9E-6	1.9E-6	1.7E-6	1.2E-6
Po-210	2.9E-11	2.9E-11	2.8E-11	2.8E-11	2.8E-11	2.7E-11	2.5E-11	2.4E-11	1.8E-11	7.5E-12	2.9E-11	2.8E-11	2.4E-11	1.7E-11
Pb-210	7.1E-9	7.0E-9	7.0E-9	7.0E-9	7.0E-9	6.7E-9	6.3E-9	5.7E-9	3.8E-9	8.1E-10	7.0E-9	7.0E-9	6.1E-9	4.2E-9
Ra-226	5.6E-6	5.6E-6	5.6E-6	5.5E-6	5.5E-6	5.3E-6	5.0E-6	4.7E-6	3.7E-6	1.6E-6	5.6E-6	5.6E-6	4.8E-6	3.5E-6
Th-227	3.6E-7	3.6E-7	3.5E-7	3.5E-7	3.5E-7	3.3E-7	3.1E-7	2.9E-7	2.2E-7	7.5E-8	3.6E-7	3.5E-7	3.1E-7	2.2E-7
Th-228	4.6E-6	4.6E-6	4.6E-6	4.6E-6	4.6E-6	4.4E-6	4.2E-6	3.9E-6	3.1E-6	1.4E-6	4.6E-6	4.6E-6	4.0E-6	2.9E-6
Th-230	1.9E-9	1.9E-9	1.9E-9	1.9E-9	1.9E-9	1.8E-9	1.7E-9	1.6E-9	1.0E-9	2.4E-10	1.9E-9	1.9E-9	1.5E-9	9.4E-10
Th-231	5.7E-8	5.7E-8	5.7E-8	5.6E-8	5.6E-8	5.4E-8	5.0E-8	4.6E-8	3.1E-8	6.9E-9	5.7E-8	5.7E-8	4.8E-8	3.1E-8
Th-232	1.3E-9	1.3E-9	1.3E-9	1.3E-9	1.3E-9	1.3E-9	1.2E-9	1.1E-9	6.8E-10	1.4E-10	1.3E-9	1.3E-9	9.8E-10	5.3E-10
Th-234	8.4E-8	8.4E-8	8.3E-8	8.2E-8	8.2E-8	7.9E-8	7.4E-8	6.9E-8	5.2E-8	1.9E-8	8.4E-8	8.3E-8	7.3E-8	5.2E-8
U-234	2.0E-9	2.0E-9	1.9E-9	1.9E-9	1.9E-9	1.9E-9	1.7E-9	1.6E-9	1.0E-9	2.0E-10	2.0E-9	1.9E-9	1.4E-9	6.5E-10
U-235	5.6E-7	5.6E-7	5.5E-7	5.5E-7	5.5E-7	5.3E-7	4.9E-7	4.5E-7	3.2E-7	9.7E-8	5.6E-7	5.5E-7	4.8E-7	3.5E-7
U-238	1.4E-9	1.4E-9	1.4E-9	1.4E-9	1.4E-9	1.3E-9	1.2E-9	1.1E-9	7.1E-10	1.3E-10	1.4E-9	1.4E-9	9.7E-10	4.0E-10
Pu-238	2.3E-9	2.3E-9	2.3E-9	2.3E-9	2.3E-9	2.2E-9	2.1E-9	1.9E-9	1.2E-9	2.2E-10	2.3E-9	2.3E-9	1.6E-9	6.9E-10
Pu-239	1.1E-9	1.1E-9	1.1E-9	1.0E-9	1.0E-9	1.0E-9	9.3E-10	8.4E-10	5.5E-10	1.2E-10	1.1E-9	1.1E-9	7.7E-10	3.7E-10
Pu-240	2.3E-9	2.3E-9	2.2E-9	2.2E-9	2.2E-9	2.1E-9	2.0E-9	1.8E-9	1.1E-9	2.1E-10	2.2E-9	2.2E-9	1.6E-9	6.6E-10
Pu-241	1.7E-11	1.7E-11	1.7E-11	1.6E-11	1.6E-11	1.6E-11	1.5E-11	1.3E-11	9.4E-12	2.6E-12	1.7E-11	1.7E-11	1.4E-11	1.0E-11
Am-241	8.4E-8	8.4E-8	8.3E-8	8.3E-8	8.3E-8	8.0E-8	7.4E-8	6.7E-8	4.5E-8	9.9E-9	8.4E-8	8.3E-8	7.2E-8	5.1E-8
Np-237	9.1E-8	9.1E-8	9.1E-8	9.0E-8	9.0E-8	8.7E-8	8.1E-8	7.3E-8	5.0E-8	1.2E-8	9.1E-8	9.1E-8	7.9E-8	5.5E-8
Cm-242	2.8E-9	2.8E-9	2.8E-9	2.8E-9	2.8E-9	2.7E-9	2.5E-9	2.2E-9	1.4E-9	2.7E-10	2.8E-9	2.8E-9	2.0E-9	8.7E-10
Cm-243	4.2E-7	4.2E-7	4.2E-7	4.1E-7	4.1E-7	4.0E-7	3.7E-7	3.4E-7	2.5E-7	7.9E-8	4.2E-7	4.2E-7	3.6E-7	2.6E-7
Cm-244	2.6E-9	2.6E-9	2.5E-9	2.5E-9	2.5E-9	2.4E-9	2.3E-9	2.0E-9	1.3E-9	2.4E-10	2.6E-9	2.5E-9	1.8E-9	7.9E-10

Table 2.1.2 *Unweighted* **DCCs** for *external exposure* of organisms that live *on soil* for a homogeneously contaminated *volume source*; the thickness of the contaminated soil layer is 10 cm, the soil density is 1.6 g/cm³.

