

## 16. Activity Factors

### 16.1 Introduction

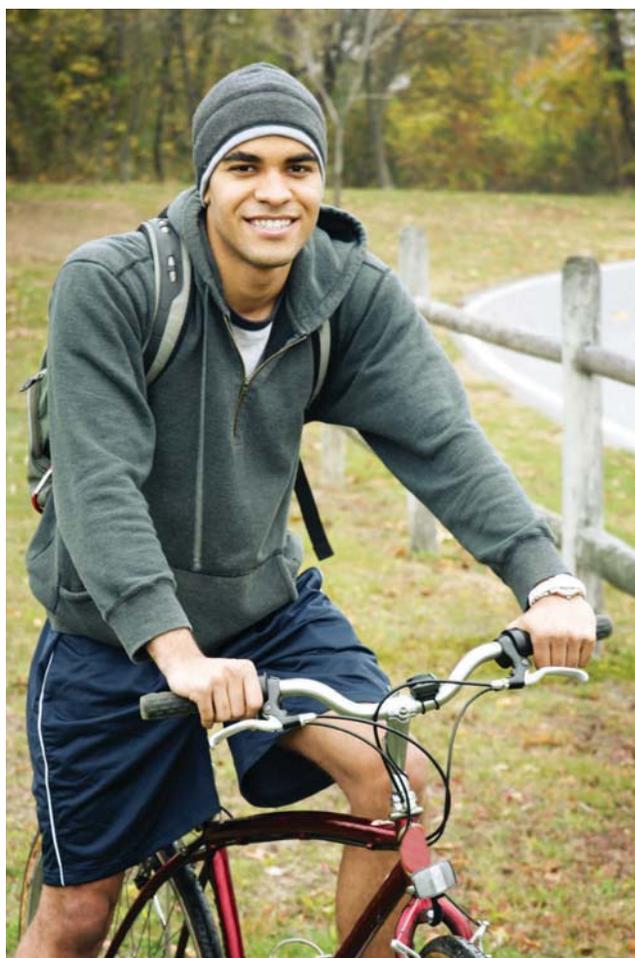
Individual or group activities are important determinants of potential exposure because toxic chemicals introduced into the environment may not cause harm to an individual until an activity is performed that subjects the individual to contact with those contaminants. The types of activities and time spent on these activities varies among individuals on the basis of, for example, culture, ethnicity, hobbies, location, sex, age, socioeconomic characteristics, and personal preferences. Chapter 16 of the *Exposure Factors Handbook* summarizes data on how much time individuals spend participating in various activities in various microenvironments and on the frequency of performing various activities. Information is also provided on occupational mobility and population mobility. Highlights of this information are provided here.

### 16.2 Recommended Exposure Factors

**Activity Factors:** The recommended values for activity factors are summarized in Table 16-1. Note that, except for swimming, all activity factors are reported in units of minutes/day. Time spent swimming is reported in units of minutes/month. These data are based on two key studies presented in this chapter: a study of children's activity patterns in California (Wiley et al., 1991) and the National Human Activity Pattern Survey (NHAPS) (U.S. EPA, 1996). The recommendations for total time spent indoors and the total time spent outdoors are based on the U.S. EPA re-analysis of the source data from Wiley et al. (1991) for children <1 year of age and U.S. EPA (1996) for childhood age groups >1 year of age. For adults 18 years and older, the recommended values are taken directly from the source document (U.S. EPA, 1996). The overall confidence in the recommendations for activity factors is medium for the mean and low for the upper percentile.

**Occupational Mobility:** Table 16.2 presents the recommended values for occupational mobility for males and females. These values are derived from Carey (1988, 1990). The overall confidence in the recommendations for occupational mobility is medium.

**Population Mobility:** There are two key studies from which the population mobility recommendations were derived: the U.S. Bureau of the Census American Housing Survey (U.S. Bureau of the Census, 2008) and Johnson and Capel (1992). Table 16-3 presents the recommendations for population mobility. The overall confidence in these recommendations is medium.



**Table 16-1. Recommended Values for Activity Patterns**

Age Group	Mean	95 <sup>th</sup> Percentile	Source
<b>Time Indoors (total) minutes/day</b>			
Birth to <1 month	1,440	-	a
1 to <3 months	1,432	-	
3 to <6 months	1,414	-	
6 to <12 months	1,301	-	
1 to <2 years	1,353	-	b
2 to <3 years	1,316	-	
3 to <6 years	1,278	-	
6 to <11 years	1,244	-	
11 to <16 years	1,260	-	
16 to <21 year	1,248	-	c, d
18 to <65 years	1,159	-	
≥65 years	1,142	-	
<b>Time Outdoors (total) minutes/day</b>			
Birth to <1 month	0	-	a
1 to <3 months	8	-	
3 to <6 months	26	-	
6 to <12 months	139	-	
1 to <2 years	36	-	b
2 to <3 years	76	-	
3 to <6 years	107	-	
6 to <11 years	132	-	
11 to <16 years	100	-	
16 to <21 year	102	-	c, e
18 to <65 years	281	-	
≥65 years	298	-	
<b>Time Indoors (at residence) minutes/day</b>			
Birth to <1 year	1,108	1,440	b
1 to <2 years	1,065	1,440	
2 to <3 years	979	1,296	
3 to <6 years	957	1,355	
6 to <11 years	893	1,275	
11 to <16 years	889	1,315	
16 to <21 years	833	1,288	
18 to <65 years	948	1,428	c
≥65 years	1,175	1,440	
<b>Showering minutes/day</b>			
Birth to <1 year	15	-	b
1 to <2 years	20	-	
2 to <3 years	22	44	
3 to <6 years	17	34	
6 to <11 years	18	41	
11 to <16 years	18	40	
16 to <21 years	20	45	

