

EXPOSURE PARAMETERS

This file contains exposure parameter values that are available from the following EPA guidance documents:

EPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

EPA 1997. Exposure Factors Handbook.

EPA 2002. Children's Exposure Factors Handbook. Interim Report. EPA-600-P-00-002B. September.

EPA 2005. Guidance on Selecting Age Groups for Monitoring and Assessing Childhood Exposures to Environmental Contaminants. EPA/630/P-03/003F. November.

In addition, an example of how to incorporate the Supplemental Guidance Age-Dependant Adjustment Factor (ADAF) age groupings with the exposure assessment age groupings is also provided, using the exposure factors for a resident under current Superfund Guidance:

Supplemental Guidance ADAF Age Groupings and
Superfund Default Exposure Parameters for a Reasonable Maximum Exposure (RME) Resident

Age (years)	BW (kg)	EF (days/year)	ED (years)	WATER	SOIL	DERMAL - SOIL				ADAF (unitless)
				IR (L/day)	IR (mg/day)	AF (mg/cm ² -event)	SA (cm ²)	EV (event/day)	ABSd [1] (unitless)	
0 - <2	15	350	2	1	200	0.2	2800	1	0.13	10
2-<6	15	350	4	1	200	0.2	2800	1	0.13	3
6-<16	70	350	10	2	100	0.07	5700	1	0.13	3
16 - <30	70	350	14	2	100	0.07	5700	1	0.13	1

ABSd = Dermal Absorbed Fraction

AF = Adherence Factor

BW = Body Weight

ED = Exposure Duration

EF = Exposure Frequency

EV = Event Frequency

IR = Intake Rate

SA = Surface Area of Exposed Skin

ADAF = Age Dependant Adjustment Factor, as recommended by USEPA (2005)

USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Draft.

USEPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

USEPA 2005. Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure of Carcinogens. EPA/630/R-03/003F. March.

[1] Chemical Specific. Value is for benzo[a]pyrene

In applying the Supplemental Guidance to risk assessments, risk assessors should decide if a more refined, age-specific, exposure assessment is warranted and use the exposure parameters/age grouping bins that make the most sense for their site.

**SUPERFUND DEFAULT EXPOSURE PARAMETERS
REASONABLE MAXIMUM EXPOSURE (RME) RESIDENT**

RECEPTOR	AGE (years)	BW (kg)	EF (days/year)	ED (years)	WATER	SOIL	DERMAL - SOIL			
					IR (L/day)	IR (mg/day)	AF (mg/cm ² -event)	SA (cm ²)	EV (event/day)	ABSd [1] (unitless)
Resident	0-6	15	350	6	1	200	0.2	2800	1	0.13
	7-30	70	350	24	2	100	0.07	5700	1	0.13

ABSd = Dermal Absorbed Fraction

AF = Adherence Factor

BW = Body Weight

ED = Exposure Duration

EF = Exposure Frequency

EV = Event Frequency

IR = Intake Rate

SA = Surface Area of Exposed Skin

USEPA 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. March.

USEPA 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Draft.

USEPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal

[1] Chemical Specific. Value is for benzo[a]pyrene

EXPOSURE FACTORS HANDBOOK
AGE-SPECIFIC EXPOSURE PARAMETERS
Residential Exposure

AGE (year)	ADAF [1] (unitless)	BW [2] (kg)	EF [3] (days/year)	ED (years)	WATER	SOIL - Residential	DERMAL - SOIL			
					IR [4] (L/day)	IR [5] (mg/day)	AF [6] (mg/cm ² -event)	SA [7] (cm ²)	EV [8] (event/day)	ABSd [9] (unitless)
0	10	11.3	350	1	0.76	200	0.2	2,625	1	0.13
1	10	13.3	350	1	1.5	200	0.2	2,571	1	0.13
2	3	15.3	350	1	1.5	200	0.2	2,434	1	0.13
3	3	17.4	350	1	1.5	200	0.2	2,893	1	0.13
4	3	19.7	350	1	1.5	200	0.2	3,175	1	0.13
5	3	22.6	350	1	1.5	200	0.2	3,255	1	0.13
6	3	24.9	350	1	1.5	100	0.2	2,949	1	0.13
7	3	28.1	350	1	1.5	100	0.2	3,182	1	0.13
8	3	31.5	350	1	1.5	100	0.2	3,434	1	0.13
9	3	36.3	350	1	1.5	100	0.2	3,657	1	0.13
10	3	41.1	350	1	1.5	100	0.2	3,819	1	0.13
11	3	45.3	350	1	2	100	0.2	4,111	1	0.13
12	3	50.4	350	1	2	100	0.2	4,453	1	0.13
13	3	56	350	1	2	100	0.07	4,916	1	0.13
14	3	58.1	350	1	2	100	0.07	5,205	1	0.13
15	3	62.6	350	1	2	100	0.07	5,386	1	0.13
16	1	63.2	350	1	2	100	0.07	5,534	1	0.13
17	1	65.1	350	1	2	100	0.07	5,641	1	0.13
18	1	66	350	1	2	100	0.07	5,700	1	0.13
19	1	67.2	350	1	2	100	0.07	5,700	1	0.13
20	1	67.2	350	1	2	100	0.07	5,700	1	0.13
21	1	67.2	350	1	2	100	0.07	5,700	1	0.13
22	1	67.2	350	1	2	100	0.07	5,700	1	0.13
23	1	67.2	350	1	2	100	0.07	5,700	1	0.13
24	1	71.5	350	1	2	100	0.07	5,700	1	0.13
25	1	71.5	350	1	2	100	0.07	5,700	1	0.13
26	1	71.5	350	1	2	100	0.07	5,700	1	0.13
27	1	71.5	350	1	2	100	0.07	5,700	1	0.13
28	1	71.5	350	1	2	100	0.07	5,700	1	0.13
29	1	71.5	350	1	2	100	0.07	5,700	1	0.13
30	1	71.5	350	0	2	100	0.07	5,700	1	0.13
31	1	71.5	350	0	2	100	0.07	5,700	1	0.13
32	1	71.5	350	0	2	100	0.07	5,700	1	0.13
33	1	71.5	350	0	2	100	0.07	5,700	1	0.13
34	1	74	350	0	2	100	0.07	5,700	1	0.13
35	1	74	350	0	2	100	0.07	5,700	1	0.13
36	1	74	350	0	2	100	0.07	5,700	1	0.13
37	1	74	350	0	2	100	0.07	5,700	1	0.13
38	1	74	350	0	2	100	0.07	5,700	1	0.13
39	1	74	350	0	2	100	0.07	5,700	1	0.13
40	1	74	350	0	2	100	0.07	5,700	1	0.13
41	1	74	350	0	2	100	0.07	5,700	1	0.13
42	1	74	350	0	2	100	0.07	5,700	1	0.13
43	1	74	350	0	2	100	0.07	5,700	1	0.13
44	1	74.5	350	0	2	100	0.07	5,700	1	0.13
45	1	74.5	350	0	2	100	0.07	5,700	1	0.13
46	1	74.5	350	0	2	100	0.07	5,700	1	0.13
47	1	74.5	350	0	2	100	0.07	5,700	1	0.13
48	1	74.5	350	0	2	100	0.07	5,700	1	0.13
49	1	74.5	350	0	2	100	0.07	5,700	1	0.13
50	1	74.5	350	0	2	100	0.07	5,700	1	0.13
51	1	74.5	350	0	2	100	0.07	5,700	1	0.13
52	1	74.5	350	0	2	100	0.07	5,700	1	0.13
53	1	74.5	350	0	2	100	0.07	5,700	1	0.13
54	1	73.4	350	0	2	100	0.07	5,700	1	0.13
55	1	73.4	350	0	2	100	0.07	5,700	1	0.13
56	1	73.4	350	0	2	100	0.07	5,700	1	0.13
57	1	73.4	350	0	2	100	0.07	5,700	1	0.13
58	1	73.4	350	0	2	100	0.07	5,700	1	0.13
59	1	73.4	350	0	2	100	0.07	5,700	1	0.13
60	1	73.4	350	0	2	100	0.07	5,700	1	0.13
61	1	73.4	350	0	2	100	0.07	5,700	1	0.13
62	1	73.4	350	0	2	100	0.07	5,700	1	0.13
63	1	73.4	350	0	2	100	0.07	5,700	1	0.13
64	1	70.7	350	0	2	100	0.07	5,700	1	0.13
65	1	70.7	350	0	2	100	0.07	5,700	1	0.13
66	1	70.7	350	0	2	100	0.07	5,700	1	0.13
67	1	70.7	350	0	2	100	0.07	5,700	1	0.13
68	1	70.7	350	0	2	100	0.07	5,700	1	0.13
69	1	70.7	350	0	2	100	0.07	5,700	1	0.13

ABSd = Dermal Absorbed Fraction

ADAF = Age-Dependant Adjustment Factor

AF = Adherence Factor

BW = Body Weight

ED = Exposure Duration

EF = Exposure Frequency

EV = Event Frequency

IR = Intake Rate

SA = Surface Area of Exposed Skin

Sources:

[1] EPA 2005. Supplemental Guidance for Early-Life Exposure to Carcinogens

[2] EPA 1997. Exposure Factors Handbook. Tables 7-2 (adults) and 7-3 (children), mean. Values are mean of male and female. Source: National Center of Health Statistics (NCHS) 1987.