Radio-nuclide	Unweighted external dose conversion coefficients (µGy/h per Bq/kg)													
	wood-louse	earth-worm	mouse	mole	weasel	snake	rabbit	red fox	row deer	cattle	small egg	big egg	herbi-vorous bird	carni-vorous bird
H-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K-40	3.0E-5	3.0E-5	3.0E-5	3.0E-5	3.0E-5	2.9E-5	2.7E-5	2.6E-5	2.1E-5	9.4E-6	3.0E-5	3.0E-5	2.9E-5	2.3E-5
Cl-36	3.1E-8	3.1E-8	3.1E-8	3.1E-8	3.1E-8	3.0E-8	2.7E-8	2.6E-8	2.0E-8	8.1E-9	3.1E-8	3.1E-8	2.9E-8	2.3E-8
Ni-59	1.4E-7	1.3E-7	1.4E-7	1.3E-7	1.3E-7	1.3E-7	1.1E-7	8.6E-8	3.6E-9	8.7E-11	1.3E-7	1.4E-7	0	0
Ni-63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr-89	1.7E-8	1.7E-8	1.7E-8	1.7E-8	1.7E-8	1.6E-8	1.5E-8	1.4E-8	1.1E-8	4.7E-9	1.7E-8	1.7E-8	1.6E-8	1.3E-8
Sr-90	1.1E-10	1.1E-10	1.0E-10	1.0E-10	1.0E-10	9.9E-11	9.0E-11	8.0E-11	4.3E-11	7.5E-12	1.1E-10	1.0E-10	4.1E-11	1.0E-11
Nb-94	3.2E-4	3.2E-4	3.2E-4	3.2E-4	3.2E-4	3.0E-4	2.8E-4	2.7E-4	2.1E-4	8.7E-5	3.2E-4	3.2E-4	3.0E-4	2.4E-4
Tc-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ru-106	4.2E-5	4.2E-5	4.2E-5	4.1E-5	4.1E-5	4.0E-5	3.7E-5	3.4E-5	2.7E-5	1.1E-5	4.2E-5	4.2E-5	3.9E-5	3.1E-5
I-129	1.7E-6	1.7E-6	1.7E-6	1.7E-6	1.7E-6	1.6E-6	1.5E-6	1.3E-6	8.7E-7	1.7E-7	1.7E-6	1.7E-6	1.4E-6	8.8E-7
I-131	7.7E-5	7.7E-5	7.7E-5	7.6E-5	7.6E-5	7.3E-5	6.7E-5	6.3E-5	5.0E-5	1.9E-5	7.7E-5	7.7E-5	7.2E-5	5.7E-5
Cs-134	3.2E-4	3.2E-4	3.2E-4	3.1E-4	3.1E-4	3.0E-4	2.8E-4	2.6E-4	2.1E-4	8.5E-5	3.2E-4	3.2E-4	3.0E-4	2.4E-4
Cs-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs-137	1.2E-4	1.2E-4	1.2E-4	1.1E-4	1.1E-4	1.1E-4	1.0E-4	9.5E-5	7.6E-5	3.1E-5	1.2E-4	1.2E-4	1.1E-4	8.6E-5
Po-210	1.7E-9	1.7E-9	1.7E-9	1.7E-9	1.7E-9	1.6E-9	1.5E-9	1.4E-9	1.1E-9	4.7E-10	1.7E-9	1.7E-9	1.6E-9	1.3E-9
Pb-210	3.5E-7	3.5E-7	3.4E-7	3.4E-7	3.4E-7	3.3E-7	3.0E-7	2.6E-7	1.5E-7	2.8E-8	3.5E-7	3.4E-7	1.8E-7	1.2E-7
Ra-226	3.4E-4	3.4E-4	3.4E-4	3.4E-4	3.4E-4	3.3E-4	3.1E-4	2.9E-4	2.3E-4	1.0E-4	3.4E-4	3.4E-4	3.2E-4	2.6E-4
Th-227	2.0E-5	2.0E-5	2.0E-5	1.9E-5	1.9E-5	1.9E-5	1.7E-5	1.6E-5	1.2E-5	4.3E-6	2.0E-5	2.0E-5	1.8E-5	1.4E-5
Th-228	2.9E-4	2.9E-4	2.9E-4	2.9E-4	2.9E-4	2.8E-4	2.6E-4	2.5E-4	2.0E-4	9.5E-5	2.9E-4	2.9E-4	2.7E-4	2.2E-4
Th-230	1.2E-7	1.2E-7	1.2E-7	1.2E-7	1.2E-7	1.2E-7	1.1E-7	9.5E-8	5.6E-8	1.2E-8	1.2E-7	1.2E-7	7.0E-8	4.2E-8
Th-231	2.4E-6	2.4E-6	2.4E-6	2.3E-6	2.3E-6	2.3E-6	2.1E-6	1.9E-6	1.2E-6	2.8E-7	2.4E-6	2.4E-6	1.8E-6	1.3E-6
Th-232	9.5E-8	9.5E-8	9.3E-8	9.2E-8	9.2E-8	8.9E-8	8.1E-8	7.2E-8	4.0E-8	7.7E-9	9.5E-8	9.3E-8	4.3E-8	2.1E-8
Th-234	4.7E-6	4.6E-6	4.6E-6	4.6E-6	4.6E-6	4.4E-6	4.1E-6	3.8E-6	2.9E-6	1.1E-6	4.6E-6	4.6E-6	4.3E-6	3.4E-6
U-234	1.2E-7	1.2E-7	1.1E-7	1.1E-7	1.1E-7	1.1E-7	9.9E-8	8.8E-8	4.8E-8	9.0E-9	1.2E-7	1.1E-7	5.0E-8	2.0E-8
U-235	3.0E-5	3.0E-5	3.0E-5	2.9E-5	2.9E-5	2.8E-5	2.6E-5	2.4E-5	1.8E-5	5.4E-6	3.0E-5	3.0E-5	2.7E-5	2.2E-5
U-238	8.7E-8	8.6E-8	8.5E-8	8.4E-8	8.3E-8	8.1E-8	7.3E-8	6.5E-8	3.5E-8	6.0E-9	8.6E-8	8.5E-8	3.2E-8	9.4E-9
Pu-238	1.2E-7	1.2E-7	1.1E-7	1.1E-7	1.1E-7	1.1E-7	9.8E-8	8.7E-8	4.8E-8	8.4E-9	1.1E-7	1.1E-7	4.7E-8	1.5E-8
Pu-239	5.2E-8	5.2E-8	5.1E-8	5.1E-8	5.1E-8	4.9E-8	4.5E-8	4.0E-8	2.3E-8	5.1E-9	5.2E-8	5.1E-8	2.6E-8	1.2E-8
Pu-240	1.1E-7	1.1E-7	1.1E-7	1.1E-7	1.1E-7	1.0E-7	9.4E-8	8.3E-8	4.6E-8	8.1E-9	1.1E-7	1.1E-7	4.5E-8	1.4E-8
Pu-241	8.2E-10	8.2E-10	8.2E-10	8.1E-10	8.1E-10	7.8E-10	7.2E-10	6.6E-10	4.6E-10	1.3E-10	8.2E-10	8.2E-10	7.3E-10	5.7E-10
Am-241	2.9E-6	2.9E-6	2.9E-6	2.9E-6	2.9E-6	2.8E-6	2.5E-6	2.3E-6	1.5E-6	3.3E-7	2.9E-6	2.9E-6	2.3E-6	1.7E-6
Np-237	3.9E-6	3.9E-6	3.9E-6	3.8E-6	3.8E-6	3.7E-6	3.4E-6	3.1E-6	2.1E-6	5.3E-7	3.9E-6	3.9E-6	3.3E-6	2.5E-6
Cm-242	1.2E-7	1.2E-7	1.1E-7	1.1E-7	1.1E-7	1.1E-7	9.9E-8	8.8E-8	4.9E-8	8.9E-9	1.2E-7	1.1E-7	5.2E-8	1.7E-8
Cm-243	2.3E-5	2.3E-5	2.2E-5	2.2E-5	2.2E-5	2.1E-5	2.0E-5	1.8E-5	1.4E-5	4.4E-6	2.3E-5	2.2E-5	2.1E-5	1.7E-5
Cm-244	1.1E-7	1.1E-7	1.0E-7	1.0E-7	1.0E-7	1.0E-7	9.1E-8	8.1E-8	4.5E-8	8.0E-9	1.1E-7	1.0E-7	4.7E-8	1.5E-8

Table 2.1.3 *Unweighted* **DCCs** for *external exposure* of organisms that live *in soil* for a homogeneously *volume source*; the thickness of the contaminated soil layer is 50 cm, the soil density is 1.6 g/cm³, the organisms live at a depth of 25 cm.