**Table 16-1. Recommended Values for Activity Patterns (continued)**

Age Group	Mean	95 <sup>th</sup> Percentile	Source
<b>Bathing minutes/day</b>			
Birth to <1 year	19	30	b
1 to <2 years	23	32	
2 to <3 years	23	45	
3 to <6 years	24	60	
6 to <11 years	24	46	
11 to <16 years	25	43	
16 to <21 years	33	60	
<b>Bathing/Showering minutes/day</b>			
18 to <65 years	17	-	c
≥65 years	17	-	
<b>Swimming minutes/month</b>			
Birth to <1 year	96	-	b
1 to <2 years	105	-	
2 to <3 years	116	181	
3 to <6 years	137	181	
6 to <11 years	151	181	
11 to <16 years	139	181	
16 to <21 years	145	181	
18 to <65 years	45 <sup>f</sup>	181	c
≥65 years	40 <sup>f</sup>	181	
<b>Playing on Sand/Gravel minutes/day</b>			
Birth to <1 year	18	-	b
1 to <2 years	43	121	
2 to <3 years	53	121	
3 to <6 years	60	121	
6 to <11 years	67	121	
11 to <16 years	67	121	
16 to <21 years	83	-	
18 to <65 years	0 <sup>f</sup>	121	c
≥65 years	0 <sup>f</sup>	-	
<b>Playing on Grass minutes/day</b>			
Birth to <1 year	52	-	b
1 to <2 years	68	121	
2 to <3 years	62	121	
3 to <6 years	79	121	
6 to <11 years	73	121	c
11 to <16 years	75	121	
16 to <21 years	60	-	
18 to <65 years	60 <sup>f</sup>	121	
≥65 years	121 <sup>f</sup>	-	

**Table 16-1. Recommended Values for Activity Patterns (continued)**

Age Group	Mean	95 <sup>th</sup> Percentile	Source
<b>Playing on Dirt minutes/day</b>			
Birth to <1 year	33	-	b
1 to <2 years	56	121	
2 to <3 years	47	121	
3 to <6 years	63	121	
6 to <11 years	63	121	
11 to <16 years	49	120	
16 to <21 years	30	-	c
18 to <65 years	0 <sup>f</sup>	120	
≥65 years	0 <sup>f</sup>	-	

<sup>a</sup> U.S. EPA analysis of source data from Wiley et al. (1991). Average for boys and girls, whole population.

<sup>b</sup> U.S. EPA re-analysis of source data from U.S. EPA (1996).

<sup>c</sup> U.S. EPA, 1996.

<sup>d</sup> Total minutes per 24 hours (1,440) minus time outdoors, doers only.

<sup>e</sup> Sum of minutes spent outdoors away from the residence and minutes spent outdoors at the residence. Doers only.

<sup>f</sup> Median value, mean not available in U.S. EPA (1996).

- Percentiles were not calculated for sample sizes less than 10 or in cases where the mean was calculated by summing the means from multiple locations or activities.

Note: All activities are reported in units of minutes/day, except swimming, which is reported in units of minutes/month. There are 1,440 minutes in a day. Time indoors and outdoors may not add up to 1,440 minutes due to activities that could not be classified as either indoors or outdoors.

**Table 16-2. Recommended Values for Occupational Mobility**

Age Group	Median Tenure (years)	
	Men <sup>a</sup>	Women <sup>a</sup>
All ages, ≥16 years	7.9	5.4
16-24 years	2.0	1.9
25-29 years	4.6	4.1
30-34 years	7.6	6.0
35-39 years	10.4	7.0
40-44 years	13.8	8.0
45-49 years	17.5	10.0
50-54 years	20.0	10.8
55-59 years	21.9	12.4
60-64 years	23.9	14.5
65-69 years	26.9	15.6
≥70 years	30.5	18.8

**Table 16-2. Recommended Values for Occupational Mobility (continued)**

Age Group	Occupational Mobility Rate <sup>b, c</sup> (percent)
16-24 years	12.7
25-34 years	6.6
35-44 years	4.0
45-54 years	1.9
55-64 years	1.0
≥64 years	0.3
Total, ≥16 years	5.3

<sup>a</sup> Source: Carey (1988).

<sup>b</sup> Source: Carey (1990).

<sup>c</sup> Occupational mobility rate = percentage of persons employed in an occupation who had voluntarily entered it from another occupation.

**Table 16-3. Recommended Values for Population Mobility**

	Mean	95 <sup>th</sup> Percentile
Residential Occupancy Period <sup>a</sup>	12 yrs	33 yrs
Current Residence Time <sup>b</sup>	13 yrs	46 yrs

<sup>a</sup> Source: Johnson and Capel (1992).

<sup>b</sup> Source: U.S. Bureau of the Census (2008).



**For more information** about the key studies used to derive the recommended activity factors, refer to **Chapter 16 of the Exposure Factors Handbook** at <http://www.epa.gov/ncea/efh/pdfs/efh-chapter16.pdf>. Detailed information on relevant studies of activity patterns is provided in Section 16.3. Studies on occupational mobility are discussed in Section 16.4, and studies on population mobility are discussed in Section 16.5.

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