[3] EPA 1991. Standard Default Exposure Factors. Default for resident.

[4] EPA 1997. Exposure Factors Handbook. Table 3-30 - Summary of Recommended Drinking Water Intake Rates. 95th Percentile.

[5] EPA 1991. Standard Default Exposure Factors. Default for resident child and adult.

[6] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

Recommended default adherence factor for a child resident (0.2) and adult resident (0.07). For older children, the geometric mean weighted adherence factor for children playing in wet soil of was used for children 6 - 12, as a central tendency estimate of a high end soil contact activity (see Exhibit 3-3).

[7] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

Calculated from Exhibit C-1 - Body Part-Specific Surface Area Calculations (Children). Data from Exposure Factors Handbook, Tables 6-6, 6-7 and 6-8.

Surface area of head, forearms, hands, lower legs and feet (for child <6 years); feet excluded from surface area calculation for >6 years.

Surface area for >18 is recommended default for adult resident (EPA 2004).

[8] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

Recommended default for RME resident for soil contact.

[9] Chemical specific. Value shown is USEPA 2004 recommended value for benzo[a]pyrene.

Note: ages are not inclusive. For example 0 -30 years includes exposure from birth up until the 30th birthday (total duration = 30 years); exposure from 3-6 years includes exposure during years 3, 4, 5 up until the 6th birthday (total duration 3 years).

CHILD-SPECIFIC EXPOSURE FACTORS HANDBOOK
AGE-SPECIFIC EXPOSURE PARAMETERS
Residential Exposure

AGE (year)	ADAF [1] (unitless)	BW [2, 3] (kg)	EF [4] (days/year)	ED (years)	WATER	SOIL - Residential	DERMAL - SOIL			
					IR [5] (L/day)	IR [6, 4] (mg/day)	AF [7] (mg/cm ² -event)	SA [8] (cm ²)	EV (event/day)	ABSd [9] (unitless)
0	10	8.4	350	1	1.055	200	0.2	2,625	1	0.13
1	10	11.4	350	1	0.972	200	0.2	2,571	1	0.13
2	3	12.9	350	1	0.924	200	0.2	2,434	1	0.13
3	3	15.1	350	1	0.924	200	0.2	2,893	1	0.13
4	3	17.1	350	1	1.15	200	0.2	3,175	1	0.13
5	3	19.4	350	1	1.15	200	0.2	3,255	1	0.13
6	3	21.7	350	1	1.15	100	0.2	2,949	1	0.13
7	3	25.5	350	1	1.202	100	0.2	3,182	1	0.13
8	3	28.1	350	1	1.202	100	0.2	3,434	1	0.13
9	3	32.7	350	1	1.202	100	0.2	3,657	1	0.13
10	3	35.6	350	1	1.202	100	0.2	3,819	1	0.13
11	3	41.5	350	1	1.717	100	0.2	4,111	1	0.13
12	3	46.9	350	1	1.717	100	0.2	4,453	1	0.13
13	3	55.1	350	1	1.717	100	0.07	4,916	1	0.13
14	3	61.1	350	1	1.717	100	0.07	5,205	1	0.13
15	3	62.8	350	1	2.063	100	0.07	5,386	1	0.13
16	1	65.8	350	1	2.063	100	0.07	5,534	1	0.13
17	1	65.1	350	1	2.063	100	0.07	5,641	1	0.13
18	1	66	350	1	2.063	100	0.07	5,700	1	0.13

ABSd = Dermal Absorbed Fraction

ADAF = Age dependant adjustment factor.

AF = Adherence Factor

BW = Body Weight

ED = Exposure Duration

EF = Exposure Frequency

EV = Event Frequency

IR = Intake Rate

SA = Surface Area of Exposed Skin

Sources:

[1] EPA 2005. Supplemental Guidance for Early-Life Exposure to Carcinogens

[2] EPA 2002. Children's Exposure Factors Handbook. Table 11-6. Male and female, mean (1-17 years). Source: USEPA 2000. Body Weight Estimates of NHANES III data.

[3] EPA 1997. Exposure Factors Handbook. Tables 7-2 (adults) - ages 18 - 70 and 7-3 (children) - ages 17-18, mean. Values are mean of male and female. Source: National Center of Health Statistics (NCHS) 1987.

[4] EPA 1991. Standard Default Exposure Factors. Default for resident.