Radio-	Unweighted external dose conversion coefficients (µGy/h per Bq/kg)						
nuclide	woodlouse	earthworm	mouse	mole	snake	rabbit	red fox
H-3	0	0	0	0	0	0	0
C-14	0	0	0	0	0	0	0
K-40	4.2E-5	4.3E-5	3.4E-5	3.4E-5	3.8E-5	2.6E-5	1.9E-5
Cl-36	3.8E-8	3.8E-8	3.1E-8	2.9E-8	3.2E-8	2.0E-8	1.4E-8
Ni-59	0	0	0	0	0	0	0
Ni-63	0	0	0	0	0	0	0
Sr-89	2.1E-8	2.4E-8	1.8E-8	1.7E-8	1.9E-8	1.3E-8	8.8E-9
Sr-90	4.5E-11	1.1E-11	0	0	0	0	0
Nb-94	4.0E-4	4.3E-4	3.4E-4	3.2E-4	3.6E-4	2.3E-4	1.6E-4
Tc-99	0	0	0	0	0	0	0
Ru-106	5.2E-5	5.2E-5	4.3E-5	4.0E-5	4.5E-5	2.9E-5	1.9E-5
I-129	2.3E-6	1.9E-6	5.5E-7	4.6E-7	1.0E-6	7.3E-8	3.5E-8
I-131	9.0E-5	8.8E-5	7.3E-5	6.9E-5	7.6E-5	4.7E-5	3.1E-5
Cs-134	4.0E-4	4.1E-4	3.3E-4	3.1E-4	3.5E-4	2.2E-4	1.5E-4
Cs-135	0	0	0	0	0	0	0
Cs-137	1.5E-4	1.5E-4	1.2E-4	1.1E-4	1.2E-4	7.9E-5	5.3E-5
Po-210	2.2E-9	2.3E-9	1.8E-9	1.7E-9	1.9E-9	1.3E-9	8.6E-10
Pb-210	2.3E-7	1.9E-7	1.1E-7	1.1E-7	1.3E-7	5.7E-8	3.5E-8
Ra-226	4.6E-4	4.6E-4	3.7E-4	3.6E-4	4.0E-4	2.7E-4	1.9E-4
Th-227	2.1E-5	2.1E-5	1.7E-5	1.6E-5	1.7E-5	1.1E-5	6.8E-6
Th-228	4.2E-4	4.0E-4	3.3E-4	3.3E-4	3.6E-4	2.5E-4	1.8E-4
Th-230	7.4E-8	5.5E-8	3.8E-8	3.6E-8	4.0E-8	2.4E-8	1.5E-8
Th-231	2.0E-6	1.7E-6	1.1E-6	1.0E-6	1.1E-6	6.7E-7	4.4E-7
Th-232	4.3E-8	2.6E-8	1.6E-8	1.5E-8	1.7E-8	9.9E-9	6.4E-9
Th-234	5.5E-6	5.8E-6	4.5E-6	4.3E-6	4.7E-6	3.1E-6	2.1E-6
U-234	5.2E-8	2.9E-8	1.1E-8	1.0E-8	1.2E-8	6.7E-9	4.4E-9
U-235	2.9E-5	2.9E-5	2.3E-5	2.2E-5	2.4E-5	1.4E-5	9.4E-6
U-238	3.3E-8	1.5E-8	2.3E-9	2.1E-9	2.5E-9	1.2E-9	7.4E-10
Pu-238	5.3E-8	2.7E-8	2.0E-9	1.9E-9	2.2E-9	1.1E-9	7.3E-10
Pu-239	3.0E-8	2.0E-8	8.6E-9	8.1E-9	8.9E-9	5.4E-9	3.5E-9
Pu-240	5.1E-8	2.6E-8	2.1E-9	2.0E-9	2.3E-9	1.2E-9	7.4E-10
Pu-241	7.9E-10	7.4E-10	5.7E-10	5.4E-10	5.7E-10	3.6E-10	2.3E-10
Am-241	3.1E-6	2.6E-6	1.7E-6	1.6E-6	1.8E-6	9.6E-7	6.2E-7
Np-237	3.7E-6	3.3E-6	2.3E-6	2.2E-6	2.4E-6	1.4E-6	9.4E-7
Cm-242	6.5E-8	3.5E-8	1.8E-9	1.7E-9	3.1E-9	1.0E-9	6.5E-10
Cm-243	2.3E-5	2.2E-5	1.8E-5	1.7E-5	1.8E-5	1.1E-5	7.3E-6
Cm-244	5.8E-8	3.1E-8	6.0E-10	5.5E-10	1.8E-9	2.7E-10	1.6E-10

Table 2.1.4 External exposure for critical organs of plants. The values are given for meristem of grass and for buds of a shrub and a tree for a planar source with a surface roughness of 3 mm and volume source with a depth of 10 cm.

Radio-nuclide	Dose conversion coefficient					
	planar source, depth = 3mm (µGy/h per Bq/m²)			volume source, depth = 10 cm, (µGy/h per Bq/kg)		
	herb	shrub	tree	herb	shrub	tree
H-3	0	0	0	0	0	0
C-14	0	0	0	0	0	0
K-40	4.5E-7	4.0E-7	3.0E-7	2.9E-5	2.7E-5	2.4E-5
Cl-36	5.0E-10	4.4E-10	3.2E-10	3.0E-8	2.9E-8	2.4E-8
Ni-59	0	0	0	3.6E-8	0	0
Ni-63	0	0	0	0	0	0
Sr-89	2.7E-10	2.4E-10	1.7E-10	1.7E-8	1.6E-8	1.3E-8
Sr-90	3.8E-12	2.1E-12	3.6E-14	1.1E-10	4.6E-11	2.5E-14
Nb-94	5.0E-6	4.4E-6	3.2E-6	3.1E-4	2.9E-4	2.5E-4
Tc-99	0	0	0	0	0	0
Ru-106	6.6E-7	5.8E-7	4.2E-7	4.1E-5	3.9E-5	3.3E-5
I-129	9.6E-8	8.0E-8	4.9E-8	2.1E-6	1.7E-6	1.1E-6
I-131	1.3E-6	1.1E-6	8.2E-7	7.6E-5	7.2E-5	6.1E-5
Cs-134	5.0E-6	4.4E-6	3.2E-6	3.1E-4	2.9E-4	2.5E-4
Cs-135	0	0	0	0	0	0
Cs-137	1.8E-6	1.6E-6	1.2E-6	1.1E-4	1.1E-4	9.0E-5
Po-210	2.7E-11	2.4E-11	1.7E-11	1.7E-9	1.6E-9	1.4E-9
Pb-210	1.1E-8	7.5E-9	4.6E-9	3.6E-7	2.0E-7	1.4E-7
Ra-226	5.3E-6	4.7E-6	3.5E-6	3.3E-4	3.2E-4	2.7E-4
Th-227	3.6E-7	3.1E-7	2.3E-7	2.0E-5	1.9E-5	1.6E-5
Th-228	4.4E-6	3.9E-6	2.9E-6	2.8E-4	2.7E-4	2.3E-4
Th-230	3.5E-9	2.1E-9	8.7E-10	1.3E-7	7.4E-8	4.4E-8
Th-231	7.2E-8	5.4E-8	3.0E-8	2.6E-6	2.0E-6	1.4E-6
Th-232	2.8E-9	1.5E-9	4.4E-10	9.6E-8	4.5E-8	1.9E-8
Th-234	8.5E-8	7.4E-8	5.3E-8	4.7E-6	4.3E-6	3.7E-6
U-234	3.7E-9	2.1E-9	3.8E-10	1.2E-7	5.4E-8	1.5E-8
U-235	5.8E-7	5.0E-7	3.6E-7	3.1E-5	2.8E-5	2.4E-5
U-238	2.9E-9	1.5E-9	1.7E-10	8.9E-8	3.5E-8	4.0E-9
Pu-238	4.1E-9	2.4E-9	2.4E-10	1.2E-7	5.3E-8	5.5E-9
Pu-239	1.7E-9	1.1E-9	2.1E-10	5.5E-8	2.9E-8	9.5E-9
Pu-240	3.9E-9	2.3E-9	2.4E-10	1.2E-7	5.1E-8	5.5E-9
Pu-241	1.8E-11	1.5E-11	1.1E-11	8.7E-10	7.7E-10	6.3E-10
Am-241	1.1E-7	8.5E-8	5.3E-8	3.4E-6	2.8E-6	2.1E-6
Np-237	1.0E-7	8.5E-8	5.5E-8	4.3E-6	3.6E-6	2.8E-6
Cm-242	4.4E-9	2.7E-9	4.7E-10	1.3E-7	6.0E-8	8.1E-9
Cm-243	4.3E-7	3.7E-7	2.7E-7	2.3E-5	2.1E-5	1.8E-5
Cm-244	4.1E-9	2.5E-9	4.2E-10	1.2E-7	5.4E-8	6.4E-9

Table 2.1.5 *Unweighted* **DCCs** for *internal exposure*, the activity is homogeneously distributed in the organisms. They are the sum of the contributions of α-, low-β, β- and γ-radiation.

Radio-nuclide	Unweighted internal dose conversion coefficients (µGy/h per Bq/kg)									
	wood-louse	earth-worm	mouse	mole	weasel	snake	rabbit	red fox	row deer	cattle
H-3	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6
C-14	2.8E-5	2.8E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5
K-40	2.0E-4	2.6E-4	2.9E-4	2.9E-4	2.9E-4	2.9E-4	3.1E-4	3.2E-4	3.3E-4	3.6E-4
Cl-36	1.4E-4	1.5E-4	1.5E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4
Ni-59	2.9E-6	3.1E-6	3.7E-6	3.8E-6	3.8E-6	3.8E-6	4.0E-6	4.0E-6	4.0E-6	4.0E-6
Ni-63	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6
Sr-89	2.2E-4	2.9E-4	3.2E-4	3.2E-4	3.2E-4	3.2E-4	3.3E-4	3.3E-4	3.3E-4	3.4E-4
Sr-90	3.5E-4	5.1E-4	6.0E-4	6.1E-4	6.1E-4	6.1E-4	6.4E-4	6.4E-4	6.5E-4	6.5E-4
Nb-94	9.5E-5	1.1E-4	1.4E-4	1.5E-4	1.5E-4	1.5E-4	2.4E-4	3.0E-4	4.0E-4	6.8E-4
Tc-99	5.7E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5
Ru-106	2.6E-4	4.9E-4	7.1E-4	7.4E-4	7.2E-4	7.3E-4	8.0E-4	8.3E-4	8.4E-4	8.9E-4
I-129	3.7E-5	3.8E-5	4.1E-5	4.2E-5	4.1E-5	4.1E-5	4.5E-5	4.6E-5	4.8E-5	5.0E-5
I-131	1.0E-4	1.1E-4	1.2E-4	1.2E-4	1.2E-4	1.2E-4	1.5E-4	1.6E-4	1.9E-4	2.6E-4
Cs-134	9.0E-5	1.1E-4	1.3E-4	1.5E-4	1.4E-4	1.5E-4	2.4E-4	3.0E-4	3.9E-4	6.8E-4
Cs-135	3.8E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5
Cs-137	1.2E-4	1.4E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	2.0E-4	2.2E-4	2.5E-4	3.6E-4
Po-210	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3
Pb-210	2.0E-4	2.3E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4	2.5E-4	2.5E-4	2.5E-4	2.5E-4
Ra-226	1.4E-2	1.4E-2	1.4E-2	1.4E-2	1.4E-2	1.4E-2	1.5E-2	1.5E-2	1.5E-2	1.5E-2
Th-227	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.5E-3	3.5E-3
Th-228	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2
Th-230	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
Th-231	9.5E-5	9.7E-5	1.0E-4	1.0E-4	1.0E-4	1.0E-4	1.0E-4	1.0E-4	1.1E-4	1.1E-4
Th-232	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3
Th-234	2.8E-4	4.0E-4	4.7E-4	4.8E-4	4.8E-4	4.8E-4	5.0E-4	5.1E-4	5.1E-4	5.2E-4
U-234	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3
U-235	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
U-238	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3	2.4E-3
Pu-238	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
Pu-239	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
Pu-240	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
Pu-241	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6
Am-241	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
Np-237	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3
Cm-242	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3
Cm-243	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.5E-3	3.5E-3
Cm-244	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3

2.2 DCCs for aquatic ecosystems

Table 2.2.1 *Unweighted* **DCCs** for *external exposure* of freshwater-estuarine organisms. The DCC is applicable for sediment or water.