[5] EPA 2004. Estimated Per Capita Water Ingestion and Body Weight in the United States - An Update. Table 5.1.A1. - Estimated Direct and Indirect Community Water Ingestion by Gender and Fine Age Categories. Part c. Both sexes, 95th Percentile.

[6] EPA 2002. Child-Specific Exposure Factors Handbook. Table 5-19, conservative estimate of the mean.

[7] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

Recommended default adherence factor for a child resident (0.2) and adult resident (0.07). For older children, the geometric mean weighted

[8] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment).

Calculated from Exhibit C-1 - Body Part-Specific Surface Area Calculations (Children). Data from Exposure Factors Handbook, Tables 6-6, 6-7 and 6-8.

Surface area of head, forearms, hands, lower legs and feet (for child <6 years); feet excluded from surface area calculation for >6 years.

Surface area for >18 is recommended default for adult resident (EPA 2004).

[9] Chemical specific. Value shown is USEPA 2004 recommended value for benzo[a]pyrene.

Note: ages are not inclusive. For example 0 -30 years includes exposure from birth up until the 30th birthday (total duration = 30 years); exposure from 3-6 years includes exposure during years 3, 4, 5 up until the 6th birthday (total duration 3 years).

**CHILD-SPECIFIC EXPOSURE FACTORS HANDBOOK
AGE-SPECIFIC EXPOSURE PARAMETERS
BY AGE GROUPING GUIDANCE BINS**

RECEPTOR	AGE [8]	BW [1] (kg)	EF [2] (days/year)	ED (years)	WATER	SOIL	DERMAL - SOIL			
					IR [3] (L/day)	IR [2, 4] (mg/day)	AF [5] (mg/cm ² -event)	SA [6] (cm ²)	EV (event/day)	ABSd [7] (unitless)
Resident	0 - < 1 month	3.3	350	0.08	1.0	200	0.2	2,625	1	0.13
	1 - < 3 month	4.1	350	0.17	1.0	200	0.2	2,625	1	0.13
	3 - < 6 month	5.7	350	0.25	1.0	200	0.2	2,625	1	0.13
	6 - < 12 month	9.2	350	0.5	1.1	200	0.2	2,625	1	0.13
	1 - < 2 years	11.2	350	1	0.9	200	0.2	2,571	1	0.13
	2 - < 3 years	13.1	350	1	0.9	200	0.2	2,434	1	0.13
	3 - < 6 years	17.1	350	3	1.1	200	0.2	3,107	1	0.13
	6 - < 11 years	27.6	350	5	1.2	100	0.2	3,408	1	0.13
	11 - < 16 years	48.6	350	5	1.8	100	0.1	4,814	1	0.13
	16 - < 21 years	63.2	350	5	2.3	100	0.07	5,655	1	0.13
21 - < 30 years	70	350	9	2.9	100	0.07	5,700	1	0.13	

ABSd = Dermal Absorbed Fraction

ADAF = Age-Dependant Adjustment Factor.

AF = Adherence Factor

BW = Body Weight

ED = Exposure Duration

EF = Exposure Frequency

EV = Event Frequency

IR = Intake Rate

SA = Surface Area of Exposed Skin

[1] Ages 0 -19: EPA 2002. Child-Specific Exposure Factors Handbook. Tables 11-1 and 11-2, as recommended by EPA 2005. 50th percentile, mean of male and female. Ages 20-<30: EPA 1997. Exposure Factors Handbook, Table 7-2; mean of male and female.

[2] EPA 1991. Standard Default Exposure Factors. OSWER Directive 9285.6-03. Default for resident

[3] EPA 2004. Estimated Per Capita Water Ingestion and Body Weight in the United States - An Update. Table 5.1.A1. - Estimated Direct and Indirect Community Water Ingestion by Gender and Fine Age Categories. Part c. Both sexes, 95th Percentile.

[4] EPA 2002. Child-Specific Exposure Factors Handbook. Table 5-19, conservative estimate of the mean.

[5] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Recommended default adherence factor for a child resident (0.2) and adult resident (0.07). For older children, the geometric mean weighted

[6] EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Calculated from Exhibit C-1 - Body Part-Specific Surface Area Calculations (Children). Data from Exposure Factors Handbook, Tables 6-6, 6-7 and 6-8. Surface area of head, forearms, hands, lower legs and feet (for child <6 years); feet excluded from surface area calculation for >6 years. Surface area for >18 is recommended default for adult resident (EPA 2004).

[7] Chemical Specific. Value is for benzo[a]pyrene

[8] As recommended by EPA 2005 Guidance on Selecting Age Groups for Monitoring and Assessing Childhood Exposures to Environmental Contaminants.