Radio-	Unweighted internal dose conversion coefficients (µGy/h per Bq/kg)												
Nuclide	Bac-teria	Phyto-plank-ton	Zoo-plank-ton	Crusta-cean	Insect larvae	Vascular plant	Gastro-pod	Amphi-bian	Bivalve mollusc	Pelagic fish	Benthic fish	Mam-mal	Bird
^{3}H	3.3E-6	5.4E-7	4.8E-9	5.4E-9	5.2E-9	1.9E-8	3.1E-10	1.8E-10	1.2E-10	1.2E-10	6.3E-11	3.6E-11	3.1E-11
^{14}C	2.9E-5	2.6E-5	1.4E-6	1.2E-6	1.3E-6	4.6E-6	8.4E-8	4.8E-8	3.1E-8	2.7E-8	1.6E-8	8.4E-9	7.0E-9
^{32}P	4.0E-4	4.0E-4	3.3E-4	2.9E-4	3.1E-4	3.7E-4	6.7E-5	3.9E-5	2.6E-5	2.0E-5	1.3E-5	6.4E-6	5.2E-6
^{36}Cl	1.6E-4	1.6E-4	7.7E-5	6.2E-5	6.9E-5	1.2E-4	7.1E-6	4.0E-6	2.6E-6	2.1E-6	1.3E-6	7.1E-7	5.9E-7
^{40}K	3.9E-4	3.9E-4	3.2E-4	2.9E-4	3.1E-4	3.7E-4	1.3E-4	1.1E-4	1.0E-4	9.6E-5	8.9E-5	7.9E-5	7.5E-5
^{59}Ni	4.0E-6	1.1E-6	9.9E-7	9.3E-7	9.3E-7	1.2E-6	2.6E-7	1.5E-7	1.0E-7	1.1E-7	6.4E-8	-1.3E-7	-1.3E-7
^{63}Ni	9.9E-6	6.1E-6	9.0E-8	8.7E-8	8.9E-8	3.3E-7	5.4E-9	3.1E-9	2.0E-9	1.9E-9	1.0E-9	5.8E-10	4.9E-10
^{60}Co	1.5E-3	1.5E-3	1.5E-3	1.4E-3	1.4E-3	1.5E-3	1.4E-3	1.4E-3	1.4E-3	1.4E-3	1.3E-3	1.2E-3	1.1E-3
^{89}Sr	3.4E-4	3.4E-4	2.6E-4	2.2E-4	2.4E-4	3.1E-4	4.4E-5	2.5E-5	1.7E-5	1.3E-5	8.1E-6	4.2E-6	3.4E-6
^{90}Sr	6.5E-4	6.5E-4	5.1E-4	4.7E-4	4.9E-4	5.9E-4	1.3E-4	8.0E-5	5.4E-5	4.2E-5	2.7E-5	1.4E-5	1.1E-5
^{95}Zr	4.9E-4	4.9E-4	4.4E-4	4.4E-4	4.4E-4	4.6E-4	4.2E-4	4.1E-4	4.1E-4	4.0E-4	3.8E-4	3.4E-4	3.3E-4
^{94}Nb	1.0E-3	1.0E-3	9.3E-4	9.3E-4	9.3E-4	9.6E-4	8.9E-4	8.8E-4	8.6E-4	8.5E-4	8.1E-4	7.4E-4	7.0E-4
^{95}Nb	4.7E-4	4.7E-4	4.4E-4	4.4E-4	4.4E-4	4.5E-4	4.3E-4	4.3E-4	4.2E-4	4.1E-4	3.9E-4	3.6E-4	3.4E-4
^{99}Tc	5.8E-5	5.7E-5	8.7E-6	7.0E-6	7.8E-6	2.2E-5	5.4E-7	3.0E-7	1.9E-7	1.6E-7	9.6E-8	5.1E-8	4.2E-8
^{106}Ru	9.4E-4	9.3E-4	8.8E-4	8.4E-4	8.6E-4	9.1E-4	4.3E-4	3.2E-4	2.5E-4	2.2E-4	1.8E-4	1.3E-4	1.2E-4
^{125}I	3.5E-5	2.8E-5	2.4E-5	2.4E-5	2.4E-5	2.4E-5	2.1E-5	1.9E-5	1.7E-5	1.6E-5	1.4E-5	9.8E-6	9.1E-6
^{129}I	5.1E-5	4.3E-5	1.5E-5	1.5E-5	1.5E-5	1.9E-5	1.3E-5	1.2E-5	1.1E-5	1.0E-5	8.7E-6	6.3E-6	5.8E-6
^{131}I	3.3E-4	3.3E-4	2.6E-4	2.5E-4	2.5E-4	2.9E-4	2.2E-4	2.1E-4	2.1E-4	2.0E-4	1.9E-4	1.7E-4	1.6E-4
^{134}Cs	9.9E-4	9.9E-4	9.3E-4	9.2E-4	9.3E-4	9.6E-4	8.8E-4	8.7E-4	8.5E-4	8.4E-4	8.0E-4	7.2E-4	6.8E-4
^{135}Cs	3.9E-5	3.7E-5	3.2E-6	2.6E-6	2.9E-6	9.4E-6	1.9E-7	1.1E-7	6.8E-8	5.9E-8	3.4E-8	1.8E-8	1.5E-8
^{137}Cs	4.7E-4	4.7E-4	3.9E-4	3.8E-4	3.8E-4	4.3E-4	3.3E-4	3.2E-4	3.1E-4	3.0E-4	2.9E-4	2.6E-4	2.5E-4
^{144}Ce	7.8E-4	7.8E-4	6.7E-4	6.3E-4	6.5E-4	7.2E-4	2.6E-4	1.7E-4	1.3E-4	1.0E-4	7.6E-5	4.9E-5	4.3E-5
^{210}Pb	2.4E-4	2.4E-4	1.4E-4	1.2E-4	1.3E-4	1.9E-4	1.8E-5	1.1E-5	7.4E-6	6.1E-6	4.1E-6	2.3E-6	2.0E-6
^{210}Po	3.1E-3	5.0E-9	4.9E-9	4.9E-9	4.9E-9	4.9E-9	4.8E-9	4.8E-9	4.7E-9	4.6E-9	4.4E-9	4.0E-9	3.8E-9
^{226}Ra	1.9E-2	1.8E-3	1.5E-3	1.4E-3	1.5E-3	1.6E-3	1.1E-3	1.0E-3	9.8E-4	9.6E-4	9.0E-4	8.2E-4	7.8E-4
^{227}Th	2.0E-2	8.4E-4	6.2E-4	5.6E-4	5.9E-4	7.4E-4	2.8E-4	2.5E-4	2.3E-4	2.2E-4	2.0E-4	1.8E-4	1.6E-4
^{228}Th	1.9E-2	1.4E-3	1.2E-3	1.2E-3	1.2E-3	1.3E-3	9.5E-4	9.1E-4	8.8E-4	8.6E-4	8.2E-4	7.5E-4	7.2E-4
^{230}Th	2.7E-3	8.0E-6	1.3E-6	1.2E-6	1.2E-6	2.3E-6	5.9E-7	5.0E-7	4.4E-7	4.3E-7	3.8E-7	2.5E-7	2.3E-7
^{231}Th	1.1E-4	5.0E-5	1.6E-5	1.6E-5	1.6E-5	2.0E-5	1.1E-5	1.0E-5	9.5E-6	9.2E-6	8.3E-6	6.2E-6	5.7E-6
^{232}Th	2.3E-3	6.6E-6	1.0E-6	9.5E-7	9.8E-7	1.7E-6	4.6E-7	3.8E-7	3.3E-7	3.2E-7	2.8E-7	1.6E-7	1.6E-7
^{234}Th	5.2E-4	5.2E-4	4.2E-4	3.8E-4	4.0E-4	4.7E-4	1.1E-4	7.2E-5	5.3E-5	4.3E-5	3.2E-5	2.1E-5	1.8E-5
^{234}U	2.7E-3	6.9E-6	1.2E-6	1.1E-6	1.1E-6	1.8E-6	5.9E-7	4.8E-7	4.1E-7	3.9E-7	3.5E-7	2.0E-7	1.9E-7
^{235}U	2.7E-3	2.0E-4	1.1E-4	1.1E-4	1.1E-4	1.3E-4	9.8E-5	9.5E-5	9.2E-5	9.0E-5	8.3E-5	7.2E-5	6.7E-5
^{237}Np	3.0E-3	2.7E-4	1.6E-4	1.6E-4	1.6E-4	1.9E-4	1.3E-4	1.3E-4	1.2E-4	1.2E-4	1.1E-4	9.9E-5	9.2E-5
^{238}U	5.7E-3	5.3E-4	4.2E-4	3.8E-4	4.0E-4	4.7E-4	1.1E-4	7.3E-5	5.3E-5	4.4E-5	3.2E-5	2.1E-5	1.9E-5
^{238}Pu	3.2E-3	5.3E-6	1.1E-6	1.1E-6	1.1E-6	1.4E-6	6.2E-7	5.0E-7	4.2E-7	4.1E-7	3.6E-7	1.9E-7	1.9E-7
^{239}Pu	3.0E-3	2.6E-6	4.6E-7	4.4E-7	4.5E-7	6.4E-7	2.6E-7	2.1E-7	1.8E-7	1.7E-7	1.5E-7	7.6E-8	6.9E-8
^{240}Pu	3.0E-3	5.4E-6	1.1E-6	1.0E-6	1.0E-6	1.4E-6	6.0E-7	4.8E-7	4.0E-7	3.9E-7	3.4E-7	1.9E-7	1.8E-7
^{241}Pu	3.1E-6	4.5E-7	7.5E-9	8.1E-9	7.9E-9	1.9E-8	3.4E-9	3.2E-9	3.0E-9	2.9E-9	2.7E-9	2.2E-9	2.0E-9
^{241}Am	3.2E-3	3.8E-5	1.9E-5	1.9E-5	1.9E-5	2.1E-5	1.6E-5	1.5E-5	1.4E-5	1.4E-5	1.2E-5	9.4E-6	8.5E-6
^{242}Cm	3.5E-3	4.9E-6	1.1E-6	1.1E-6	1.1E-6	1.4E-6	6.5E-7	5.3E-7	4.5E-7	4.3E-7	3.8E-7	2.1E-7	2.1E-7
^{243}Cm	3.5E-3	1.4E-4	9.1E-5	8.8E-5	9.0E-5	1.1E-4	7.4E-5	7.2E-5	7.0E-5	6.8E-5	6.4E-5	5.5E-5	5.1E-5
^{244}Cm	3.3E-3	4.4E-6	1.0E-6	9.9E-7	9.9E-7	1.3E-6	6.0E-7	4.9E-7	4.1E-7	4.0E-7	3.5E-7	2.0E-7	1.9E-7

Table 2.2.2 *Unweighted* **DCCs** for *internal exposure* of freshwater-estuarine organisms, the activity is homogeneously distributed in the organisms.

Radio-	Unweighted internal dose conversion coefficients (µGy/h per Bq/kg)												
Nuclide	Bac-teria	Phyto-plank-ton	Zoo-plank-ton	Crusta-cean	Insect larvae	Vas-cular plant	Gastro-pod	Amphi-bian	Bivalve mollusc	Pelagic fish	Benthic fish	Mam-mal	Bird
^{3}H	0	2.7E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6
^{14}C	0	2.2E-6	2.7E-5	2.7E-5	2.7E-5	2.4E-5	2.8E-5	2.8E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5
^{32}P	0	2.1E-7	7.5E-5	1.1E-4	9.3E-5	2.7E-5	3.3E-4	3.6E-4	3.8E-4	3.8E-4	3.9E-4	3.9E-4	4.0E-4
^{36}Cl	0	5.0E-7	8.1E-5	9.6E-5	8.9E-5	3.8E-5	1.5E-4	1.5E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4
^{40}K	0	3.5E-7	7.1E-5	1.0E-4	8.6E-5	2.6E-5	2.6E-4	2.8E-4	2.9E-4	3.0E-4	3.0E-4	3.1E-4	3.2E-4
^{59}Ni	0	2.9E-6	3.0E-6	3.1E-6	3.1E-6	2.8E-6	3.7E-6	3.8E-6	3.9E-6	3.9E-6	3.9E-6	4.1E-6	4.1E-6
^{63}Ni	0	3.8E-6	9.8E-6	9.8E-6	9.8E-6	9.6E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6
^{60}Co	0	1.3E-6	5.0E-5	5.2E-5	5.2E-5	3.6E-5	8.1E-5	9.9E-5	1.2E-4	1.5E-4	2.0E-4	3.0E-4	3.6E-4
^{89}Sr	0	2.5E-7	8.0E-5	1.1E-4	9.6E-5	2.9E-5	2.9E-4	3.1E-4	3.2E-4	3.2E-4	3.3E-4	3.3E-4	3.3E-4
^{90}Sr	0	8.3E-7	1.4E-4	1.9E-4	1.6E-4	6.3E-5	5.2E-4	5.7E-4	6.0E-4	6.1E-4	6.3E-4	6.4E-4	6.4E-4
^{95}Zr	0	1.1E-6	5.6E-5	5.8E-5	5.7E-5	3.8E-5	7.5E-5	8.1E-5	8.9E-5	9.7E-5	1.2E-4	1.5E-4	1.7E-4
^{94}Nb	0	7.8E-7	7.0E-5	7.7E-5	7.4E-5	4.1E-5	1.1E-4	1.3E-4	1.4E-4	1.6E-4	2.0E-4	2.7E-4	3.1E-4
^{95}Nb	0	2.4E-6	2.5E-5	2.5E-5	2.5E-5	2.2E-5	3.4E-5	4.0E-5	4.8E-5	5.6E-5	7.5E-5	1.1E-4	1.3E-4
^{99}Tc	0	1.2E-6	5.0E-5	5.1E-5	5.1E-5	3.6E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5
^{106}Ru	0	3.8E-6	6.0E-5	9.8E-5	7.9E-5	2.4E-5	5.0E-4	6.2E-4	6.8E-4	7.2E-4	7.6E-4	8.0E-4	8.2E-4
^{125}I	0	7.0E-6	1.1E-5	1.2E-5	1.2E-5	1.1E-5	1.5E-5	1.6E-5	1.8E-5	1.9E-5	2.2E-5	2.6E-5	2.6E-5
^{129}I	0	7.1E-6	3.6E-5	3.6E-5	3.6E-5	3.2E-5	3.9E-5	4.0E-5	4.1E-5	4.1E-5	4.3E-5	4.5E-5	4.6E-5
^{131}I	0	8.8E-7	7.4E-5	8.2E-5	7.9E-5	4.2E-5	1.1E-4	1.2E-4	1.2E-4	1.3E-4	1.4E-4	1.6E-4	1.7E-4
^{134}Cs	0	1.4E-6	6.1E-5	6.8E-5	6.5E-5	3.3E-5	1.1E-4	1.2E-4	1.4E-4	1.6E-4	2.0E-4	2.7E-4	3.1E-4
^{135}Cs	0	1.7E-6	3.6E-5	3.6E-5	3.6E-5	2.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5
^{137}Cs	0	9.9E-7	7.9E-5	9.0E-5	8.5E-5	4.3E-5	1.4E-4	1.5E-4	1.6E-4	1.6E-4	1.8E-4	2.1E-4	2.2E-4
^{144}Ce	0	2.4E-6	1.1E-4	1.5E-4	1.3E-4	5.6E-5	5.2E-4	6.1E-4	6.5E-4	6.8E-4	7.0E-4	7.3E-4	7.4E-4
^{210}Pb	0	7.6E-6	1.0E-4	1.3E-4	1.1E-4	5.5E-5	2.3E-4	2.3E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4
^{210}Po	0	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3
^{226}Ra	0	1.7E-2	1.7E-2	1.7E-2	1.7E-2	1.7E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2
^{227}Th	0	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2
^{228}Th	0	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2
^{230}Th	0	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
^{231}Th	0	5.8E-5	9.2E-5	9.2E-5	9.2E-5	8.7E-5	9.6E-5	9.7E-5	9.8E-5	9.9E-5	9.9E-5	1.0E-4	1.0E-4
^{232}Th	0	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3
^{234}Th	0	4.1E-6	1.0E-4	1.4E-4	1.2E-4	5.4E-5	4.1E-4	4.5E-4	4.7E-4	4.8E-4	4.9E-4	5.0E-4	5.0E-4
^{234}U	0	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
^{235}U	0	2.5E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.7E-3	2.7E-3
^{237}Np	0	2.7E-3	2.8E-3	2.8E-3	2.8E-3	2.8E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3
^{238}U	0	5.2E-3	5.3E-3	5.4E-3	5.3E-3	5.3E-3	5.6E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3
^{238}Pu	0	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
^{239}Pu	0	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
^{240}Pu	0	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
^{241}Pu	0	2.7E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6
^{241}Am	0	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
^{242}Cm	0	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3
^{243}Cm	0	3.3E-3	3.4E-3	3.4E-3	3.4E-3	3.3E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3
^{244}Cm	0	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3

Table 2.2.3 *Unweighted* **DCCs** for *external exposure* of coastal-estuarine organisms. The DCC is applicable for sediment or water.

Radio-Nuclide	External dose conversion coefficients (µGy/h per Bq/kg)											
	Bac-teria	Phyto-plankton	Zoo-plankton	Mollusc	Worm	Vascular plant	Pelagic fish	Bird	Macro-algae	Benthic fish	Crusta-cean	Mammal
^{3}H	3.3E-6	1.1E-7	2.6E-9	1.8E-10	4.7E-10	1.8E-10	6.9E-11	6.6E-11	1.3E-10	8.7E-11	7.6E-11	3.5E-11
^{14}C	2.9E-5	1.9E-5	5.9E-7	4.8E-8	1.2E-7	3.4E-8	1.8E-8	1.5E-8	2.8E-8	2.1E-8	1.5E-8	5.1E-9
^{32}P	4.0E-4	4.0E-4	2.2E-4	4.0E-5	7.8E-5	2.0E-5	1.6E-5	1.1E-5	1.9E-5	1.6E-5	9.7E-6	2.3E-6
^{36}Cl	1.6E-4	1.5E-4	3.6E-5	4.1E-6	8.9E-6	2.3E-6	1.6E-6	1.2E-6	2.1E-6	1.7E-6	1.1E-6	3.1E-7
^{40}K	3.9E-4	3.9E-4	2.3E-4	1.1E-4	1.4E-4	9.6E-5	9.2E-5	8.8E-5	9.5E-5	9.3E-5	8.5E-5	5.3E-5
^{59}Ni	4.0E-6	1.5E-6	6.8E-7	1.4E-7	3.7E-7	7.6E-8	7.2E-8	-6.5E-8	6.2E-8	8.3E-8	2.6E-9	-2.9E-7
^{63}Ni	9.9E-6	2.2E-6	4.2E-8	3.1E-9	7.8E-9	2.6E-9	1.2E-9	1.0E-9	2.0E-9	1.4E-9	1.1E-9	4.4E-10
^{60}Co	1.5E-3	1.5E-3	1.4E-3	1.4E-3	1.4E-3	1.3E-3	1.3E-3	1.3E-3	1.3E-3	1.3E-3	1.3E-3	8.0E-4
^{89}Sr	3.4E-4	3.4E-4	1.6E-4	2.6E-5	5.2E-5	1.3E-5	1.0E-5	7.1E-6	1.2E-5	1.1E-5	6.4E-6	1.6E-6
^{90}Sr	6.5E-4	6.5E-4	3.7E-4	8.3E-5	1.5E-4	4.0E-5	3.4E-5	2.3E-5	3.9E-5	3.4E-5	2.0E-5	4.6E-6
^{95}Zr	4.9E-4	4.9E-4	4.3E-4	4.1E-4	4.2E-4	4.0E-4	3.9E-4	3.8E-4	3.9E-4	3.9E-4	3.7E-4	2.1E-4
^{94}Nb	1.0E-3	1.0E-3	9.2E-4	8.8E-4	8.9E-4	8.4E-4	8.3E-4	8.1E-4	8.4E-4	8.3E-4	7.9E-4	4.6E-4
^{95}Nb	4.7E-4	4.6E-4	4.4E-4	4.3E-4	4.3E-4	4.1E-4	4.0E-4	3.9E-4	4.1E-4	4.0E-4	3.8E-4	2.2E-4
^{99}Tc	5.8E-5	5.2E-5	3.5E-6	3.0E-7	7.1E-7	1.9E-7	1.2E-7	8.9E-8	1.7E-7	1.3E-7	8.9E-8	2.7E-8
^{106}Ru	9.4E-4	9.3E-4	7.5E-4	3.3E-4	4.6E-4	2.1E-4	2.0E-4	1.7E-4	2.1E-4	2.0E-4	1.5E-4	6.9E-5
^{125}I	3.5E-5	2.6E-5	2.3E-5	1.9E-5	2.1E-5	1.5E-5	1.5E-5	1.2E-5	1.5E-5	1.5E-5	1.2E-5	4.6E-6
^{129}I	5.1E-5	3.5E-5	1.4E-5	1.2E-5	1.3E-5	9.7E-6	9.2E-6	8.0E-6	9.7E-6	9.5E-6	7.8E-6	3.0E-6
^{131}I	3.3E-4	3.3E-4	2.3E-4	2.1E-4	2.2E-4	2.0E-4	2.0E-4	1.9E-4	2.0E-4	2.0E-4	1.9E-4	1.0E-4
^{134}Cs	9.9E-4	9.9E-4	9.1E-4	8.7E-4	8.8E-4	8.3E-4	8.2E-4	8.0E-4	8.3E-4	8.2E-4	7.7E-4	4.5E-4
^{135}Cs	3.9E-5	3.1E-5	1.3E-6	1.1E-7	2.5E-7	7.2E-8	4.1E-8	3.2E-8	6.0E-8	4.6E-8	3.3E-8	1.0E-8
^{137}Cs	4.7E-4	4.6E-4	3.6E-4	3.2E-4	3.3E-4	3.0E-4	3.0E-4	2.9E-4	3.0E-4	3.0E-4	2.8E-4	1.6E-4
^{144}Ce	7.8E-4	7.7E-4	5.4E-4	1.8E-4	2.8E-4	1.0E-4	9.1E-5	6.9E-5	9.9E-5	9.1E-5	6.2E-5	2.3E-5
^{210}Pb	2.4E-4	2.3E-4	7.6E-5	1.1E-5	2.2E-5	6.3E-6	4.9E-6	3.6E-6	5.9E-6	5.1E-6	3.4E-6	8.5E-7
^{210}Po	3.1E-3	5.0E-9	4.9E-9	4.8E-9	4.8E-9	4.6E-9	4.5E-9	4.4E-9	4.5E-9	4.5E-9	4.2E-9	2.5E-9
^{226}Ra	1.9E-2	1.8E-3	1.3E-3	1.0E-3	1.1E-3	9.5E-4	9.3E-4	9.0E-4	9.5E-4	9.3E-4	8.8E-4	5.4E-4
^{227}Th	2.0E-2	8.2E-4	4.5E-4	2.5E-4	2.9E-4	2.2E-4	2.1E-4	2.0E-4	2.2E-4	2.1E-4	1.9E-4	1.0E-4
^{228}Th	1.9E-2	1.4E-3	1.1E-3	9.1E-4	9.6E-4	8.6E-4	8.4E-4	8.2E-4	8.5E-4	8.4E-4	8.0E-4	5.2E-4
^{230}Th	2.7E-3	6.2E-6	9.4E-7	4.9E-7	6.4E-7	4.1E-7	3.9E-7	3.1E-7	4.0E-7	4.1E-7	3.4E-7	8.3E-8
^{231}Th	1.1E-4	3.8E-5	1.4E-5	1.0E-5	1.2E-5	8.9E-6	8.6E-6	7.5E-6	8.9E-6	8.8E-6	7.6E-6	2.8E-6
^{232}Th	2.3E-3	4.8E-6	7.6E-7	3.8E-7	5.1E-7	3.0E-7	2.9E-7	2.1E-7	3.0E-7	3.0E-7	2.4E-7	3.7E-8
^{234}Th	5.2E-4	5.1E-4	3.0E-4	7.4E-5	1.3E-4	4.3E-5	3.7E-5	2.9E-5	4.2E-5	3.8E-5	2.7E-5	1.0E-5
^{234}U	2.7E-3	4.8E-6	9.3E-7	4.8E-7	6.5E-7	3.7E-7	3.5E-7	2.5E-7	3.7E-7	3.8E-7	3.0E-7	3.9E-8
^{235}U	2.7E-3	1.8E-4	1.0E-4	9.5E-5	9.8E-5	8.9E-5	8.7E-5	8.3E-5	8.8E-5	8.7E-5	8.0E-5	4.0E-5
^{237}Np	3.0E-3	2.5E-4	1.5E-4	1.3E-4	1.3E-4	1.2E-4	1.2E-4	1.1E-4	1.2E-4	1.2E-4	1.1E-4	5.6E-5
^{238}U	5.7E-3	5.2E-4	3.0E-4	7.5E-5	1.3E-4	4.3E-5	3.8E-5	2.9E-5	4.2E-5	3.8E-5	2.7E-5	1.0E-5
^{238}Pu	3.2E-3	3.3E-6	9.3E-7	5.0E-7	6.8E-7	3.8E-7	3.6E-7	2.4E-7	3.8E-7	3.9E-7	3.0E-7	3.5E-8
^{239}Pu	3.0E-3	1.5E-6	3.8E-7	2.1E-7	2.8E-7	1.6E-7	1.5E-7	1.0E-7	1.6E-7	1.6E-7	1.2E-7	-1.2E-9
^{240}Pu	3.0E-3	3.3E-6	9.0E-7	4.8E-7	6.5E-7	3.6E-7	3.5E-7	2.3E-7	3.6E-7	3.7E-7	2.9E-7	3.5E-8
^{241}Pu	3.1E-6	9.4E-8	5.6E-9	3.1E-9	3.6E-9	3.0E-9	2.8E-9	2.6E-9	2.8E-9	2.8E-9	2.5E-9	1.1E-9
^{241}Am	3.2E-3	2.9E-5	1.8E-5	1.5E-5	1.6E-5	1.3E-5	1.3E-5	1.2E-5	1.3E-5	1.3E-5	1.1E-5	4.6E-6
^{242}Cm	3.5E-3	3.0E-6	9.5E-7	5.3E-7	7.1E-7	4.0E-7	3.9E-7	2.7E-7	4.0E-7	4.1E-7	3.2E-7	5.0E-8
^{243}Cm	3.5E-3	1.4E-4	8.2E-5	7.2E-5	7.5E-5	6.8E-5	6.6E-5	6.3E-5	6.7E-5	6.6E-5	6.1E-5	3.1E-5
^{244}Cm	3.3E-3	2.7E-6	8.7E-7	4.9E-7	6.6E-7	3.7E-7	3.6E-7	2.5E-7	3.7E-7	3.8E-7	3.0E-7	4.5E-8

Table 2.2.4 *Unweighted* **DCCs** for *internal exposure* of coastal-estuarine organisms, the activity is homogeneously distributed in the organisms.

Radio-	Unweighted internal dose conversion coefficients (µGy/h per Bq/kg)											
Nuclide	Bac-teria	Phyto-plankton	Zoo-plankton	Mollusc	Worm	Vascular plant	Pelagic fish	Bird	Macro-algae	Benthic fish	Crusta-cean	Mammal
^{3}H	0	3.2E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6	3.3E-6
^{14}C	0	9.3E-6	2.8E-5	2.8E-5	2.8E-5	2.8E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5	2.9E-5
^{32}P	0	1.3E-6	1.8E-4	3.6E-4	3.2E-4	3.8E-4	3.8E-4	3.9E-4	3.8E-4	3.8E-4	3.9E-4	4.0E-4
^{36}Cl	0	2.9E-6	1.2E-4	1.5E-4	1.5E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4	1.6E-4
^{40}K	0	1.5E-6	1.6E-4	2.8E-4	2.6E-4	3.0E-4	3.0E-4	3.0E-4	3.0E-4	3.0E-4	3.1E-4	3.4E-4
^{59}Ni	0	2.5E-6	3.3E-6	3.8E-6	3.6E-6	3.9E-6	3.9E-6	4.1E-6	3.9E-6	3.9E-6	4.0E-6	4.3E-6
^{63}Ni	0	7.7E-6	9.8E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6	9.9E-6
^{60}Co	0	6.8E-6	5.9E-5	9.8E-5	8.1E-5	1.5E-4	1.7E-4	2.0E-4	1.6E-4	1.7E-4	2.3E-4	7.0E-4
^{89}Sr	0	1.6E-6	1.8E-4	3.1E-4	2.8E-4	3.2E-4	3.3E-4	3.3E-4	3.2E-4	3.3E-4	3.3E-4	3.4E-4
^{90}Sr	0	5.0E-6	2.9E-4	5.7E-4	5.0E-4	6.1E-4	6.2E-4	6.3E-4	6.1E-4	6.2E-4	6.3E-4	6.5E-4
^{95}Zr	0	6.1E-6	6.4E-5	8.1E-5	7.5E-5	9.9E-5	1.1E-4	1.1E-4	1.0E-4	1.1E-4	1.3E-4	2.8E-4
^{94}Nb	0	4.6E-6	8.9E-5	1.2E-4	1.1E-4	1.6E-4	1.8E-4	2.0E-4	1.7E-4	1.8E-4	2.2E-4	5.4E-4
^{95}Nb	0	9.6E-6	2.7E-5	3.9E-5	3.4E-5	5.8E-5	6.5E-5	7.4E-5	5.9E-5	6.4E-5	8.6E-5	2.4E-4
^{99}Tc	0	6.5E-6	5.5E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5	5.8E-5
^{106}Ru	0	6.0E-6	1.9E-4	6.1E-4	4.8E-4	7.2E-4	7.4E-4	7.7E-4	7.2E-4	7.4E-4	7.8E-4	8.7E-4
^{125}I	0	9.1E-6	1.2E-5	1.6E-5	1.4E-5	2.0E-5	2.1E-5	2.3E-5	2.0E-5	2.0E-5	2.3E-5	3.1E-5
^{129}I	0	1.5E-5	3.7E-5	4.0E-5	3.9E-5	4.2E-5	4.2E-5	4.3E-5	4.2E-5	4.2E-5	4.4E-5	4.8E-5
^{131}I	0	4.9E-6	9.6E-5	1.2E-4	1.1E-4	1.3E-4	1.3E-4	1.4E-4	1.3E-4	1.3E-4	1.4E-4	2.3E-4
^{134}Cs	0	5.3E-6	8.3E-5	1.2E-4	1.1E-4	1.6E-4	1.7E-4	1.9E-4	1.6E-4	1.7E-4	2.2E-4	5.4E-4
^{135}Cs	0	8.3E-6	3.8E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5	3.9E-5
^{137}Cs	0	4.7E-6	1.1E-4	1.5E-4	1.4E-4	1.7E-4	1.7E-4	1.8E-4	1.7E-4	1.7E-4	1.9E-4	3.1E-4
^{144}Ce	0	1.0E-5	2.4E-4	6.0E-4	5.0E-4	6.8E-4	6.9E-4	7.1E-4	6.8E-4	6.9E-4	7.2E-4	7.6E-4
^{210}Pb	0	1.6E-5	1.7E-4	2.3E-4	2.2E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4	2.4E-4
^{210}Po	0	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3	3.1E-3
^{226}Ra	0	1.7E-2	1.7E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.8E-2
^{227}Th	0	1.9E-2	1.9E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2	2.0E-2
^{228}Th	0	1.8E-2	1.8E-2	1.8E-2	1.8E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2	1.9E-2
^{230}Th	0	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
^{231}Th	0	7.0E-5	9.4E-5	9.7E-5	9.6E-5	9.9E-5	9.9E-5	1.0E-4	9.9E-5	9.9E-5	1.0E-4	1.0E-4
^{232}Th	0	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3	2.3E-3
^{234}Th	0	1.4E-5	2.2E-4	4.5E-4	3.9E-4	4.8E-4	4.8E-4	4.9E-4	4.8E-4	4.8E-4	4.9E-4	5.1E-4
^{234}U	0	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3	2.7E-3
^{235}U	0	2.5E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.6E-3	2.7E-3
^{237}Np	0	2.7E-3	2.8E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3	2.9E-3
^{238}U	0	5.2E-3	5.4E-3	5.7E-3	5.6E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3	5.7E-3
^{238}Pu	0	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
^{239}Pu	0	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
^{240}Pu	0	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3	3.0E-3
^{241}Pu	0	3.0E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6	3.1E-6
^{241}Am	0	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3	3.2E-3
^{242}Cm	0	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3	3.5E-3
^{243}Cm	0	3.3E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3	3.4E-3
^{244}Cm	0	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3	3.3E-3

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